

METHOD OF SUCCESSIVE APPROXIMATIONS

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1. Core Definition

The method of successive approximations, universally recognized in behavioral science as **shaping**, is an instrumental procedure used to establish a novel behavior that is not currently part of an organism's existing repertoire. This technique operates under the principles of operant conditioning, where the frequency of a voluntary response is modified by the consequences it produces. Shaping is fundamentally necessary when the desired target behavior is too complex or too improbable to occur spontaneously, meaning that simple reinforcement of the target behavior would be ineffective due to the extremely low probability of its initial occurrence.

The core mechanism of shaping involves the strategic use of **differential reinforcement**. Initially, any response that vaguely resembles the target behavior, or even movements occurring in the general vicinity of the desired response, is reinforced. This initial reinforcement increases the frequency of these rough approximations. As these initial behaviors become stable and reliable, the criterion for receiving reinforcement is progressively tightened. Behaviors that were previously reinforced are now ignored (extinguished), while only responses that are closer, or more refined, approximations of the final target behavior are rewarded. This step-by-step refinement ensures that the organism is continually guided toward the ultimate behavioral goal.

Successive approximations demand the careful and skillful observation of the subject by the trainer or researcher. The process is dynamic; the trainer must constantly assess the organism's current performance and adjust the reinforcement schedule accordingly. If the criteria are raised too quickly, the subject may cease responding and the behavior will extinguish; if the criteria are maintained for too long, progress will stall, and the animal may become fixated on an intermediate, suboptimal behavior. Therefore, the efficacy of the method relies heavily on the precise timing and sensitivity of the reinforcement delivery, ensuring that the behavioral steps taken are small enough to be achievable yet large enough to constitute significant progress toward the complex objective.

2. Etymology and Historical Development

The systematic development and formalization of the method of successive approximations are directly attributable to the pioneering work of B. F. Skinner during the mid-20th century. Skinner's research, conducted primarily using the operant chamber (often called the Skinner box), demonstrated that while simple responses like lever pressing could be easily conditioned, more elaborate and complex behaviors required a methodical approach to bridge the gap between spontaneous actions and sophisticated outcomes. Prior to shaping, teaching complex behaviors

often relied on methods like imitation or chaining, which assumed the constituent behaviors were already present or easily prompted. Shaping offered a radical, behaviorist alternative.

Skinner first observed the inherent variability in an organism's behavior, realizing that even random, low-frequency responses could serve as the raw material for learning. He utilized this natural variability to establish behaviors that had never been performed before, such as teaching pigeons to "play ping-pong" or navigate complex mazes. The famous demonstration of teaching pigeons to guide bombs during World War II (Project Pigeon, though never deployed) relied heavily on successive approximations to condition extremely precise visual recognition and motor control.

The historical importance of successive approximations lies in its validation of the fundamental principles of behaviorism: that complex psychological phenomena can be broken down into measurable, observable behavioral units that are learned through interaction with the environment. It provided a powerful, reproducible experimental tool, moving behavior analysis beyond merely describing learned responses to actively engineering and creating new behavioral patterns. Today, it remains the gold standard technique for establishing new behaviors in both laboratory settings and applied environments.

3. Mechanisms of Behavioral Change

The behavioral change wrought by successive approximations is achieved through the interplay of two primary mechanisms: **differential reinforcement** and **extinction**. Differential reinforcement means selectively reinforcing certain responses within a class of behaviors while ignoring others. Early in the process, the class of behaviors eligible for reinforcement is broad (e.g., any movement toward the lever). As training progresses, the class of behaviors eligible for reinforcement narrows drastically (e.g., only touching the lever with the paw, then only pressing it).

Extinction plays a crucial, though often counter-intuitive, role. When the trainer raises the criterion for reinforcement, the previously reinforced, less-refined behaviors are subjected to extinction--meaning they no longer yield a reward. This extinction causes a temporary increase in behavioral variability, often referred to as an **extinction burst**. This increased variability is precisely what the trainer leverages, as it generates new, slightly different responses, some of which will naturally be closer to the target behavior. The trainer immediately captures and reinforces these closer responses, effectively selecting a new, more advanced baseline for the next phase of training.

Furthermore, successive approximations relies on the concept of **response induction** or generalization. Once a specific response is reinforced, the organism is more likely to emit responses that are physically or functionally similar to the reinforced behavior. This generalization allows the trainer to move smoothly between steps, as reinforcement of a slightly better response encourages the subject to try variations around that new level of performance, making the next, even closer approximation more probable. Thus, shaping is a cycle of reinforcement, extinction

leading to variability, and re-reinforcement of the selected, improved variation.

4. The Process of Shaping

Implementing the method of successive approximations is a highly systematic process that generally involves five distinct phases, which must be executed sequentially and adapted based on the subject's progress. The first phase is the **Specification of the Target Behavior**. This involves defining the final behavioral objective in clear, measurable, and unambiguous terms. Vague goals (e.g., "be better behaved") are replaced with operational definitions (e.g., "sit quietly on the mat for five minutes after the doorbell rings"). Establishing a precise target is crucial because it dictates the entire trajectory of the reinforcement schedule.

The second phase involves **Establishing the Baseline and Selecting the Initial Approximation**. The trainer must observe the subject's current, unconditioned repertoire to identify a starting point--a behavior that the subject already performs with reasonable frequency and that can logically lead toward the target behavior. The initial approximation must be easy enough to elicit quickly so that the subject experiences early success and the connection between response and reinforcement is readily established. If the target is complex (e.g., fetching a specific object), the initial approximation might simply be looking at the object or moving toward it.

