



# Snake Reciprocation in Terms of Classical Conditioning: Scent and Auditory Stimuli

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## ABSTRACT

This study explored the classical conditioning of a snake in order to understand and interpret the physiological responses and behavior exhibited. The conditioning process involved scent and auditory stimuli where the snake was exposed to running water sounds and a mouse scent. The purpose of this research study is to examine how the snake will later associate the scent of the mouse with the sound and how it would react when sound was the only stimuli administered. The type of snake species used was a young Brook's Kingsnake. The snake was placed in a test tank and the experiment was split into four conditioning sessions and one additional session throughout four days of the week to test the outcome. The first session consisted of familiarization with foreign objects and new placement. The following sessions are followed by a series of conditioning the snake to the sound with the mouse scent. The results indicate that the length of conditioning affected the snake. The results could have been more satisfactory if it was shortened to about four or five tests conducted through two sessions in about two days instead since it was twice as long. This conclusion was based on the second day's data where the snake was most responsive to the stimuli (Average tongue flicks = 102, duration spent near stimuli = 3 minutes, and speed reaction was moderate).

## INTRODUCTION

- The biological adaptations of snakes have led them to sense their surroundings through sensory functions like the flicking of their tongue. Snakes have forked tongues and its structure helps them to identify chemical gradients used as indicators of information in the environment (Durso, 2014).
- They are limited in certain aspects in regard to their senses, like hearing, since snakes do not have external ears but hear sounds differently than other animals and human beings (Hartline & Campbell, 1969). Due to a snake's biological ear setup, it is more sensitive to ground vibrations and can only hear a narrow range of frequencies (Sawe, 2019).
- Classical conditioning is a learning process that occurs through associations between a neutral stimulus (sound) and an unconditioned stimulus (mouse scent) (Cherry, 2019).
- The purpose of this study is to condition the snake to come to the sound without the scent of food and in terms replacing the association of scent means food to sound means food.

## HYPOTHESES

The hypothesis predicted that the snake would show an increase in responsiveness to the sound without the mouse scent after conditioning.

## METHOD

**Subject** The subject of the experiment was a Brook's Kingsnake (*Lampropeltis getula brooksi*). The snake was around a year old.

### Measures

There were three measurements used to assess the snake's responses before, during, and after conditioning. The **number of tongue flicks** was based on how many times the snake flicked its tongue in close range to the stimuli (used for sensing surroundings and showing interest). The **speed reaction** was rated on an ordinal scale using the terms *slow*, *moderate*, *slightly fast*, and *immediate* to distinguish the speed of response of the snake when the items are first added. The **duration** was the amount of time the snake spent in close proximity to the stimuli.

### Procedure

- The experiment was split into four conditioning sessions and one additional session throughout four days of the week to test the outcome. Each session was done once a day while the last day had two sessions.
- The snake was set in a special area, a test tank, made for it to be able to move within its parameters.
- The snake was presented with a type of odor, in this case a mouse odor paired with a natural sound, running water sounds.
- The sound emitted slight vibrations and the device was placed in the test tank at the side of the wall and on the ground because snakes cannot hear or recognize most airborne sounds and are more responsive to vibrations.

