Magnitude estimation of anxiety*

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Twenty-six males rated and estimated magnitudes of anxiety experienced during a stress condition. The findings suggest that the direct method of magnitude estimation is an appropriate scaling procedure for the measurement of transitory anxiety. Taylor MAS scores were not related to anxiety levels expressed on either category or estimation scales. The method of direct estimation of anxiety may serve as a corollary to other measures of transitory anxiety and prove useful in behavioral therapy settings.

The subjective discrimination of differences in the magnitude of anxiety experienced in various conditions of stress suggests that anxiety is an intensive mode capable of being scaled psychophysically. Due both to the lack of experimental control of sources and intensities of stimulation and the nature of the subjective experience itself, classical jnd procedures are not applicable to the scaling of anxiety. Category-rating procedures have a practical appeal in the measurement of transitory anxiety states but may lack validity when applied to the scaling of intensive continua. The use of *direct* methods in the scaling of intensive continua has been recommended by Stevens (1961), and he has demonstrated their application in conditions where the stimuli had no related physical metric. In the scaling of anxiety, Ss' ratings of experienced magnitudes may be used as an ordinal metric for comparison with the *direct* estimation of magnitudes. In contrast to the scaling of nonintensive continua where category ratings are linearly related to *direct* estimates, the typical slope obtained between these two methods in the scaling of intensive modes is concave downward (Stevens, 1960; Torgerson, 1960). Stevens (1961) has used the slope resulting from the comparison of the two methods as a criterion for determining whether a given discrimination belongs to an intensive or nonintensive continuum. In a similar manner the slope resulting from a comparison of category ratings and *direct* estimates of anxiety could be used to determine if Ss judge their subjective continuum of anxiety as an intensive mode. In the present study the attempt was made to determine if Ss could directly estimate magnitudes of anxiety during a stress condition (examination periods) and if the resulting plot of ratings and estimates would obtain a concave downward slope.

In the attempt to measure anxiety, it has been customary to consider *trait* scales (e.g., Manifest Anxiety Scale, Taylor, 1953; IPAT Anxiety (O-A) Battery, Cattell & Scheier, 1960) as relevant to the prediction of *state* or transitory levels of anxiety. Cattell (1964) has aptly discussed the distinction between *trait* and *state* anxiety variables and noted that they may require different measures. One obvious difference between *trait* and *state* measures of anxiety is the emphasis of the former on retrospective report of reactions to anxiety and of the latter, on current report of differences in the amplitude of experienced anxiety. To determine the relationship of *trait* levels to *state* levels of anxiety, the Taylor MAS was administered to the Ss.

METHOD

Twenty-six male undergraduates in an introductory psychology course served as Ss. Following the normal procedure of the course the three major psychophysical procedures were demonstrated using white noise as the stimulus. Instruction given to the Ss for the direct magnitude estimation of loudness followed those used by Stevens & Tulving (1957) in a similar setting. The Ss estimated the loudness of various amplitudes in an initial demonstration of *direct* methods through use of a standard noise level and an assigned number. In a second demonstration Ss estimated amplitudes of loudness by using the ambient or average level of noise found in their daily environment as a standard and assigned numbers of their choice to that standard. For the category-rating demonstration, verbal anchors were provided on a 7-equal-interval scale, and Ss again rated the average daily noise level as well as the presented noise amplitudes. The apparatus and general procedure used for the demonstration is described elsewhere (Sullivan, 1969). Only the results of the magnitude-estimation procedure were plotted on a blackboard for exposition. Visual best fits of the two slopes approximated straight lines on log-log coordinates. On a subsequent occasion a number of tests, including the Taylor MAS, were administered to the Ss as a demonstration. To ensure anonymity, the Ss placed the last four digits of their phone numbers on the collected test sheets. Prior to the midterm exam the Ss were asked to participate in an experiment to determine if the anxiety they experienced during examination periods could be judged in the same manner as they had judged loudness. The Ss were asked to rate their average or general level of anxiety on a provided scale much as they had previously rated the level of average noise in their daily environment. Similarly, they were asked to assign a

