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Cognitive Map and Latent Learning Tolmans Experiment with the Retrial in Iranian Children

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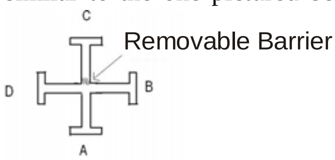
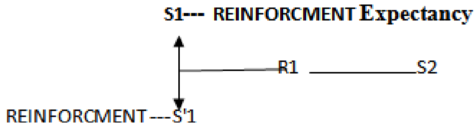
Abstract: His contributions, like his accomplishments, are numerous. Tolman had four main contributions to psychology. The first was showing cognitive maps in rats. The second was latent learning in which he also used the rats to back up his findings. The third was the concept of the intervening variable, and lastly was his support of rats for subject use. To successfully show that rats used cognitive maps rather than just running and turning right, he used his rats as examples. He would run them through a maze similar to the one pictured below.



A was the starting point for the rats. Bwas the goal at which he wanted them to reach. He ran several experiments in which one would have the rats start at A and learn to run to B to get the food. In doing so, they would have to turn right to get the food. Once the rats learned, this he tried a different method. He would start them at point C; if the rat turned right and went to section D, then they were not using cognitive maps, but instead he found they turned left and went to section B proving the use of cognitive maps. (a2zpsychology.com, 2002). This idea that rats don't just learn movements for only rewards but instead learn even when there are no rewards suggests a latent learning theory. Again, by using a rat to run a maze, he could show how this latent learning was possible. The setup would be three different groups with as a control that would start with food automatically. Another second experimental group would not get food until the 7th day. Finally, another third experimental group would not get the food until the 3rd day. Surprisingly, in the two experimental groups, once food was given at the goal point, the rats began to improve their routes after the reward was introduced. After they were fed, the rat began to run the maze better on the next trial, showing that even though there was no reward the rat was still making a cognitive map of the maze. This was evident when the reward was introduced. Tolman coined this phenomenon, "latent learning" and said that this experiment could be extended to humans and that we too use latent learning everyday. From this latent learning theory, he also found "intervening variables". These were variables that could not be observed and. For example, hunger was an intervening variable. He showed that these variables were the actual determinants of a behavior. It forced behaviorists to think in a new light. They could no longer only use the model S-R (stimulus to response), but now had to add the organism in to become S-O-R (stimulus to organism to response) In most of Tolman experiments map cognitive influence in animals studied.In this study the researcher based on series of new experiments with children from five to ten years wich studied the cognitive map and field expectancies on learning effect .It is recommended that the model S1-R1-S2 be changed in to



Key words: CognitIve map, Latent learning, Field expecteancies.

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INTRODUCTION

I shall devote the body of this paper to a description of experiments with rats. But I shall also attempt in a few words at the close to indicate the significance of these findings on rats for the clinical behavior of men. Most of the rat investigations, which I shall report, were carried out in the Berkeley laboratory. But I shall also include, occasionally, accounts of the behavior of non-Berkeley rats who obviously have misspent their lives in out-of-State laboratories. Furthermore, in reporting our Berkeley experiments I shall have to omit a very great many. The ones I *shall* talk about were carried out by graduate students (or underpaid research assistants) who, supposedly, got some of their ideas from me. And a few, though a very few, were even carried out by me myself.

Let me begin by presenting diagrams for a couple of typical mazes, an alley maze and an elevated maze. In the typical experiment a hungry rat is put at the entrance of the maze (alley or elevated), and wanders about through the various true path segments and blind alleys until he finally comes to the food box and eats. This is repeated (again in the typical experiment) one trial every 24 hours and the animal tends to make fewer and fewer errors (that is, blind-alley entrances) and to take less and less time between start and goal-box until finally he is entering no blinds at all and running in a very few seconds from start to goal. The results are usually presented in the form of average curves of blind-entrances, or of seconds from start to finish, for groups of rats.

Tolmans Experiment:

All students agree as to the facts. They disagree, however, on theory and explanation.

(1) First, there is a school of animal psychologists which believes that the maze behavior of rats is a matter of mere simple stimulus-response connections. Learning, according to them, consists in the strengthening of some of these connections and in the weakening of others. According to this 'stimulus-response' school the rat in progressing down the maze is helplessly responding to a succession of external stimuli-sights, sounds, smells, pressures, etc. impinging upon his external sense organs-plus internal stimuli coming from the viscera and from the skeletal muscles. These external and internal stimuli call out the walkings, runnings, turnings, retracings, smellings, rearings, and the like which appear. The rat's central [p.190] nervous system, according to this view, may be likened to a complicated telephone switchboard.

