Learning Psychology:

Classically Conditioning Sniffy: The Virtual Rat

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Abstract

The purpose of this paper is to take an in depth look at the many phenomena of learning psychology. This review will use the Sniffy Virtual Rat Pro book and computer program to examine the basic concepts of the learning. The rat exemplified learning through the basic skills of classical conditioning. The various stimuli of each trial successfully conditioned the rat. Understanding all of these functions will hopefully create a better understanding of the branch of learning psychology and classical conditioning.

*Keywords:* learning, Sniffy, rat, classical conditioning

Introduction

Classical conditioning is what occurs when two stimuli are paired together and presented in many trials and typically allowing one stimulus to predict the other stimulus (Alloway, Wilson, & Graham, 2012). Conditioned stimulus (CS) is the stimulus that has the power to elicit the conditioned response (Alloway et al., 2012). Unconditioned stimulus (US) is the stimulus that has the capacity to elicit a response that can be measured (Alloway et al., 2012). The conditioned response (CR) occurs when the conditioned stimulus is paired with an unconditioned stimulus and learning occurs (Alloway et al., 2012). The automatic response to the US is known as the unconditioned response (UR) (Alloway et al., 2012).

Acquisition is produced by setting up a many of trials in which a CS follows the US in a regular pattern (Alloway et al., 2012). Hitting someone with a nurf gun every time they hear an alarm go off represents acquisition training. The strength of the CS plays a major factor in the speed in which acquisition occurs (Alloway et al., 2012). Hitting someone with the nurf gun, yet varying the tone of the alarm would be an example of varying the strength of the CS. The stronger the CS strength the faster conditioning occurs (Figure 1). Varying the strength of the US affects the speed of acquisition and the how high or low the level of classical conditioning will occur (Alloway et al., 2012). An example of this would be keeping the alarm tone the same but changing the speed of how fast the nurf gun hits the person. The harder the nurf gun bullet the faster classical conditioning should occur (Figure 2). Extinction is presenting the CS many times but not pairing it with the US, the result will cause a decrease in the CR (Powell, Honey, & Symbaluk, 2012). If the alarm kept going off, but the subject was no longer hit with the nurf gun this would be extinction. Eventually, the strength CR which would be flinching to the sound of the alarm would decrease. Spontaneous recovery is what occurs when the CR reemerges after a period of extinction (Powell et al., 2012). This would happen if the nurf gun shot was reintroduced with the alarm. The CR of flinching to the alarm would begin reoccur.

Prior inhibitory conditioning is a conditioning procedure in which the neutral stimulus (NS) becomes associated with the removal of the US (Powell et al., 2012). Inhibitory conditioning slows excitatory conditioning when the NS is associated with the presentation of a US (Powell et al., 2012). An example of this would be hitting someone with an eraser every time someone talks in class. First, every time someone talked the subject would get hit with the eraser for the whole class period, until they started flinching when someone talked. Next class every time someone talked they would not be hit with the eraser. Then the third class period the researcher would reintroduce throwing the eraser every time someone talked, initiating the flinching again. However, it would take them a lot more time because the second class period made the talking inhibitory. Inhibitory measured by response summation is when an inhibitory CS can also stop responding to another excitatory CS with which it has never previously occurred. (Alloway et al., 2012). Trying to wake someone up using light, alarm, bell, and nurf gun would be example of this phenomenon. The first day, they would be woken up with the light and shot by the nurf gun. The second day they would be woken up with the alarm and the light without any nurf gun shot. The third day they would be woken up with the bell and a shot by the nurf gun. Then the fourth day they would be woken up with just the bell. The fifth day they would be woken up with the tone and the bell. Since, the bell has already been conditioned as excitatory it should wake the subject up faster, than the first time compound pairing of the bell and the alarm.

