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SOME FACTORS OF OBSERVATIONAL LEARNING IN CATS*[1]

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A. THE PROBLEM

During the early days of psychology the solution of problems by imitation in animals became a source of great interest. It was thought to be an important clue to rational behavior, because the sudden emergence of an act, after observing it in another animal, was thought to be dependent on an ideational process on the part of the imitator. Later workers rejected this approach as essentially anthropomorphic and not open to proof and preferred to regard imitation as merely learning by observation.

The interest has also shifted to some extent from phylogenetic comparison to the factors responsible for observational learning. For example Miller and Dollard (23) and Skinner (31) studied the development of such learning in the rat and pigeon, respectively. Herbert and Harsh (18) were interested in the number of observations as a factor in imitation by cats. Aronowitch and Chotin (1) studied the effect of age and social factors in monkeys, while Crawford and Spence (10) were interested in the perception of the demonstrator's act by chimpanzees. Warden and co-workers (41, 42) were interested primarily in the speed and complexity of motor acts that could be learned by monkeys.

General reviews of the literature have been presented by Warden, Jenkins and Warner (40), Warden and Jackson (41), Spence (35), Crawford (9), and Miller and Dollard (23). A summary of reported work on observational learning is given in Table 1. It can be seen that results with the same species are often contradictory but that the weight of the evidence indicates some observational learning in most of the higher vertebrates tested. This summary is limited to the question of the presence or absence of observa-

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tional learning for the species in question. The inconsistency of the various results can be explained in part by the fact that the methods used by the various experimenters were not comparable.

TABLE 1
SUMMARY OF EXPERIMENTAL WORK ON OBSERVATIONAL LEARNING ("IMITATION")

Species	Experimenter	Year	Results
Fish	Welty (45)	1934	Yes
Bird	Porter (27)	1900	Yes
Bird	Skinner (31)	1951	Yes
Rat	Small (32)	1900	Doubtful
Rat	Small (33)	1901	No
Rat	Berry (3)	1906	Yes
Rat	Bruce (7)	1941	No
Rat	Miller and Dollard (23)	1941	Yes
Rat	Bayroff and Lard (2)	1944	Doubtful
Racoon	Davis (11)	1903	No
Racoon	Cole (8)	1907	No
Racoon	Sheperd (29)	1911	No
Cat	Thorndike (37)	1898	No
Cat	Hobhouse (19)	1901	Yes
Cat	Berry (4)	1908	Yes
Cat	Herbert and Harsh (18)	1944	Yes
Dog	Thorndike (37)	1898	No
Dog	Hobhouse (19)	1901	Yes
Dog	Kriazhev (22)	1929	Yes
Dog	Brogden (6)	1942	No
Monkey	Thorndike (38)	1901	No
Monkey	Kinnaman (21)	1902	Yes
Monkey	Watson (43)	1908	No
Monkey	Haggerty (15)	1909	Yes
Monkey	Sheperd (28)	1910	Yes
Monkey	Witmer (47)	1910	Yes
Monkey	Kempf (20)	1916	Yes
Monkey	Aronowitch and Chotin (1)	1929	Yes
Monkey	Warden and Jackson (41)	1939	Yes
Monkey	Warden, Fjeld and Koch (42)	1940	Yes
Orangutan	Sheperd (30)	1923	No
Gorilla	Yerkes (48)	1927	No
Chimpanzee	Sheperd (30)	1923	No
Chimpanzee	Yerkes (49)	1934	Yes
Chimpanzee	Crawford and Spence (10)	1939	Yes
Chimpanzee	Grzimek (14)	1941	Yes
Chimpanzee	Hayes (17)	1951	Yes

Most workers in this field used one of three methods. The single cage method allows both the previously trained animal and the "observer" to work on the task at the same time. In the observation cage method, originated by Thorndike, the observer watches the "demonstrator" from an adjoining cage. After the observations the demonstrator is removed from the problem cage and the observer transferred into it. The Warden Duplicate

Cage method avoids the delay inherent in the previous situation, by having two cages with duplicate sets of puzzle devices, with the observer able to react immediately on completion of the demonstration.