There are the incoming calls from sense-organs and there are the outgoing messages to muscles. Before the learning of a specific maze, the connecting switches (synapses according to the physiologist) are closed in one set of ways and produce the primarily exploratory responses which appear in the early trials. *Learning*, according to this view, consists in the respective strengthening and weakening of various of these connections; those connections which result in the animal's going down the true path become relatively more open to the passage of nervous impulses, whereas those which lead him into the blinds become relatively less open.

It must be noted in addition, however, that this stimulus-response school divides further into two subgroups.

(a) There is a subgroup which holds that the mere mechanics involved in the running of a maze is such that the crucial stimuli from the maze get presented simultaneously with the correct responses more frequently than they do with any of the incorrect responses. Hence, just on a basis of this greater frequency, the neural connections between the crucial stimuli and the correct responses will tend, it is said, to [p.191] get strengthened at the expense of the incorrect connections.

(b) There is a second subgroup in this stimulus-response school which holds that the reason the appropriate connections get strengthened relatively to the inappropriate ones is, rather, the fact that the responses resulting from the correct connections are followed more closely in time by need-reductions. Thus a hungry rat in a maze tends to get to food and have his hunger reduced *sooner* as a result of the true path responses than as a result of the blind alley responses. And such immediately following need-reductions or, to use another term, such 'positive reinforcements' tend somehow, it is said, to strengthen the connections which have most closely preceded them. Thus it is as if-although this is certainly not the way this subgroup would themselves state it-the satisfaction-receiving part of the rat telephoned back to Central and said to the girl: "Hold that connection; it was good; and see to it that you blankety-blank well use it again the next time these same stimuli come in."

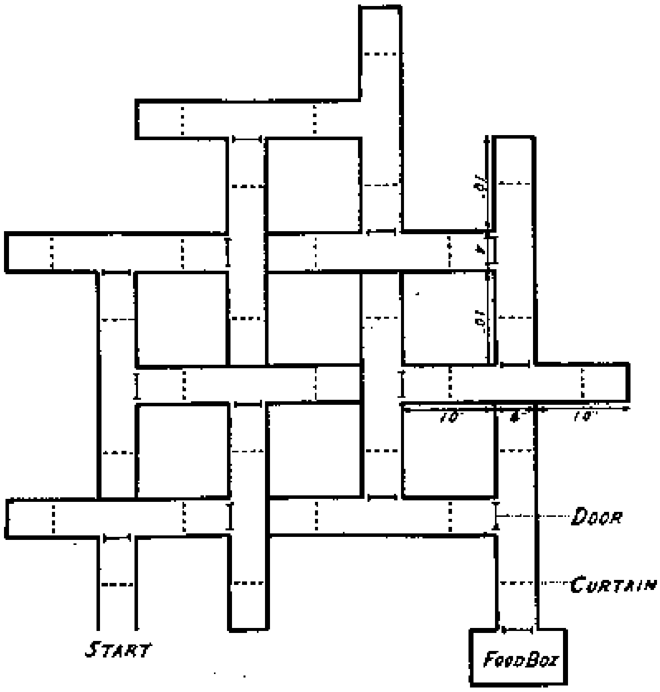


Fig. 1: From M.H. Elliott, The effect of change of reward on the maza per-fromance of rat Univ. Calif. Publ. Pshychol., 1928, 4: 20.