Sensory preconditioning is when a stimulus is conditioned as a CS, another stimulus it was previously paired with can also become as CS (Powell et al., 2012). An example of this would be an advertisement that is seen on TV. The attractive image is the original CS paired with the product the second CS. The positive feelings that someone gets when they see the product is the CR. Higher order conditioning is what happens when a NS that has been paired and associated with a CS thus also becoming a CS (Powell et al., 2012). This could be exemplified with a significant other. You have been conditioned to know that they create the feeling happiness. Then they start wearing a certain perfume or cologne. The originally neutral stimulus of the perfume and cologne is now associated with those happy feelings. From this point forward every time the perfume or cologne is smelled it elicits happiness. Compound conditioning is when two stimuli that have been conditioned are presented and removed at the same time (Alloway et al., 2012). An example of this would be pairing a light and an alarm together with a nurf gun shot to wake someone up. After being presented all together in a trial with the nurf gun shot, if then these stimuli are presented alone without the shot the response of waking up will be moderate. However, if these stimuli occurred in a separate pairing with the shot and then presented alone with no nurf gun shot the response would be stronger. Overshadowing occurs when a conditioned stimulus with a higher salience is paired with another conditioned stimulus with a lower salience in a compound stimulus (Alloway et al., 2012). The high salience stimulus will elicit a greater response and the low salience CS will be overlooked (Alloway et al., 2012). Pairing gunfire with a flickering light and then getting food would elicit salivation. From that point on hearing the gun fire would elicit salvation. However, the light flickering it would elicit very little salivation.

Blocking is the phenomenon whereby one CS inhibits the learning of another CS. (Powell et al., 2012). An example of this would be throwing up every time after eat cotton candy is consumed. Eventually cotton candy and throwing up are automatically associated. However, if one time soda was paired with the cotton candy and throw up followed, the soda would not be associated with throwing up. CS Pre-Exposure Effect is a phenomenon of classical conditioning in which repeated presentations of a CS slow down conditioning when the CS is paired with an US repeatedly (Alloway et al., 2012). An example of this phenomenon would be paring the alarm with no nurf gun shot and then pairing the alarm with the nurf gun shot. Since, the alarm has already been exposed with no nurf gun shot the learning will take a lot slower. US Pre-Exposure Effect is similar to the CS pre-exposure effect, but instead Sniffy receives a series of US trials only (Alloway et al., 2012). This would be exemplified by just shooting someone with a nurf gun to wake them up, then pairing the nurf gun with the alarm. Since, the subject has already been conditioned to the nurf gun it will take longer for learning to occur. Habituation occurs when a decrease in the strength of a certain behavior due to the repeatedly presenting the stimulus that elicited that behavior (Powell et al., 2012). An example of this would be the clock ticking in the classroom. The clock ticking has happen so often that it has become habituated; there is no longer a surprise when the clock ticks. Sensitization occurs when there is an increase in the strength of the desired behavior following repeated presentations of the stimulus that is eliciting the behavior. This concept can be exemplified in many of our servicemen and women returning home from war. They are often sensitized to certain sounds. When they hear the clicking of a pen, the sound could bother them and elicit the alarming behavior. Background conditioning is when things in the environment become the CS and this background information elicits a CR (Alloway et al., 2012). For example, if you are getting an eraser thrown at you every time someone talks in class, then you may be starting to fear the classroom itself. The classroom has now become the conditioned stimulus that elicits the fear.

Stimulus-Stimulus (S-S) model occurs when the NS becomes associated with the US, and therefore a response occurs that is attributed to the US (Powell et al., 2012). A Stimulus-Response model is represented when the NS becomes paired with the UR and comes to gain the same response as the UR (Powell et al., 2012). These two models can be measured using habituation and US devaluation.

Over expectation occurs when two CS’s are paired an US and are presented all together (Alloway et al., 2012). At the end of presenting these compound trials the CS will be lesser in strength than if the CS’s were paired separately (Alloway et al., 2012). An example of this would be pairing a light with an alarm to wake someone up. Originally the light and alarm would be paired alone with the US being the nurf gun shot to wake someone up. However, when you pair both the alarm and the light together with the nurf gun shot, and then separately measure them without the nurf gun shot the wake up response will only be moderate.

**Method**

**Participants**

The participant will include a virtual rat apparatus known as Sniffy. The participant will be used to complete exercises 1-21.

**Procedure**

Exercises 1-21 were completed using the Sniffy Program Manual. Each exercise contains background information, a set of directions, and sample models for viewing purposes. The directions were followed exactly as the manual states. The background was used to identify the purpose of each experiment. The sample models were used to compare and contrast different phenomena of classical conditioning. The results of each experiment were then saved to the computer’s hard drive for viewing purposes.

