

Contrast effects in the child's judgment of lifted weight*

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In this study on anchor effectiveness, the hypothesis that the locus of inflection points of adaptation level varies with chronological age was tested and confirmed. Altogether 62 Ss, divided into four age groups (4;8-12;11 years) had to judge either a 20- to 180-g weight series or a 200- to 400-g series, with anchor values ranging either from 95 to 1700 g or from 16 to 270 g, according to Helson's standard experimental paradigm which was slightly modified with regard to children's testing perceptual response. For children more than 7;0 years old, the anchor-AL trend follows a cubic trend, whereas for younger Ss a monotonic contrast effect trend was obtained. These results are interpreted in terms of cognitive rather than sensory contrast effects in psychophysics.

While the basic quantitative model of adaptation level (AL) theory implies that neutral psychophysical judgment varies as a monotonic function of the anchor value (Helson, 1964), several parametric studies have shown that the empirical anchor-AL relationship follows, actually, a cubic trend (Helson & Masters, 1966; Sarris, 1967, 1968, 1969; Sarris & Haider, 1970; Sarris et al, 1970). This well established finding must be interpreted in cognitive rather than in sensory terms, since it means that the well known psychophysical contrast effect gradually disappears when the anchor becomes psychologically extreme. This general relationship is predicted from a mathematical "similarity-classification" (SC) model, which holds that a numerically "extreme" anchor (psychologically unsimilar to the series) will no longer serve as a partial point of reference for the perceptual judgment (classification) of the series stimuli (Sarris, 1971, Chap. 3.3).

The general significance of the SC model's main implication may be empirically tested also in the realm of developmental psychology in a double sense. (1) Since judgmental category width is known to decrease with chronological age (see, e.g., Gilbert, 1894; Piaget & Inhelder, 1959; Olver & Hornsby, 1966), it may be predicted, in accordance with the SC model, that the locus of gradual disappearance of contrast effects also covaries with age; i.e., that younger children, because of their poorer discrimination ability, are still including rather distant anchors in

their perceptual-cognitive field of judgment, thus showing increasing contrast effects as compared to older Ss. (2) Furthermore, when using another method of measuring perceptual judgment in children, the question of convergent empirical evidence in regard to the assumed perceptual nature of psychophysical contrast effects may be tested on a reasonable basis (Garner et al, 1956).

METHOD

The psychophysical test situation followed Helson's (1964) well known experimental paradigm with lifted weights, with necessary alterations to meet the requirements of the child testing situation.

Subjects

Ss were 62 children (29 boys, 33 girls) living in a rural area near Hannover (West Germany). They were tested in four different age groups (number of Ss given in parentheses): Group I: 4;8-5;8 years (16); Group II: 6;0-7;0 years (16); Group III: 7;8-8;7 years (16); Group IV: 12;0-12;11 years (14). Their median IQ values were found to be in the normal range ("Coloured Progressive Matrices," Raven, 1956).

Stimuli and Main Procedure

Small plastic buckets with handles measuring 6 cm in diam and 14 cm in height were filled with variable amounts of lead shot. Other things being equal, almost the same measurement series as that used in an earlier lifted-weights experiment with adults (Sarris, 1968) were constructed, namely, a "light series" (20, 60, 100, 140, 180 g) along with four heavier anchor weights (450, 701, 1092, 1700 g) plus one control anchor (about 95 g), in order to test for an upper inflection point, and a "heavy series" (200, 250, 300, 350, 400 g) along with three lighter anchor weights

(16, 35, 75 g) plus one control anchor (about 270 g), in order to test for a lower inflection point in the anchor-AL relationship. The same semiautomatic apparatus employed in previous studies was also used in the present experiment. The single weights, concealed from the Ss by a shield, were successively presented to the right hand in a random permutation order (5 practice runs, then 6-10 test runs). The Ss' task was to judge the stimuli series under the various anchor conditions, using a special seven-point category scale consisting of drawings of buckets with the symbolized amount of "sand" increasing linearly in size (see, e.g., O'Rielly & Steger, 1970). The instructions asked S to point to the picture of the weight that was "identical" to the heaviness he just experienced. The S's task was simply, therefore, to single out the "correct" bucket weight after each lifting trial. The total time for each experimental session took approximately 30 min.

Experimental Design

Each age group was divided randomly into two parallel subgroups in which Subgroup A received the "heavy series" and Subgroup B the "light series." Both subgroups were tested first under a no-anchor condition (in order to obtain also the context-free control AL measures K_1 and K_2) and, then, under all four respective five anchor conditions as noted above ("repeated-measurements design"). In order to avoid "carry-over effects" from one experimental session to the other, the time interval between S's experimental sessions was chosen to be about 1 week. Furthermore, the order of anchor presentation followed a balanced permutation plan.

RESULTS

The 62 Ss' mean judgments for the 6-10 test runs were computed first by calculating the empirical ALs (Helson, 1964, p. 196). Then the mean anchor-AL trend for the different age groups (I-IV) was investigated separately for the heavy- and light-weight series. Since Lindquist's (1953) test of trend difference did not result in statistically reliable anchor-AL trend differences for either the younger age Groups I and II or the older Groups III and IV, the respective AL values were combined, thus constituting Age Group 1 (4;8-7;0 years) and Age Group 2 (7;8-12;11 years). Nonparametric trend analyses (Ferguson, 1965) resulted for Age Group 1 in a statistically highly significant monotonic anchor-AL trend ($z > 3.5$; $p < .01$) for both the light (20- to 180-g) and the heavy (200- to 400-g) weight series. For Age Group 2, a statistically highly significant bitonic anchor-AL trend

