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THE DEGREE OF EXTENSIONAL AGREEMENT AMONG TWENTY PSYCHOLOGISTS IN THEIR USE OF THE LABELS HYPOTHESIS, THEORY AND LAW

WENDELL JOHNSON AND JOHN T. WILSON

I. The Problem

This study represents an attempt to measure the degree of extensional agreement among a group of psychologists in their usage of certain labels, which were familiar to and commonly employed by all members of the group. Specifically, the problem was to measure the degree of agreement among the twenty psychologists as to the applicability of the three labels, *hypothesis*, *theory* and *law* to a group of twenty statements, each of which had been labelled in one of the three ways by the original author of the statement.

II. Procedure and Subjects

The group of subjects was made up of twenty persons, all in the field of psychology, either graduate students or teachers. None of the subjects had had less than a year's graduate work in the field and all were conversant with the type of material used.

The material for the study consisted of the following twenty statements, each one typed on a 3 x 5 index card. The statements were chosen from a heterogeneous group of psychological writings (text-books, systematic treatises and histories of psychology) and were selected because each had been definitely labelled in each case as *hypothesis*, *theory*, or *law* by the original author of the statement.

The statements:

1. "Other things being equal, those acts leading to consequences which satisfy a need are selected and learned whereas those leading to consequences which do not satisfy a need are eliminated or inhibited."
2. "When action is defined as units of energy multiplied by units of time, movement occurs from one position to the other, over the shortest possible path."
3. "The work decrement of a given S-R (stimulus-response) connection is relative to the recency of the previous functions of that connection."
4. "Human organisms, when forced to make a decision, tend to exhibit emotionally-toned behavior."
5. "For every color sensation there may be found an antagonistic or complementary one, which, when mixed with it in proper proportions, gives gray; and, if mixed in any other proportions, gives a color sensation of low saturation having the hue of the stronger component."
6. "All observable facts are ultimately explainable on a common basis—the physical continuum."
7. "This apprehension or definition of a perceived figure is always such as to express as sharply as possible the essence of the structure as the subject gets it."

8. "Consciousness of bodily disturbance is the essential element in emotional consciousness."
9. "The propagated disturbance evoked by a single stimulus in a single functional unit of nerve or muscle is always as large as that functional unit is capable of producing at the moment when the response is evoked, no matter how strong the stimulus may be."
10. "In nature, qualitative changes may take place in a strictly definite way for each separate case only by means of quantitative gains or of quantitative losses of matter or motion (so-called energy)."
11. "Certain behavior mechanisms are organized in animals during the pre-adult phases of life by virtue of the same or similar endogenous regulatory agencies as those accounting for characteristic changes of the egg, gastrulation, histogenesis, organogenesis and many other phases of somatic growth."
12. "All psychical phenomena originate in the particular creative force of the individual and are expressions of his personality."
13. "When a person has in mind any two or more ideas he has more or less power to bring to mind any relation that essentially holds between them."
14. "Other things being equal, the more frequently a connection has been exercised the stronger the connection."
15. "The mean number of repetitions between the first success and the last failure is an increasing function of the mean number of repetitions required for learning."
16. "In comparing magnitudes it is not the arithmetical difference but the ratio of the magnitudes which we perceive."
17. "Resistance at the synapse changes during learning, fatigue and under various metabolic conditions."
18. "Intelligence is composed of a general capacity and specific capacities for expression in various fields of reaction such as music, skating and mathematics."
19. "Awarenesses are the reactions to the central nervous system, particularly of the cerebrum, which take place independently of afferent or efferent nerves, but may finally culminate in action of effectors."
20. "The motivation of life is the *libido*, which is sexual energy undifferentiated from hunger at birth (sex and food-getting instincts)."

The general procedure for the investigation was to hand to the subject a pack of 20 cards upon which the statements were typed and numbered, one to a card, along with three sets of instructions, each set being typed on a card which was contained in an envelope. The specific instructions were as follows:

Directions: After shuffling the 3 x 5 cards, indicate on the attached slip of paper by an (X) beside the number corresponding to the index number on each of the 20 cards if you would label the statement on the card a

HYPOTHESIS

When finished with all the statements replace this card and the slip of paper in the envelope and repeat the directions found in the other two envelopes.

On the two additional instruction cards the words *theory* and *law* were substituted in the above for the word *hypothesis*. An attached slip of paper, upon which the subject was to indicate his agreement or disagreement that the label fit the respective statements, accom-

panied each set of directions. There was no time limit imposed upon the subject, but it was stipulated that he was not to go back and compare subsequent labelings with the one or two which he had previously finished. The order in which the sets of directions were chosen by each subject was a chance arrangement, the experimenter placing each of the three sets of directions in its respective envelope and shuffling the three envelopes before handing the experimental materials to the subject.

III. Results

The way in which the subjects labeled the statements by means of the three terms *hypothesis*, *theory* and *law* is indicated in Table 1.

Table 1. The number of subjects (N=20) labeling each of twenty statements *hypothesis*, *theory* and *law*.