According to Warden (40) the criteria of "imitation" are: (*a*) the task must be novel and sufficiently complex, (*b*) the response must appear immediately after observing the demonstrator, (*c*) practice must be excluded by the experimental conditions, (*d*) the act of the observer must be substantially identical with that of the demonstrator, and (*e*) a sufficient number of instances must occur, under varied conditions, to eliminate the chance factor. These criteria were actually applied in the studies by Warden and Jackson (41) and Warden, Fjeld, and Koch (42). With respect to other investigations there has been a confusing array of criteria. The complexity of the task has varied considerably, from the complicated puzzles used by Warden and Jackson (41) to the simple "follow the leader" behavior of Miller and Dollard (23). The time allowed for the response to appear was different for each investigator. Some experimenters, notably Haggerty (15) and Kinnaman (21) with monkeys and Berry (4) with cats, allowed considerable practice, only letting an animal observe after it had failed to solve the task by trial and error. The degree of similarity in the response has never been clearly specified among various workers. Finally the number of animals used has generally been very small and the factor of chance has never been ruled out by use of a control group.

Basically, observational learning can be defined in the following fashion. The observer is allowed to observe the actions of a demonstrator who has previously been trained on a problem. Insofar as the observer can profit from this experience, when confronted with the same problem, he has learned by observation. This can be shown either by a more or less complete reproduction of the responses of the demonstrator to the same stimuli, or by a saving in trials or time in the solution of the same problem, as compared with a non-observational performance.

In the further analysis of observational learning it is clear that there are a great number of variables which influence the behavior of the observer. Only two have been subject to systematic investigation. Herbert and Harsh (18), as mentioned above, investigated the effect of the number of observations. With cats as subjects, using five tasks, they found that 30 observations were superior to 15 in all cases. The mean time of both observer groups was less than that of a group which learned the tasks without benefit of observation, except in the case of the 15 demonstration groups for their most difficult task. The other investigation is that of Miller and Dollard (23). Using a light-dark discrimination, they found that eight rats could learn to follow a leader when consistently rewarded for this act. They further showed that this tendency held even when black rats were substituted for white rats as leaders, and when motivation was changed from hunger to thirst.

Another important factor, the discrimination by the observer of the behavior of the demonstrator, has been discussed (5, 23, 31, 32, 34, 35, 41) but never attacked experimentally. In particular, Spence (35) and Bird (5) felt that the observation of an animal consistently getting food in a certain part of the apparatus tends to limit the responses of the observer to this region, with the result that the probability of hitting upon the proper solution is greatly increased. This is essentially a place discrimination. The alternative, that the response of the demonstrator is discriminated, has been implicit in most of the early treatments (39, 44). In this case it is primarily the object manipulated or the act which must be discriminated.

This investigation was designed to do two things: (*a*) to clear up the contradictory results of previous work on observational learning in cats,[3] (*b*) to obtain data on the type of discrimination made by the observer.

B. Apparatus and Procedure

The Warden Duplicate Cage apparatus was employed, with slight modification from the model described in Warden, Jenkins, and Warner (40). This consisted of two adjacent compartments 36″ long, 30″ wide, and 36″ high (*A, B*). A dividing screen of ½″ wire mesh permitted clear observation of the demonstrator by the observer. Two panels were mounted four inches to the right and left of the dividing screen and carried the learning tasks. For a floor plan see Figure 1.

Glass windows were inserted in the removable panels. At the bottom of the panel there was a small opening leading to a wooden runner 24″ long (*C, D*). On the side of the right compartment an equivalent window had been cut into the beaver board, also leading to a runner of the same length (*E*).

The experimenter watched the animals through small holes bored into the beaver board covering the sides of the cage. Illumination was provided by two 150-watt bulbs mounted in reflectors on top of the compartment, giving adequate lighting, but not directed on the puzzle devices, in order to pre-

[3]Thorndike's (37) negative results have been strongly disputed by Hobhouse (19) and Berry (4). Herbert and Harsh (18), who got positive results, used very few cats in their experiment.