**Results**

In many of the exercises the phenomena that are being studied can be seen through the movement windows, suppression ratio, CS response strength window, and movement ratio. Sniffy represents basic acquisition of the CR very clearly in the first exercise. The increase can be seen in the CS response strength window, it shows that Sniffy is exemplifying the freezing behavior (See Ex-1 ClassAcq CS response strength). Extinction, another fundamental aspect of classical conditioning can be viewed in exercise two can be understood by looking at both the movement ration and the CS response strength window. In both of these windows it can be seen that in presenting the CS without the US, Sniffy gradually no longer is showing fear like behavior (See Ex2-ClassExt-Movment ratio/CS response strength). Another phenomena related closely to extinction is conditioned inhibition. In exercises ten and eleven it is evident that Sniffy has learned conditioned inhibition. In exercise ten this can be clearly shown through the CS response strength window. In that window it can be seen that the light is producing an above zero response strength, however the tone is producing a below zero inhibitory response strength (See Ex10-Inhibitory1-CS response strength). This inhibitory action is explained by originally pairing the tone with no US. In exercise 11 the bell is added to the experiment creating a compound stimulus. The results are very similar and can be clearly viewed in the CS response strength window (See Ex11-Inhibitory2-CS response strength). In this window it is seen that the bell and light has response strengths greater than zero, however the tone does not. Both the bell and the light were presented separately with US of the shock; the tone was originally presented in a compound stimulus with no shock thus leading to the inhibition. Exercise three outlines what can occur after conditioned inhibition and extinction, spontaneous recovery. Represented in the movement ratio window after a period of time the CS is reintroduced to the US, therefore the CR has remerged (See-Ex3ClassSponRec-movement ratio).

The next step in the classical conditioning process is varying the strength of the CS. In exercise four this is displayed very clearly in the movement ratio for the low tone and the high tone. In the low tone it is displayed that when the CS is slower than the CR is will be obtained slower (See Ex-4 LoToneCS-CS response strength window). In the high tone CS response window the CR is obtained at a very quick speed compare to the low tone (See Ex-4 HighTone CS-CS response strength window). The effect of CS intensity on the weak CS, medium CS, and strong CS can also be seen clearly in Figure 1 (See Figure 1). Next varying the strength of the US can be used to show the relationship between acquisition and classical conditioning. In exercise five the strength of the US is best shown in the movement ratio windows. In the low intensity shock movement ratio, the graph shows that conditioning occurs slower when the US is low (See Ex-5 LowUS movement ratio). The high intensity shock movement ratio graph the conditioning occurs at a fast rate (See Ex-5 HighUS movement ratio). In (Figure 2) the low shock, medium shock, and high shock are all compared with one another. In this figure the differences can be seen in conditioning when there are differences in the intensity of the US.

Sensory preconditioning can be shown through the movement ratio in Exercise 12. In the window it can be seen that there is no CR in stage one, however in stage two both the light and the tone elicit a CR even though the light is not being presented (See Ex12-SPC-movement ratio). This happens because Sniffy has been preconditioned to associate the light with the tone. Higher order conditioning similar to sensory preconditioning can be viewed on CS response strength window of Exercise 13. In stage one the tone is paired with the shock and eliciting the CR and in stage two the light and the tone are paired together. In stage two it can be seen that after the light had been paired with the tone, now both the light and the tone are eliciting the CR (See Ex13-HOC-CS response strength window).

Exercise 6 is comparing classical conditioning through separate pairing and compound pairing. In the compound conditioning trial the light and the tone are presented together with the medium intensity shock. In the CS response strength window the light and tone elicit a medium strength CR that is slowly decreasing by stage two (See Ex6-CompCon-CS response strength window). In the separate pairings trials the light and tone are presented separately and paired separately with the medium intensity tone. The CS response strength window shows that when the two CS’s are paired separately with the US, then there will be a stronger CR response (See Ex6-SepPair-CS response strength window).

Overshadowing occurs when there is an unequal salience between the CS’s in a compound relationship. In Exercise 8 the high tone is paired with the low light and the shock in stage one. In stage two both the light and the tone are presented separately without the shock. The results of this are shown in the CS response strength window. Here it can be seen that the tone elicits a much stronger CR than the light (See Ex8-Overshadow-CS response strength window). Although they were presented at the same time, the light in the first trial was low and the tone was loud and thus the tone overshadowed the light.