## RESULTS

Sound on right side of wall --> No response

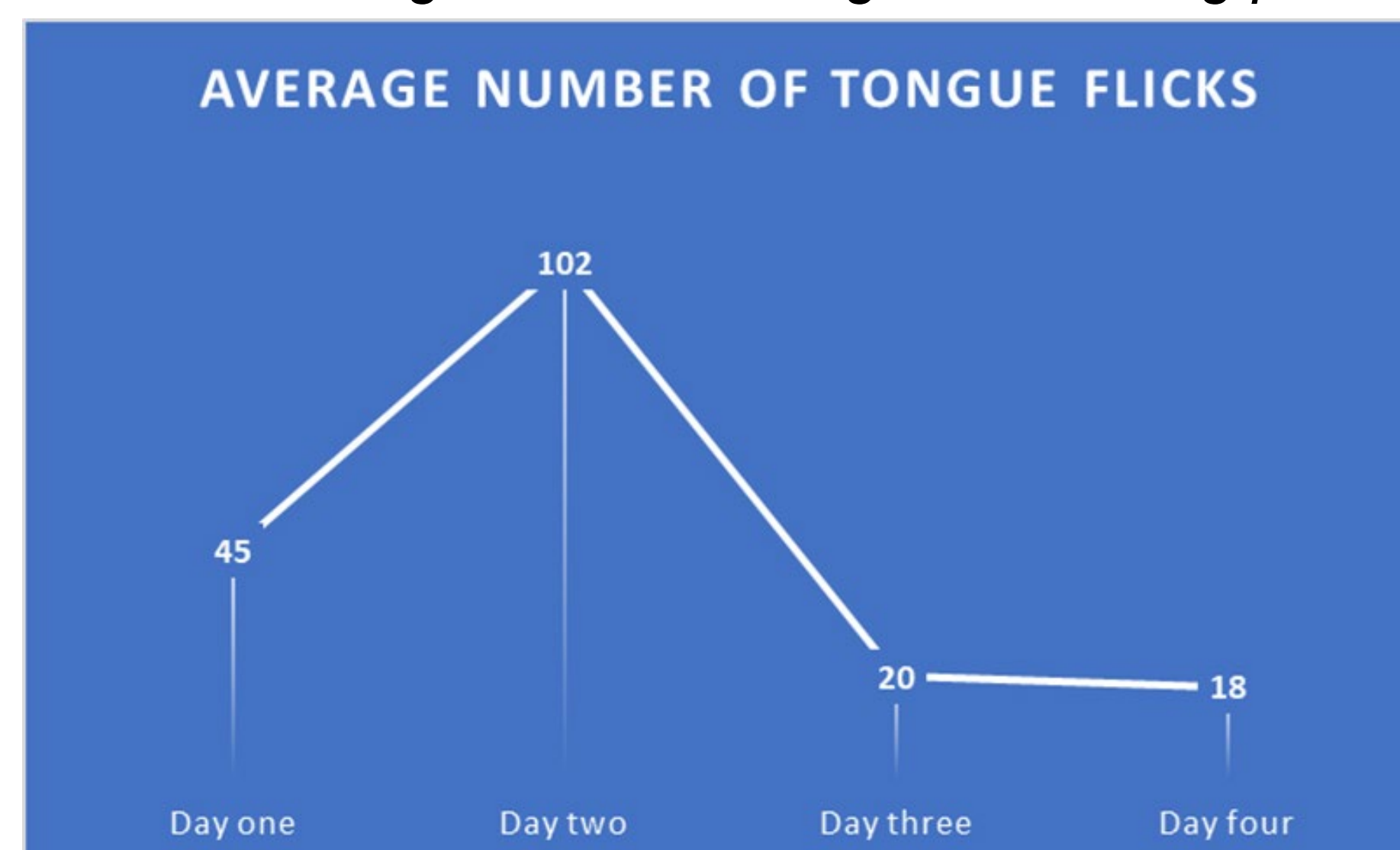
Sound on left side of wall --> Avoids device with sound at first then it went to it and stayed near it for around 2 mins

Sound on opposite wall ---> Response (Slow, 1 min, around 30 tongue flicks)

Spends almost equal amount of time with device with no sound at left wall and with device emitting sound at the right side of the test tank. (2 mins each)

