7. W. Kuhn, H. Majer, H. Heusser, B. Zen Ruffinen, *ibid.* **13**, 469 (1957).
8. The dialyzing fluid had the following composition: NaCl, 6.6 g; $NaHCO_3$, 2.25 g; KCl, 0.3 g; $MgCl_2 \cdot 6 H_2O$, 0.1 g; $CaCl_2 \cdot 2 H_2O$, 0.2 g; glucose, 2.0 g/liter.
9. Faraday Instruments Co.
10. L. Hösli and M. Monnier, *Arch. Ges. Physiol.* **275**, 439 (1962).
11. M. Monnier and R. Tissot, in *Physiologie de l'Hippocampe* (Centre National de la Recherche Scientifique, Paris, 1962).
12. This work was supported by grants from the Ciba-Stiftung, Basel, from Fonds zur Förderung von Lehre und Forschung of the University of Basel and the Freiwillige Akademische Gesellschaft der Stadt Basel.

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Attitude Statements as Positive and Negative Reinforcements

Abstract. *The finding that attraction is a function of attitude similarity has been interpreted as a special case of the effect of positive and negative reinforcements on attraction. A simple discrimination learning task was employed in which the reinforcements were attitude statements similar and dissimilar to the opinions of the subject. The presentation of similar attitude statements after each correct response and dissimilar attitude statements after each incorrect response significantly changed response probability. The hypothesis that such statements could be used as reinforcers in a learning situation was thus confirmed.*

Attitude is a construct which refers to an enduring, learned readiness to behave in a consistent way along an affective dimension toward a given object or class of objects. On the basis of a variety of antecedent experiences, each individual holds a large number of beliefs, opinions, values, and judgments which involve attitudinal components. The relative similarity or dissimilarity of the attitudes of any two individuals has been found to exert a significant effect on their mutual attraction.

In the typical experimental study of attitude-similarity and attraction, the investigator obtains a sample of the attitudes of a group of subjects, later presents the subjects with the real or purported attitudes of a stranger, and measures the subject's attraction toward this stranger. It is a consistent finding that attraction toward the stranger is a positive linear function of the proportion of that stranger's attitudes similar to those of the subject (*1*).

In accounting for this relationship, one approach has been to interpret the effects of attitude similarity-dissimilarity as a special case of the effect of positive and negative reinforcements on attraction (*2*). Briefly, the rationale is that there is a learned drive to be logical and to interpret the environment correctly. With respect to the physical world, objective criteria are available to denote correct and incorrect behavior. Positive and negative reinforcements are usually provided immediately in terms of direct perceptual feedback (for example, fire is hot, stones are hard). There also exists, however, a complex social environment in which there are equal demands to be logical and correct but for which the only criterion is that of consensual validation. Thus, agreement by others concerning political affiliations or religious practices or morality acts as a reward in that it provides evidence that one is functioning in a logical and correct manner. Consensual invalidation and hence punishment occurs when there is disagreement by others. To date, there has been no direct test of the proposition that similar and dissimilar attitude statements act as reinforcing stimuli.

In the investigation described here, a simple discrimination learning task was employed in which the traditional reinforcements were replaced by statements of attitudes. If the reinforcement interpretation of attitude similarity-dissimilarity is correct, such statements should act to change behavior. Specifically, it was hypothesized that the probability of the occurrence of a response increases if that response is followed by the presentation of a statement consonant with an attitude held by the responder and decreases if that response is followed by the presentation of a statement dissonant with an attitude held by the responder.

A 45-item attitude scale was administered to over 100 students enrolled in introductory psychology at the University of Texas. The items concerned such topics as birth control, political parties, and belief in God. Subjects responded to each item on a six-point scale. For the experiment itself, 60 subjects who had relatively extreme views (1, 2, 5, or 6 on the scale) on at least 20 topics were selected.

