

many of its expressions is extremely complex. The author has no use for psychological assumptions, such as that the rat "perceives relations," or "makes practical judgments," or "has ideas." We do not know why "it is needless to say that no evidence of ideational behaviour has been found in the white rat."

When a rat emerges from a blind alley in the maze, it may run forward or it may return on its own track. But with experience the percentage of returns rapidly decreases, especially in the case of the culs-de-sac nearer the end of the journey—the food-box. There is a progressive elimination of entrances to blind alleys, but this does not come about mainly by a decrease in the number of entrances, but principally, especially in the case of the longer alleys, by a gradual decrease in the degree or distance of entrance. "Just before entrance is eliminated completely, there frequently occurs a peculiar and very rapid vibration of the rat's head between the direction of the true path and that of the tempting blind alley." Entrances to short culs-de-sac are eliminated more readily, other things being equal, than entrances to long ones.

Many facts indicate that to a large extent the maze is learned "as a whole." There must be "some sort of short-circuiting process" by which the right path is suggested for the line of action when the animal comes to the entrance of any blind alley. "It is not clear how any of the usually accepted laws of learning—frequency, recency, and intensity—can operate to bring this about. Frequency and recency fail entirely to account for the behaviour of the rat in the maze. The real process of learning, the gradual elimination of unsuccessful random acts, such as entrances to culs-de-sac and returns towards the entrance place in the maze, must be accounted for on the basis of some entirely different principle. The principles named show only how an act, directed by some other factor, becomes gradually more mechanically reflex."

What, then, is the author's theory? He calls it the "completeness of response" principle in learning. "Responses to stimuli cannot take place instantaneously, neither do stimulation effects fade away momentarily. Besides this, response tendencies and muscular strains, maintained for a shorter or longer time, constantly set up new sensory impulses (propriceptive stimuli), which again stimulate reactions." By such means the effects of successive stimuli, such as the rat encounters in the maze, come to operate in a measure simultaneously, and the resulting response is on the whole the most consistent or complete that can be given in the whole circumstance. "The channels to this most complete response are gradually forced most open or permeable; their greater consistency of operation (facilitation) brings about an intensity of activity through them, which in repeated trials gradually short-circuits through the infinitely numerous pathways involved, and thus brings about the gradual elimination of useless random acts." This is not exactly luminous; the author's theory is only tentative.

It is suggested that learning comes about by this means, and that theories of the "stamping-in of the effects of pleasantness" or of the direction of the animal by conscious states must be laid on the shelf. It can scarcely be said, however, that Mr. Peterson's new theory has yet reached a high degree of lucidity, and there seems to us a smack of dogmatism in the brushing aside of unfashionable ideational interpretations. But the conception of the overlapping of effects of successive nerve functionings is very interesting, and we shall look forward to hearing more of it—especially as a suggested interpretation of the results of ingeniously contrived and punctiliously controlled experiments.

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## INTERNATIONAL FISHERY STATISTICS.<sup>1</sup>

THE publication of the eighth Annual Statistical Bulletin of the International Council for Fishery Investigations is of interest from the point of view of questions of post-war reconstruction. When the council began its work in 1902 it was decided that an annual summary of the commercial fishery statistics of the maritime countries of northern Europe should be compiled. Probably no one except those actually engaged in this task of compilation has ever really appreciated the difficulties of this work. There is no uniformity in the methods of collection of fishery statistics in the countries participating in the schemes of investigation; the ideals of detail and accuracy have always been very different, and official custom and tradition have made it exceedingly difficult to modify or change the methods. To all this we must add international susceptibilities; thus some of the official reports of the International Council are framed in diplomatic style and published in French, but the *Bulletin Statistique* is presented to the public in a queer mixture of English and German. Much of the matter, explanations, discussions, headings, descriptions of tables, and so on, are given in duplicate—an irritating and wasteful compromise.

There has always been (an evidently inevitable) delay in publication; thus the first bulletin, which appeared in 1906, dealt with the statistics of 1903-4, while this last one, published in 1917, summarises the data for 1911-12. The figures for the various fisheries are admittedly estimates and are rounded off, and there are, apparently, no means of arriving at any notions of the magnitudes of the errors involved. The whole treatment is very general and detail is minimal. Now, with all these defects the bulletins have achieved very much, how much anyone may attempt to estimate by trying to think of any other international industry for which we have even an approximation to the knowledge which we possess with regard to European fisheries. The defects of the bulletins are necessarily those of the national systems of fishery statistics, which are the sources of information. In May of 1914 the council began to consider changes, both with regard to arrangement and matter, and the possibilities of speedier publication. Then followed the events of the last three years, postponing indefinitely this task of reconstruction.

Apart from the improvement of the national statistical systems, any improvement of the International Bulletin would have been of little significance. Now the hiatus in fishery investigation that has existed since August of 1914 simplifies the task of reconstruction; there has been a break of continuity which really invites "scrapping" on a large scale. Nowadays there is so much uniformity in general methods of fishing and in commercial methods of distribution that there is scarcely any excuse for diversity of treatment with regard to statistics; given the will to improve and there need be no real difficulty in remodelling official methods. In almost all the national systems (the reports of the Fishery Board for Scotland are perhaps the only exception) there is an irritating and fatal absence of detail. Pedantic accuracy is unnecessary, even if it were attainable, but every local fishery should somewhere or other be recorded; as it is, generalised statements only are accessible. It is the continual experience of everyone who attempts to make use of official fishery statistics that the data are inadequate, or ambiguous, or misleading. All this imperfection must necessarily be reflected in the data of the international *Bulletin Statistique*, and rearrangement of the matter of the latter would only go a little way towards the reconstruction that is so desirable. J. J.

<sup>1</sup> "Bulletin Statistique des Pêches maritimes des pays du Nord de l'Europe." Vol. viii., pour les années 1911-12. Edited by Prof. D'Arcy W. Thompson. (Copenhagen, 1917.)