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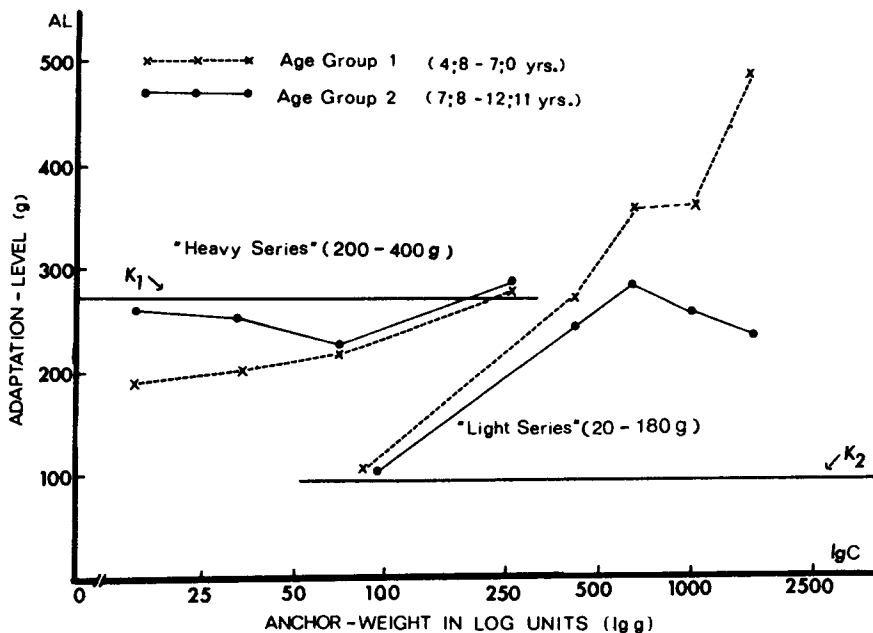


Fig. 1. Mean adaptation level as a function of anchor values and chronological age.

($z > 3.0$; $p < .01$) was found. This main result is depicted in Fig. 1. As predicted, the single empirical anchor-AL relationships vary as a function of Ss' chronological age. For children older than 7;0 years, the combined anchor-AL trends (for the "light" and "heavy" series) follow a cubic (tritone) trend as found for adult Ss (Sarris, 1968), whereas for younger children, the contrast effect trend is monotonic in character.

DISCUSSION

The general experimental finding in this investigation, based on rather direct perceptual measures instead of rating scale values, must be interpreted in cognitive rather than in sensory terms. In accordance with Sarris's (1971) SC model, the gradual disappearance of contrast effects with

relatively extreme anchor values (Age Group 2) is explained by the assumption that older children experience anchors that are numerically extreme relative to the series stimuli as yet not belonging to the series class to be judged. The reverse process is, however, to be assumed for the younger Ss. This psychological interpretation is consistent with the class hypothesis as stated above, namely, that perceptual discriminability varies with chronological age (for further details see Wilkening et al, in press).

REFERENCES

FERGUSON, G. A. *Nonparametric trend analysis*. Montreal: McGill University Press, 1965.
 GARNER, W. R., HAKE, H. W., &

ERIKSEN, C. W. Operationism and the concept of perception. *Psychological Review*, 1956, 63, 149-159.
 GILBERT, J. A. Researches on the mental and physical development of school-children. Studies from the Yale Psychological Laboratories, 1894, 2, 40-100.
 HELSON, H. *Adaptation-level theory*. New York: Harper & Row, 1964.
 HELSON, H., & MASTERS, H. G. A study of inflection-points in the locus of adaptation-levels as a function of anchor-stimuli. *American Journal of Psychology*, 1966, 79, 400-408.
 LINDQUIST, E. F. *Design and analysis of experiments in psychology and education*. Boston: Houghton Mifflin, 1953.
 OLVER, R. R., & HORNSBY, J. R. On equivalence. In J. S. Bruner, R. R. Olver, and P. M. Greenfield (Eds.), *Studies in cognitive growth*. New York: Wiley, 1966. Pp. 68-85.
 O'RIELLY, E., & STEGER, J. A. Children's use of context in judgment of weight. *Child Development*, 1970, 41, 1095-1101.
 PIAGET, J., & INHELDER, B. *La genèse des structures logiques élémentaires: Classifications et sériations*. Neuchâtel: Delachaux & Niestlé, 1959.
 RAVEN, J. C. *Coloured progressive matrices*. Sets A, AB, B. London: Lewis, 1956.
 SARRIS, V. Adaptation-level theory: Two critical experiments on Helson's weighted-average model. *American Journal of Psychology*, 1967, 80, 331-344.
 SARRIS, V. Adaptation-level theory: Absolute or relative anchor effectiveness? *Psychonomic Science*, 1968, 13, 307-308.
 SARRIS, V. Ankerreiz-Effekte bei Tonhöhenbeurteilungen: Überprüfung von Helson's Adaptationsniveau-Modell. In M. Irle (Ed.), *Bericht über den 26. Kongress der Deutschen Gesellschaft für Psychologie, Tübingen 1968*. Göttingen: Hogrefe, 1969. Pp. 399-405.
 SARRIS, V. *Wahrnehmung und Urteil*. Göttingen: Hogrefe, 1971.
 SARRIS, V., & HAIDER, M. Average evoked potentials and the anchoring of pitch judgments. *Psychonomic Science*, 1970, 20, 113-115.
 SARRIS, V., TEWS, B., & SCHÖNPFLUG, W. GSR and the anchoring of pitch judgments. *Psychonomic Science*, 1970, 20, 193-194.
 WILKENING, F., SARRIS, V., & WILKENING, K. Context effects in the child's perceptual judgment: A psychometric analysis. *Child Development*, in press.