The learning task consisted of a simple discrimination problem. The subjects sat in front of a large wooden apparatus which contained a window for the presentation of the stimulus

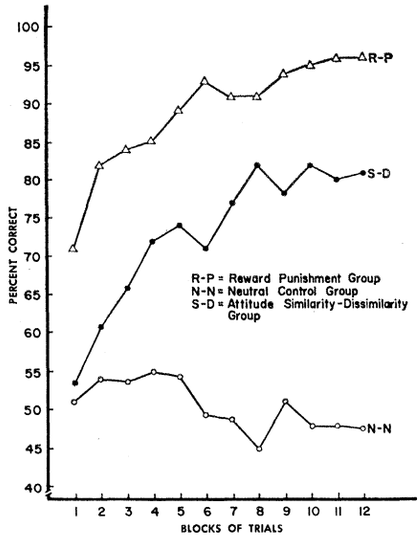

Fig. 1. Learning curves for the three groups of subjects showing percentage of correct responses over eight-trial blocks as a function of experimental conditions.

cards. A total of 96 cards was used, one for each trial, each containing a circle and a square of which one was black and one white, one large and one small. Each of the eight possible combinations of shape, size, color, and position appeared in random order in each block of eight trials. All subjects, run individually, were told that the experiment dealt with learning. When a stimulus card appeared in the window, the subject chose one of the two figures and said it aloud. Immediately afterward, a card was presented through a slit. The subject read the information printed on the card and then disposed of it in a discard box.

The 60 subjects were randomly assigned to one of three experimental conditions. The discrimination to be learned was small-large. In each group, small was correct and large incorrect for half of the subjects with the reverse for the other half. In the traditional reward-punishment group, the choice of the correct stimulus was followed by a card saying "RIGHT"; choice of the incorrect stimulus was followed by "WRONG." The attitude similarity-dissimilarity group received cards containing statements agreeing or disagreeing with their own position on one of the 20 topics about which they had strong views, depending on whether they gave correct or incorrect responses. Examples are: "There is definitely a God," or "There is no God"; "The Democratic Party is best," or "The Republican Party is best." Re-

gardless of the correctness of each response, the control group received cards containing neutral statements relevant to one of the 20 topics about which they held extreme attitudes. Examples are: "Most modern religions are monotheistic"; "Political conventions are held in large cities." Trials were continued until the subject reached a criterion of eight consecutive correct responses or until 96 trials were completed. Responses were scored according to the number of correct responses per block of eight trials.

The results are depicted in Fig. 1. Analysis of variance yielded a number of significant F ratios. Two findings were critical in confirming the hypothesis. Both in terms of overall performance scores [$F=14.35$, degrees of freedom (df) $=1/54$, $p<.001$] and in terms of the linear trend ($F=16.38$, $df=1/54$, $p<.001$), the attitude similarity-dissimilarity group was superior to the control group. The presentation of statements with attitudes similar and dissimilar to those of the subject acted to change response probability; hence, the reinforcement interpretation of similar and dissimilar attitudes is on considerably firmer theoretical ground. The particular research design employed in this investigation makes it impossible to determine if similar and dissimilar attitudes are both necessary to bring about learning or if just one of these conditions would be sufficient.

None of the other significant findings is directly relevant to the hypothesis under investigation. The traditional reinforcement group performed better than the other two groups ($F=26.78$, $df=1/54$, $p<.001$), but this is hardly surprising. In addition, there was a small but significant difference ($F=5.04$, $df=1/54$, $p<.05$) between the small and large condition; large was easier to learn as the correct response than small. Since this variable was controlled across groups, it could have no effect on the major findings.

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References and Notes

1. D. Byrne and D. Nelson, *J. Abnorm. Soc. Psychol.*, in press.
2. D. Byrne, *J. Personality* **30**, 164 (1962); T. M. Newcomb, *Am. Psychol.* **11**, 575 (1956); R. D. McDonald, thesis, Univ. of Texas (1962).
3. This research was supported in part by the U.S. Air Force Office of Scientific Research of the Air Research and Development Command grant AF-AFOSR 261-64.

