THE EFFECTS OF JACKPOTS ON RESPONDING AND CHOICE IN TWO DOMESTIC DOGS

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The current study investigated the impact of delivering a jackpot on response rate and response allocation in two domestic dogs. For the purpose of this research, a jackpot was defined as a one-time, within-session increase in the magnitude of reinforcement. Two experiments were conducted to investigate the effects of delivering a jackpot in both single-operant and concurrent schedule procedures. Experiment 1 investigated the impact of a one-time, within-session increase in the magnitude of reinforcement on response rate in a single-operant procedure. Results of Experiment 1 showed no clear change in response rate after the delivery of the jackpot. Experiment 2 investigated the impact of a one-time, within-session increase in the magnitude of reinforcement on response allocation in a concurrent schedule procedure. Results of Experiment 2 showed an increase in response allocation to the jackpotted contingency in both subjects. These results suggest that a jackpot, as defined here, has no effect in single-operant procedures while having an effect in concurrent schedule procedures. These effects are similar to those reported in the magnitude of reinforcement literature.

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INTRODUCTION

Within the animal training community delivering a jackpot is a commonly used practice and is widespread. Despite this popularity, the use of a jackpot has not been scientifically explored. The conditions under which a jackpot may be effective as well as the effects of using a jackpot have not been experimentally investigated.

Published definitions of a jackpot share common characteristics. A jackpot is frequently discussed as the delivery of a temporary, large reinforcer (Fisher, 2009; Pryor, 1984) that is unexpected by the subject (Burch & Bailey, 1991; Honolulu Zoo, 2008; Pryor, 2006). It is commonly used within a training session immediately after a “break through,” that is, the jackpot is contingent upon a high quality approximation (Fisher, 2009; McConnell & London, 2003; Miller, 2001; Pryor, 1984, 2006).

Typically, definitions describe a jackpot as an increase in the magnitude of reinforcement (Pryor, 1984). The term magnitude can be discussed in reference to intensity, quantity or duration (Hoch, McComas, Johnson, Faranda & Guenther, 2002). These distinctions also exist in how a jackpot is defined. Some depict a jackpot as an increase in the quantity of reinforcement, such as the delivery of 10 treats rather than the standard 1 treat reinforcer (Fisher, 2009; McConnell & London, 2003; Pryor, 1984). It has also been suggested that a jackpot can be the introduction of a high value reinforcer or an increase in the duration of reinforcer delivery (Fisher, 2009; Miller, 2001). While McConnell and London (2003) suggest a combination of all three such as, “giving a dog 10 to 15 pieces of an extra yummy treat one at a time.”

Despite commonalities in how a jackpot is defined in the animal training community, there are reported differences in when a jackpot should be utilized. Fisher (2009) reports that a jackpot should be delivered at the start of a session to immediately establish to the subject that you are capable of delivering high value reinforcement. Others suggest that a jackpot should be delivered at the very end of the training session (Aloff, 2002).

The aforementioned dimensions of a jackpot are certainly worthy of investigation. However, based on the most frequently reported dimensions of a jackpot, it was defined for the purpose of this research as a one-time, within-session increase in the magnitude of reinforcement. Magnitude, as discussed with respect to this research, is referencing an increase in the quantity of reinforcement.

Although the effects of delivering a jackpot have not been experimentally investigated, a great deal of attention has been given to magnitude of reinforcement. A jackpot as defined here is a manipulation of the magnitude of reinforcement by increasing the magnitude of reinforcement within a session. However, it differs from traditional magnitude research in that it is a one-time increase in reinforcement delivered within a session. That is, once the increase has occurred for one response the reinforcer value is then immediately returned to its previous level. As such, a general review of magnitude of reinforcement is warranted.

There has been a great deal of variability in the results of magnitude of reinforcement literature (for reviews, see Belke, 1997 & Reed, 1991). Some research has pointed to a positive relationship between increasing the magnitude of reinforcement and responding (Catania, 1963; Hoch, McComas, Johnson, Faranda & Guenther, 2002; Hutt, 1954). For example, Weatherly, McSweeny and Swindell (2004) reported an increase in response rate when the magnitude of reinforcement was increased as well as a decrease in response rate when the magnitude was decreased. Additionally, Heyman and Monaghan (1994) reported that response rate was a negatively accelerated function of reinforcement rate.

A similar positive relationship has also been reported between delivering a jackpot and responding. Some ascertain that jackpots can be effective in improving responding in fearful or unresponsive animals (Pryor, 1984). Others suggest that they have positive effects and can increase motivation (Fisher, 2009; McConnell & London, 2003). Although these reports do not present a functional definition of motivation, it is likely they are referencing an increase in response rate. As Weaver and Watson (2004) point out, what many refer to as intrinsic motivation translates in a behavioral perspective to task performance and persistence.

Other research in magnitude of reinforcement has pointed to a negative relationship (Harzem, Lowe & Priddle-Higson, 1978; Roscoe, Iwata & Rand, 2003; Leslie, Boyle & Shaw, 2000). In one example, Belke (1997) reported that when reinforcer duration was increased, rates of both lever pressing and running decreased. To add more confusion, some have found mixed or even few effects of manipulating reinforcer magnitude (Keesey & Kling, 1961; Reed & Wright, 1988).

Similarly, it has also been suggested that jackpots can have a negative impact on responding. Burch & Bailey (1999) theorized that a jackpot will result in decreased responding or even diminish the effects of standard reinforcers if over used. Fisher (2009) also noted that jackpots should be used sparingly. Neither offers a definition of what would constitute an appropriate amount of usage. These statements appear to be in accord with discussions on the role of satiation on diminishing the effectiveness of a repeatedly presented reinforcer (Koehler, Iwata, Roscoe, Rolider & O'Steen, 2005; Leslie et al., 2000; Weatherly et. al, 2004).

An additional negative report was presented by Alexander (2006) who posed the subject of delivering a jackpot to a group of assistance dog trainers on an electronic mailing list. She described an overwhelmingly negative response to delivering a jackpot from this community of applied dog trainers. Specifically, she reported that the majority of the trainers responded by suggesting that offering a jackpot can “interrupt the flow of training and focus the dog on the food, rather than the task” (para. 2).

A possible explanation for such inconsistencies in the magnitude of reinforcement literature is that experimental conditions may play a large role. One such condition that has been examined is the impact of schedules on reinforcer magnitude effects. After examining published findings, Trosclair-Lasserre, Lerman, Call, Addison, and Kodak (2008) theorized that inconsistencies may be due, in part, to single-operant versus concurrent schedule procedures. They point to a large body of data showing a positive correlation between responding and magnitude in concurrent schedule procedures. They also note that in single-operant procedures correlations vary from positive, to negative, to negligible.

It has also been suggested that reinforcement magnitude is most effective when manipulated within a session rather than between sessions (Neuringer, 1967; Doughty & Richards, 2002; Weatherly, McSweeney & Swindell, 2004). These findings could be explained by examining the contrast theory. “Contrast views suggest that increased reinforcement magnitudes will increase performances only in those situations that allow contrast effects to develop” (Reed, 1991 p.110). A within-session shift in the magnitude of reinforcement would be such a situation in which there would be a clear contrast between reinforcer magnitudes. This phenomenon would seemingly support the effectiveness of the jackpot, in that a jackpot is a manipulation of reinforcement magnitude within session. However, a jackpot is temporary manipulation, not a permanent shift as in the above research. As such, it would be valuable to explore the effects of a temporary shift within a session.

The current study investigated the impact of jackpots, as here defined, on response rate and choice in domestic dogs. Two experiments were conducted to investigate the effects of jackpots in both a single-operant and concurrent schedule procedure. Experiment 1 investigated the impact of a one-time, within-session increase in the magnitude of reinforcement on response rate in a single-operant procedure. Experiment 2 investigated the impact of a one-time, within-session increase in the magnitude of reinforcement on response allocation in a concurrent schedule procedure.

METHODS

Participants

Two domestic dogs, *Canis familiaris,* participated in this study. Both dogs were cared for and housed as domestic pets in a home environment. Each dog was fed twice daily and weights were stable throughout the experiment. Both dogs were current on all vaccinations and determined to be in good health and body condition by veterinary examination. Subject 1, Pepper, a neutered male Boston terrier, was 8 years old at the start of the study and 9 at its completion. At the time of the experiments Pepper had extensive free shaping and clicker training experience and responded systematically to more than 20 cues. Subject 2, Stitch, a beagle/Boston terrier mix, was 2.5 years old at the start of the study and 3.5 at its completion. Stitch had no formal training at the start of the study and responded reliably only to the “sit” cue. These dogs were chosen as participants because of the wide range of shaping experience, from none to extensive, that they represented. Neither dog had any experience with a jackpot prior to the experiment.

Setting

All experimental sessions were conducted in a small room in a home environment where distractions could be minimized. The experimental area consisted of a 1.83 m wide by 2.13 m deep area enclosed on three sides by white walls with white tile flooring. The target consisted of a solid yellow foam ball 23.5 cm in circumference attached through the center to a 3.23 cm diameter piece of balsam wood. The target stick from ball to tip measured 47.5 centimeters. A small piece of string was attached through a hole at the end of the stick opposite the ball to form a small loop. The target was suspended to the wall with a nail through a locking c-clap attached to the end of the string. The center of the yellow ball hung at the approximate height of each subject's nose. This height was determined by measuring the height of the dog's nose while in a standing position with the head held erect. The target stick was located at the midpoint of the wall opposite the open side of the experimental area. A ceramic bowl measuring 35.48 cm in diameter was located five feet directly in front of the target. A stool for the experimenter was placed one foot to the right of the bowl. Three feet behind the experimenter's stool another stool was located. This stool held a Flip Mino® **(**Pure Digital Technologies LLC, San Francisco, CA**,** www.theflip.com) video camera on a Flip Mino® tripod. For each experimental session, the experimenter was seated on the stool located one foot to the right of the bowl. This experimenter was equipped with a box style clicker, a timer and a dog treat pouch containing the reinforcers. The food was delivered by dropping it into the bowl located five feet in front of the target. Bil Jac Little Bites® (Bil-Jac Foods, Medina, Ohio**,** www.biljac.com) dog treats were used as reinforcers. The reinforcing function of these treats was determined during pre-training when they were used to shape and maintain a behavior for both subjects. Additionally, they were chosen for their consistent size, shape, and texture.

