

Fagen et al. (elephant learning)

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Fagen, A., Acharya, N., & Kaufman, G. E. (2014). Positive reinforcement training for a trunk wash in Nepal's working elephants: demonstrating alternatives to traditional elephant training techniques. *Journal of Applied Animal Welfare Science*, 17(2), 83-97.

Psychology Being Investigated

1. Operant Conditioning

Operant conditioning is a theory of learning where behavior is influenced by its consequences.

Behavior that is reinforced (rewarded) will likely be repeated, and behavior that is punished will occur less frequently.

The study demonstrates that elephants can learn complex sequences of behaviors through positive reinforcement and that this learning can occur in natural settings.

2. Secondary Positive Reinforcement

The study emphasizes the effectiveness of positive reinforcement in shaping animal behavior.

The primary reinforcer is something that inherently motivates a behavior because it satisfies a basic need.

For example, chopped bananas served as the primary reinforcer in the Fagen et al. study as they satisfy an elephant's hunger.

A secondary reinforcer does not inherently meet any needs but gains its power through classical conditioning.

Secondary positive reinforcement (SPR) is a training technique that utilizes a secondary reinforcer, which is a stimulus that becomes reinforcing after being associated with a primary reinforcer.

In classical conditioning, a neutral stimulus (like a whistle) is repeatedly paired with a primary reinforcer (like bananas).

Over time, the neutral stimulus becomes a conditioned stimulus (a secondary reinforcer) that elicits a conditioned response similar to the response elicited by the primary reinforcer.

The whistle in Fagen et al. research acts as a secondary reinforcer because it is associated with the arrival of the chopped bananas.

This contrasts with traditional elephant training in Nepal, which heavily relies on punishment and aversion techniques.

3. Training Methods & Animal Welfare

Humane training methods like SPR can positively affect animal mental health and welfare, reducing stress and improving cooperation.

This is particularly relevant given the study's focus on training elephants to voluntarily participate in a trunk wash for tuberculosis testing, a procedure that could be stressful under traditional training methods.

By demonstrating the success of SPR in training elephants to voluntarily participate in a potentially stressful veterinary procedure, the study advocates for a more humane and ethical approach to animal training and care.

Background

Traditional elephant training in Nepal heavily relies on punishment and aversion-based techniques.

However, there has been a global shift towards more humane training approaches, specifically positive reinforcement training.

Fagen et al. wanted to investigate if secondary positive reinforcement (SPR) could train captive elephants to voluntarily participate in trunk washes for tuberculosis testing.

This is important because TB is a significant health concern for both elephants and humans due to the possibility of transmission between species.

Aim

The primary aim was to investigate whether secondary positive reinforcement (SPR) techniques could effectively train traditionally trained elephants in Nepal to voluntarily participate in trunk wash procedures.

Research Method

The study employed an observational research method.

This means researchers systematically observed and recorded the elephants' behavior during the training process without directly manipulating other variables in the environment.

This approach allowed for an in-depth understanding of the elephants' responses to the training methods and how their behavior changed over time.

Sample

The study involved a small sample of five female Asian elephants, with four juveniles (aged 5 to 7 years old) and one adult elephant (estimated to be in her 50s).

All elephants were housed at the same elephant stable in Nepal.

An opportunity sampling technique was used to select the elephants for the study.

This means the researchers selected elephants that were readily available and met certain criteria, such as being docile, not pregnant or nursing a calf, and having handlers (mahouts) willing to participate.

Experimental Design

The researchers used a pre-post design with repeated measures.

This design involves collecting data on the elephants' behavior before the training intervention (**pre-training**), implementing the training program, and then collecting data again to assess changes in behavior after the training (**post-training**).

The repeated measures aspect means that the same elephants were assessed at both time points, allowing for direct comparisons of individual elephant's behavior before and after the SPR training.

Independent Variable (IV)

The independent variable, which is the factor being manipulated or changed by the researchers, was the implementation of the SPR training technique.

