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A SUMMARY OF THE FACTS AND A RESTATEMENT
OF THE THEORY OF SOUND LOCALIZATION

OTIS C. TRIMBLE

Experimentation has repeatedly demonstrated that phase, time and intensity, as physical variants, function in much the same manner in determining the directional localization of sound. Their "effects" are alike; the relationship of the angular displacement to the differences in the stimuli in each case is approximately the same; each factor has its optimal effectiveness; the very slight differences in the stimuli in each case are not perceived as differences in phase, time and intensity as such; and each factor may modify the effectiveness of the others. But, in the complex conditions of ordinary hearing, does either of these factors predominate in determining the directional localization, or are all of these factors reducible to some common factor, or do they each and all contribute to a pattern of effects that results in directional perception?

This question has been variously answered. Some investigators would have it that a single one of these physical factors predominates in determining localization under ordinary conditions. But, since all of these factors are approximately equally effective in determining localization under experimental conditions; and, since each factor has its optimal effectiveness; and, since the conditions of normal hearing involve more than one of the factors in question, it would seem that this interpretation assumes too much. Others would reduce time, phase and intensity to intensity or to some other common factor; but since each of these factors is effective under conditions in which the others are present though equalized at the ears, this reduction, it seems, does not follow. Still others would limit the range of the effectiveness of each of the different factors to different frequency ranges, phase being the effective agent in ranges of low frequency, intensity in ranges of high frequency, while time, phase and intensity, all three, are effective in the intermediate ranges. This, perhaps, is a more adequate interpretation of the facts; but the range of effectiveness in each case is perhaps too closely defined.

In the light of the facts, it seems reasonable to assume that all three factors, *i.e.*, phase, time and intensity, and possibly also mass, the physical correlate of quality, contribute in the complex conditions of ordinary hearing, to a difference pattern that results in directional localization. Each factor contributes to the pattern to a

varying degree, depending upon the magnitude of its difference in the different situations. Under ordinary conditions, except when the sound source is in the median plane, one ear is always nearer the source than the other, which means that there is always, under such conditions, a phase, a temporal and an intensive difference at the ears. Under such conditions it seems unreasonable to assume that the organs of hearing analyze the stimuli and respond to a single factor. Directional localization is a cortical function, an immediate, unanalyzable experience in the sense that the "effects" of the different stimuli cannot be identified. The organs of hearing serve as mediating agencies for transmitting to the central nervous system the effects corresponding to the difference in the stimuli.

According to this hypothesis no single one of the physical factors in question predominates, in the absolute sense, in determining directional perception under ordinary conditions. Nor are such factors reducible to one, except as they contribute to a common difference-pattern. The directional localization of a sound source, under the ordinary conditions of hearing, depends upon the configurational nature of the cortical effects that correspond to the physical "difference-pattern" at the ears.

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USE OF THE NEW TYPE EXAMINATIONS

B. F. ZUEHL

A study was made of the value of the new type examinations in classes aggregating 64 students, of whom 28 were Juniors and 36 were Sophomores in the College of Liberal Arts of Western Union College. Four of the eight forms of new type questions were used as described by Paterson. (See Preparation and Use of New-Type Examinations, by Paterson, pages 14 to 41.) The four used were:

- (1) Single word completion (Recall type).
- (2) Several words or clauses necessary for completion (Recall).
- (3) Best of three alternative answers (Recognition).
- (4) True and false (Recognition).

Two plans were followed in preparing lists of questions, i.e., by the students and by the teachers. The former were prepared as class assignments, were collected by the teachers and as far as time would permit were used in testing the classes; this was followed by class discussions, questions and criticisms by students and teacher. The questions prepared by the teacher were used in place of the traditional monthly "quiz."