Blocking is the result of one of the CS’s already being associated with the CR before being presented in a compound stimulus. In stage one the tone is presented with the medium shock, then in stage two the medium tone is presented with the medium light and the medium intensity shock all together. In the CS response strength window the tone is eliciting the CR and the light is not eliciting any fear behavior (Ex7-Blocking-CS response strength window). The tone originally paired with the shock in stage one has blocked any learning from occurring in stage two. Therefore, Sniffy did not learn anything when the shock was paired with the light and the tone, because he was already conditioned to the tone.

Over-expectation occurs when there is a decline in the CS strength, although it seems like it should be very strong. First, the medium tone and the medium light are paired separately with the medium shock. Then they are both paired separately with no US. They are then part of a compound stimulus paired with the medium shock. Then presented separately again with no US. In the CS response strength window when the medium tone and light were presented separately with no shock learning occurred faster. However, once they were in a compound stimulus the rate at which learning occurs dropped and Sniffy maintained a moderate CR.

CS pre-exposure effect occurs when the CS is presented without a US and then presented with the US; in this case conditioning will occur slower. In stage one the medium tone was paired with no US. Stage two the medium tone is paired with the medium shock. The movement ratio and the CS response strength ratio both show that conditioning is occurring at a very slow rate, because Sniffy was pre-exposed to the CS (See Ex-20CSPE-movement ratio/CS response strength). In Exercise 21 US Pre-Exposure effect is tested. US Pre-Exposure happens when the US or medium shock is presented without the US. In stage one of this experiment the medium shock was presented to Sniffy. In stage two the medium tone was paired with the medium shock. In the CS response strength window during the first stage background conditioning started to occur (See Ex-21USPE-CS response strength). Sniffy started to associate fear with the cage, because whenever he was in the cage he was getting shocked. Also, seen in stage two in the CS response strength window conditioning starts to occur, however it is occurring at a much slower rate than the control group (See Ex-21USPE-CS response strength). Figure 3 represents the relationship between the US and CS Pre-Exposure effect compare to each other and with the control. The graph shows that learning occurs much slower and ineffectively in the US and CS Pre-Exposure effects compared to the control experiment (Figure 3).

In Exercise 19 background conditioning, sensitization, and habituation were all viewed. Three different experiments were conducted use the low, medium, and high intensity US. In the first low intensity US experiment Sniffy was presented with the low shock 50 times. In the fear and sensitivity model, movement ratio, and CS response strength window for the low shock, Sniffy did habituate to the shock and showed no signs of background conditioning (See Ex19-Bkgrl-movement ratio/CS response strength/fear and sensitivity). In the medium intensity shock experiment it can be viewed in the fear and sensitivity model that Sniffy has little to no change in his response to the shock (See Ex19-BkgrM-fear and sensitivity). In the CS response strength window Sniffy shows a moderate level of background conditioning to the cage, but not a significant amount (See Ex19-BkgrM-CS response strength). Finally in the high shock experiment in the fear and sensitivity model Sniffy shows a very strong reaction to the high shock (See Ex-19-BkgrH-fear and sensitivity). In the CS response strength window for the high shock Sniffy represents a very strong background conditioning (See Ex19-BkgrH-CS response strength). The cage now elicits the fearful behavior due to the high intensity of the shock.

Exercise 14 is showing basic acquisition under all for models of conditioning and Exercise 16 is showing higher order conditioning for all four models of conditioning. The models being represented are S-S-S-R, S-S-S-S, S-R-S-R, and S-R-S-S. These letters stand for stimulus in response. In each experiment, each different model is paired with the same US and the CS producing the same CR. In Exercise 14 all of the models the CS response strength and movement ratios are identical and it does show that acquisition did occur (See ALL of Ex14 movement ratio/CS response strength window). Exercise 16 represents a concept already discussed known as higher order conditioning. In this experiment all of the four models were tested using the exact same higher order conditioning conditions. The medium tone was paired with the medium shock and then the medium light was paired with the medium tone. In all conditions the medium intensity light elicited the CR. These can be clearly seen in all models in the movement ratio and the CS response strength window (See ALL of Ex16-movement ratio/CS response strength window).

