The effect of light, tone and movement interferences on selective association behavior in laboratory white rats during day and night

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Abstract
This study investigated the effect of light, tone and movement interference on selective association behavior in laboratory white rats during day and night circle. Subjects included four white laboratory rats (i.e., 2males and 2 females). They were randomly selected and divided into two experimental and control pairs. These pairs were exposed to day and night stimuli such as shock avoidance, and compound antecedent stimuli (i.e., light, tone and movement). Both pairs were exposed to shock avoidance either at nights or during the day to arrive at the level of asymptote. At the next stage, two pairs were exposed to antecedent stimuli by deleting shock reinforcement either at nights or during the daytime to be conditioned during training and reinforcement. The research method was behavior experimental analysis. Test results and observations were analyzed and the findings revealed that there was significant difference between the frequencies of the associations at night or during the daytime ($p<.05$). However, there was not a significant difference between light, tone, and movement association frequencies at night and daytime in both pairs ($p<.050$). [Parviz Askari. The effect of light, tone and movement interferences on selective association behavior in laboratory white rats during day and night. Journal of American Science 2011; 7(7):62-67]. (ISSN: 1545-1003). http://www.americanscience.org.

Key words: light, tone, movement, interferences, stimuli, rats, avoidance training

Introduction

Selective association refers to a kind of association that happens among a compound of conditioned stimulus and unconditioned stimulus more easily in comparison with other compounds (Domjan, 2008). When the test animals learn some compounds among conditioned stimulus and unconditioned stimulus more easily than other compounds, selective association has been happened (Tomarken, Mineka & Cook, 1989; Cook & Mineka, 1990; Wises & Panilio, 1993; Lolardo & Foree, 1976). The visual signs (light), audio (tone) and tasting (taste or smell) are effective signs as conditioned stimuli; however, they can be effective only when accompanying with special unconditioned stimuli or make association. These results indicate the phenomenon of selective association (Lolardo & Droungas, 1989, quoted by Domjan, 2002). According to Balkenus (2000) organism equipped with innate and biological mechanisms for learning; and learning principles related to animal biological willingness significantly. Also, biological limitations have been considered as an important matter concerning learning in animals (Kari, 1998; Domjan & Galef, 1983). Biological limitations can be defined in the simplest form as follows:

The innate capability makes some signs of learning very easy and possible and other kinds of learning very difficult and impossible. The most evident principle of biological limitation is that limitation supports behaviors that have value of survival and avoids behaviors that are destructive for survival (Lefransowa, 2000, translated by Seyyed Mohammadi, 2006). The biological limitations explain that learning is not an integrated and general process but it is a collection of comfortable responses (Zeiler, 2002). It is believed that n each learning experiment, organism's heredity deposit should be considered. The innate capacity limits the associations that animal can learn and responses that will show in a special situation (Moore, 2004).

According to Timberlake (1999; 2005), the animal's behavior can be understood better when it is based on evolutional and ecological environment; we should also be aware of evolutional pre- readiness that is effective in an organism. From the viewpoint of Seligman (1971, quoted in McDonald & Chiappe, 2003), some kinds of animals learn some associations better than other kinds of animals because they have more readiness concerned with their biological characteristics. Accordingly, for some kinds of animals, making a kind of association is difficult because they are not ready to learn it biologically; therefore, animals should capable of having evolutional readiness to acquire such behaviors previously. For example, rats learn pressing the lever to receive food more easily than pecking to a button

tone with negative reinforcement (electric shock) was more than association between tone and food. Doves also made association between light and food easily. Brennan and Riccio (1994) conditioned the rats and observed that they learn association between tone and shock more easily than association than the association between light and shock. On the other hand, rats showed avoidance response by hearing the tone while they did not show the avoidance response by seeing light.

In a collection of responses, Zahoric, Houpt andSwartzman (190) indicated that selective association in conditioning hatred of taste. The results showed that ruminant animals like sheep and goat can avoid food related to disease but disease should happen during a short time after eating food so that animal shows hatred of taste. Boakes and Poli (1975) compared rats and doves in an experiment concerning their responses to food program and found that rats pressed lever in order to get food while doves pecked the button to receive food. Haofman and Timberlake (1998) indicated that rats use audio and smelling stimuli more than visual stimuli for searching in T form maze during day.