**Figure 1.**

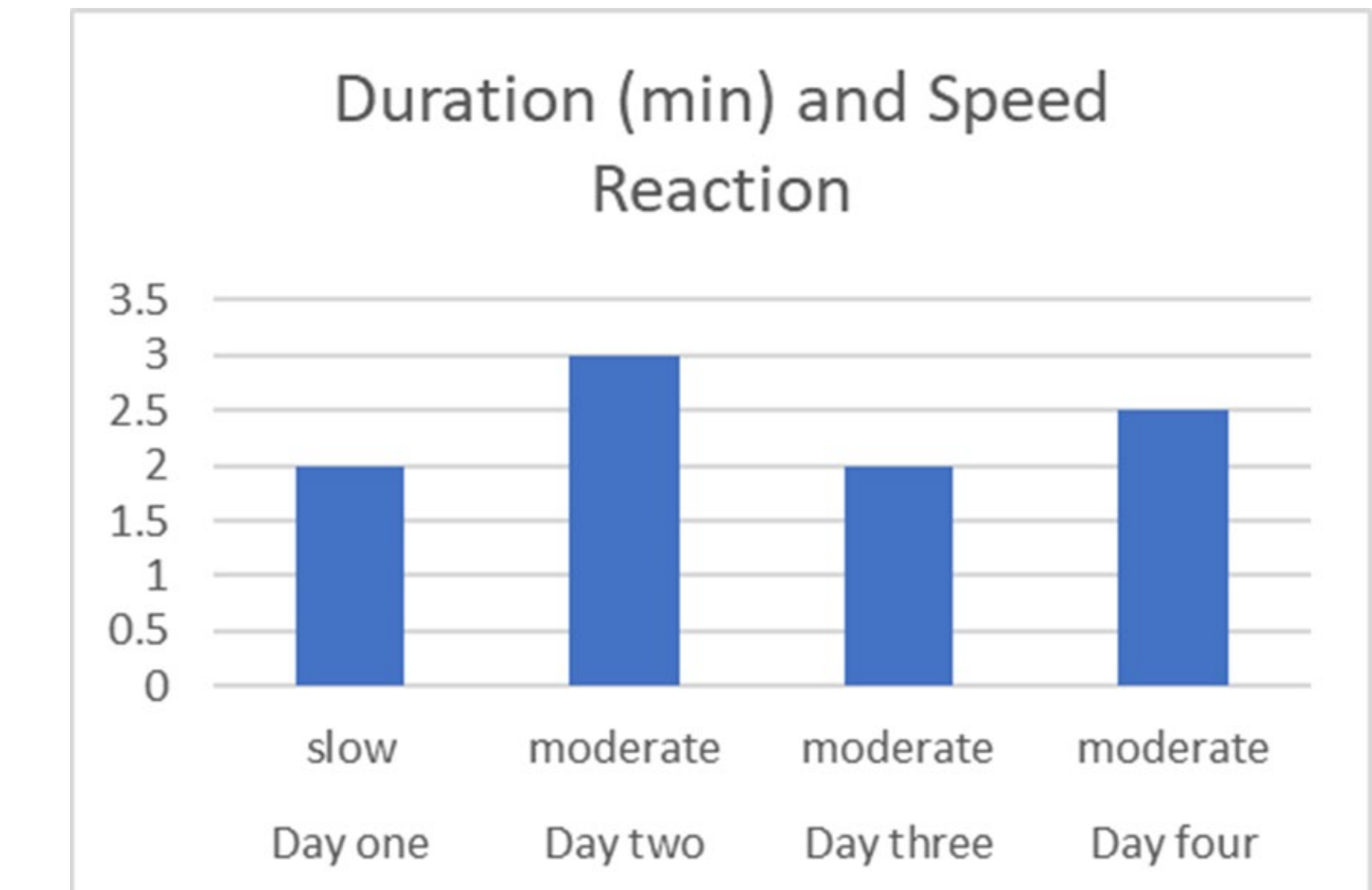
Average Number of Tongue Flicks During Conditioning per Day.



Note. The figure above displays the mean value of the number of tongue flicks during conditioning for each day.

**Figure 2.**

Average Duration Spent in Close Proximity to Scent and Sound Device in Terms of Average Speed Reaction During Conditioning per Day



Note. The bar graph displays the mean speed reaction of the snake when presented with the stimuli and the duration spent near the mouse scent and sound during conditioning in four days.

## DISCUSSION

In the hypothesis, it was predicted that the snake would show an increase in responses to the sound without food scent after conditioning. The results indicated that there was a decreased interest over time in the repetitive process and eventually showed that it did not respond as predicted or expected.

### Conclusions

This outcome could have resulted from an excessive number of conditioning trials because the scent and sound were paired together 10 times. It appears that conducting the conditioning associations between the previously neutral stimulus paired with the unconditioned stimulus at about 4 to 5 times was enough to condition the snake and make the sound a conditioned stimulus. Although, when it continued to 10 sessions, the snake lost interest because of the lack of reinforcement and finding nothing repeatedly. This could mean that snakes, when searching for prey, will repeatedly revisit an area that has its food's scent for the amount of 4 to 5 times that is in terms of these sessions accounts for two to three times in an hour per day so which would amount to 2 to 3 days in total.

### Limitations

- The housing enclosure of the snake could have affected its interest in the items and behavior.
- If the study incorporated some level of operant conditioning (reward), the snake may have been more receptive.

## REFERENCES

Cherry, K. (2019, September 05). What Is Classical Conditioning? A Step-by-Step Guide to How Classical Conditioning Really Works. [verywellmind.com/classical-conditioning-2794859](https://www.verywellmind.com/classical-conditioning-2794859)

Durso, A. (2014, July 31). Explainer: why do snakes flick their tongues? The Conversation. <https://theconversation.com/explainer-why-do-snakes-flick-their-tongues-29935>

Hartline, P. H., & Campbell, H. W. (1969). Auditory and Vibratory Responses in the Midbrains of Snakes. *Science*, 163(3872), 1221–1223. <http://www.jstor.org/stable/1726558>