Each session began when the dog entered the experimental area. Prior to the session start, the dog was kept behind a gate at the entrance to the experimental area. At the start of the session, the dog was released into the area and the session began when the first target touch occurred. All sessions were held between 2 and 4 PM, prior to feeding the dogs their daily afternoon diet, with morning diet having been given no later than 9 AM. No additional food items were given to the dogs prior to sessions on experimental days. Sessions were not conducted on days in which the normal daily routine for the dog had been altered.

Measurement

All experimental sessions were videotaped with a Flip Mino® camera. The video from each experimental session was used to collect data. During viewing, data were collected with the Rosales-Ruiz data capture system. This computer software program recorded data by pressing or holding the keyboard keys of a computer. Each behavior was assigned a key and when the behavior was observed the corresponding key was depressed and held down for the duration of the behavior. A depressed key resulted in a data record of the behavior occurrence. The software program recorded the occurrence of a behavior in consecutive .11s intervals.

Four dependent variables were continuously recorded in each session: touch target, check feeder, approach target, and consume food. Frequency of occurrence was recorded for target touching. A target touch was defined as the dog's nose making contact with the ball on the target. Frequency of occurrence was also recorded for check feeder. The check feeder behavior was defined as the occurrence of sniffing, exploring, licking, and consummatory behaviors that occurred within 3 feet of the bowl when no food was in the bowl. Duration was recorded for target approach. A target approach was defined as the dog orienting its body position away from the bowl and moving toward the target until it touches it. Duration was recorded for target consumption. Total consumption time was calculated by adding together consumption time for all responses in a session. Consumption was defined as beginning when the top of the dog's nose crossed into the top of the food bowl and ending when the nose crossed out of the top of the food bowl. If treats were delivered outside of the bowl, the behavior ended when the final treat was no longer visible on camera. A fifth dependent variable, post-reinforcement-pause, was calculated by totaling all time after consumption ended until the next target response began. This measure included time spent engaged in the target approach and feeder checking behaviors as well as any time spent engaged in undefined behaviors after consumption ended but prior to the next target touch. The average post-reinforcement-pause was calculated for each session.

Consistency, a form of reliability, was assessed by comparing the observer's score for one session to a score previously determined for that same session also calculated by the same observer. The previously determined score was calculated as data collection occurred and time between comparison samples ranged from 30 to 102 days. This score comparison was done for one session in each condition for both subjects. Agreement for four dependent variables was calculated by dividing each session into consecutive 0.11 s intervals. The number of intervals in which there was agreement was divided by the number of agreements plus the number of disagreements and multiplied by 100%. Mean agreement for target responses was 95.7%. Mean agreement for consumption responses was 92.5%. Mean agreement for check feeder responses was 98%. Mean agreement for approach feeder responses was 91.3%. This agreement demonstrates reliability of the recording system. Agreement of 100% was not achieved for any behavior, including the target behavior which was easily visible. This is likely the result of the recording system that measured behavior in 0.11s intervals, thus requiring exact precision for perfect agreement to occur.

Experiment 1

Pre-training

During pre-training, both subjects were trained to respond reliably to the presence of the target in the experimental area with a target touch behavior. This was accomplished by reinforcing successive approximations in the direction of the target followed by reinforcing only target touching. During this phase, all target responses were followed by one treat delivered in close proximity to the target. When stable responding to the target was observed, the bowl was introduced and treats were then placed in the bowl. Both subjects readily consumed treats from the bowl and stable responding to the target was maintained.

Procedure

In the baseline condition, each target response was continuously reinforced with one treat. Each session was conducted for 60 seconds after the first target response. In the jackpot 5 condition, all but one target responses were followed by one treat, and once in each session a target response resulted in five treats. This one-time increase was delivered between 20-30 seconds after the first target response.

Each session in the jackpot 5 condition lasted for 60 seconds after the first target response plus any subsequent time spent consuming the jackpot. In the jackpot 10 condition, 10 treats were delivered as the jackpot.

Experimental Design

An ABACAC design was used for Pepper and an ABACA design was used for Stitch. Baseline conditions were designated as A, jackpot 5 conditions as B, and jackpot 10 conditions as C.

Experiment 2

Pre-training

During pre-training, both subjects were trained to respond reliably to the presence of two targets in the experimental area with an alternating target touch behavior. Initially, a touch to either target was followed by one treat. When stable responding was observed, only alternating responses from one target to the other were reinforced. A left target touch response had to be followed by a right target touch. Conversely, a right target touch response had to be followed by a left target touch. Each correct individual target touch was reinforced, and the dog returned to the food bowl before the subsequent alternating response occurred. No reinforcement was given if the subject repeated a target touch behavior to the right or the left target, rather than alternating between them.

Procedure

Experiment 2 was conducted with the same participants and in the same setting as Experiment 1. However, the apparatus differed in that no target stick was mounted on the wall. In its place, two identical flat, blue plastic circles 9 cm in diameter were placed on the wall. The circles were placed equidistant from the midpoint of the wall the at the dog's nose height. Session length was determined by the number of responses. In baseline, sessions ended after a total of 12 responses. In the jackpot conditions, sessions ended after a total of 13 responses. Sessions were videotaped and data were collected as in Experiment 1. However, target touches were further differentiated between left and right responses. The final 8 target responses in each session were used in data analysis.

During baseline, the first 4 alternating responses were reinforced. Once a target was touched repeated responses to the same target were not clicked or reinforced, but a touch to the other target was reinforced and the process repeated until 4 responses were reinforced. This was followed by 8 reinforced target responses with no alternating requirement. In the jackpot left condition, sessions began by reinforcing the first 4 alternating responses as in baseline. This was followed by a jackpot, a one-time increase in magnitude of reinforcement of 10 treats, for the first left response immediately following the 4 alternating responses. If a right response occurred following the alternating responses, it was not clicked or reinforced. The jackpot right condition proceeded as the jackpot left condition but differed in that the first right response following the alternating requirement was followed by 10 treats.

Experimental Design

An ABACACAC design was used for Pepper and an ACABABA design was used for Stitch. Baseline conditions were designated as A, jackpot left conditions as B, and jackpot right conditions as C.

RESULTS

Touch Target

Experiment 1

Figure 1 shows the rate of target touching during baseline and jackpot conditions for both Pepper (top graph) and Stitch (bottom graph) in Experiment 1. In the initial baseline condition, Pepper emitted between 12 and 15 responses per minute from Session 1 to Session 14. From Session 15, continuing to the end of baseline, responding remained between 14 to15 responses per minute with the exception of two data points of 13 responses per minute. During jackpot 5, more variability was seen. Responding ranged from 13 to 14 responses per minute throughout with two low data points of 9 and 5 responses per minute. In Baseline 2, variability increased again. Initially responding ranged between 12 and 14 responses per minute with one low data point of 8 and one high of 15 responses per minute. This was followed by an increase, with responses per minute ranging from 15 to 17 after which responding again decreased and stabilized between 13 and 14 responses per minute. In 10, there was an initial decrease in responding with first three sessions ranging from 12 to 14 responses per minute. This was followed by a small increase to between 14 and

15 responses per minute that maintained for the rest of the condition with one data point of 13 and two of 16. In Baseline 3, responses consistently ranged between 13 and 16 responses per minute. In the second jackpot 10 condition, there was a gradual increase in responding across the first four sessions to a high of 18 responses per minute. This was followed by variable responding ranging from 13 to 17 responses per minute for the remainder of the condition.

In the initial baseline condition, Stitch emitted between 8 and 16 responses per minute from Session 1 to Session 16. From Session 17 to the end of the condition, his responses ranged from 14 to 16 responses per minute with one high data point of 17 responses per minute. In jackpot 5, responding ranged between 8 and 15 responses per minute for the first three sessions. It then immediately recovered to between 14 to 16 responses per minute for the remainder of the condition with one high of 17 responses per minute and one low of 13 responses per minute. In Baseline 2, responses per minute ranged between 13 and 16 for the first seven sessions. Thereafter, responding stabilized at 14 to 15 responses per minute for the remainder of the condition. In jackpot 10, responding dropped to 12 to 14 responses per minute for the first 5 sessions in the condition. This was followed by a return to between 14 and 16 responses per minute for the remainder of the condition, with one session yielding a low of 13 responses per minute and another yielding a high of 16 responses per minute. In Baseline 3, responding was stable, ranging from 14 to 16 responses per minute throughout.

