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## Fixed interval reinforcement schedule

Modified: 2020-03-27 One of the major discoveries of operant conditioning was that not only do reinforcers have the power to cause responses to be made more often, but that how and when those reinforcers are delivered also affects the pattern of responses. Controlling the how and when of reinforcement is a reinforcement schedule. Schedules are of two main types, time-based and response-based. Time-based schedules usually contain the word interval, as in time interval. Response-based schedules usually contain the word ratio, referring to the ratio of responses over time. Fixed interval (FI) schedules reinforce any response made after a given interval measured from the preceding reinforcement is reinforced. A given interval is indicated by the addition of a number to the letter FI (minutes, usually).Thus, in FI 5 the first response which occurs five minutes or more after the preceding reinforcement is reinforced. (Thanks to Julie Vargas) Fixed ratio (FR) schedules deliver a reinforcer based upon a constant number of responses. For example, a FR-15 schedule would deliver a reinforcer every 15th response. Variable ratio (VR) schedules are similar to fixed ratio, except that the number of responses required for a reinforcer changes each time. So, a VR-15 schedule would deliver a reinforcer over an average of 15 responses, not on every 15th response. Let's examine some everyday examples of reinforcement schedules and their effects. A paycheck is a good example of an FI schedule. Workers get a check once a week, for example, if they show up and work. They do not get rewarded for working harder, or penalized for working less. Workers who work by the piece or by the job, piecework, are paid more if they produce more, and are paid less if they produce less. Piecework is an example of an FR schedule. Workers typically work harder on FR schedules than they do on FI schedules. Gambling is the classic example of a VR schedule. Part of the allure of gambling is its uncertain payoff. Imagine a slot machine that paid off every 10th time; only the 10th pull would be exciting. A real slot machine, on the other hand, pays off on a random basis, so each pull is exciting. VR schedules maintain behavior at very high rates. About the best everyday example of a VI schedule that I can think of is working for a shady character. This person pays you, but you never know when payday is going to be. It could be a week, two weeks, a month. So, you don't work very hard. You would probably jump to another job if the pay were the same but given regularly. Back to Chapter 6 Lectures There are several options in terms of reinforcement schedules that can be used for behaviour modification. In this text I will provide you with a quick description of each of the different simple schedules and a couple of examples for each (one human example and one animal training example). I will also offer a couple of considerations for people debating the idea of which schedule to use for a given situation. Early in my career I was told that, in general, a good way to go about training animals would be to use a continuous schedule of reinforcement for teaching a new behaviour and to then maintain the behaviour using a “variable schedule of reinforcement”. This is a very broad statement and one that seems to make sense to someone being introduced to animal training. However, is this really the best option to go about when training animals? And what do people mean when they mention “a variable schedule of reinforcement”? Let's start by defining the most common types of simple schedules of reinforcement according to Paul Chance's book Learning and behavior (2003; figure 1). Figure 1 – The most common types of simple reinforcement schedules The simplest type of reinforcement schedule is a Continuous reinforcement schedule. In this case every correct behaviour that meets the established criteria is reinforced. For example, the dog gets a treat every time it sits when asked to do so; the salesman gets paid every time he sells a book. Partial Schedules of reinforcement can be divided into Fixed Ratio, Variable Ratio, Fixed Interval and Variable Interval. In a Fixed Ratio reinforcement schedule, the behaviour is reinforced after a certain amount of correct responses has occurred. For example, the dog gets a treat after sitting three times (FR 3); the salesman gets paid when four books are sold (FR 4). In a Variable Ratio reinforcement schedule, the behaviour is reinforced when a variable number of correct responses has occurred. This variable number can be around a given average. For example, the dog gets a treat after sitting twice, after sitting four times and after sitting six times. The average in this example is four, so this would be a VR 4 schedule of reinforcement. Using our human example, if the salesman gets paid after selling five, fifteen and ten books he would be on a VR 10 schedule of reinforcement, given than ten is the average number around which his payments are offered. In a Fixed Interval reinforcement schedule, the behaviour is reinforced after a certain behaviour has happened, but only when that behaviour occurs after a certain amount of time. For example, if a dog is in a FI 8 schedule of reinforcement it will get a treat the first time it sits, but sitting will not produce treats for the next 8 seconds. After the 8 second period, the first sit will produce a treat again. The salesman will get paid after selling a book but then not receive payment for each book sold for the next 3 hours. After the 3-hour period, the first book he sells results in the salesman getting paid again (FI 3). In a Variable Interval reinforcement schedule, the behaviour is reinforced after a certain variable amount of time has elapsed. The amount of time can vary around a given average. For example, instead of always reinforcing the sit behaviour after 8 seconds, that behaviour could be reinforced after 4, 8 or 12 seconds. In this case the average is 8, so it would be a VI 8 schedule of reinforcement. The salesman could be paid when selling a book after 1, 3 or 5 hours, a VI 3 schedule of reinforcement. The next question would be ‘How do the different schedules of reinforcement compare to each other?’