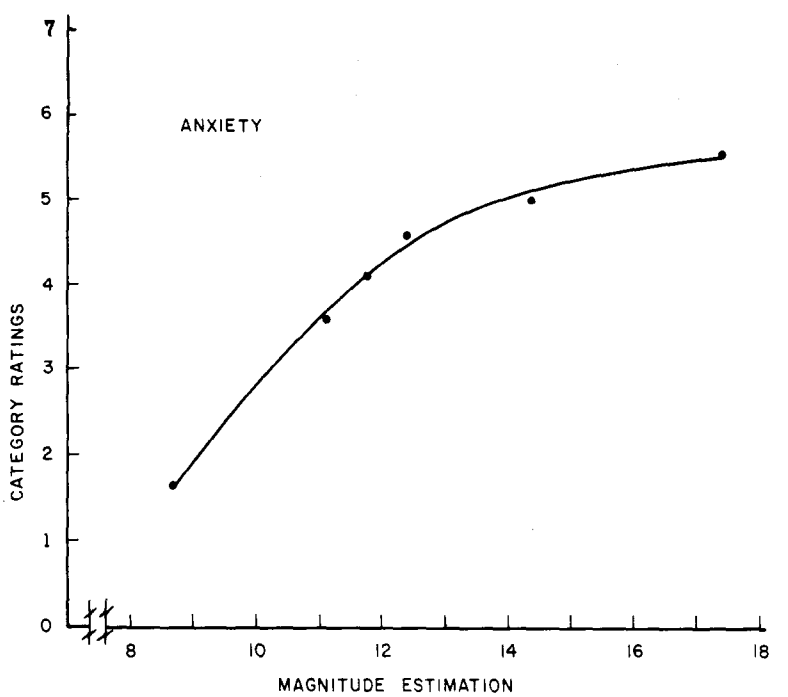

Fig. 1. Mean category ratings and geometric means of estimated magnitudes of anxiety for ordered data (N = 26).

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number to their average level of anxiety and to use this number as their standard in estimating anxiety levels during the examination period. During the instruction period emphasis was placed on acuteness of self-observation, and the attempt was made to establish a response set which would reduce the possible negative implications of admitting anxiety.

During the midterm exam half the Ss rated their anxiety levels and half estimated magnitudes of anxiety. On the final exam those who had previously rated anxiety levels now estimated magnitudes, and vice versa. The general procedure on both occasions was the same. Ss were given a booklet with instructions on the first page and subsequent pages arranged so that as one page was filled out, it was covered by the next succeeding page. The pages for the estimation procedure read: "Compared to my standard level of anxiety, the level of anxiety I am now experiencing is _____." The pages for the category rating procedure read: "On the basis of the above rating scale I would rate my anxiety as being at...." On each of the category-rating sheets there was a 7-equal-interval scale with verbal anchors presented at both ends of the line (i.e., 0-1, perfectly at ease, comfortable, no experience of anxiety; 6-7, anxiety is extremely intense, aversive, and intolerable). Ss placed an X on the presented line to indicate their current level of anxiety. The previously rated and estimated average levels of anxiety were given on the first page of the booklet. For purposes of identification the Ss were once again asked to use the last four digits of their phone numbers. Following a procedure outlined elsewhere (Sullivan, 1969), Ss rated and estimated their anxiety levels at five different time intervals during the two examination periods (before the exam = 5-min judgment, then at 30, 55, 80, and 105 min, the last judgment being made after the exam).

RESULTS AND DISCUSSION

Estimates of average anxiety levels were transformed to a common base by multiplying individual numerical assignments by a factor resulting in a product equal to 10 and then changing all other estimates by this same factor. Category-scale values were read directly from the seven interval lines, and mean ratings calculated for the average anxiety rating and the five stress ratings.