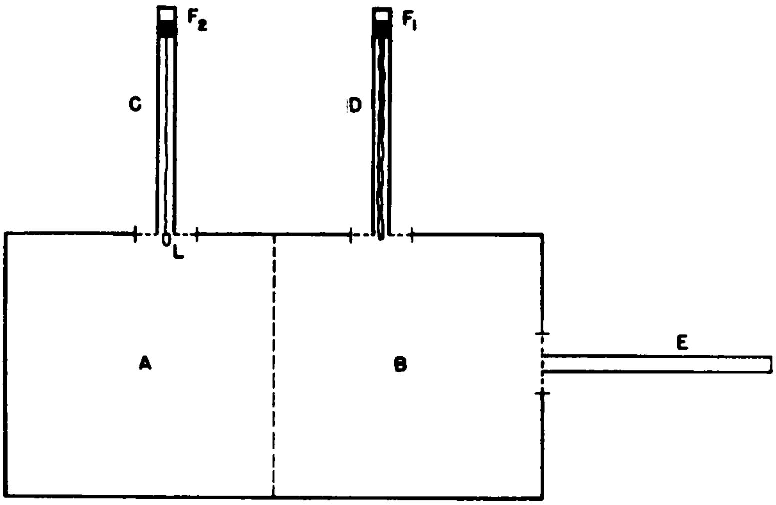

FIGURE 1
FLOOR PLAN OF MODIFIED WARDEN DUPLICATE CAGE
A, B, reaction compartments; C, D, E, runners; F_1, F_2 food carts; L, lever.

vent any place enhancement from this source. An electric fan provided a soundscreen. Two problems were used:

1. *Ribbon pulling.* A small food cart, 2″ x 2″ (F_1) sliding on a runner, could be pulled into the cage by means of a white ½″ grosgrain ribbon 12″ long. The cat had to pull in the whole length of the ribbon in order to reach the food through the opening in the panel.

2. *Lever pressing.* By depressing an articulated lever (*L*), mounted on the end of the runner and projecting into the cage, the cat could release the food cart (F_2), which was then propelled along the runner to the panel by a weighted cord.

C. SUBJECTS

A total of 54 cats was used. The colony was plagued by outbreaks of pneumonitis and cat distemper. Sixteen cats died of disease during the experiment.[4] Three cats were used in standardizing the procedure and are not included among the subjects. Six other cats had to be discarded because they showed no evidence of learning in the experimental situation even by trial and error.

[4]Terramycin, supplied by J. Pfizer & Co., was found helpful against the pneumonitis. Distemper serum was employed with varying success on sick animals. A standard procedure of immunizing all cats on arrival was finally adopted.

The 29 experimental animals ranged in age from six months to a year. Their diet consisted of canned dog and cat food. Canned sardines were used as reward during the experiment. Each new arrival in the laboratory was given a period of adjustment, usually of two weeks, in which it became adjusted to the experimenter, the feeding cycle, and its individual living cage. The animals were fed together in the experimental room and allowed to exercise there several hours a day. They were then returned to their cages in a different room, which had been cleaned in the meantime, and where milk, but no food, was available. They were about 23 hours hungry when used in an experiment. All animals were experimentally naïve.

D. Design

The cats were assigned at random to four groups. Their treatment consisted of three phases as outlined in Table 2.

TABLE 2
EXPERIMENTAL DESIGN

	Phase 1	Phase 2	Phase 3
Group I	Five 15-minute feeding periods in apparatus	15 observations of demonstrator pulling ribbon	20 trials with ribbon, *same position*
Group II	Same	15 observations of demonstrator pressing lever	20 trials with ribbon, *same position*
Group III	Same	15 observations of demonstrator pulling ribbon	20 trials with ribbon, *different position*
Group IV	Same	No observations; trial and error only (Control Group)	20 trials with ribbon

The first phase was an adjustment procedure in which each animal was given a 15-minute feeding period, for five days, with one cat in each compartment and an individual food dish in the middle of the cage.

On the sixth day the learning phase began for the three observational groups (I-III). Each animal was given 15 observations of another cat working in the *adjoining* compartment. All demonstrators had learned the problem previously and were skilled performers. Immediately after the last demonstration, the ribbon was made available to the observing animal. A record was taken of the time required for the cat to pull the food cart to the cage. After the animal had eaten its small piece of sardine, the food cart was reloaded, the ribbon replaced, and another trial commenced.