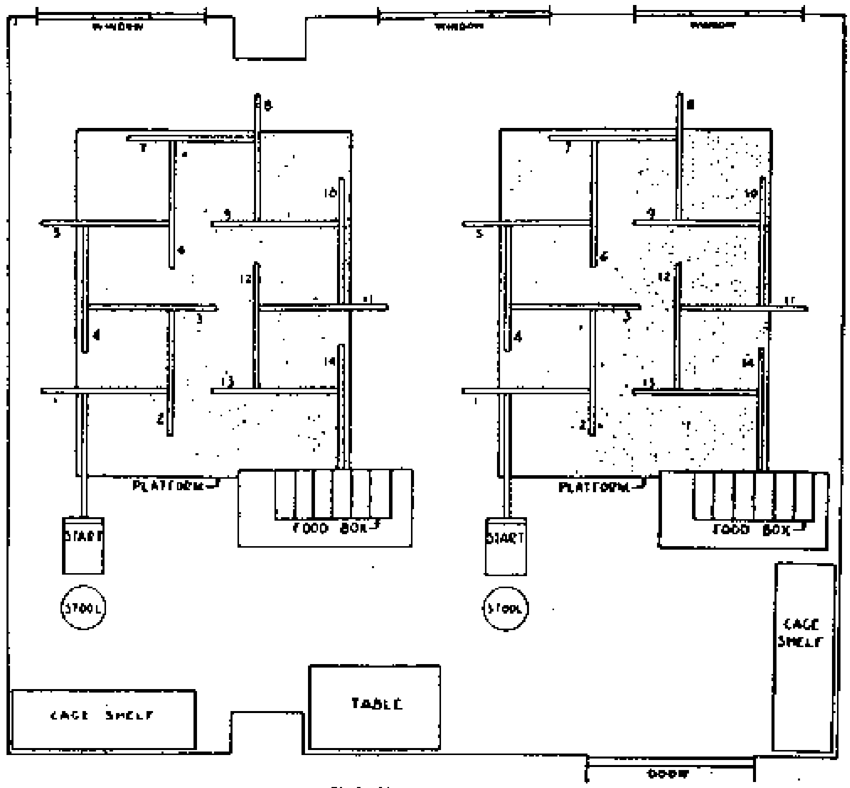


Fig. 2: From C.H. Hondk, the sensory basis of maze learning in rat. Compar. Psychol. Monogr., 1936, 13(4): 4. These were two identical maza placed side by side in the same room.

These theorists also assume (at least some of them do some of the [p.192] time) that, if bad results-'annoyances,' 'negative reinforcements'-follow, then this same satisfaction-and annoyance-receiving part of the rat will telephone back and say, "Break that connection and don't you dare use it next time either."
So much for a brief summary of the two subvarieties of the 'stimulus-response,' or telephone switchboard school.

(2) Let us turn now to the second main school. This group (and I belong to them) may be called the field theorists. We believe that in the course of learning something like a field map of the environment gets established in the rat's brain. We agree with the other school that the rat in running a maze is exposed to stimuli and is finally led as a result of these stimuli to the responses which actually occur. We feel, however, that the intervening brain processes are more complicated, more patterned and often, pragmatically speaking, more autonomous than do the stimulus-response psychologists. Although we admit that the rat is bombarded by stimuli, we hold that his nervous system is surprisingly selective as to which of these stimuli it will let in at any given time.

Secondly, we assert that the central office itself is far more like a map control room than it is like an old-fashioned telephone exchange. The stimuli, which are allowed in, are not connected by just simple one-to-one switches to the outgoing responses. Rather, the incoming impulses are usually worked over and elaborated in the central control room into a tentative, cognitive-like map of the environment. And it is this tentative map, indicating routes and paths and environmental relationships, which finally determines what responses, if any, the animal will finally release. [p.193]

Finally, I, personally, would hold further that it is also important to discover in how far these maps are relatively narrow and strip-like or relatively broad and comprehensive. Both strip-maps and comprehensive-maps may be either correct or incorrect in the sense that they may (or may not), when acted upon, lead successfully to the animal's goal. The differences between such strip maps and such comprehensive maps will appear only when the rat is later presented with some change within the given environment. Then, the narrower and more strip-like the original map, the less will it carry over successfully to the new problem; whereas, the wider and the more comprehensive it was, the more adequately it will serve in the new set-up. In a strip-map the given position of the animal is connected by only a relatively simple and single path to the position of the goal. In a comprehensive-map a wider arc of the environment is represented, so that, if the starting position of the animal be changed or variations in the specific routes be introduced, this wider map will allow the animal still to behave relatively correctly and to choose the appropriate new route.