Experiment 2

Figure 2 shows the rate of right position target touching responses during baseline and jackpot conditions for both Pepper (top graph) and Stitch (bottom graph) in Experiment 2. In the initial baseline condition, Pepper's responding decreased over the first four sessions with a range of 1 to 4. In right jackpot, responding ranged between 3 and 6 responses per minute in Sessions 5 through 8. This was followed by a decrease to between 2 and 4 responses per minute for the final 4 sessions. In the second baseline condition, responding was stable at 4 responses per minute in Sessions 15, 16, and 17. Thereafter, responding gradually increased with a range of 3 to 8 responses per minute. This was followed by a decrease in responding to between 5 and 7 responses per minute for the final 3 sessions in the condition. In jackpot left, responding initially ranged between 6 and 8 responses per minute for four sessions and then decreased to a between 3 and 4 responses per minute for the remainder of the condition. In the third baseline, condition responding ranged between 5 and 7 responses per minute with the exception of one data point of 4 responses per minute. In the second left jackpot, condition responses ranged from 3 to 5 throughout the condition. In Baseline 4, responses ranged between 4 and 7 responses per minute in Sessions 72 through 77. The range of responses in the final 3 sessions of this condition was between 0 and 6. The first three sessions in the final jackpot left condition were consistent at 4 responses per minute. This was followed by a range of 3 to 5 responses per minute for the remainder of the condition.

In the initial baseline condition, Stitch emitted between 3 and 8 responses to the right target per minute. In jackpot left, responding decreased gradually over the first three sessions in the condition, ranging from 3 to 7 responses per minute and ending with between zero and two responses per minute in the final 4 sessions. In Baseline 2, responding immediately increased to between 3 and 5 responses per minute in the first three sessions. Responding then decreased gradually to a range of 1 to 2 responses per minute for the last 4 sessions in the condition. In jackpot right, much variability occurred with responses ranging from 1 per minute to 5 per minute. In the Baseline 3, responding decreased to 1 response per minute for the first four sessions in the condition. In the final 4 sessions, responding ranged between 0 and 1 responses per minute. In the second right jackpot condition, all responses were between 1 and 2 per minute. In the Baseline 3, responding decreased to between 0 and 1 responses per minute throughout.

Check Feeder

Experiment 1

Figure 3 shows the rate of feeder checking responses during baseline and jackpot conditions for both Pepper (top graph) and Stitch (bottom graph) in Experiment 1. In the initial baseline condition, Pepper emitted between 11 and 14 responses per minute, except in 2 sessions in which he emitted 10 responses per minute. In jackpot 5, responding remained consistent with baseline, ranging between 11 and 14 responses per minute with the exception of one low data point of 9 responses per minute. More variability occurred in Baseline 2. In this condition, responding ranged between 7 and 14 responses per minute with one low occurrence of 0. In jackpot 10, there was an overall increase in rate of responding. Response rates in this condition ranged from 9 to 17 responses per minute. In all but four of the 19 sessions, there were between 13 and 14 responses per minute. In the third baseline, condition responding immediately fell to 0 for the first session. This was followed by a return to 13 responses per minute and then a gradual decrease in responding. The condition ended with sessions ranging between 9 and 12 responses per minute. In the final jackpot 10 condition, there was an immediate and sustained increase to 12 to 15 responses per minute. The exceptions were three data points, one at 11 responses per minute, one at 16 responses per minute, and one at 17 responses per minute.

In the initial baseline condition, Stitch emitted 1 to 4 responses per minute from Session 1 to 18. From Session 19 to the end of the condition responding stabilized to between 0 and 1 response per minute. In jackpot 5, responding immediately increased to between 3 and 8 responses per minute for the first five sessions. Responding then decreased gradually and stabilized to between 2 and 3 responses per minute for the remainder of the session with one data point of 0 responses per minute. In the second, baseline condition responses decreased, ranging between 0 and 2 responses per minute with one data point at 3 responses per minute. In jackpot 10, responding increased immediately with the first three sessions with a range of 4 to 6 responses per minute for the first three data points. Throughout the condition responding ranged between three and seven responses per minute with the exception of two data points for sessions of 1 response per minute. In the third baseline, variability in response rates continued as in the previous condition but rates were lower, ranging from 0 to 5 for the first 6 sessions. Thereafter responding stabilized at 0 to 1 response per minute for the remainder of the condition.

Experiment 2

Figure 4 shows the rate of feeder checking responses during baseline and jackpot conditions for both Pepper (top graph) and Stitch (bottom graph) in Experiment 2. In the initial baseline condition, Pepper had a gradual increase in responding from 0 to 3 responses per session over 4 sessions. In jackpot right, responding ranged between 0 and 4 responses per session. In the second baseline condition, responding remained relatively stable with between 0 and 2 responses per session throughout with the exception of one session in which there were 3 responses per session. In jackpot left, responding increased and the majority of sessions had response rates ranging from 2 to 5 responses per session. One session had 1 response per session. In Baseline 2, responding dropped rapidly and stabilized at 0 responses per session throughout the session with the exception of 1 session in which there was 1 response per session. In the second left jackpot condition, responding ranged between 1 and 3 responses per session for the first seven sessions in the condition. It then decreased to between 0 and 1 response per session for the final 8 sessions in the condition. In Baseline 3, responding decreased to between 0 and 2 responses throughout. In the third left jackpot condition, responding was highly variable with a range of 0 to 6 responses per session.

In the initial baseline condition, Stitch emitted between 0 and 2 responses per session. In the jackpot left, responding increased to between 3 and 4 responses per session for the first three sessions and then decreased to between 1 and 3 responses per session for remainder of the condition. In Baseline 2, responding ranged between 0 and 2 responses per session throughout. In right jackpot, responding ranged between 0 and 2 responses per session with the exception of one session in which 3 responses were emitted. In Baseline 3, the first three data points ranged from 0 to 3 responses per session followed by a decrease to between 0 and 1 response per session for the rest of the condition. In the second right jackpot condition, responding decreased to 0 responses per session for the first three sessions in the condition. This was followed by an increase with a range of 1 to 2 responses per session for the remainder of the session with the exception of one data point of 9 responses. In Baseline 4, responding decreased to between 0 and 1 response per session for the first three sessions followed by a decrease to 0 responses per session where it maintained for the remainder of the session.

Consume Food

Experiment 1

Figure 5 shows the total consumption time per session in seconds during baseline and jackpot conditions for both Pepper (top graph) and Stitch (bottom graph) in Experiment 1. In the initial baseline condition, Pepper's average consumption ranged from 7.52 s to 13.36 s in Sessions 1 to 17. From Session 18 until the end of the condition, it ranged between 10.84 s and 12.62 s. In jackpot 5, greater variability was observed. Consumption times in this condition ranged from 3.18 s to 15.67 s. In Baseline 2, more variability occurred. The range of the initial 7 sessions in this condition was 5.57 s to 12.87 s. This was followed by a small, gradual increase in time with a range of 8.64 s to 11.25 s for the remainder of the condition. In the jackpot 10, the range of values increased overall to 13.25 s to 19.25 s. In Baseline 3, there was an overall decrease in time with a range of 7.52 s to 11.81 s. In the second jackpot 10, there was an initial increase from the previous condition with the first three data points in the session ranging from 18.15 s to 22.75 s. This was followed by a gradual decrease with the final three data points ranging from 12.02 s to 15.32 s.

In the initial baseline condition, Stitch's average consumption ranged from 5.61 s to 15.31 s in Sessions 1 to 20. From Session 21 until the end of the condition, it stabilized and ranged between 8.43 s and 11.43 s. In jackpot 5, there was an immediate increase with the first three data points ranging between 11.03 s and 19.56 s. This was followed by a gradual decrease in Sessions 44 through

51 with a range of 12.53 s to 18.30 s. The condition ended with an increase in the final three data points with a range of 13.50 s to 17.51 s. In the second baseline condition, consumption varied from 8.66 s to 14.88 s in the initial 7 sessions. Thereafter, consumption time consistently ranged between 8.99 s and 11.24 s with the exception of one data point of 12.50 s. In the second jackpot 10, consumption time was variable with data points ranging between 17.99 s and 21.83 s with the exception of two data points of 15.69 s and 28.65 s. In Baseline 3, consumption time increased gradually with a range of 9.95 s to 13.43 s.

Experiment 2

Figure 6 shows the total consumption time per session in seconds during baseline and jackpot conditions for both Pepper (top graph) and Stitch (bottom graph) in Experiment 2. In the initial baseline condition, Pepper's average consumption time ranged from 4.73 s to 6.35 s. In right jackpot, there was an immediate increase in consumption time with a range of 9.42 s to 14.27 s. In Baseline 2, there was more variability and a decrease with a range of 4.38 s to 7.22 s. In jackpot left, there was an increasing trend throughout the condition with a range of 12.81 s to 18.75 s. In Baseline 3, responding decreased as compared to the previous condition and remained stable with a range of 5.44 s to 6.79 s. In the second jackpot left condition, consumption times increased with a range of 10.49 s to 15.29 s. In Baseline 4, consumption times decreased and ranged from

5.48 s to 7.86 s. In the third jackpot left condition, consumption time increased with a range of 11.11 s to 18.52 s.

In the initial baseline condition, Stitch's average consumption time showed an increasing trend with a range of 5.15 s to 7.61 s. In jackpot left, there was an immediate increase in consumption time with a range of 11.15 s to 17.40 s. In Baseline 2, there was more variability and an immediate decrease with a range of 4.29 s to 7.87 s. In jackpot right, there was again an immediate increase and greater variability with a range of 9.98 s to 16.51 s. In Baseline 3, variability decreased but was still present with a range of 5.25 s to 8.0 s. In the second right jackpot condition, consumption time increased with most consumption times ranging from 10.73 s to 16.62 s with the exception of one data point at 21.87 s. In Baseline 4, consumption times decreased and ranged from 4.81 s to 6.55 s.