Damjan (2005) indicated the animals' motivational behaviors (e.g., hunger, fear, etc.) concerned with doves' attention to the certain kinds of signs. He found that the animals' motivational behaviors like hunger and fear activate a stimulus filter that makes bias animals' attention to certain kinds of signs. When the doves were hungry ad motivated to find food, the showed responses and reactions to the visual signs; however, under the condition of fear that were exited to avoid hunger, they reacted against audio signs. Foree and Lolodo (1973) trained the doves to press the lever with the existence of the compound stimulus consisting tone and red light. For some doves, the reinforcement was avoiding electrical shock and for other group, it was representing food. In the appetitive test, the compound stimulus and light could control the way of pressing the lever strongly; however, control of tone on the response was very slight. On the other hand, in the avoidance test, the compound stimulus and tone controlled most responses than light (Lolordo & Foree, 1973).

Wilcoxon, Dragoin and Kral (1971) in comparison between quails and rats found that quails make association between taste more than visual characteristics. Timberlake (2002) wit comparison of rats' searches during day and night in the maze has shown that he rats without deprivation and reinforcement continue searching in the maze successfully if they are tested during the night. Seligman (1971) indicated that rats learn pressing the lever to get food more easily than pecking to a button; to get food. Doves also learn pecking to a button to receive food more easily than pressing the lever because doves have readiness evolutionally and biologically with pecking to the button and rats by using their class (Ohman & Mineka, 2001). Timberlake (2001) explains that birds like doves use visual stimuli in order to each and peck the grain and they do pecking during day and cannot do it during the night while animals like rats search in environment during night. The rats react to the visual stimuli, tone and movements in their environments during the night. These different activities are due to evolutional and biological pre-readiness (Timberlake, 2001).

The traditional learning theories lead us to this hypothesis that learning laws are general among different kinds of stimuli and responses in all situations for all the animals. These hypotheses are seen in Skinner Operant conditioning and Pavlov Classical conditioning. According to the Skinner's (1938) theory, all animals can be conditioned based on the method of Operant conditioning. According to Pavlov's (1928) Classical conditioning, each stimulus like tone and light can be conditioned in all animals due to the concordance with unconditioned stimuli (mower & klin, 2001). According to Breland & Breland's (1961) viewpoint, no animal can be understood, predicted and controlled well unless there is enough information concerning their instinctive behavior patterns, evolutional history and ecological situation.

Garcia & Loelling (1966, quoted in Malon, 1990) in an experiment on four groups of rats indicated that rates learn association between taste and vomiting while they cannot make association between tone and taste. Rats also make association between light and shock easily. The theory of selective association with recognition behavior idea and emphasis of this idea an animal's evolutional concordance with environment is completely relevant. The rats rely on taste in order to select food in their natural habitats; therefore, there is a kind of genetic or innate relation between taste and intestine reactions that that only facilitates the relation between taste and vomiting (Kari, 2003). Some small birds make association between disease and color sensory pattern better than its taste (Sinervo, 2007).

Brushfield, Luu, Callahan, and Gilbert (2008) compared the learning of acquiring smelling audio and visual activities in laboratory rats. The findings showed that test animals learn acquiring smelling and audio activities during day but they have problem in acquiring visual activities. The results of Panililio and Wises' (2005) research on doves revealed that when light or tone were represented to show avoidance responses separately, association between

equipment to produce shock in the lower part of the cage in the right and left parts and there was an equipment to make vibration in these two parts.

The schedule

Night: The test time during the night was changeable from 10 p.m. to 3 a.m.

Day: The test time during the night was changeable from 9 a.m. to 5 p.m.

First stage of the test

The subjects of the experimental pair (one in the night and the other in the day) were exposed to concurrent conditioning method. In this type of conditioning, the conditioned stimulus is represented in the similar time and also ends with each other simultaneously. Thus the experimental group was exposed to antecedent stimuli of tone, light and vibration with electrical shock reinforcement during 17 days and nights till the subjects learnt avoidance the response completely. When conditioned and unconditioned stimuli were represented to the experimental pair, they went from cage floor where there was no shock and their learning achieved at the approximate level.

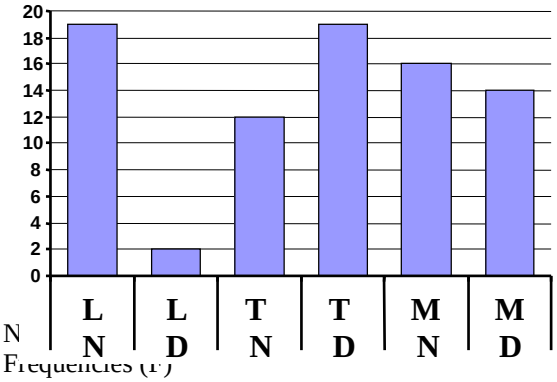
The second stage

The subjects were exposed to antecedent stimuli by deleting shock reinforcement.