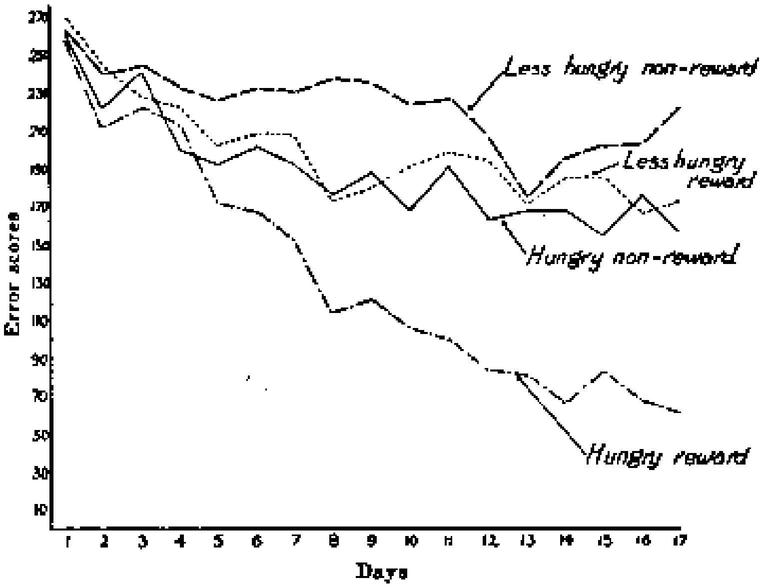
But let us turn, now, to the actual experiments. The ones, out of many, which I have selected to report are simply ones which seem especially important in reinforcing the theoretical position I have been presenting. This position, I repeat, contains two assumptions: First, that learning consists not in stimulus-response connections but in the building up in the nervous system of sets which function like cognitive maps, and second, that such cognitive maps may be usefully characterized as varying from a narrow strip variety to a broader comprehensive variety.

The experiments fall under five heads: (1) "latent learning," (2) "vicarious trail and error" or "VTE," (3) "searching for the stimulus," (4) "hypotheses" and (5) "spatial orientation."[p.194]

(1) *"Latent Learning" Experiments.* The first of the latent learning experiments was performed at Berkeley by Blodgett. It was published in 1929. Blodgett not only performed the experiments, he also originated the concept. He ran three groups of rats through a six-unit alley maze, shown in Fig. 4. He had a control group and two experimental groups. The error curves for these groups appear in Fig. 5. The solid line shows the error curve for Group I, the control group. These animals were run in orthodox fashion. That is, they were run one trial a day and found food in the goal-box at the end of each trial. Groups II and III were the experimental groups.

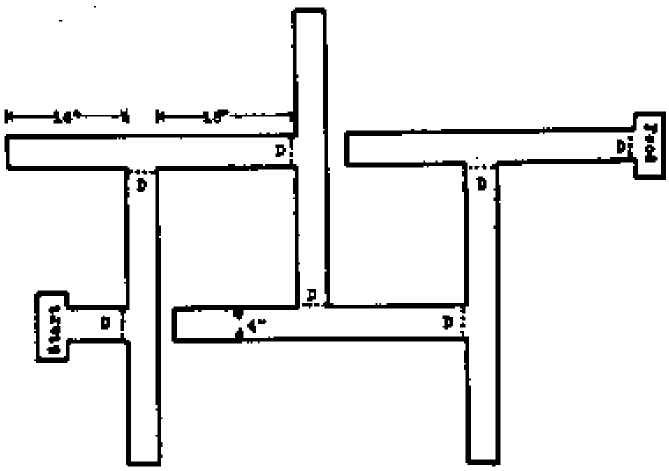
The animals of Group II, the dash line, were not fed in the maze for the first six days but only in their home cages some two hours later. On the seventh day (indicated by the small cross) the rats found food at the end of the maze for the first time and continued to find it on subsequent days. The animals of Group III were treated similarly except that they first found food at the end of the maze on the third day and continued to find it there on subsequent days. It will be observed that the experimental groups as long as they were not finding food did not appear to learn much. (Their error curves did not drop.) But on the days immediately succeeding their first finding of the food their error curves did drop astoundingly. It appeared, in short, that during the non-rewarded trials these animals had been learning much more than they had exhibited. This learning, which did not manifest itself until after the food had been introduced, Blodgett called "latent learning." Interpreting these results anthropomorphically, we would say that as long as the animals were not getting any food at the end of the maze they continued to take their [p.195] time in going through it-they continued to enter many blinds. Once, however, they knew they were to get food, they demonstrated that during these preceding non-rewarded trials they had learned where many of the blinds were. They had been building up a 'map,' and could utilize the latter as soon as they were motivated to do so.

Honzik and myself repeated the experiments (or rather he did and I got some of the credit) with the 14-unit T-mazes shown in Fig.1, and with larger groups of animals, and got similar results. The resulting curves are shown in Fig.6. We used two control groups-one that never found food in the maze (HNR) and one that found it throughout (HR). The experimental group (HNR-R) found food at the end of the maze from the probably the best experiment demonstrating latent learning.



Error curves for four groups, 36 rats.