Number of subjects Labeling			
Statement	Hypothesis	Theory	Law
1	8	7	10
2	7	2	12
3	6	3	14
4	11	5	4
5	2	1	18
6	7	12	3
7	10	10	2
8	12	12	1
9	4	5	15
10	6	12	6
11	16	11	1
12	12	9	0
13	10	8	0
14	10	7	12
15	7	3	9
16	3	4	10
17	12	11	2
18	10	16	0
19	9	13	0
20	9	16	0

From these basic data it is possible to compute an Extensional Agreement Index, EAI (1) for each of the three labels with reference to its application to each statement, and then to determine the average EAI for each of the three labels with reference to the group of statements. The EAI is the absolute value of $\frac{2x-n}{n}$ in which x

is the number who label the statement as either *hypothesis*, *theory*, or *law*, as the case may be, and n is the number of subjects in the group (2). This formula takes into account both the agreement derived from the labeling of a statement and the agreement derived from the non-labeling of it, so that if half the group labels and half does not, the net agreement is zero. Thus the index of agreement is a measure of the degree of agreement among the subjects with reference to the label in terms of either its applicability or non-applicability to the statement in question, and this degree of agreement will

range along a scale from 0.00 (complete disagreement among the subjects) to 1.00 (complete agreement among the subjects).

Table 2 shows the agreement indices for the three labels with reference to their applicability and non-applicability to each of the statements, and also the average EAI of each of the three labels with reference to the group of statements. The results should be considered as having been derived from three separate investigations, and not as being continuous from label to label.

As can be seen from Table 2, the degree of agreement among the subjects as to the applicability of the term *hypothesis* to the group of statements was not high, the mean EAI being .28.

Table 2. The extensional agreement index of each of the three labels *hypothesis*, *theory* and *law* with reference to their applicability to the twenty statements.

Statement	EAI <i>Hypothesis</i>	EAI <i>Theory</i>	EAI <i>Law</i>
1	.20	.30	.00
2	.30	.80	.20
3	.40	.70	.40
4	.10	.50	.60
5	.80	.90	.80
6	.30	.20	.70
7	.00	.00	.80
8	.20	.20	.90
9	.60	.50	.50
10	.40	.20	.40
11	.60	.10	.90
12	.20	.10	1.00
13	.00	.20	1.00
14	.00	.30	.20
15	.30	.70	.10
16	.70	.60	.00
17	.20	.10	.80
18	.00	.60	1.00
19	.10	.30	1.00
20	.10	.60	1.00
Average EAI	.28 ± .24	.40 ± .26	.62 ± .35

For only four of the statements, numbers 5, 9, 11, and 16, the EAI for the term *hypothesis* was higher than .50. In other words, 16 times out of the possible 20, the 20 subjects were approximately evenly divided as to whether the statements represented or did not represent that to which the label *hypothesis* supposedly refers.

In their usage of the label *theory* there was somewhat more agreement, the mean EAI being .40. Even this value, however, would appear to be low. It is interesting to note that for nine of the 20 statements the EAI was .50 or higher and on only one statement, number 7, was there a complete lack of agreement as to whether the statement did or did not represent a *theory*. The statement for which there was the highest degree of agreement was number 5, and in this case 19 subjects agreed that the statement did not represent what to them is meant by the term *theory*.

Although there is a difference of .12 between the agreement indices of the labels *hypothesis* and *theory*, as they refer to the sam-

pling of statements, this difference is not a statistically significant one. The critical ratio of the difference between the mean EAI's is .57. From these results it is apparent that at least with reference to the twenty statements in question there is no clear-cut difference among the twenty subjects in their agreement concerning the usage of the two labels *theory* and *hypothesis*.

Turning to the third term, *law*, we find a somewhat higher index of agreement. The average EAI is .62. Thirteen of the statements show an EAI of .50 or higher, and in the case of five of these 13 there was perfect agreement that the label *law* could not be applied. Five of the statements had indices of .20 or below and on two statements, numbers 1 and 16, there was no agreement, half of the subjects being of one opinion and half of the opposite opinion.

The degree of agreement among the subjects with reference to their usage of the label *law* in the present situation tended to be significantly higher than the degree of agreement in the usage of the other two labels. The critical ratio of the difference between the mean EAI's for *hypothesis* and *law* was 2.63, and the CR of the difference between mean EAI's for *theory* and *law* was 2.08.

IV. Summary

In an investigation designed to measure the degree of extensional agreement among a group of twenty psychologists relative to the applicability of the three labels, *hypothesis*, *theory* and *law*, it was found that indices of such agreement (EAI's) for the three labels were .28, .40 and .62, respectively. In other words, agreement as to whether or not the furnished materials (in the form of twenty statements) represented that to which the three labels refer was low, especially so in the case of the first two terms.

Such findings necessarily bear only on the relationship between the three labels in question and the twenty statements used as material for the study. However, from these results it may be inferred with some reason that a comparable lack of extensional agreement as to the referents of other fundamental terms exists not only among the present twenty subjects but also among the larger group of which they are a sampling. The lack of such basic extensional agreement may well account for a considerable portion of the controversy existing today in the field of psychology.

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