The trials were given in blocks of five each day in order to minimize the effect of reduced motivation. Each animal received 20 trials over four successive days. The control group (IV) was treated identically with the other groups in the third phase, with another animal present in the duplicate cage to keep the effect of mere social facilitation constant.

Group I was designed to test observational learning with the observer working on the panel in the same relative position as that of the demonstrator. There were 10 cats in this group.

The animals in Group II worked the ribbon at the same place, but had previously observed a demonstrator working the lever. The performance of the six animals in this group tested the effect of enhancing the position of the puzzle device, but required a different set of responses for solution.

In Group III both animals pulled the ribbon. In the demonstrator's cage the ribbon was in the usual place at the back. However, in the observer's cage the ribbon had been placed 45° to the right side. The glass window in the panel at the back of the cage had been replaced by wood, and an opening of the same size in the side of the cage uncovered. In order to solve this problem the animals in the group (six cats) had to turn 90° to find the ribbon.

Group IV learned the task by trial and error and served as the control group.

E. Results

The strongest evidence for observational learning will show up most clearly on the first trial. For this reason the first trial will be treated at some length. Some attention will be given later to the combined results of the first five trials and the learning curves for the first 15 trials.

1. *Results of Trial 1*

The working time measures for Trial 1 for the four groups are shown in Table 3.

Examination of the data revealed a consistent skewness of the distribution of scores and heterogeneity of the variances. The t-test was therefore

TABLE 3
MEDIANS, MEANS, AND *SD*'S IN SECONDS FOR TRIAL 1

Group	*N*	Median	Mean	*SD*
I	10	102	203.10	206.26
II	6	1,702	1,500.17	1,206.24
III	6	194	197.00	95.61
IV	7	531	728.57	466.92

not applicable and, as a first step, it was decided to apply the median test (24, 25) which makes no assumptions about the distribution of scores. Table 4 shows the evaluation of the first trial data by this test, giving both the chi-square values, obtained with Yates' correction, and the probabilities as obtained by Fisher's direct method (12, 13) on the two significant comparisons.

TABLE 4
MEDIAN TESTS ON FIRST TRIAL SCORES

Groups compared	Chi-Square (with correction)	Direct probability
I vs. II	.26 ($P > .05$)	——
I vs. III	.26 ($P > .05$)	——
I vs. IV	3.14 ($.05 > P > .01$)	.03640
II vs. III	.33 ($P > .05$)	——
II vs. IV	.16 ($P > .05$)	——
III vs. IV	4.73 ($.05 > P > .01$)	.02504

The disadvantage of such non-parametric tests is their low sensitivity. In data of this kind a logarithmic transformation is applicable (26) and was found in this case to normalize the distribution. The means, standard deviations and tests of significance of the transformed data are given in Tables 5 and 6.

These results indicate that Group I, the members of which observed the pulling of the ribbon and then had to perform the same task at the same

TABLE 5
MEANS AND *SD*'S OF LOG TIME IN SECONDS ON FIRST TRIAL

Group	Mean log time	*SD*
I	2.0560	.5371
II	2.7901	.9036
III	2.2435	.2410
IV	2.6913	.5539

TABLE 6
TESTS OF SIGNIFICANCE FOR TRIAL 1 AFTER TRANSFORMATION OF SCORES TO LOG TIME

Comparison	Difference	*t*	Level of confidence*
I vs. II	.7342	2.06	.05
I vs. III	.1875	.80	—
I vs. IV	.6353	2.37	.05
II vs. III	.5467	1.43	—
II vs. IV	.0989	.24	—
III vs. IV	.4478	1.83	.05

**P*-values based on the single-tailed *t*-test.

place, profited most from the observation. This is shown by a saving in time over that of the control group, IV. This is the typical "imitation" situation. Group III, which was also required to duplicate the task of the demonstrator, but in a different location, also shows a significant saving on the first trial. Only the animals of Group II, which had observed lever pressing before being confronted with the ribbon at the same place, showed no saving. In fact their scores were generally higher than those of the control group, although the difference is not significant. The time of this group and Group I differ significantly.