The researchers controlled the introduction and progression of the SPR training steps, making it the variable they systematically altered to observe its effects on the elephants' behavior.

Dependent Variables (DV)

The study had multiple dependent variables, which are the factors being measured or observed to assess the effects of the independent variable. These included:

- **Training session duration:** The assistant timed the session to the nearest minute. It started from when the first cue was offered. It ended after the elephant's response to the last cue offered.
- **Number of offers:** Researchers recorded how many times the elephants successfully offered their trunks through the hole in the wall.
- **Percentage of correct responses:** Performance tests were conducted every five training sessions to assess the elephants' mastery of the tasks. Researchers calculated the percentage of correct responses or successful completion of each behavioral task during these tests. This provided a quantitative measure of the elephants' learning progress and the effectiveness of the training in shaping their behavior.
- **Cumulative time spent on training:** The total time in minutes spent training each elephant throughout the study. The measurement involved summing the duration of all training sessions for each individual elephant.
- **Overall improvement in performance:** Researchers analyzed the progression of learning throughout the study by looking at the mean percent correct in all tasks for all elephants for each test session. This measure reflects the overall trend of skill acquisition and improvement in the elephants' performance as a result of the SPR training.

Procedure

The study followed a systematic procedure to implement and evaluate the SPR training:

1. Selection Criteria:

Elephants were selected based on their docility, availability (not pregnant or nursing), and the willingness of their mahouts to participate in the study.

2. Training Methodology:

The training exclusively used the **SPR technique**, with chopped bananas serving as the primary reinforcer and a short whistle blow as the secondary reinforcer.

The whistle was initially a neutral stimulus, but it became associated with the **primary reinforcer** (chopped bananas) through **classical conditioning**.

Over time, the elephants learned to associate the whistle with the reward, making the whistle itself a powerful motivator for performing the desired trunk movements

- **Primary reinforcer:** Chopped bananas, which directly satisfy the elephant's hunger.
- **Secondary reinforcer:** A short whistle blast, paired with the bananas to create a conditioned association. Elephants learn to associate the whistle with the reward (bananas), so it becomes a powerful reinforcer on its own.

3. Training Setting:

Training sessions were conducted in the mornings (7:30-10:00 am) and afternoons (4:00-7:00 pm) while the elephants were chained in their stalls.

The mahouts, the elephants' handlers, were present for safety but were instructed not to interact with the elephants during training to maintain the integrity of the training.

This ensured that any observed changes were solely attributable to the SPR training.

To ensure the elephants would not drink the saline solution or water used for the trunk wash, they were offered water before each session.

4. Training Techniques:

The elephants next went through a progressive series of training stages using **secondary positive reinforcement** techniques.

The elephants were then trained to perform these tasks in sequence (behavioural chaining), culminating in the full trunk wash sequence.

The researchers adopted a flexible approach to training, tailoring the plan to each elephant's individual needs and learning pace.

There was no fixed time limit for each stage; progression was determined by the elephant's success and comfort level. This individualized approach likely contributed to the positive training outcomes.

1. **Bridge Training:** Establishing the link between the primary and secondary reinforcer by repeatedly pairing the whistle with the banana reward.
2. **Target Behaviors:** The elephants were then trained individually on five basic behavioral tasks essential for the trunk wash:
 - **Trunk Here:** The elephant places the tip of her trunk into the trainer's hand.
 - **Trunk Up:** The elephant lifts her trunk upwards.
 - **Bucket:** The elephant places her trunk tip into a bucket.
 - **Blow:** The elephant blows air forcefully out of her trunk.
 - **Steady:** Maintaining a specific trunk position for a certain duration.