Data collection and registration

Data were manually recorded through observation. On the other hand, the researchers recorded data by representing conditioned stimuli and observing animal responses in the form of escape or lack of escape of the rats.

Linear and column representation of the frequency related to avoidance response with existence of antecedent stimuli during day and night is shown in Graphs 1 and 2 concerned with the hypotheses 2 to 6.



N), Frequencies (F)

Graph 1. Frequency of responses

Results

Hypothesis 1: There is meaningful difference between association frequencies during day and night.

moreover, doves learn pecking to a button to receive food more quickly than pressing the lever (Sligman, 1971, quoted in McDonald & Cheap, 2003). Shappir, Jacobs and Lolordo (1980, quoted in Domjan, 2002) found that doves which are conditioned with food as reinforcement may make association between visual stimuli with food more than audio stimuli and food. When doves are conditioned to avoid shock, they may be conditioned with audio signs more than visual signs. Gemberling and Domjan (1982) indicated that the selective association in the laboratory rats. In this research, taste and a lithium chloride and a sensory stimulus (tone) with electrical shock reinforcement was used The results showed that rats cannot make association between taste and shock while rats made association between the sensory stimulus (tone) with electrical shock and test animals could make association between taste and lithium chloride (vomiting).

Shattelworth (1973, quoted in Blue, 1979) in a research on the chickens found that when chickens are thirsty they peck on a button to receive water while they use more visual signs than audio signs.Therefore, the aim of this research was to indicate the effect of light, tone and movement interferences as environmental factors on selective association behavior during day and night cycle among the laboratory white rats. The main concern was that whether in the avoidance conditioning situation with compound conditioned stimulus and unconditioned stimulus or electrical shock reinforcement with changing time situation between conditioned stimuli and unconditioned stimuli throughout day and night. In doing so, the conditioned stimuli which are selected to control avoidance response are similar or not.

Subjects

The subjects under the test included four laboratory white rats (i.e., two male and two females with the age range of four months). The subjects divided into two experimental and control pairs randomly. The experimental pair included two white rats. One of them was tested during night and another was tested during the daytime. The control pair were also two white rats. One of them was tested during night and the other was tested during the daytime. The research method was behavior experimental analysis.

Research procedure

In this research, two similar cages with similar conditions and facilities were used to test the subjects during day and night. One cage was special for experiment and conditioning the rats and another one was considered for the rest of the rats. There was a bell ringing on the top of the cage and a lamp was used to light beside the bell and an electrical

Discussion and conclusion

The aim of performing this research is indicating the effect of light, tone and movement interferences as environmental factors on selective association behavior during day and night in laboratory white rats. In general, the results showed that there is meaningful difference between frequencies of associations' interferences like light, tone and movement during day and night.

According to Tables 1 and 2 as well as Graphs 1 to 3, the results indicated that there is meaningful difference between associations frequency during day and night in the level ($p<0.0.5$) and shows that associations during day and night are different, because rats are night-rover and searcher and active during night naturally; therefore, they response visual stimuli (light) and (audio), (tone) and (movement) almost similarly. Moreover, in the natural factor like cold whether and wound is always rooted in the external stimuli as a result , there is a kind of innate relation between external stimuli and innate relation between external stimuli and external ache during night that facilitates the association between tone and movement and light during night for rats. Rats learn fear of audio stimuli (tone and movement) and visual (light) more easily during night for activity and searching food, because these stimuli prepare better safety and security signs for rats. But rats react less during day to the visual signs and learn fear of audio stimuli more easily during fear of audio stimuli more easily during day according to the previous findings.

This findings are concordant with the research of Timberlake (2002) indicated that rats are more active during night and use all signs in the maze and also concordant with the research of Timberlake and Haofman (1998) indicated that rats use less visual signs during day. Also it is concordant with the research of Brushfield, Luu and co-workers (2008) and research of wises and panlilio (2005).

Also it was seen that the difference between associations frequencies during day in the level ($p<0.05$) is meaningful. Rat's response to tone and movement is more during day, while rat does not show avoidance response to the light during day. Because audio stimuli at tone and movement are responded by rats better during day, for fear is a better signs than tone and movement concerning safety or audio signs during day cause more fear for rats than light. Moreover, it is distinguished that rats use less visual signs for less activity during day and use more smelling and audio signs to search food during day.

These research are concordant with findings of Timberlake (2002), Timberlake and Haofman (1998),

According to table 1 and figure 1, it can be seen that the required value in the level ($p<0.05$) is meaningful; therefore, there is difference between frequency during day and night and hypothesis 1 is approved.

