answered negatively. The results of the experiments with distraction reflect very fairly the different opinions of different psychologists in regard to the effects of attention during the time interval. Wolfe inclines to the belief that the accuracy of comparison depends in great measure on the exertion of attention during the interval. Lehmann, on the other hand, found that his reagents could discriminate better between gray disks if they did not concentrate their attention on a memory-image in the meantime. Radoslawow gives for his results the explanation that by repeated reproductions of the norm the memory for it becomes 'blunted.' The common psychological explanation is so 'plastic,' as the author remarks, that it suits even diametrically opposed facts. The main conclusion to be drawn from the distraction experiments is that judgments of tone discriminations can take place without conscious comparison between the present sensation and a memory-image of a past sensation.

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Studies from the Yale Psychological Laboratory: 1. Researches in Experimental Phonetics. By E. W. SCRIPTURE. Vol. VII., 1899.

This article, though it contains few results which can be called quite new, is excellent in many respects. It contains a bibliography and a discussion of the various theories usually comprehended under the term 'phonetics,' so that it may be recommended as an introduction to phonetics. The experiments which the author made himself are valuable, since they confirm some theoretical conclusions of previous investigators with such certainty that no further doubt is left, and they demonstrate that some problems, unsolved as yet, no longer offer any technical difficulty, so that their final solution is but a question of time. The author has been particularly fortunate in selecting for a recording instrument the gramophone, which doubtless possesses, for investigations of this kind, great advantages over every other recording instrument, including the Edison phonograph.

There can no longer be any doubt that a *vowel* is made up of a 'cord tone' and one or more 'resonance tones' produced in the cavity of the mouth by the air puffs sent out from the larynx. It was for a long time supposed to be impossible to produce a resonance tone by means of the air puffs of a sounding reed. Hensen, who tried to prove experimentally that this was impossible, called those of his experiments in which a resonance tone was heard 'unsuccessful,' as

Scripture mentions, whereas he should have called just these experiments the successful ones. Scripture demonstrates, as previously shown by Willis and Hermann, that a resonance tone of a cavity may indeed be produced by the air-puffs of a reed instrument. Those opposed to this theory (Hensen, Helmholtz) assume that only an *overtone* of the cord tone could be *reinforced* by the resonance of the mouth cavity. Actually, however, the pitch of the resonance tone of the mouth is quite independent of the frequency of the air-puffs by which it is produced, except so far as the resonance tone of the mouth cannot be lower than the cord tone. A consequence of this independence is that in analyzing graphic records of speech sounds one must not make use of the Fourier analysis. This analysis would be permitted only if the 'resonance tones' were reinforced overtones of the cord tone. A vowel, therefore, is made up of a cord tone with its overtones and a certain number of independent resonance tones of the cavity of the mouth.

The author's comparison of the records of the diphthong *ai* in various words and in the same word when spoken with different emphasis and emotion is extremely interesting. The analyses show that the *ai* is not simply the succession of the two vowels *a* and *i*, but an organic union into a new sound *ai*. Thus, there is no necessary pause or sudden change of intensity, or change in pitch, or even change in character. The later sound shows its influence in the earlier one, and the earlier one keeps its influence far into the later one. This is what would be expected on psychological grounds. The author is certainly right in his assumption that the difference of character of a vowel, so noticeable in language, must depend upon certain differences of structure, though he has not yet succeeded in finding a definite law.

Of other results we will mention here only the most important: The tone of the *h* (*e. g.*, the first sound in 'who') is a resonance tone arising from the passage of the air through the mouth; it is not a cord tone. The first sound of 'who' is *not* a voiceless form of *u*.

Previous investigators have had in mind almost exclusively the vowels sung on musical notes. The voice tones of *spoken* vowels are seldom of constant pitch. Some are nearly constant in pitch, some fluctuate, some rise and fall, in various simple or complicated ways. When words are sung they lose most of their character; speech is capable of expressing by its modulations the various emotions and conditions of the individual, whereas the singer has few resources at his command.

English verse makes use of all three elements, length, pitch and

intensity, by means of which strength may be produced. The strength of a syllable may be kept the same by increasing one of the factors as another one decreases.

2. *Observations on Rhythmic Action.* By E. W. SCRIPTURE.

The author points out that regulated rhythmic action differs from free rhythmic action mainly in a *judgment* on the part of the subject concerning the coincidence of his movements with the sound heard or light seen. All physiological theories of regulated rhythmic action must be discarded. The 'difficulty' of free rhythmic action of various frequency the author expresses by a simple formula.

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Beiträge zur Analyse der Gesichtswahrnehmungen. By F. SCHUMANN. Zweite Abtheilung. Zur Schätzung räumlicher Grössen. Zeitschr. f. Psych., XXIV., 1 u. 2. Pp. 1-33.

In this second paper of the series Professor Schumann gives an analysis of the factors involved in the judgments of comparison, as they affect space perception. Briefly put, his problem is to seek out the conditions that are involved in the statement that one line is greater, less or equal to another. It is possible that an explanation may be in terms of elements that are to be revealed by an immediate examination of consciousness; that these mediating elements are conscious, but are only to be demonstrated indirectly, or that they are unconscious. The success of Schumann himself in the time-sense, of Müller and Miss Martin with little weights, and of Stumpf in his analysis of the factors involved in the recognition of the musical intervals give hope that a similar analysis of the space perception will also reveal mediate elements that will serve to explain the judgment.

The first fact revealed by the analysis is that other factors than the mere forms compared must be considered. For instance, a square upon its base seems smaller than the same square with one diagonal vertical because in the latter case we assume that the area is determined by the diagonals, instead of by the sides. Also the lines that bound areas tend to be added to the areas in the comparison.

The second principle to be considered is that the area or line attended to is increased in size. If, for example, you attend to the space between series of squares, the size of the space is increased as compared with the squares. Upon this principle is explained the over-es-