Post-Reinforcement-Pause

Experiment 1

Figure 7 shows the average post-reinforcement-pause time (PRP) per session in seconds during baseline and jackpot conditions for both Pepper (top graph) and Stitch (bottom graph) in Experiment 1. In the initial baseline condition, Pepper's average PRP ranged from 1.41 s to 2.67 s in Sessions 1 to 14. From Session 15 until the end of the condition, it ranged between 1.33 s and 1.98 s. In jackpot 5, a gradual increase in the PRP time occurred, with the first three data points in the condition ranging from 1.86 s to 2.08 s and the final three ranging from 2.20 s to 2.82 s. One high data point of 6.13s occurred in this condition. In the second baseline, more variability occurred. The range of the initial 6 sessions in this condition was 1.41 s to 5.44 s. This was followed by a decrease in PRP time with a range of 1.30 s to 1.64 s for the next 10 sessions. In the final 8 sessions in Baseline 2, PRP time increased with a range of 1.72 s to 2.29 s. In jackpot 10, most PRP times were between 1.60 s and 2.11 s with three times measuring between 2.36 s and 2.86 s. In Baseline 3, there was an overall decrease in PRP time with the majority of session times ranging between 1.25 s and 1.84 s with three sessions measuring 2.03 s, 2.15 s, and 2.22 s each. In the second jackpot 10, condition PRP time increased and stabilized with all sessions ranging between 1.61 s and 2.05 s.

In the initial baseline condition, Stitch's average PRP ranged from 1.50 s to 4.53 s in from Sessions 1 to 19. From Session 19 until the end of the condition, it stabilized and ranged between 1.38 s and 1.84 s. In jackpot 5, variability and overall PRP time increased with a range of 1.37 s to 2.83 s. In the second baseline condition, PRP times consistently ranged between 1.49 s and 1.96 s with the exception of one data point representing 2.16 s. In jackpot 10, PRP time decreased gradually, with the first three PRP times in the session ranging between 1.81 s to 2.2.0 s and the final three ranging between 1.52 s and 1.61 s. In Baseline 3, PRP time decreased further with a range of 1.35 s to 1.74 s with the exception of one data point of 2.47 s.

Experiment 2

Figure 8 shows the average post-reinforcement-pause time (PRP) per session in seconds during baseline and jackpot conditions for both Pepper (top graph) and Stitch (bottom graph) in Experiment 2. In the initial baseline condition, Pepper's average PRP ranged from 1.31 s to 1.40 s. In jackpot right, the average PRP ranged between 1.29 s and 2.15 s. In the second baseline, a gradual increase occurred over the first nine sessions with a range of 1.42 s to 2.24 s. This was followed by a gradual decrease with a range of 1.19 s to 1.94 s for the remainder of the condition. In jackpot left, there was a slight decrease in PRP time with the majority of session times ranging between 1.30 s and 1.57 s with one session measuring 1.73 s. In Baseline 3, PRP times decreased slightly, ranging from 1.20 s and 1.46 s. In the second left jackpot condition, there was a slight decrease in PRP time with the majority of session times ranging between 1.17 s and 1.50 s with one session measuring 2.59 s. In Baseline 4, PRP time increased gradually with a range of 1.0 s to 1.75 s. In the third left jackpot condition, PRP time initially dropped over the first seven sessions with a range of 1.10 s to 1.64 s. This was followed by a gradual increase over the final three sessions with a range of 1.36 s to 2.0 s.

In the initial baseline condition, Stitch's average PRP ranged from 1.40 s to 1.84 s. Overall PRP time increased in jackpot left with responses ranging from 1.62 to 2.13. In Baseline 2, PRP time decreased with a range of 1.25 s to 1.85 s. In jackpot right, more variability was observed. PRP times in this condition range from 1.38 s to 2.17 s. In Baseline 3, PRP time ranged from 1.28 s to 1.88 s for the first five sessions and then stabilized to between 1.33 s and 1.55 s for the remainder of the condition. In the second right jackpot condition, PRP time increased gradually with a range of 1.26 s to 2.21 s in all sessions with the exception of one data point of 4.46 s. In Baseline 4, PRP time gradually increased throughout the condition with a range of 1.30 s to 1.83 s.

DISCUSSION

The purpose of this study was to determine if delivering a jackpot had an impact on response rate and choice in two domestic dogs. The results of this study show that jackpots had no effect on response rate in a single-operant procedure while having a modest impact on response allocation in a concurrent schedule procedure.

In Experiment 1, results of response rates were inconsistent. As compared to the preceding baseline, Pepper showed a small decrease in responding in the jackpot 5 condition, little change in the first jackpot 10 condition and an increase in the second jackpot 10 condition. Stitch showed additional inconsistency with no noticeable change in responding in the jackpot 5 condition and overall decrease in responding in the jackpot 10 condition. A consideration is the possibility that response rates in both subjects were at their highest potential in baseline, therefore, hitting a ceiling rendering them unable to further increase in the jackpot conditions. However, responding was very stable in the initial baseline after which it did drop for both subjects in at least one jackpot condition rather than remaining at the baseline levels. If the jackpot did have a discernible positive effect, it is logical that response rates would have maintained at baseline levels despite being unable to increase.

In Experiment 2, an increase in responding to the jackpotted target was observed in both subjects. Both subjects exhibited the same pattern of responding. In the first jackpot condition, there was a gradual increase in responding to the jackpotted target. In the second jackpot condition, when the jackpot contingency was changed to the other target, a modest decrease in responding to the initially jackpotted target was observed. This decrease was not as dramatic as the initial increase resulting from the first jackpot contingency.

These findings are consistent with the magnitude of reinforcement literature. These results suggest that the effects of jackpots may be inconsistent in single-operant procedures. Similar findings have been reported in reinforcement magnitude literature (Belke, 1997; Keesey & Kling, 1961; Lerman, Kelley, Vorndran, Kuhn, & Rue, 2002). Conversely, the findings imply that jackpots do have an effect on increasing response allocation in a concurrent schedule procedure. This is consistent with the theory of Trosclair-Lasserre et al. (2008).

Additional trends consistent across both experiments were clear. In all jackpot conditions in both experiments, there was a clear increase in feeder checking responses as compared to baseline conditions. One potential explanation for this increase is that perhaps the reinforcers supplied when the jackpot is delivered are functioning to reinforce the checking behavior, or the return to the feeder, rather than the target behavior. This is a significant question and one worth further investigation.

As would be expected, consumption time was greater in all jackpot conditions as compared to baseline conditions. This could simply be a result of the increase in reinforcer magnitude offered in the jackpot conditions that would subsequently require more time to consume. However, some interested trends were observed. Although jackpot volumes were held consistent within each condition there was a large amount of variability in consumption time in jackpot conditions as compared to baseline conditions. In Experiment 1, this variability carried over to the first several responses in Baseline 2. These findings were consistent with the findings of Roscoe et al. (2003) who reported that larger magnitudes of reinforcement extended consumption time, which could ultimately suppress response rate. It is possible that this variability is a result of the definition used for consumption. Consumption was defined as beginning when the top of the dog's nose crossed into the top of the food bowl and ending when the nose crossed out of the top of the food bowl. This definition did not take into account whether all of the treats in the bowl had been consumed because this was not visible to the observer. There is potential that the variability is a result of true consumption ending, that is, all of the treats having been consumed while the dog continues to explore the feeder, which may have been better measured as feeder checking.

Increased PRP time as compared to baseline was observed in the first jackpot condition for Stitch and in all jackpot conditions for Pepper in Experiment 1. Additionally, there was an increase in PRP variability in the first jackpot condition for both subjects in Experiment 1. In Experiment 2, increased PRP time was observed in the first jackpot condition for Pepper and in the first and third jackpot conditions for Stitch. This increase in PRP implies that in both single-operant and concurrent schedule procedures, a jackpot may disrupt the flow of behavior and result in greater time between responses. Similar increases in PRP as a result of increased reinforcer magnitude have been reported (Leslie et al., 2000; Lerman et al., 2002; Reed, & Wright, 1988).

It is also noteworthy that emotional responding was observed in both subjects in Experiment 1. While this emotional responding was not measured, and as such can only be reported anecdotally, it was consistently observed and of interest. After the presentation of the first jackpot following the initial baseline condition, both subjects appeared to approach the target with less speed. Upon making contact with the target, both subjects jumped in a manner consistent with startling. Furthermore, the topography of the actual target touch differed for both subjects as compared to previous responses. Stitch appeared to hold his head and hindquarters in a lower position and avoided looking toward the target. Pepper, who had consistently pushed the target with force in baseline, made minimal contact with the target when responding. Pepper also approached the target on multiple occasions but did not make contact. Additionally, in this initial jackpot condition, both subjects abruptly stopped responding and left the session on one occasion each. This is reflected in the first data point of jackpot 5 for Stitch and the ninth for Pepper. This apparent emotional responding decreased throughout the condition and the following baseline condition reappeared briefly with lesser severity in the jackpot 10 condition and was not observed again.

Future research in the area of jackpots is warranted. The results of this study suggest that the effects of delivering a jackpot as defined here may be similar to effects reported in the magnitude of reinforcement literature (Belke,1997; Keesey & Kling,1961; Lerman et al., 2002; Leslie et al., 2000; Reed & Wright, 1988; Trosclair-Lasserre et al., 2008; Vorndran et al., 2002). However, this study defined magnitude only in terms of quantity of reinforcement. It has been proposed that a jackpot represents not an increase in the magnitude of reinforcement but the presentation of a high quality reinforcer (Fisher, 2009; McConnell & London 2003; Miller, 2001). Issues of quantity versus quality are complex but it has been suggested that repeated exposure to the same reinforcer even over short times can result in performance decrements, possibly as a result of satiation or habituation (Hutt, 1954; Koehler et al., 2005). This would seemingly support the idea of using novel, preferred reinforcers as a jackpot and should be further investigated.