3. **Individual Behavior Training:** The researchers trained each of the five target behaviors separately using:

- **Capture:** Involves reinforcing a behavior that the animal already spontaneously performs, shaping it towards the desired action. The researchers used capturing to train the elephants to “blow,” or exhale forcefully through their trunks. They waited for the elephants to exhale naturally and then marked and rewarded the behavior with a banana.
- **Lure:** Uses a reward to guide the animal into the desired position or action. Luring was employed in several tasks, including “trunk here” and “trunk up.” For “trunk here,” the trainer initially placed chopped bananas in their hand, encouraging the elephant to place its trunk on the trainer’s palm to retrieve the reward. For “trunk up,” the trainer lifted the banana above the elephant’s head, prompting it to lift its trunk to reach the treat. In both cases, the lure was gradually faded as the elephant learned the behavior.
- **Shaping:** Gradually reinforces successive approximations of the desired behavior, rewarding increasingly closer attempts until the full behavior is achieved. For instance, in the “blow” task, the researchers initially rewarded any exhale directed towards the bucket. As the elephants became more proficient, they only rewarded exhales aimed at the center of the bucket, gradually shaping the behavior towards the desired accuracy.

4. **Verbal Cues:** Once an elephant mastered a behavior, a unique, monosyllabic verbal cue was paired with the action. These cues were non-words to avoid any potential understanding of the cues by the mahouts. The verbal cues played a crucial role in the behavioral chaining process. As the elephants learned to associate each cue with a specific behavior, the trainers could then use the cues to prompt the elephants through the complete trunk wash sequence. The completion of one behavior, triggered by its corresponding verbal cue, would then serve as a cue for the next behavior in the chain.

5. **Behavioral Chaining:** After mastering individual behaviors, the elephants were trained to link them together in sequence. For the trunk wash, this involved performing “Trunk Here,” “Trunk Up,” “Bucket,” and “Blow” in a smooth, continuous sequence.
- **Short Sequences:** Initially, trainers started with short sequences, such as combining “bucket” and “blow.”
 - **Longer Sequences:** Gradually, these sequences were expanded until the elephants could perform the entire trunk wash procedure: “trunk here,” “steady,” “trunk up,” “steady,” “bucket,” and “blow.”
 - **Rewarding the Complete Sequence:** The elephants received the primary reinforcer (banana) only upon successfully completing the entire sequence in the correct order. This motivated them to link the behaviors together and perform the trunk wash as a unified action.
6. **Syringe and Fluid Desensitization:** This crucial stage involved acclimating the elephants to the syringe and the sensation of fluid being inserted into their trunks. The researchers achieved this using:
- **Desensitization:** Gradually exposing the elephants to the syringe, starting by touching it to the outside of the trunk and progressing to inserting it into the nostril.
 - **Counterconditioning:** Pairing the presentation of the syringe with the banana reward to create a positive association and reduce aversion.
 - **Gradual Fluid Introduction:** Initially injecting only a drop of fluid and slowly increasing the volume in small increments until the full 60ml needed for sample collection was tolerated.

5. Data Collection:

Detailed data was collected throughout the training process:

- **Session Times:** The assistant timed the session to the nearest minute. It started from when the first cue was offered. It ended after the elephant’s response to the last cue offered.
- **Number of Offers:** Recorded to track the elephants’ responsiveness to cues for each behavior.
- **Performance Tests:** Administered every 5 sessions, starting at Session 10, to assess mastery of individual behaviors and sequences. A passing score was 80% or higher. If an elephant failed, they were retested to pinpoint areas for improvement.

Results

- **Success Rate:** Out of the five elephants, four, all juveniles, successfully learned the complete trunk wash sequence. The adult elephant, despite making progress, did not learn the entire sequence.
- **Training Duration:** The total training time varied between the elephants. The shortest training time was 257 minutes, and the longest was 451 minutes. This difference could be due to individual learning paces and variations in mastering specific tasks.
- **Task Difficulty:** The researchers found that the “Trunk Here” task, where the elephant had to place the tip of her trunk into the trainer’s hand, proved to be the most challenging and required the most practice.