2. *Trials 1-5*

Table 7 shows the medians, means, and *SD*'s for Trials 1 to 5.

After making a logarithmic transformation these data were analyzed by the *t*-test. The means are plotted in Figure 2 and the results of the tests of significance summarized in Table 8. The scores of Groups I and III are still significantly below the control group at the .05 level.

TABLE 7
MEDIANS, MEANS, AND *SD*'S IN SECONDS FOR TRIALS 1-5

Group	*N*	Median	Mean	*SD*
I	10	58	111.92	89.21
II	6	146.5	539.77	432.61
III	6	46.5	118.46	90.88
IV	7	108	332.62	262.65

TABLE 8
SUMMARY OF TESTS OF SIGNIFICANCE ON MEAN LOG TIMES FOR TRIALS 1-5

Group	I	II	III	IV
I	x	1.69	.18	2.17†
II	x	x	1.26	.10
III	x	x	x	1.86†

†.05 level on single-tailed *t*-test.

3. *The Learning Curves*

The learning curves for the four groups are shown in Figure 3.

All show a drop from the first to the second trial, with the downward trend continuing for Groups I and II, and for Group IV after an inversion, until the fifth trial. For Groups II and IV the improvement from the first to the second trial was quite rapid. The Learning proceeded irregularly for the rest of the trials. The curves approach a minimum value at 15 trials. The advantage gained by the two groups profiting from observation

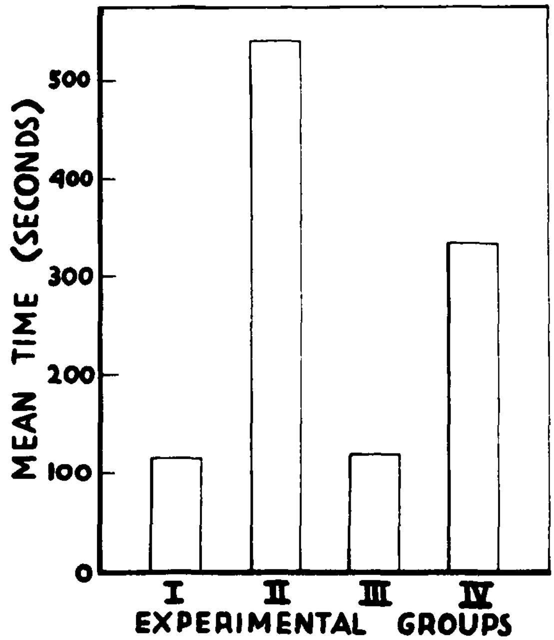

FIGURE 2
MEAN TIME IN SECONDS FOR TRIALS 1-5 FOR THE FOUR GROUPS

persists until the fifth trial. Individual differences and variability from trial to trial were very high and tend to obscure any further trends.

Analyzing the learning process in another way we can set a criterion of one minute or less required to pull in the ribbon in four out of five trials. It was found that Group I required 3.8 trials, Group II 7.7 trials, Group III 4.3 trials, and the control group (IV) 5.6 trials to reach this criterion.

4. *Individual Differences*

All groups showed great individual differences in learning times. There is therefore considerable overlapping in the distribution of scores on the first trial. All but one animal in the control group (IV) took longer than five minutes to pull in the ribbon on this trial. By setting an arbitrary criterion of five minutes we can calculate the percentage of animals in each group falling below this score (Table 9).