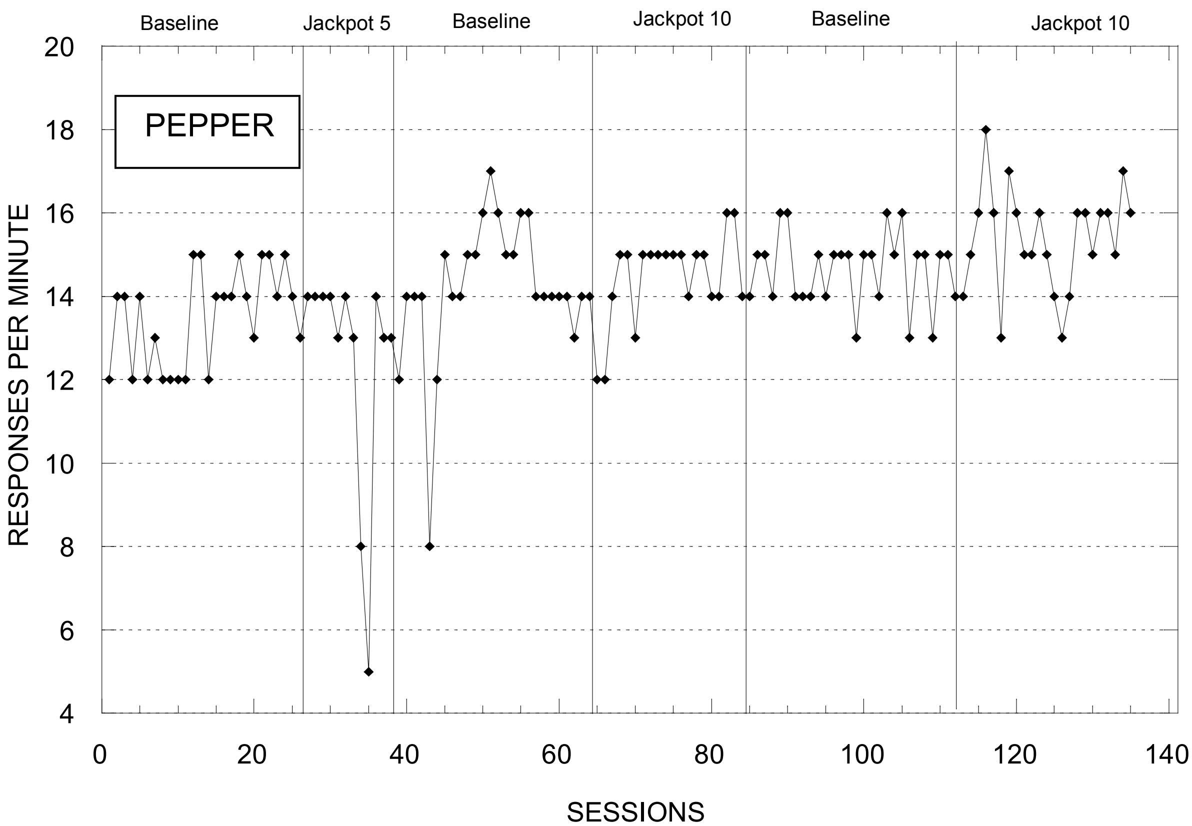
The results of this study showed effects of jackpots that are inconsistent with reports of the positive effects of delivering a jackpot (Fisher, 2009; McConnell & London, 2003; Pryor, 1984). Jackpots did not increase responding in a single-operant procedure and actually appeared to disrupt the behavior. This is a significant finding if applied to animal training. It implies that jackpots do not increase motivation as described by many applied animal trainers. It also appears that if used repeatedly, jackpots may result in a decrease in behavior, an increased disruption of behavior, and possible emotional responding.

Additionally, the results of this study suggest that in a choice situation a jackpot may be effective in altering preference. This effect was diminished when the jackpot condition ended but did maintain at a higher level than before the jackpot. At first glance, this may appear to be a promising and useful finding as there are situations in which a shift in preference is desirable. However, it is noteworthy that when the jackpot contingency was changed a second time, the changes in the subsequent response preference were much less robust. One possible explanation for this diminished effect is that the magnitude of the jackpot was held constant throughout Experiment 2.

Gambling literature has pointed to a similar correlation between lottery prize value and ticket sales. When the prize winnings are increased, a subsequent increase in sales occurs. However, if this increased prize amount is held constant, a decrease in sales follows. In order for high levels of ticket sales to be maintained, the lottery prize value must also be consistently increased (Lyons & Ghezzi, 1995; Bartsch & Paton, 1999).

Although further research is warranted, the results of this study suggest that the first experience with a jackpot may have greater influence over response allocation than subsequent jackpots. If this is correct, it would be prudent to carefully weigh all options in an animal training scenario before introducing a jackpot as the first behavior you jackpot could potentially become a long lasting preference.

Figure 1. Photographs of the apparatus used in Experiment 1(top) and in Experiment 2 (bottom).



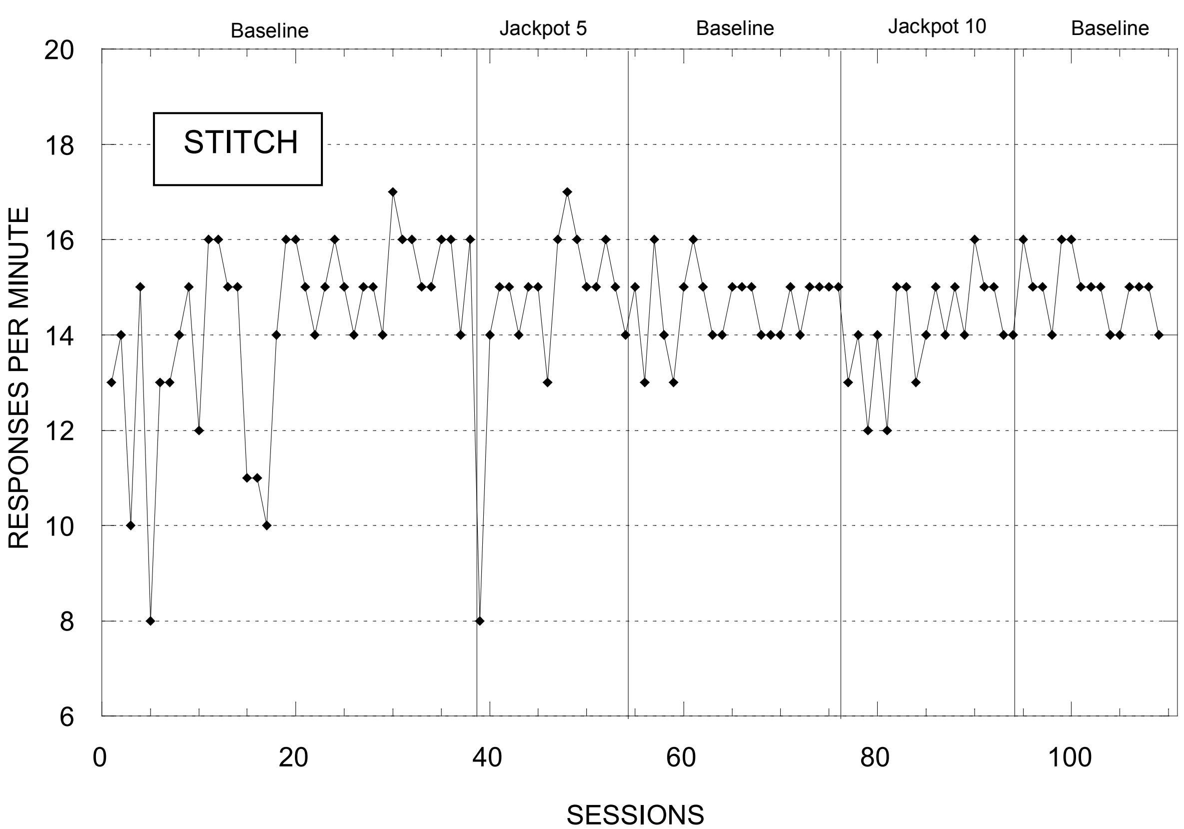
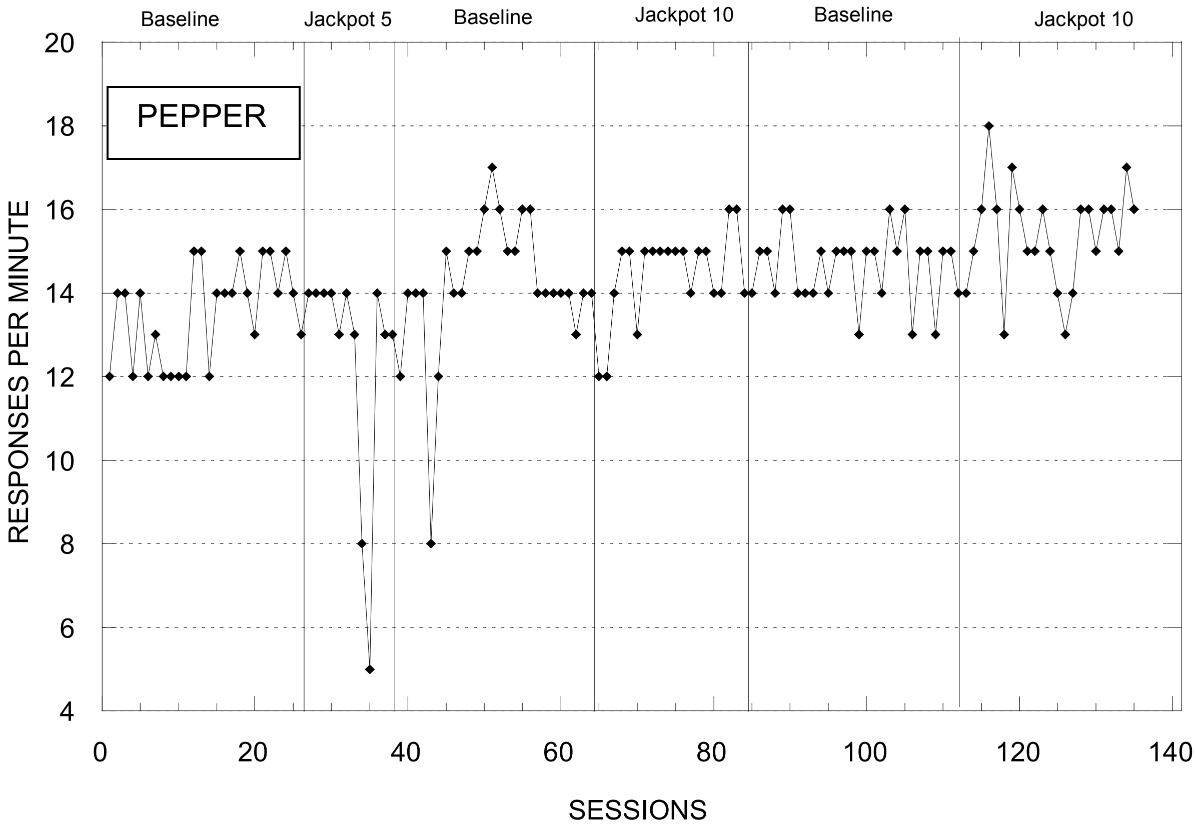