Conclusions

- **SPR as an Effective Training Method:** The study demonstrated that SPR can be successfully implemented to train elephants for veterinary procedures like the trunk wash. This method, which relies on positive reinforcement and gradual desensitization, proved effective in teaching elephants a sequence of behaviors necessary for sample collection.
- **Implications for Elephant Welfare:** The study highlighted the potential benefits of SPR for elephant welfare. By using positive reinforcement, the training process can be less stressful and more humane compared to traditional elephant training techniques in Nepal, which often involve punishment and aversion. Voluntary participation in veterinary procedures can also reduce stress and improve the safety of both the elephants and their handlers.
- **Age as a Factor in Training Success:** The study observed that all four juvenile elephants learned the trunk wash, while the adult elephant did not. This finding suggests that age may play a role in an elephant’s learning ability and that younger elephants might be more receptive to this type of training.
- **Future Applications:** The success of this study opens up possibilities for using SPR to train elephants for other essential healthcare procedures. This could lead to improvements in elephant management and veterinary care, ultimately contributing to better overall health and well-being for captive elephants.

Strengths

1. Standardised Training Procedures:

The researchers utilized standardized training procedures across all five elephants participating in the study.

Each elephant learned the same five basic behaviors: “Trunk here,” “Trunk up,” “Bucket,” “Blow,” and “Steady.”

They also experienced the same sequence of training steps.

This standardisation enhances the internal validity of the study by ensuring that any observed differences in learning and performance were due to the elephants’ individual differences rather than variations in training methods.

2. Control and Validity:

The study design incorporated several controls to enhance the **internal validity** of the results.

The mahouts, who typically interacted with the elephants, were instructed to remain silent and avoid giving cues during the training sessions.

This ensured that any changes in the elephants’ behavior were solely attributable to the training provided by the researchers, not external influences.

The use of standardized training procedures across all subjects, with the same behavioral tasks and training steps, further strengthened the internal validity.

This standardization helped to minimize the impact of extraneous variables, ensuring that any observed differences in the elephants’ learning were due to their individual abilities rather than variations in the training methods.

3. Objectivity

Quantitative data provide numerical measurements, reducing subjectivity and enabling clear comparisons between groups or conditions.

In the Fagen study, the use of quantitative data, such as session times and number of offers, allowed for objective assessment of the elephants’ progress and the effectiveness of the training method.

4. Ecological Validity:

The study was conducted in the elephants' natural living environment, allowing them to train in a familiar setting.

This approach increases the ecological validity of the findings.

The behaviors and responses of the elephants are more likely to reflect their natural reactions, making the results applicable to real-world situations.

The data collection process considered the natural sounds of the jungle, further enhancing the ecological validity and suggesting that the results would be similar in other natural settings like safari parks or zoos.

5. Replicability:

The researchers provided clear documentation of their training methodology, objective measures, and detailed descriptions of the behavioral tasks.

This meticulous approach makes the study replicable, enabling other researchers to conduct similar studies to verify the findings and contribute to the research's overall reliability.

6. Ethical Considerations:

The study demonstrated a strong commitment to ethical guidelines.

Withdrawal

Elephants were allowed to withdraw from a training session at any time by simply walking away. This voluntary participation ensured that the elephants were not subjected to undue stress or coercion.

Respecting their autonomy and allowing them to opt out minimized any potential psychological distress associated with the training.

This approach also ensured the safety of trainers and observers by reducing the risk of negative reactions from the elephants.

Minimizing Potential Distress

By associating the trunk wash procedure with positive experiences (receiving chopped bananas and the sound of the whistle), the researchers encouraged the elephants to cooperate willingly.

This approach aligns with the principles of humane animal training, which emphasizes positive reinforcement as a more ethical and effective alternative to traditional methods that often involved physical punishment or negative reinforcement.

The researchers took steps to minimize any potential distress or discomfort experienced by the elephants during training.