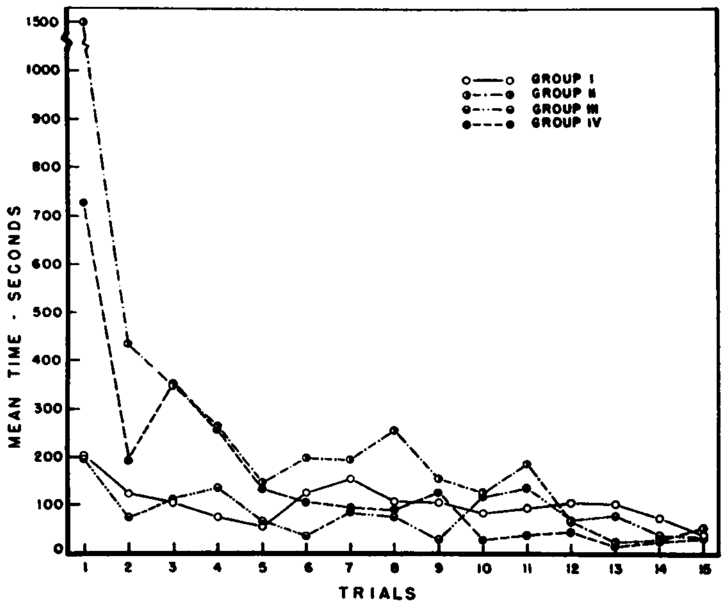

FIGURE 3
LEARNING CURVES FOR THE FOUR GROUPS OF CATS

TABLE 9
PER CENT ANIMALS FALLING BELOW CRITERION SCORE OF FIVE MINUTES

Group	*N*	Per cent
I	10	70
II	6	33
III	6	83
IV	7	14

Using the *t*-test for percentages we find that both Groups I and III significantly exceed Group IV at the .01 level ($t = 2.70$, $df = 15$, and $t = 3.45$, $df = 11$). It should be noted that 1/3 of the cats in Group II also solved the puzzle in less than five minutes. The high average of this group is due to the remaining cats which produced the longest times of all animals. This seems to indicate that some animals profited from observing the place at which the demonstrators worked, while others tended to be negatively influenced by observing a response which was not appropriate to their task.

Observations were recorded on all animals during their stay in the apparatus. A typical animal in Group I, which had observed the ribbon pulled in 15 times before it had been made available to it at the duplicate panel, was Cat 7-I. This animal started to pull on the ribbon almost immediately and was timed at 40 seconds. It is of interest to note that it hooked its claws into the end of the ribbon like the demonstrator. The second trial took 44 seconds, but a washing reaction delayed the time on Trial 3 to 88 seconds. The cat worked smoothly on Trials 4 and 5, taking 48 and 32 seconds respectively. However on the next day the animal responded much slower. On the 6th trial it had abandoned the ribbon after pulling it in part-way and wandered around the cage before resuming work again, taking a total of 83 seconds. A long period of washing broke up Trial 7, after pulling the ribbon about 1/3 of the way in so that the animal took 165 seconds. Distraction by its neighbor in the duplicate cage accounted for a time of 242 seconds on Trial 9. The animal continued very variable and easily distracted, but working smoothly during the actual pulling.

Cat 6-A in the same group was already exploring around its window during the demonstration series. When the ribbon was available it started pulling immediately, using both its teeth and claws. The demonstrator in this case had used its teeth to pull in the ribbon. It took 61 seconds on Trial 1, only 7 seconds on Trial 2, and 22 seconds on Trial 3. On this trial it lost the ribbon once during the process of pulling it in, and from then on discontinued the use of the teeth, using its claws only. Outside of some distraction by the animal in the duplicate cage, this animal continued to learn smoothly during the balance of the 20 trials.

Animal 5-C, which was rather timid, watched from the far corner of its cage. However, when the ribbon was available it went to the window and pulled in the cart half of the way. It then returned to its corner and lay there quietly for about 8 minutes. It then went over to the panel again and pulled the ribbon in within 515 seconds. The second trial was marked by steady work, but the animal was very inefficient. It often failed to thrust out its claws deep enough to catch the ribbon, but pulled in the cart in 319 seconds. The food was secured in 54 seconds on the 3rd trial, although the responding was by no means smooth. Trial 4 was marked by sitting, crying, and washing, delaying the work so that the trial took 116 seconds. Work became smooth subsequently with the later trials constituting one of the better records.

In general the animals in this group tended to be very variable in the early trials and to improve slowly, although the first trials were quite fast as compared with Groups II and IV. On the average there was a loss of efficiency from the last of the trials on the first day to Trial 6, which was the first trial of the second day. The second block of 5 trials was marked by more intervening activity, such as washing, walking around the cage, and interest in the animal in the duplicate cage. Another rise in the learning curve was apparent in the average cat, from the second to the third day. After that the performance generally became quite smooth for the rest of the trials. At least some of the variability from trial to trial may be due to the fact that the cats were never in a state of great hunger, as milk had been available to them since their last feeding 23 hours before the trials since they were young enough to require it.