Fig. 3: From E.C. Tolman and C.H. Honzik, Degrees of hunger, reward and non-reward and maza learning in rat. Univ. Calif. Publ. Psychol., 1930, 4(16): 246. A maza identical with the alley maza shown in Fig. 1 was used.



6-Unit Alley T-Maze

Fig. 4: From H.C. Biodgelt, The effect of the introduction of reward upon the maza performance of rat. Univ. Calif. Publ. Psychol., 1920, 4(8): 117.

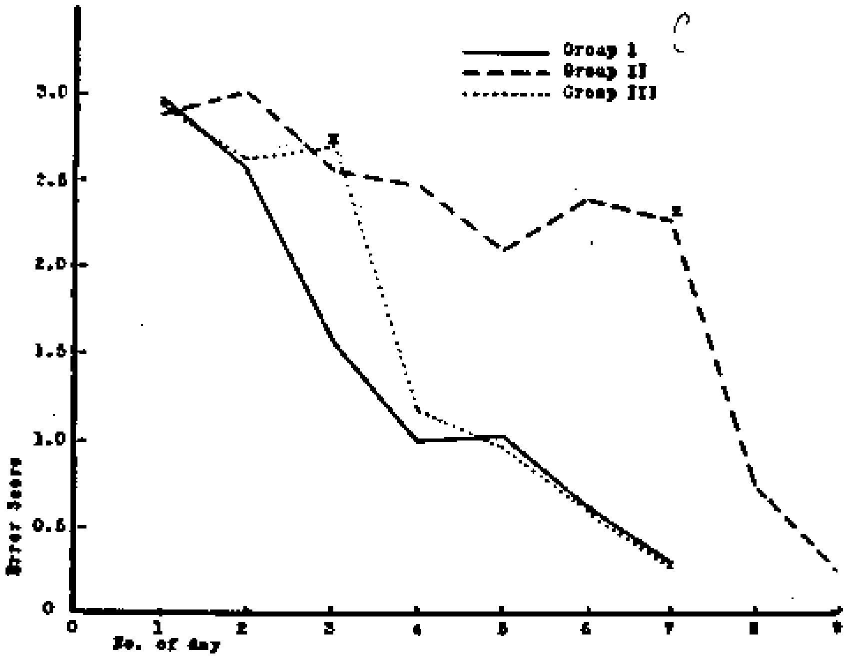


Fig. 5: From H.C. Blodgett. The effect of the introduction of reward upon the maze per-formance of rat. Univ. Calif. Publ. Psychol., 1929, 4(8): 120.

Maccorquodal and Meehl (1953) tried to accurate the terms of Tolman and change the concepts of the theory of him in a way that easily be testable.They have described the Tolman's theory as a S1-R1-S2 in this formula S1 produces a kind of expectation .R1 refers to the way of the action of organism that in according to that expectation is done and S2 shows that according to imaging the organism what will happen as a result of that action in that special conditions. In other words it seems that the organism thinks that under these conditions (S1).if I do this action (R1) a particular experience (S2) will be my portion.for example:seeing a special cross roads and this believe that turning right (R1) will take you to the gas station (S2) If the relationship between

S1-R1-S2 be more repeated, the expectation will be more stronge on the contrary ,the expectation will be weaker.They also emphasised that if a expectation occurs by S1 ,also that expectation will be created by the same simulas.

Retrial of Tolman's Experiments with Iranin Chihdrens:

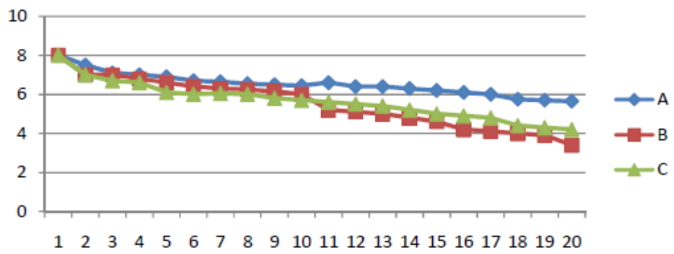
Because of the emphasising of Tolmans experiments on animal Learning, the researcher (author) With year of work concerning education of children wants todo a series of experiments similar to Tolmans tests on children 5 years and ten years old .The description of these experiments is as follows.To study (To consider) the cognitive maps in 5years old children ,a maze as below was designed that in the maze in the point A and B and C as soon as a pen deal to an invisible point in the bottom of the pen would have lights.

Telling the children that in each period they have 60 seconds time in each period with out being a dead three times their lights is on and they get out the maze without error.