A plot of category ratings for the various levels of anxiety during both exam periods closely approximated the findings of a previous study wherein the same category scale and stress setting were used (Sullivan, 1969). In general, the highest level of anxiety is reported just prior to the exam (5-min judgment) and the lowest is either the average level or that experienced at the end of the exam. Mean category ratings of anxiety levels at the five stress-condition intervals (i.e., 5, 30, 55, 80, and 105 min) and the average level were 5.24, 4.88, 4.63, 4.55, 3.86, and 2.30, respectively. The geometric means of the transformed estimates were 15.3, 14.4, 13.0, 12.7, 11.5, and 10.0, respectively. Since not all Ss experienced their highest level of anxiety at the beginning of the exam or lowest at its completion, it appeared more reasonable, in comparing ratings with estimates, to arrange individual responses from highest to lowest levels on both scales. A plot of the ordered values is presented in Fig. 1. The slope of the function strongly suggests a concave-downward curvature and is similar to functions obtained in the comparative scaling of intensive continua. The Ss apparently differed in the manner of judging anxiety levels, depending on which scale they applied.

To determine the relationship of an S's use of numbers on the two scales, a rank (Rho) correlation was obtained for the highest rating estimate and lowest rating estimate. Both correlations were significant ($r_R = .49$ and .48, both $p < .01$, highest and lowest, respectively) (Siegel, 1956). However, a rank correlation of high-low ratios expressed on the two scales was insignificant ($r_R = .21$, $p > .10$), as might be expected from the graph in Fig. 1. These findings suggest that the general manner in which Ss used the two scales to reflect anxiety levels was related across the two exam periods, but the manner in which the scales were used differed. The range of anxiety experienced, as expressed in the high-low ratio of estimates, has been found to be inversely related to total scores on the Cattell Anxiety (O-A) battery. This previous finding suggested that high *trait* anxious Ss do not experience the same degree of alteration in anxiety states in a stress condition as low *trait* anxious Ss.[1] In the present study the relationship between the range measure and the Taylor MAS score was insignificant ($r_R = .18$, $p > .10$), as were the relationships between category range scores, high-low ratings and estimates, and the MAS. The lack of a relationship between Taylor MAS scores which indicate *trait* levels of anxiety and measures of *state* alterations in anxiety has similarly been reported in other studies (Schalling & Levander, 1964; Katkin & McCubbin, 1969; Epstein & Fenz, 1970).

As noted by Torgerson (1960), category scales are particularly susceptible to the effects of stimulus spacing, and magnitude estimation is sensitive to the effects of anchoring. Stimulus spacing basically involves selecting a set of amplitudes which provide maximum information regarding a stimulus continuum by evoking minimal confusion in the discrimination of magnitudes. Since E had no control over amplitudes, a crude measure of spacing was obtained by calculating the frequency of different category ratings and estimates used by each S to represent his anxiety level. The mean of different number usage on the category scale was 4.6; on the estimation scale it was 3.8. On the basis of number usage, the spread of responses during the stress period and the plot of the ordered responses, it appears that approximately four different amplitudes of anxiety were experienced by the typical S.[2] In this respect it seems that the rather fine distinctions illustrated in category ratings of anxiety (e.g., 3.8 vs 4.0) may not represent clearly discriminated subjective states. On the basis of S's reports, it appeared that estimation was an easier discrimination than was interval judgment.

The effect of having the standard level of anxiety as either the lowest or next lowest magnitude suggests that anchoring shifted the scale upward. However, since the majority of Ss did experience their highest level of anxiety at the 5-min interval, the scale might have shifted downward. The effects of anchoring may then have balanced out.