For instance, they modified the training sessions for Elephant 1, the youngest elephant, who showed signs of impatience and frustration during longer sessions.

By reducing the number of trials per session for Elephant 1, they addressed her individual needs and ensured her well-being throughout the study.

To ensure the elephants would not drink the saline solution or water used for the trunk wash, they were offered water before each session.

This sensitivity to the elephants' individual responses highlights the researchers' commitment to ethical treatment and their willingness to adapt procedures to prioritize animal welfare.

Weaknesses

1. Limited Sample Size and Generalizability:

The study only included five female Asian elephants from a single elephant stable in Nepal. This small sample size raises concerns about the generalizability of the results to a wider elephant population.

The findings might not be applicable to male elephants, older elephants, or elephants from different regions or with diverse training histories.

A larger and more diverse sample would strengthen the study's conclusions and provide more robust evidence for the effectiveness of SPR across different elephant populations.

The study acknowledges that the adult elephant in the sample failed to learn the full trunk wash, and speculates that adult elephants may require a different approach or more extended training.

This suggests further research is needed to confirm whether SPR is as effective for older elephants.

2. Subjectivity in Assessing Behavior:

The subjective nature of the behavioral assessments used in the study.

While the researchers employed a detailed behavioral checklist, the determination of whether an elephant had successfully completed a behavior was ultimately left to the trainer's judgment.

This subjectivity could introduce bias into the data, potentially inflating the perceived success rate of the training.

For example, the study mentions that determining the angle at which the elephant held her trunk during the “steady” task was subjective.

Different observers might have interpreted the angle differently, leading to inconsistent results.

Using more objective measures, such as video recordings that could be reviewed by multiple observers, could help to mitigate this bias.

3. Inaccurate Measurement of Training Time:

The study included the time spent training behaviors that were ultimately not part of the final trunk wash sequence in the total training time.

This inclusion could make the reported training times appear longer than necessary.

For instance, four elephants were initially trained on the “trunk-out” behavior, which was later deemed unnecessary.

Including this time in the total training duration might give an inaccurate representation of the time required to train the essential trunk wash behaviors.

To provide a more precise measure of training efficiency, the researchers could have excluded the time spent on behaviors not included in the final trunk wash sequence.

4. Environmental Influences and Distractions:

The training took place in an environment with potential distractions, such as the presence of tourists, other animals, and the proximity to meal times.

These uncontrolled variables could have affected the elephants' focus and learning, potentially influencing the results.

The study acknowledges this, noting that Elephant 5, the adult elephant, was particularly distracted by a young calf in an adjacent stall.

To minimize the impact of these distractions, the researchers could have conducted the training in a more controlled environment or implemented strategies to reduce distractions during the sessions.

5. Lack of Follow-Up:

The study does not mention any follow-up assessments to determine if the elephants retained the learned behaviors over time.

Without long-term follow-up data, it is unclear whether the training effects are sustainable or if periodic refresher training is necessary.

Future research could address this limitation by including follow-up assessments at various intervals after the initial training to track the retention of the trunk wash behaviors.

Issues and Debates

Application to everyday life: Training Animals

The study's success in training elephants for a specific procedure, the trunk wash, highlights the potential of SPR in teaching animals a wide range of tasks and behaviors.

This has practical implications for various fields, including:

- **Veterinary Care:** Training animals to cooperate with medical procedures, such as vaccinations or examinations, can significantly reduce stress for both the animal and the veterinarian.
- **Service Animal Training:** Training service dogs to perform specific tasks to assist individuals with disabilities requires consistent and effective reinforcement techniques.
- **Animal Enrichment in Zoos and Sanctuaries:** SPR can be utilized to encourage natural behaviors and mental stimulation in captive animals, enhancing their overall well-being.