Animals in Group II had seen the lever pressed before being tested on the ribbon at the same relative position in their cage. With some exceptions they tended to take a very long time before solving the puzzle for the first time. In general they went to the correct place but appeared confused when clawing (or stepping on the ribbon) did not result in the food cart coming to them. Cat 8-B, for example, which took 36 minutes to pull in the ribbon completely, was immediately interested in the ribbon and actually pulled it half-way to the cage in 25 seconds. When nothing happened, it showed no further interest until it had been in the cage 18 minutes. The final solution came when the animal played with the ribbon and accidentally pulled it to the cage.

Animal 8-J jumped to the panel, when the ribbon was inserted, and waited there for food to come to it. It did not solve the problem until vigorous exploration started after 20 minutes in the cage.

This should be compared with an animal in Group III, 8-A, whose record reads: "Waits for a while at division where it had been watching the demonstrator intently, then turns and immediately becomes interested in the ribbon." This animal completed the first trial in 141 seconds. Another animal in this group (2-G) pulled the ribbon at 42 seconds, but did not exert enough energy to move the cart, so that its eventual solution only came in 124 seconds. These animals had observed the demonstrator pulling a ribbon, requiring consistent effort, but had to turn around to solve the same problem at a different place.

The variability from trial to trial seems least obvious in the control group, which, except for the second trial, produced the smoothest learning curve (Figure 3). This suggests that trial and error was a more steady means of fixing the correct response than was observation. The records of the cats also seem to indicate that while the observations had an appreciable influence on early trials in most subjects, some further learning by trial and error took place before the task was smoothly performed. In this connection it is interesting to note that in many cases the observer used the same means of pulling in the ribbon as the demonstrator (whether claws, teeth or both), but might shift its method as the series of trials went on.

As noted before, there were great differences in temperament between individual cats. Of the six cats which had to be discarded, three merely went to sleep when placed in the cage, without paying attention to anything. The other three included two which spent their time viciously hissing and spitting at the demonstrator animal, without any attempt to work. One animal was very active in exploring its cage, climbing up the sides, and clawing at the walls indiscriminately without, however, paying any attention to the ribbon.

The animals which learned showed very much the same type of differences in temperament. Some worked slowly with much interspersed resting and washing. Others were distracted by the animal in the duplicate cage. The third type was very active and fast, but often spent their time running around the cage, climbing up the walls, or clawing the wooden runner instead of the ribbon. These various types of behavior were especially marked during the early trials.

F. Discussion

The results indicate that observational learning occurs in cats, although of limited usefulness in problem solving. In preliminary exploration it had been found that in a more difficult task, such as pulling a string which indirectly opened a door, there was little or no improvement through observation. Pulling at the ribbon is a response which occurs naturally in the cat's behavioral repertoire, but pulling in the ribbon completely requires a moderate amount of skill and persistency.

The response of the observer animal obviously depends upon its perception of the activity of the demonstrator. In general it was found that the cat's interest was first aroused when it saw the other cat securing food. Observation was generally good after that, with some animals standing at the partition and trying to reach the ribbon in the demonstrator's cage. The significantly lower scores of Group III indicate that the majority of the animals in this group discriminated the object manipulated by the demonstrator. The inappropriate responses of Group II confirm the fact that object rather than place discrimination was involved. Cats in Group III did not go to the place where the demonstrators had worked, but paid attention to the ribbon only, regardless of place.

This is in disagreement with much of the work on discrimination in animals, in which spatial discrimination has been found to be easier to learn than object discrimination. It agrees, however, with the work of Harlow (16) on monkeys in which he found object discrimination much easier than spatial discrimination. Spence (36) has pointed out that in object discrimination, such as a circle and square in the Yerkes-Watson apparatus, the animal is actually rewarded for position 50 per cent of the time, since the object is systematically switched from right to left. The choice of the correct object is, of course, rewarded 100 per cent of the time. Learning then depends on the differential in reward between place and object. Thus there is always an interference between spatial and object reward which Spence refers to as "ambiguous" reinforcement. In the case of Harlow's study, as well as in the present experiment, this confusion factor was eliminated with the result that object discrimination was prepotent over place discrimination.