Hypothesis 2: There is meaningful difference between association frequencies during day.

According to Table 2 and figure 1, it is seen that the required value in the level ($p<0.05$) is meaningful; therefore, there is difference between frequency in day and hypothesis 2 is approved.

Hypothesis 3: There is meaningful difference between interferences frequency during night.

According to Table 2 and figure 1, it is seen that the required value in the level ($p<0.05$) is not meaningful; therefore, there is not difference between frequency during night and hypothesis 3 is not approved.

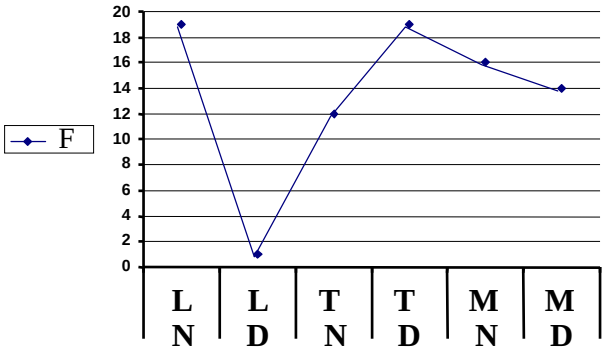
Hypothesis 4: There is meaningful difference between frequencies of light selection during night and day as condition stimulus to make avoidance response. According to Table 2 and figure1, it is seen that the required value in the level ($p<0.05$) is meaningful, therefore, there is difference between frequency of light selection during day and night and hypothesis 4 is approved.

Hypothesis 5: There is meaningful difference between frequencies of tone selection during day and night as condition stimulus in order to make avoidance response.

According to table 2 and figure 1, it is seen that the required value in the level ($p<0.05$) is not meaningful; therefore, there is not difference between frequency of tone selection during day and night and hypothesis 5 is not approved.

Hypothesis 6: There is meaningful difference between frequencies of movement selection during day and night as condition stimulus in order to make avoidance response.

According to table 2 and figure 1, it is seen that the required value in the level of the ($p<0.05$) is not meaningful. Therefore, movement selection during day and night and hypothesis 6 is not approved.



Graph 2. Frequency of responses

more facility in comparison with other associations and the environment and situation within which concordance of stimuli is performed and it can be effective as the differences between various kinds of animal and stimulus situation in finding the kind of selective association. This belief challenges the traditional learning theories that free responses of organism cause conditioning automatically if they are accompanied with reinforcement or if a conditioned stimulus is accompanied with unconditioned stimulus.

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Brushfield and co-workers (2008), Brennan and Riccio (1994). It was distinguished that the associations during night happen almost similarly and rats response to all conditions stimuli during night like tone , light and movement almost equally because rats are more active during nights; therefore, they may use each stimulus to predict danger and since there is more danger during night, rats may response to tone, light and movement. In the natural environment of rats, fear of external factors is always rooted in external stimuli. Therefore, a kind of innate relation is between external stimulus and external ache which are the result of visual and audio signs the same as audio signs and they may suddenly stand by seeing light during night and it maybe rat's innate response to see a cat at night.

The results of this research were concordant with the findings of Timberlake (2002) , Timberlake and Haofman (1998) , Brushfield and co-workers (2008) , Brennan and Riccio (1994). The results indicated that the difference between light association frequencies is meaningful during day and night in the level of ($p<0.05$). The reason at this difference is that the rats are more active during night and have more capability concerning sight than day and since these animals have less activity during day and rest in their habitat they may be less exposed to light during day. Also, it is distinguished that rats have problem in acquiring visual activities during day (e.g., Brushfield and co-workers, 2008). Another difference concerning light associations during day and night was that the rats responded audio signs more than visual signs in the stimulus situation of fear in order to avoid danger during day. These results are concordant with the findings of Timberlake (2002); Timberlake and Haofman (1998); Brushfield and co-workers (2008); Brennan and Riccio (1994); and Domjan (2005). The results showed that rats' responses during day and night to the tone stimulus was almost similar , because rats may response to the environment tones either when they are in their rest place or outside. These result are concordant with the findings of Timberlake (2002); Timberlake and Haofman (1998); Brushfield and co-workers (2008), Brennan and Riccio (1994) and Domjan (2005). Also, results indicated that rat's response to movement stimulus during day and night is almost similar, because rats may response to the environment either when they are in their rest place or outside. These results are concordant with the findings of Timberlake (2002); Timberlake and Haofman (1998); Brushfield and co-workers (2008), Brennan and Riccio (1994) and Domjan (2005).

According to the results of this research it can be said that natural associations or associations that are directly related to organism survival are formed with

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