Application to everyday life: Human Learning and Behavior Change

- **Parenting and Child Development:** Positive reinforcement techniques, similar to those used with the elephants, can be highly effective in shaping desired behaviors in children. By consistently rewarding positive actions and providing clear expectations, parents and caregivers can foster pro-social behaviors, encourage responsibility, and motivate learning.
- **Education and Learning:** The study's findings support the application of reinforcement principles in educational settings. Educators can utilize positive reinforcement strategies to motivate students, encourage participation, and promote academic achievement. This could involve:
 - Providing verbal praise and encouragement for effort and progress.
 - Implementing reward systems, such as points or privileges, for completing assignments or achieving learning goals.
 - Creating a positive learning environment that fosters a sense of accomplishment and motivates students to strive for success.
- **Personal Growth and Habit Formation:** The principles of reinforcement can be applied to personal growth and habit formation. By setting clear goals, identifying desired behaviors, and implementing a consistent system of rewards, individuals can increase the likelihood of achieving personal objectives, such as:
 - Developing healthy habits (exercise, balanced diet).
 - Improving time management skills.
 - Breaking unwanted habits (procrastination, unhealthy snacking).

Nature versus nurture

While all elephants in the study received the same standardized training, they exhibited individual differences in their learning speed and performance.

These variations could be attributed to inherent differences in their personalities, cognitive abilities, or previous experiences (**nature**).

For example, Elephant 1, the youngest, required shorter training sessions, while Elephant 5, the adult, struggled with distractions. These differences highlight the influence of individual predispositions on learning outcomes.

By consistently rewarding desired actions, the researchers were able to teach the elephants a complex sequence of behaviors involved in the trunk wash procedure.

This success underscores the impact of environmental factors (**nurture**) and learning experiences in modifying behavior, even in animals with distinct innate characteristics.

Individual and situational explanations

The study's design and findings also relate to the individual vs. situational debate, which explores whether behavior is primarily driven by internal factors (personality, disposition) or external factors (environmental cues, social context).

The study's focus on individual differences in learning speed and performance among the elephants lends support to the **individual side** of the debate.

The variations observed suggest that innate characteristics, such as temperament or cognitive abilities, play a role in shaping how animals respond to training.

However, the study also acknowledges the **influence of situational factors** on elephant behavior. The researchers note the impact of distractions during training, such as the presence of tourists or other animals.

These external factors could influence the elephants' focus and performance, highlighting how environmental cues can affect behavior regardless of individual predispositions.

Reductionism versus holism

Fagen et al. (2014) primarily employs a **reductionist approach** by focusing on a specific behavioral mechanism, Secondary positive reinforcement (SPR), to explain and modify elephant behavior.

This focus on a single learning principle exemplifies a reductionist approach, simplifying the explanation of behavior to a specific mechanism without fully considering the potential influence of other factors.

However, the study also demonstrates some aspects of a **holistic perspective** by recognizing the role of individual differences and situational factors in the training process.

The researchers acknowledge the **individual differences** in learning speed and performance among the elephants, suggesting that factors like personality, cognitive abilities, and previous experiences could influence their responses to training.

Keep Learning

To help reinforce your understanding and prepare for potential exam questions, here are some practice questions related to this study and the A-level psychology syllabus:

1. From the Fagen study, what type of conditioning was investigated? (1 mark)
2. How were session times measured in the Fagen study? (2 marks)
3. How many elephants were in the study? (1 mark)
4. What specific behaviors were the elephants trained to perform? (3 marks)
5. What were the primary and secondary reinforcers used in the study? (4 marks)
6. Outline what quantitative data were collected in the Fagen et al. (2014) study. (3 marks)
7. Outline one strength and one weakness of the research method used in the Fagen et al. (2014) study. (10 marks)
8. Explain how secondary positive reinforcement was used in the Fagen et al. (2014) study. (4 marks)
9. Identify two features of the sample used in the Fagen et al. (2014) study. (2 marks)

Remember to use specific details from the study when answering these questions. Practice structuring your responses clearly, using psychological terminology correctly, and balancing description with evaluation where required.