21 September 1964

Visual Function of the Forebrain Commissures in the Chimpanzee

Abstract. *Interocular transfer of learned pattern discrimination tasks in chimpanzees with sectioned optic chiasma is dependent on the forebrain commissures. This function is sustained by the splenium and the anterior commissure, the former pathway being the more capable.*

That the commissures of the forebrain play a vital role in the transmission of patterns of visual experience between the cerebral hemispheres has been established in the cat and in the monkey (*1*). In a study of the localization of this visual function in the commissure of the cat, the posterior half of the corpus callosum was found to participate (*2*). This distribution probably relates to the disposition of visually related cortex on gyrus lateralis of the cat. Work with the monkey suggested that the anterior commissure, as well as corpus callosum, may transmit visual information (*3*). Apart from the suggestion that the anterior commissure may participate in visual transmissions, the contribution of the various segments of corpus callosum to transfer of visual information in the primate has not been analyzed previously. The present study was therefore undertaken to determine the pattern of localization of visual transfer functions in the forebrain commissures of a higher primate.

Eight young adult chimpanzees were subjected to midsagittal section of the optic chiasma, whereby the visual sensory input from the two eyes was restricted to the separate hemispheres over the remaining uncrossed pathways. To assess the role of particular parts of the forebrain commissures, seven of the animals underwent surgical section of varying portions of the corpus callosum. In four of the seven, the anterior commissure was also sectioned. One animal served as a control, with only the optic chiasma sectioned.

Training on visual discrimination problems began 2 weeks after surgery. The training apparatus was designed to limit the subject's viewing of the discriminanda to one eye. The visual stimulus-objects consisted of pairs of patterns mounted on two separate lids covering adjacent metal cups. The cup covered by the "correct" lid was baited with food. An opaque sliding door between the animal and the stimulus objects was raised to permit response. The animals were allowed to use the hand contralateral to the viewing eye, both the visual afferent and motor efferent projections thereby being related to the same hemisphere. The location of the lids containing the two stimulus choices was shifted from right to left positions according to a chance sequence. Each animal was given 100 trials daily. When an animal achieved 17 or more correct trials in 20 (criterion of learned performance), it received four additional days of "overtraining" to stabilize performance through the eye and hand receiving the training.

Transfer-of-training tests were then carried out through the, heretofore, untrained opposite eye and hand. High-level transfer-of-training occurred when there was immediate recognition of the discrimination task through the second eye and hand. Interocular transfer was impaired or absent when additional trials were required for learning.

For the discrimination training, a series of two pairs of black and white, flat patterns were employed: problem A, two rectangles versus a single rectangle; and problem B, a triangle versus a square. The first-mentioned member of each pair was arbitrarily select-

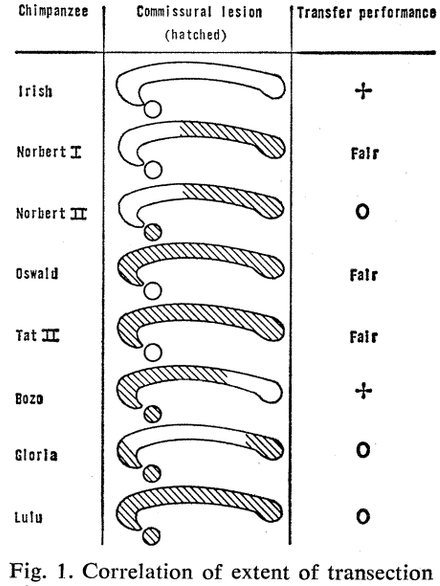

Fig. 1. Correlation of extent of transection of corpus callosum and anterior commissure with the degree of transfer of pattern discrimination training between the two eyes in chiasma-sectioned chimpanzees. Symbols: +, 90 to 100 percent saving of learning on transfer-testing; fair, 60 to 85 percent saving; 0, virtual failure—that is, minus 7 percent to plus 15 percent saving of learning.