Every time without error one point is given to the child .children had 20 opporthunity for doing the test children take part (attended) the test in three groups of 15 persons according to their IQ levels.to the group 1 any reward was given after passing through the maze.to the groups after each success without error a reward is given and to the group 3 after the eleventh time after each correct move ment is strengthen.

In the first stage of the test the results were nearly (almost) similar to the tolmans experiments that is shown is fighure1.

In not strengthen group . there was some decrease in error that children spatial relations.offering the reward after the eleventh stage cause children to use their cognitive map and their errors were decreased.in fact late reward cause better performance than the group that were strengthened reqularlly.



Graph 1: Stage1 experiment.

After two weeks ,the experiment again was repeated .and this time group 1 was selected randomly but they weren't told when they will be strengthened,but in the third times they were randomly encouraged .in the fourth stage, because they expected to be strengthen they had been created improved performance; but in this stage, despite the better performance, they didn't receive any strengthening in the fifth, sixth, seventh, eighth and ninth times the performance approximately back to the firth ,second and third mode and in the ninth stage they again received reinforce but this time unlike the time of four stage,the performance in the tenth stage were not already different with the previous stages because they weren't expected to be strengthened according to the experience of the fourth stage .in eleventh stage they after practice again were reinforced and in twelfth stage, despite the normal performance they were again reinforced and in stage 13 and 14The performance was as same as in the previous steps .After stage 15 they were again reinforced and children were given experience of stage 11,in stage 16 performance of children again improved,but at this stage no reinforcement was received.and in stages 17 to 20 children diden't receive any reinforcement Despite improved performance in these stages,the performance was not as same as the stages 4 and 11.In second and third groups, such experiment was done without any changes in laboratory conditions that in camparision to the previous stage, the performance was a little improved that can be as a result of laten learning effect in their earlier stages.

The Second Stage of Graphs Experiment:

In second test by the investigator,30 children,11 years old ,were selected and they learned two methods to test the accuracy of action beat remember was given .These two action are as follows.

1-method of the nine minus .In this method,firstly we add numbers and after reaching the answer,or more than, we subtract number nine from it and we put remain that is less than ,in A area of the following figure.and then we do the second row of multiplication like the first case and write the remains in B area after that multiple the number of A area in the number of B area If the obtained number was greater than nine ,It is necessary to subtract ,from it while reaching to less than nine and put obtaine number in C area .Then add the product numbers as the first method and a continue to reach number less than ,and then put the obtained number in D area if the C and D area be equal, multiplication operation will be true.for example: 5437*364=1979068

Stage 1: 5+4=9-9=0 3+7=10-9=1

Stage 2: 3+6=9-9=0 4

Stage 3 : 1+9=10-9=1+7+9=17-9=8+6=14-9=5+8=13-9=4

Stage 4: A*B (1*4=4) because four smallerof the itself nine write D area

Because of C ,D row are equal so multiplication operations is true

The second method :diviede product to second row.If obtaind number be equal to the first number so the multiplication operation is correct.

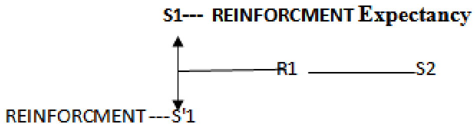
Eg: 5437*364=1979068 1979068 ÷364=5437

So multiplication operation is correct.

After considering that 11 years old children have learned these two methods completely.they were are pointed randomly in 15 member groups and take part in methematices test and theey were asked to test their multiplication operation accuracy with both of this methods.In the first stage ,any significant differences weren,t observed between groups.but after than exam; in first group only the members that have used the first method were encouraged.after two weeks both groups again were tested .this time in the first group that were encouraged and the childrens that had used the second ,use the first method .That means both encourage group and waiting to encourage group used the first solution .The second group that were not encourage despite of using first or second solution, In the second stage used the first solution because of forming the expectation of encouragement.

Canclusion:

The result of 1and 2 stage emphasised on the Tolman's theory that:as cognitive map is formed and improved the performance the field expectation will be made.Inthe organism learns that what cause the others.the S1-R1-S2 mast be changed to



That in it the expectation of reward also must be added to the model in the first stage so S'1 reward and S1 the expectation of reward can be equality effect on R1that is refers to the way of organism operation that cause S2 what ever relation S1-R1-S2 more repeated so the expectation will be strenghte and vice-versa .this relatitions also must be amended that what ever relation S'1-R1-S2 also be more repeated so the expectation will be strength and vice-versa.