The question has been raised as to whether observational learning is natural or must be acquired during early experience. The previous history of these cats is not known, except for the fact that they had never been used for experimentation. There is, therefore, no answer to the question whether the ability to profit from observation is innate or acquired during early experience.

If observational learning does emerge from early experience, there are several theories that might be used to account for it. For example, Skinner (31) points out that an animal learns to profit from observation when it is reinforced for executing the same responses as another, while it is not being reinforced for a different response. In all our cats there would have been a chance for this particular contingency to occur.

Miller and Dollard (23) analyze observational learning in terms of drive, cue, response, and reward. The response of the observer has to be matched to that of the demonstrator and is dependent on cues provided by the leader. Following their paradigm the essential facts in this experiment may be diagrammed as follows:

	Demonstrator		Observer
Drive	Hunger		Hunger
Cue	Sight of puzzle	dependent	Demonstrator working puzzle
Response	Pulling ribbon	matched	Pulling ribbon
Reward	Food		Food

The response of the observer depends then on the discriminated stimulus of the demonstrator pulling the ribbon. This results in a response which is essentially similar to that of the demonstrator and which leads to food. The reward keeps up the tendency of the observer to repeat the act of pulling in the ribbon at the next trial.

Social facilitation is defined by Crawford (9) as "any increment of individual activity which results from the presence of another individual." In the present experiment possible social facilitation was held constant by the presence of another animal in the duplicate cage in all four groups. In this connection it might be pointed out that Winslow (46) found very little evidence of social facilitation in cats in an experimental runway situation. However, he found that observation of the other cat did influence the behavior of the second cat. As he says: "The two cats observed each other through the wire mesh partition and the preparation that each made for its performance in the runway seemed to depend on which cat the other one saw through the partition. . . . The most common response of the loser was to watch intently as the winner devoured the piece of food." This confirms the present observation that cats tend to pay attention to each other's behavior, especially if food is involved.

The fact that the responses of the observer did not lead to perfect solution of the puzzle on the first trial does not necessarily detract from a conclusion that observational learning took place. Since the behavior of the animals depended on their perception of the demonstrator's act, there is no reason to believe that all of his responses were discriminated. It appears from the results that the benefit derived from observation gave a definite advantage to the observer on the earlier trials, as long as their problem was the same as that which they had observed. The finding that this advantage is not very permanent, and that individual differences in trial and error learning tend to show up strongly in subsequent trials, points to the fact that cats do not make much use of observation learning. They could presumably be trained to do so in the manner of Miller and Dollard's rats.

G. Summary and Conclusions

A total of 29 cats, randomly assigned to four groups, were tested in the Warden Duplicate Cage apparatus. All groups were required to pull in a food cart by means of a 12″ ribbon.

1. Group I was given 15 observations of a trained cat solving the same problem at the same position in the duplicate cage.

2. Group II observed an animal pressing a lever before being presented with the ribbon at the same position in their cage.

3. Group III was required to pull in the ribbon in a different part of their cage after observing 15 demonstrations of the same task.

4. Group IV solved the ribbon problem without demonstrations but with another cat present in the duplicate cage, to equalize conditions.

From an analysis of the results the following conclusions are drawn:

1. The average time of response of Groups I and III was significantly lower than for Group IV (control) on the first trial and also on Trials 1-5, Group II being somewhat higher than Group I. This means that observation was effective in the learning of the task, whether the latter was in the same place or in a different place in the duplicate cage.

2. Observation was effective primarily with the object which the demonstrator manipulated, rather than the place at which he worked. This is shown by the results of Group II in which the observer was required to manipulate a different object, but in the same place as that of the demonstrator. It was further shown by the fact that requiring the animal to turn 90° to the right (Group III) made little or no difference in the amount of observational effect.

3. Inspection of the learning curves shows that the positive effects of observation operate mainly in the earlier trials.

4. A number of suggestions toward a theoretical interpretation of observational learning have been discussed.

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