Figure 2. Number of target responses per minute across baseline, jackpot 5 and jackpot 10 conditions for both subjects in Experiment 1.



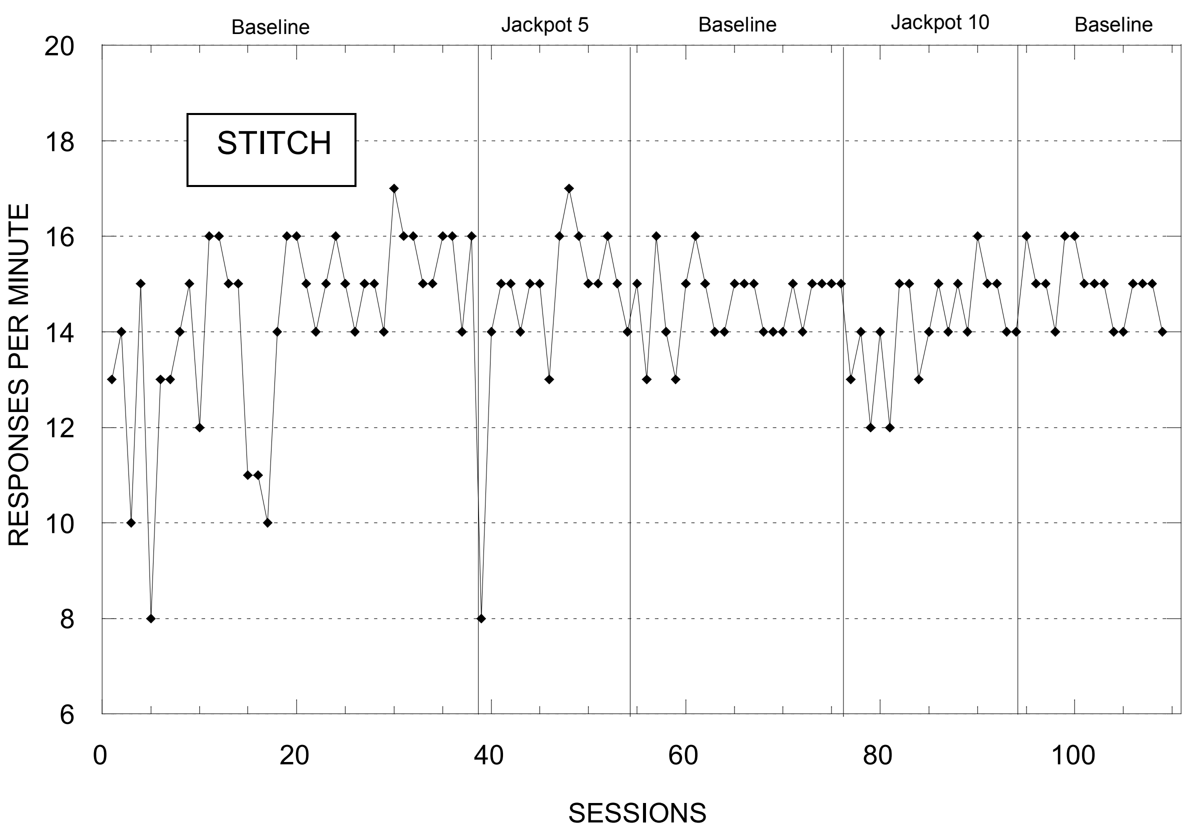


Figure 3. Number of responses made to the right position target per session across baseline, jackpot right and jackpot left conditions for both subjects in Experiment 2.

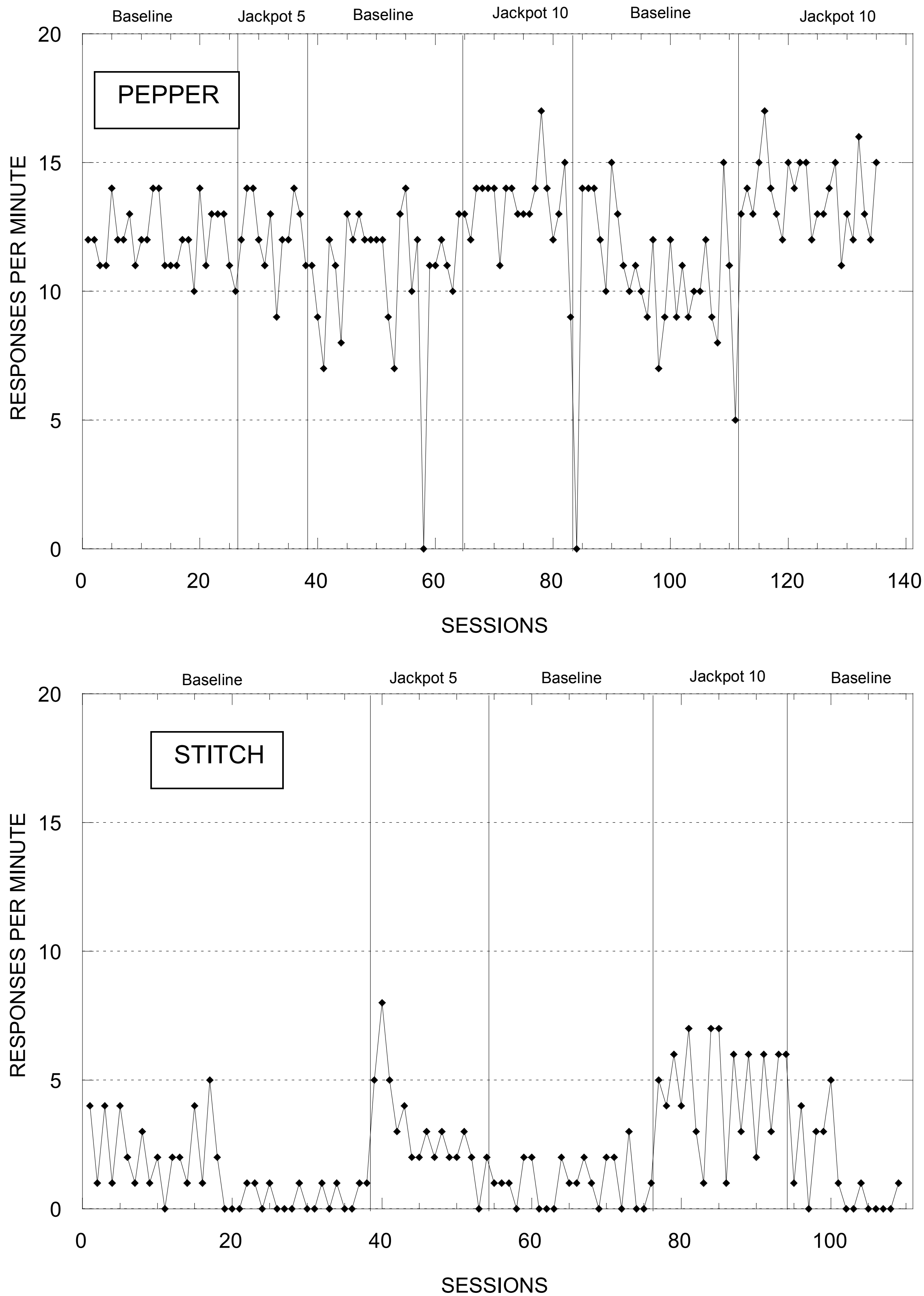


Figure 4. Feeder checking responses per minute across baseline, jackpot 5 and jackpot 10 conditions for both subjects in Experiment 1.