The present findings suggest that anxiety can be directly estimated as a subjective magnitude. The shape of the comparative function presented here is likely to differ under other stress conditions, adopted anchors and stimulus spacings. However, it would appear that the method of magnitude estimation may be used as a corollary to other techniques in the measurement of transitory anxiety *states*. With a minimal amount of training, Ss can appreciate anxiety as a stimulus continuum having distinguishable magnitudes. The method's major appeal is its ease of administration and reporting. Questions raised regarding the honesty of subjective reports, Ss' sensitivity to different magnitudes of anxiety and the validity of measuring an experimentally undefined stimulus may be answered when such scaling is used in conjunction with other measures of anxiety. The present procedure may have application in behavioral therapy settings wherein patients could use estimates of anxiety states and changes in experienced magnitudes as an index of the degree of success attained in reducing the anxiety related to particular sources.

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NOTES

1. Sullivan, R., Trupin, E., & Blumberg, H. Anxiety, pain and aversiveness: A correlational study. Submitted for publication.

2. In a similar study currently in preparation, the method of successive interval scaling was used to establish category boundaries for different anxiety judgments. As suggested here, the findings indicate that approximately four different anxiety stimuli are present in this experimental setting.

Age differences in sequential form recognition*

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Children (ages 3.7 to 9.2 years) viewed patterns moved continuously behind a stationary aperture, identifying the shapes by referring to a confusion matrix. Age affected recognition of sequentially viewed (but not simultaneously viewed) shapes; recognition errors for the different shapes (square, cross, and "E") were only marginally different.

Adults are able to recognize forms presented sequentially by exposing them in piecemeal fashion through an aperture that is smaller than the whole pattern (Parks, 1965; Anstis & Atkinson, 1967; Haber & Nathanson, 1968; Hochberg, 1968). Although sensory factors can account for the integration of the successive views when the latter are presented in rapid succession (Anstis & Atkinson, 1967), adults also easily recognize forms with slow piecemeal presentation (Hochberg, 1968; Haber & Nathanson, 1968), thus implying more central integration of the sequentially presented stimuli.

In fact, if a set of corners and sides is presented in a discrete and discontinuous sequence (e.g., a static view of a corner followed by a static view of a side, followed by another corner, etc.), so that the S is given no external information concerning each feature's relative location, only his knowledge of the overall pattern can explain his identification of the series of views when they are longer than his immediate memory span (Hochberg, 1968). That is, only an organizing schematic map would enable the S to recognize such discontinuous successive input as being a part of some specific shape. This kind of sequential piecemeal presentation might therefore provide us with a tool with which to study children's acquisition of such visual concepts or schemas.

We were not at all sure, however, that young children could recognize any forms, even familiar ones, presented in discontinuous piecemeal sequence. A continually moving pattern, viewed through an aperture, presents the S with a less demanding task in the following fashion: If cues to the directions of movement are given, so that the S actually sees each corner and side passing behind the aperture, the stimulus contains definite information about the relative positions of each shape's corners and sides. If there are more features than the S can retain as isolated elements in immediate memory, however—i.e., if he has no overall schematic map of the shape—he should not be able to recognize the form that is presented in this manner, even though the movement cues are provided (Hochberg, 1968). The present experiment was therefore undertaken using the less demanding method of aperture viewing (i.e., with continuous movement cues given) to see if preliterate children could recognize two familiar forms and one somewhat less familiar form presented in this fashion.

SUBJECTS

Twelve children between the ages of 3 and 10 years served as Ss. They were divided into three age groups: six 3- to 4-year-olds (three girls and three boys, mean age 3.7 years), three 5- to 6-year-olds (one girl and two boys, mean age 6.0 years), and three 8- to 9-year-olds (three boys, mean age 9.2 years).

APPARATUS

The stimuli to be recognized were an outline square, cross, and block E. The side of the square was equal in length to one arm of the cross and to the middle arm of the block E. Each stimulus was prepared for presentation in two ways: (1) whole form presentation—the form was drawn with a soft pencil on a white index card—and (2) sequential form presentation—each stimulus was drawn on an index card and photographed with a motion-picture camera through a circular aperture cut in a piece of gray construction paper. The diameter of the aperture was equal to the length of one side of the square. The first view of each form was of a corner (right-angle), which subscribed one-quarter of the area of the aperture. Each photographed view, moving

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