Exercise 15 is examining the effect of first order conditioning of habituating the UR using all four of the models. In stage one each model is presented with the medium tone and the medium shock. In the second stage each model was presented low intensity shock and then in stage three the medium tone with no US. The results for the S-R-S-S and the S-R-S-R models were identical. These the movement ratio windows exemplified it best that in stage two Sniffy became habituated to the shock and then is stage three he exhibits the fear like responses (See Ex15-HabSRSS/HabSRSR movement ratio). This happens because in the S-R models Sniffy has learned a direction connection between the stimulus and the response. However, in the movement ratio for the models S-S-S-R and S-S-S-S the movement ratios are identical and show in stage two Sniffy becomes habituated to the shock and shows little responses in stage three (See Ex15-HabSSSR/HabSSSS movement ratio). This happens because in the S-S models because the stimulus is associated with the other stimulus, not the response. This same effect can be seen when looking at the effect of higher order conditioning when extinguishing the first order. The CS response strength for the S-S-S-S and the S-R-S-S models are identical. The CS response strength represents that even though the light was being presented Sniffy was not responding to this (See Ex17-HOCExtSRSS/HOCExtSSSS-CS strength window). In the S-R-S-R and S-S-S-R models in the movement ratio it can be seen that even though the tones effect is wearing off, Sniffy is still responding to the light (See Ex17-HOCExtSRSr/HOCExtSSSR-CS strength window). The S-R model has built a direct connection to the light and the shock and that will not diminish.

Another way this pattern can be shown is through higher order conditioning of habituating the UR. The CS response strength window for the S-S-S-R model exemplifies that the CS for the first order tone becomes habituated; however the CS for the higher order conditioning light is still eliciting a response (See Ex18-HOCHabUSSSR CS response strength window). This occurs because Sniffy has learned that the light and the tone had a direct S-R connection, therefore he was able to respond to the light even if he was no longer responding to the tone. The CS response strength for the S-S-S-S model shows that Sniffy had become habituated to both the light and the tone, because the S-S connection was not strong enough to maintain the CR (See Ex18-HOCHabUSSSS CS response strength window). The S-R-S-S and the S-R-S-R CS response strength and movement ratio are identical. These models both contained the S-R association so it can be seen in the CS response strength window that the CS for the first order and higher order conditioning remain unchanged (See Ex18-HOCHabUSSRSS/HOCHabUSSRSR CS response strength window). This is due to the fact that they have the strong S-R connection and will respond to both CS’s, the movement ratio for both models exemplifies this too (See Ex18-HOCHabUSSRSS/HOCHabUSSRSR CS movement ratio).

**Discussion**

In going through each of the exercises I found that they all were very interactive and for the most part they accurately represented the points appropriately. The earlier activities, 1-13 were very straight forward in what they were trying to accomplish. I found that it was very easy to master the basic concepts of classical conditioning through these exercises. This made it very easy to build a foundation for the other more complicated exercises. The way that the exercises were presented in the Sniffy schedule made the exercises flow together very well. However, it was a little confusing jumping from chapter to chapter. It would’ve been nice if the book had done a better job of putting the activities that went together in sequential order. It was very easy to follow the activities when looking at the Sniffy schedule, but the book made it a little more difficult. I found exercises 19, 20, and 21 particularly interesting. It was very easy for me to follow them and I think that they really clicked with me. I particularly liked that we had to make graph comparing 20 and 21 that really helped with understanding the difference between the US and the CS. The graph being labeled incorrectly did throw me off briefly. Exercises 14-18 were probably my least favorite. Although, I understood the point that they were trying to get across it felt very repetitive. I do understand that they were representing very different parts of the four model concept, but I felt like it only confused me more. Those exercises were trying to accomplish something very interesting, but I felt like I missed the point on a lot of it. All in all I think that the Sniffy program to this point is very helpful and great tool in learning the basics and more complex aspects of classical conditioning.

References

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*Figure 1*. Compares the CS intensity to the rate at which conditioning occurs, the stronger the CS

the faster conditioning occurs.

*Figure 2.* Compares the US intensity to the rate at which conditioning occurs, the stronger the US

the faster conditioning occurs.

*Figure 3.* Compares the rate at which conditioning occurs when exposed to the US and the CS are pre-

exposed. This figure shows that when there is no pre-exposure learning occurs faster.