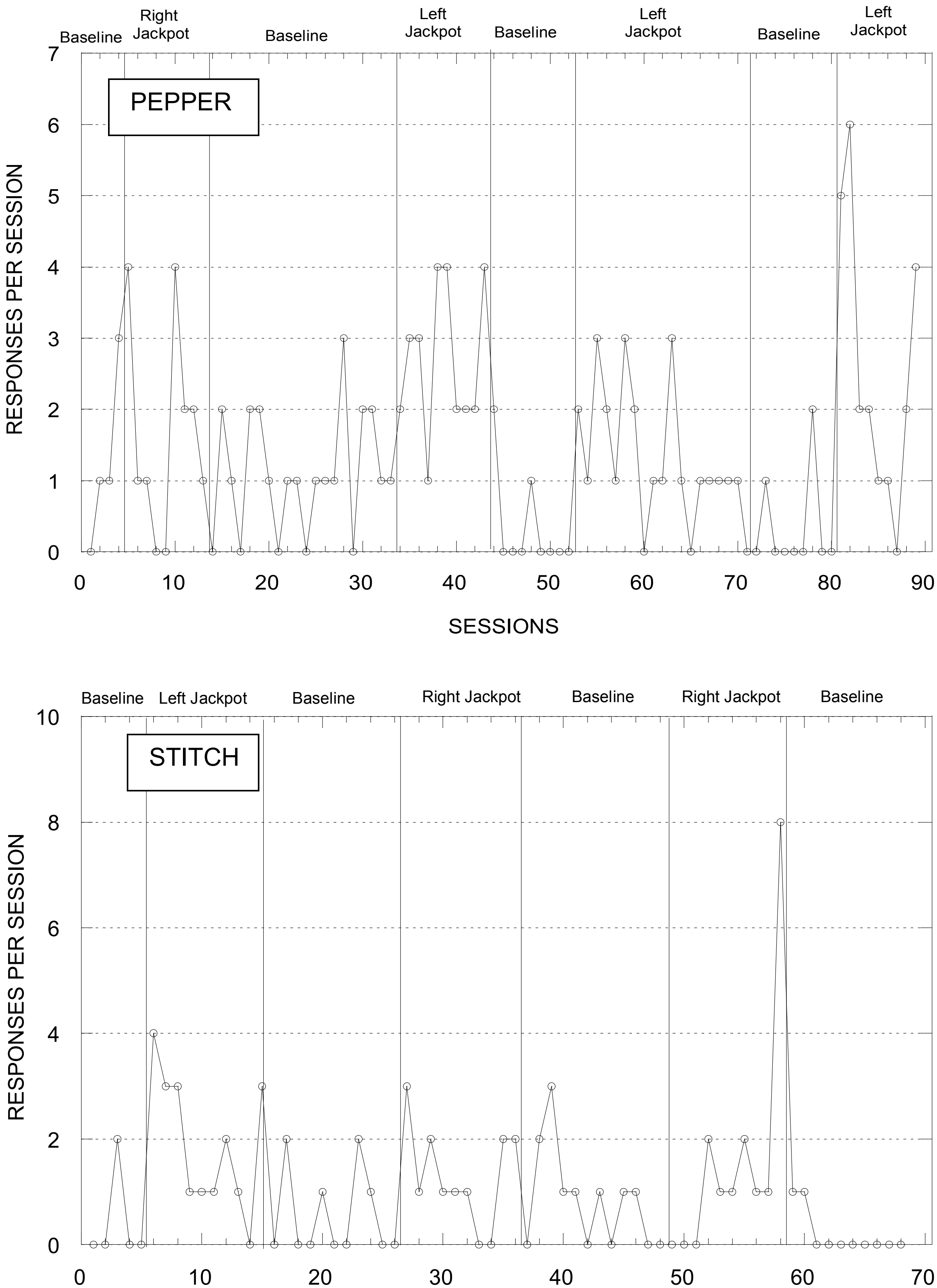


Figure 5. Feeder checking responses per session across baseline, jackpot right and jackpot left conditions for both subjects in Experiment 2.

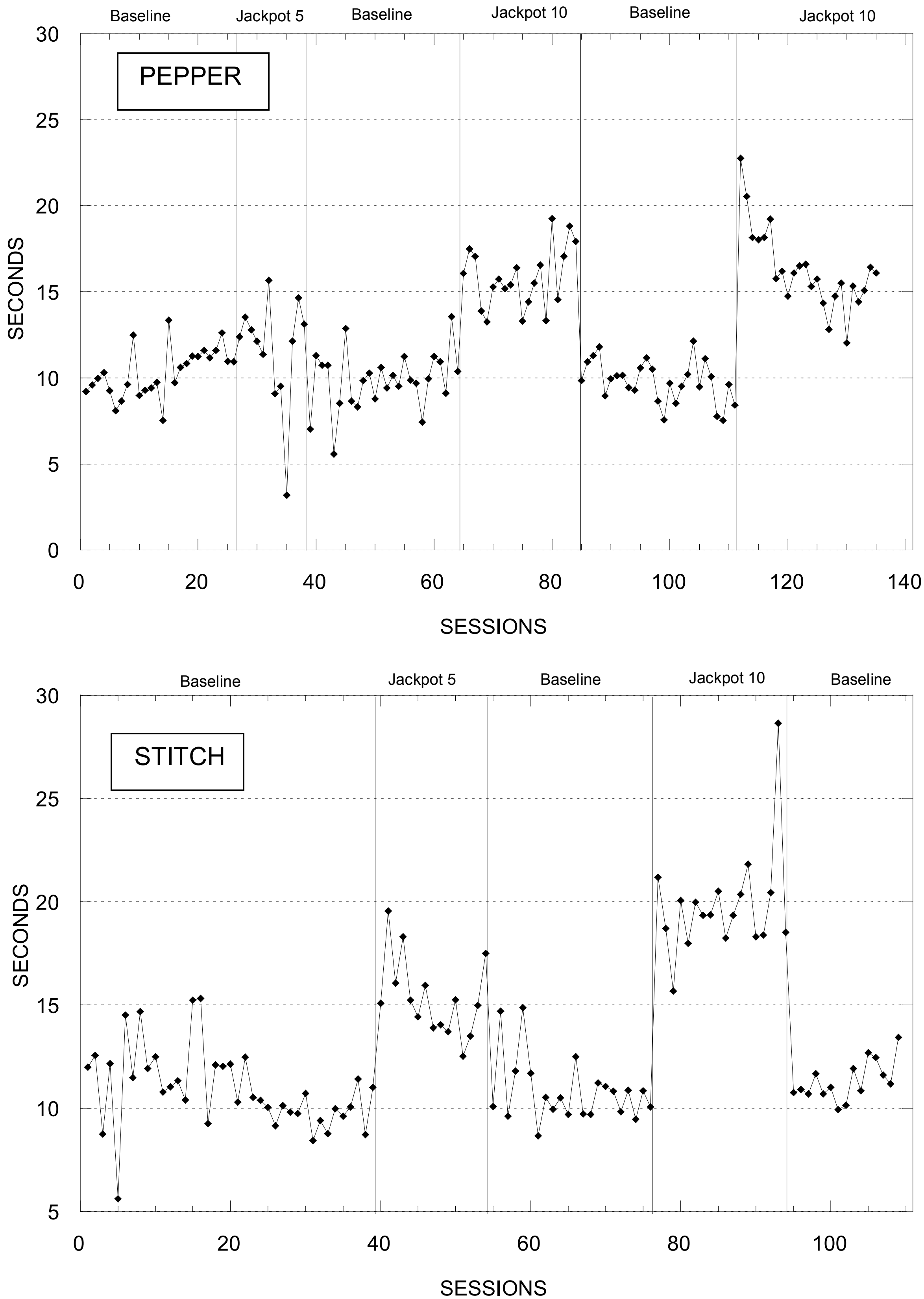


Figure 6. Total consumption time per session in seconds across baseline, jackpot 5 and jackpot 10 conditions for both subjects in Experiment 1.