. Kazdin (1994) argues that a continuous schedule of reinforcement or at the very least a “generous” schedule of reinforcement is ideal when teaching new behaviours. After a behaviour has been learned, the choice of which type of reinforcement schedule to use becomes somewhat more complex. Kazdin also mentions that behaviours maintained under a partial schedule of reinforcement are more resistant to extinction than behaviours maintained under a continuous schedule of reinforcement. The thinner the reinforcement schedule for a certain behaviour, the more resistant to extinction that behaviour is. In other words, the learner presents more responses for less reinforcers under partial schedules when compared to a continuous schedule of reinforcement. According to figure 2 we can see that, in general, a variable ratio schedule produces more responses for a similar or lower number of reinforcers than other partial schedules of reinforcement. In many situations it also seems to produce those responses faster and with little latency from the individual. This information, along with my own personal observations and communication with professionals in the field of animal training, makes me believe that when trainers use the broad term “Variable Schedule of Reinforcement” they usually mean a variable ratio schedule. Figure 2 – Behaviour responses under the most common types of partial schedules of reinforcement (Chance, 2003; Kazdin, 1994; Schunk, 2012). A variable ratio schedule might elicit the highest response rate, a constant pattern of responses with minimal pauses and the most resistance to extinction. A fixed ratio has a slightly lower response rate, a steady pattern of responses and a resistance to extinction that is dependent on the ratio used. A fixed interval schedule produces a moderate response rate, a long pause in responding after reinforcement followed by gradual acceleration in responding and a resistance to extinction that is dependent on the interval chosen (the longer the interval, the more resistance). A variable interval has a similar response rate, a steady pattern of responses and is more resilient to extinction than a fixed interval schedule. These characteristics of partial schedules of reinforcement are summarised in table 1. Table 1 – Characteristics of the most common types of partial schedules of reinforcement (Wood, Wood & Boyd, 2005). With all these different types of schedules, each with different characteristics you might be wondering: “Do I need to master all of these principles to successfully train my pet at home?” The quick and simple answer is “No, you don’t”. For most animal training situations, a continuous schedule of reinforcement will be a simple, easy and effective tool that will yield the results you want. Doing a training session with your dog in which you ask for behaviours on cue when the dog is in front of you (sit, down, stand, shake, play dead) could be very well maintained using a continuous schedule. A continuous schedule of reinforcement would be an efficient and easy approach and it would allow you to change the cue or stop a behaviour easily (faster extinction) if you change your mind about a given behaviour later. One could argue that a variable ratio schedule would possibly produce more responses with less reinforcement, and a higher resistance to extinction for these behaviours. One of the disadvantages of this option would be the possibility of a ratio strain (post-reinforcement pauses or decrease in responding). Some specific situations might justify the maintenance of a behaviour using partial schedules of reinforcement. For example, when a dog has learned that lying down on a mat in the living room results in reinforcement, the dog's carer could maintain this behaviour using a variable interval schedule of reinforcement, in which the dog only gets reinforced after varying amounts of time for lying on the mat. Martin and Friedman (2011) offer another example in which partial reinforcement schedules could be helpful. If a trainer wants to train a lion to make several trips to a public viewing window throughout the day, the behaviour should be trained using a continuous schedule to get a high rate of window passes in the early stages. The trainer should then use a variable ratio schedule of reinforcement to maintain the behaviour. They do advise however, that this would require “careful planning to keep the reinforcement rate high enough for the lion to remain engaged in the training”. The process of extinction of a reinforced behaviour and is more resilient to extinction than a fixed interval schedule. These characteristics of partial schedules of reinforcement are summarised in table 1. Table 1 – Characteristics of the most common types of partial schedules of reinforcement (Wood, Wood & Boyd, 2005). With all these different types of schedules, each with different characteristics you might be wondering: “Do I need to master all of these principles to successfully train my pet at home?” The quick and simple answer is “No, you don’t”. For most animal training situations, a continuous schedule of reinforcement will be a simple, easy and effective tool that will yield the results you want. 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In those situations, you should remember to follow each bridge with a backup reinforcer, plan your training well and keep the reinforcement rate high enough for the animal to remain engaged. Have fun with your training! Bailey, B., Bailey, M., (1998). “Clickersolutions Training Articles - Ratios, Schedules - Why And When”. Clickersolutions.com. N.p., Accessed 2 February 2018.Chance, P. (2003). Learning and behavior (5th ed.). Belmont: Thomson Wadsworth.Kazdin, A. (1994). Behavior modification in applied settings (5th ed.). Belmont: Brooks/Cole Publishing Company.Martin, S., Friedman, S.G., (2011, November). Blazing clickers. Paper present at Animal Behavior Management Alliance conference, Denver, Co.Pryor, K. (2006). Reinforce Every Behavior?. Clickertraining.com. Retrieved 2 February 2018, from D. (2012). Chapter 3: Behaviorism. In Learning theories: An educational perspective (6th ed., pp. 71-116). MA: Pearson.Wood, S., Wood, E., & Boyd, D. (2005). 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