III. SOME INTERRELATIONS OF BEHAVIORAL MEASURES OF FRUSTRATION IN CHIMPANZEES

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Frustration can be experimentally manipulated if one is able to change the goal tendencies so that various degrees of negativity to a situation replace or conflict with the previous positive tendencies. One may use either a native drive like sex or thirst and prevent or redirect the satisfaction of the drive, or one may build up a reward-expectation by training and then systematically interfere with the tendency.

For several summers I have had the opportunity to work on the latter problem at the Yale Laboratory of Primate Biology at Orange Park and wish here to acknowledge my thanks. The experimental advantages of studying frustration in as manlike an animal as the chimpanzee are so obvious that they need not be enumerated. Tests were made on six adult chimpanzees, two males and four females, and four child chimpanzees, three males and one female.

Several possible ways of building up an expectation (used purely behaviorally to indicate a relatively persistent activity in a significant direction or mode) might have been used in these experiments, but I found special advantages in a modification of the pull-in technique. By concealing behind a curtain and under a platform the two wheels upon which an endless V-type belt was mounted, one presents the subject with a constant pulling situation. In the food or standard trials a piece of orange in a tin container was clipped on the belt from behind the curtain when the Veeder counter indicated four turns of the wheels or about 90 cm. of belt. The animals pulled with one hand through a hole in an outdoor living cage.

With this apparatus, including a falling door to prevent access to the belt between trials, many variations in the reward-expectancy relationship are possible. One may have:

a. After a standard pull, only an empty food container appears.

b. After a standard pull, the falling door is quickly lowered to end the trial (interruption to the animal).

c. Unlimited pull until the animal leaves the task.

d. Replacement of expected reward by one of low value in the appetite hierarchy.

e. After standard pull, allow the animal to pull the food almost within reach; then interrupt the trial with the falling door.

f. After standard pull, allow the animal to pull the food almost within reach; then have it retrieved behind curtain away from animal.

The first three methods—empty food container, interrupted pull, and the unlimited pull—were used in my work, and it is about them that the following summarizing statements will be made.[1] Let us analyze these three ways. In the training and control trials the tin carriage drawn from behind the curtain always contained food. When the animal first experiences the empty carriage, usually it pauses and then continues to pull, eyes on the curtain, as though a loaded carriage were still to appear. Later the empty carriage became a signal terminating the trial for the animal, for the pulling would stop as soon as the carriage appeared empty. The second type, interrupting the pulling after the standard amount of work, seemed psychologically a very different thing to the animal. Even though the work had been the same as in the first method and the reward as lacking, the animals acted as though the trial were incomplete or interrupted. Some tried to hold up the falling wooden screen. One animal tried to hold on to the belt, even though the wooden screen came down gently on her arm and prevented further pulling. In the third situation where the belt was left exposed as long as the animal wanted to pull on it, at first the animal pulled as much as twenty times as much belt and took ten to twenty times as much time as in the standard trials. Later this became less, but seldom went below twice the standard pull. Some of the animals would drop the pulling for several seconds, resume the task, and alternate thus for a considerable time. Most, however, would drop the task definitely and retreat out of the situation.

The six adult and four child chimpanzees were tested on the three types of frustrating situations, with difficulty levels of one, two, four, and eight successive frustrations. The following quantitative measures were used: the level of frustration the animal can withstand, the time after a frustration before resuming the next trial, the time of performing the trial following a frustration, and finally a description and rating on a scale from 0 to 4 of the emotional and behavioral data of the frustration. Changes in time and behavior

[1] The complete data is in preparation for publication elsewhere.

from the standard or control trials serve as indicators of the degree of experienced frustration.

The results of these experiments indicate that frustration is much more a function of *how* a reward-expectancy is thwarted than of the simple loss of the reward. For all subjects, except one adult male, the interrupted pull leads to the most pronounced frustration, with the unlimited pull second, and the empty food container last. Roughly, they stand respectively in the proportion of 2, 4/3, and 1 times the frustration of the empty food container. This is true for the level of difficulty reached and the behavioral rating, and only a little less clear for the delay and hesitation scores.

Frustration may be revealed among other ways by hesitation at work on the task, reluctance to resume a task after a frustrated attempt, or various amounts of violence and emotion directed toward environmental objects or toward the animal itself. All these criteria show a tendency to be related in the grouped data, but the correlation of individual instances of frustrated behavior ratings is practically zero with delay in resuming the trials and the time of subsequent pull. Evidently the expression of the tensions of frustration can be predicted only very generally. Similarly one finds that in a series of eight successive frustrations, the ratings and time expended do not indicate a steadily mounting tension but a rather sporadic variation, e.g., 2, 0, 2½, 1, etc.

The animals also vary in their expression of and resistance to frustration. Among the six adults, three (two females and one male) showed a low threshold for frustration as judged by our time and rating criteria, while the other three were much less affected and began to show the phenomena plainly only with four to eight successive frustrations. Sex differences are not apparent. The child chimpanzees, however, are so markedly less resistant to frustration than the adults that age before maturity is surely a factor. Three of the four children could not go beyond two successive frustrations. The one that completed work through eight successive frustrating trials had the highest emotional ratings of any animal tested.

While the intensity and modes of expression of frustration tend to be characteristic of each animal individually, a progressive change occurs during the course of the experiment. The adult, and to a much less extent the child chimpanzee, evidently learns to adapt to a frustrating situation. For example, if two successive empty food-container frustrating trials are succeeded by two days of interrupted

trials, the time and behavioral scores are much lower the next day on a return to frustrations of the empty carriage type.

In conclusion, I should like to point out that this experiment has given us the following information about certain measures of frustration: the interruption of a pull results in twice as much observable frustration as the pulling in of an empty food container; the tensions of frustration work themselves out so variously that only with massed data can one observe tendencies; although the adults differ greatly in their resistance to frustration, all of them far excel the child chimpanzees; and finally the animals tend to adapt to the frustrating situations.

Some additional interrelationships between measures of frustration that I have been working on but have not yet unraveled are: the relation of types of frustration to learning; the relation of types of frustration to experimental extinction; the relation between the general and specific effects of a particular kind of frustrating situation; and the factors determining the limits of frustration. I hope that further work may help solve some of these problems in the chimpanzee.

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