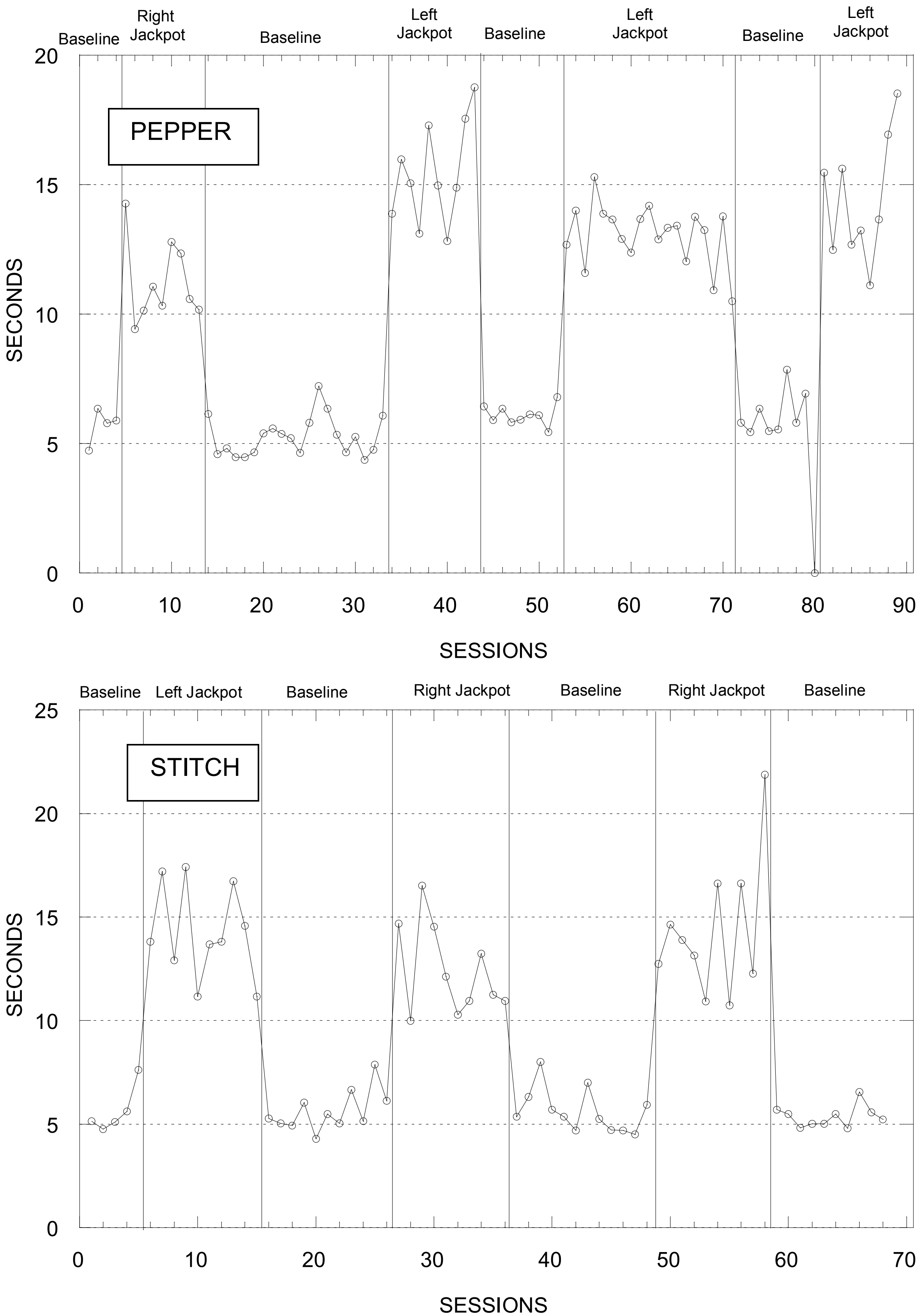


Figure 7. Total consumption time per session in seconds across baseline, jackpot right and jackpot left conditions for both subjects in Experiment 2.

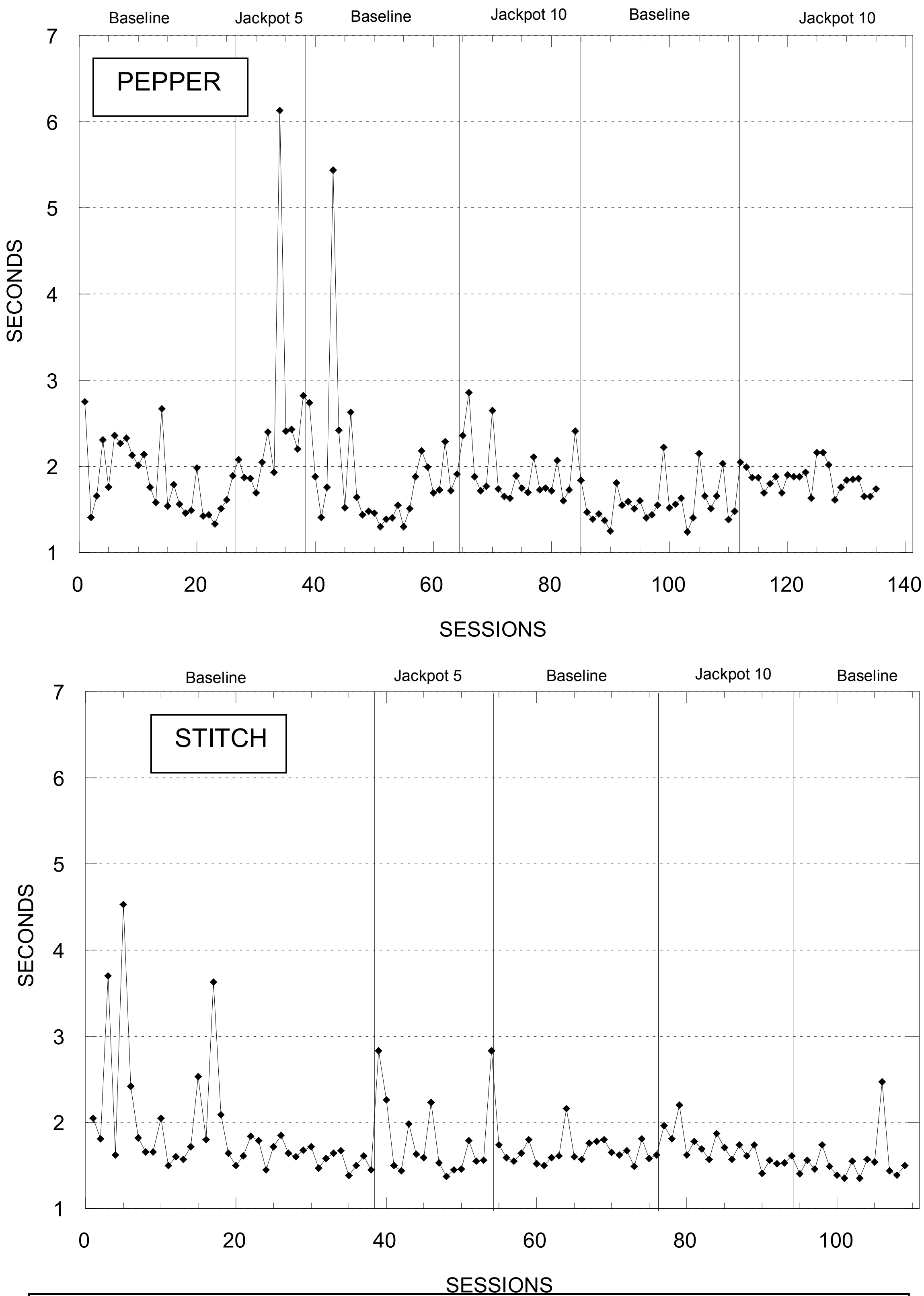


Figure 8. Average post-reinforcement-pause time per session in seconds across baseline, jackpot 5 and jackpot 10 conditions for both subjects in Experiment 1.

POST REINFORCEMENT PAUSE- PEPPER

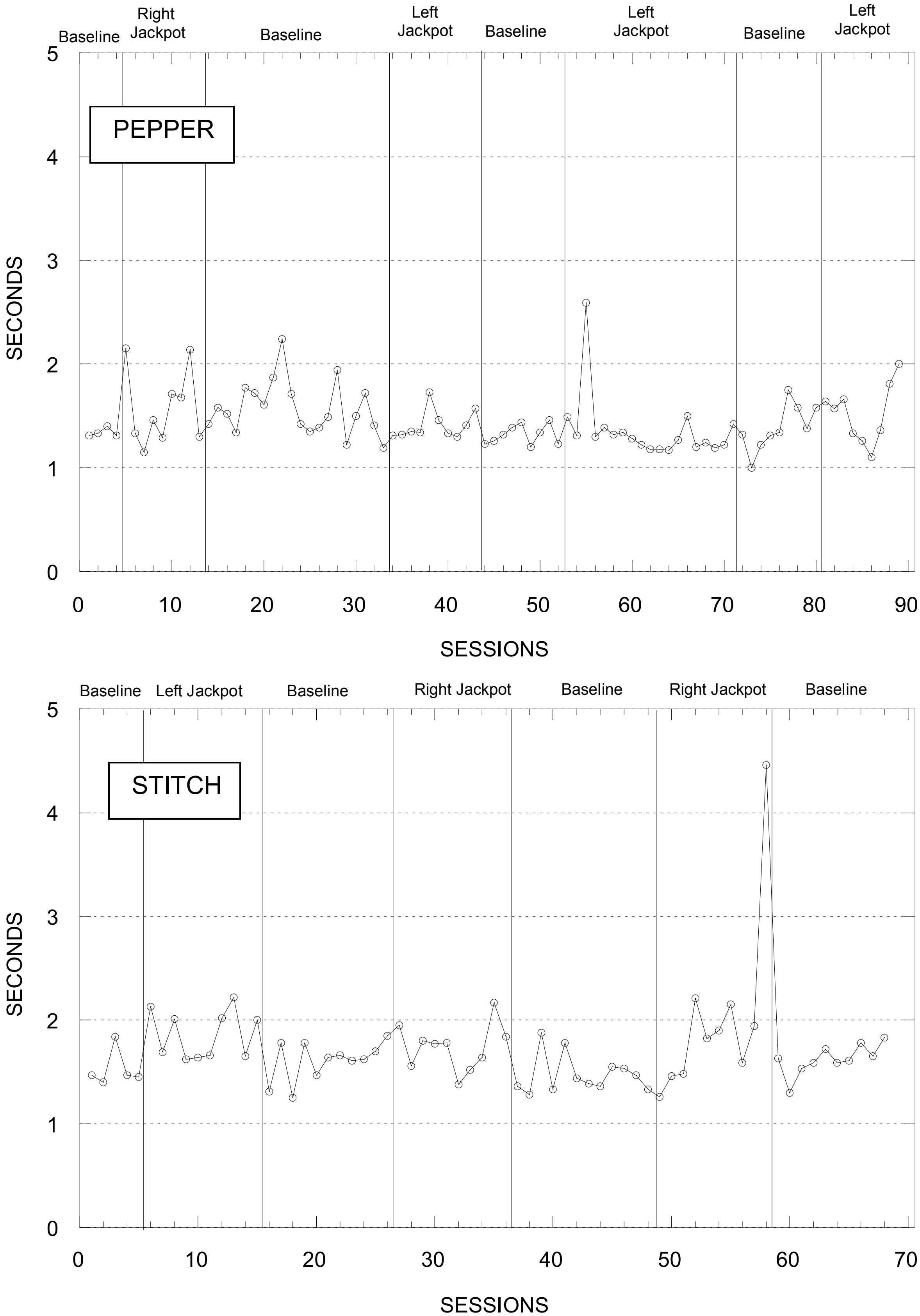


Figure 9. Average post-reinforcement-pause time per session in seconds across baseline, jackpot right and jackpot left conditions for both subjects in Experiment 2.

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