The third phase is the **Intermediate Shaping Steps**, which constitutes the bulk of the training. The trainer creates a graded series of intermediate behaviors, each one representing a slight improvement over the last. The trainer must maintain meticulous records of progress and be prepared to deviate from the planned steps if the subject fails to meet a new criterion. Reinforcement is delivered immediately and consistently every time the organism meets the current step's requirement. Once a step is reliably achieved (e.g., 90% accuracy), the criterion is immediately raised, and the previous, less-refined response is extinguished.

Finally, the last phases involve **Refining the Behavior and Achieving Maintenance**. As the behavior nears the target, the trainer shifts from reinforcing all correct approximations to reinforcing only perfect performances. Once the target behavior is reliably achieved, the reinforcement schedule is often thinned out from continuous reinforcement (CRF) to an intermittent schedule (e.g., variable ratio or variable interval). This thinning makes the behavior more resistant to extinction and ensures the long-term maintenance of the complex response, moving the control of the behavior from the immediate external reinforcer to the natural, inherent consequences of the successful response.

5. Applications Across Disciplines

The method of successive approximations is one of the most widely applied behavioral techniques, extending far beyond the laboratory setting into clinical, educational, vocational, and animal

training environments. In **animal training**, particularly for sophisticated tasks performed by service animals (e.g., guide dogs) or performing animals, shaping is indispensable. It allows trainers to construct elaborate behavioral sequences, such as opening doors, retrieving specific medical items, or performing complex athletic feats, by breaking these macro-behaviors down into manageable micro-steps that are chained together through reinforcement.

In **clinical psychology** and behavior modification, shaping is a crucial component of interventions designed to teach adaptive skills to individuals with developmental disabilities, autism spectrum disorder, or specific phobias. For example, teaching complex self-care routines (like brushing teeth or dressing) involves shaping small, individual motor components until the full sequence is mastered. Similarly, treating severe social anxiety might involve successive approximations where the individual is first reinforced for simply tolerating a social situation from a distance, then for brief verbal exchanges, and finally for sustained social interaction.

Within **education and organizational management**, shaping is applied to improve academic performance and employee productivity. In classrooms, teachers use successive approximations when introducing complex mathematical problems or writing skills, rewarding small steps of mastery rather than demanding immediate, perfect performance. In organizational behavior management (OBM), shaping can be used to improve job performance by reinforcing employees for slight increases in efficiency, reductions in error rates, or improvements in safety compliance, incrementally moving their performance towards high-level standards.

6. Comparison with Related Techniques

While shaping is the fundamental method for establishing a new behavior, it is often confused with or used in conjunction with two related operant techniques: **chaining** and **fading**. Chaining involves linking together a series of established, simpler behaviors to form a single, complex sequence. Unlike shaping, which builds individual responses from the ground up, chaining assumes the component behaviors already exist in the organism's repertoire. Shaping is necessary to teach the components; chaining is used to organize them (e.g., shaping the skill of unlocking a door, then chaining that skill with walking to the door and entering the room).

Fading, on the other hand, refers to the gradual withdrawal of a specific prompt or cue that helps elicit a behavior. Fading ensures that the behavior comes under the control of the natural environmental stimulus rather than an artificial prompt. For instance, if a trainer physically guides a dog's body into a "sit" position (a physical prompt), fading involves reducing the intensity of that physical guidance until the dog sits solely in response to the verbal command. Shaping is used to establish the response; fading is used to refine the stimulus control over that response.

In practice, these techniques often complement one another. Shaping might be used to establish the first difficult step in a sequence, followed by chaining the remaining, already known steps.

Fading is frequently integrated into shaping when prompts are used to initially facilitate a closer approximation, and those prompts are then gradually withdrawn as the subject learns to emit the behavior independently. Understanding the distinction is vital: shaping changes the topography (form) of the behavior, chaining changes the organization of behaviors, and fading changes the stimulus control of the behavior.

7. Criticisms and Ethical Considerations

Despite its efficacy, the method of successive approximations is subject to practical and ethical criticisms. One primary practical challenge is the **time commitment and skill required** of the trainer. Shaping is labor-intensive; the trainer must be constantly attentive, flexible, and capable of identifying subtle behavioral variations that deserve reinforcement. If the trainer is inconsistent or unskilled, the process can fail, resulting in frustration for both the trainer and the subject, and potentially leading to the conditioning of unintended behaviors.

Ethical considerations often arise concerning the potential for **manipulation and control**. As shaping is a powerful tool for modifying behavior, concerns have been raised about its use in controlling human behavior without explicit informed consent, particularly in institutional or educational settings where external control might be prioritized over self-determination. Critics argue that when used improperly, it can undermine an individual's sense of agency, leading to behaviors that are dependent solely on external, immediate rewards rather than intrinsic motivation.

Furthermore, shaping can sometimes lead to **behavioral rigidities**. Because the process relies on the systematic selection and stabilization of specific responses, if the environmental conditions change slightly, the rigidly shaped behavior may fail to generalize or adapt effectively. Advanced applications of shaping, therefore, must often include steps specifically designed to reinforce variability around the desired response, ensuring that the organism retains flexibility and is capable of adapting the learned behavior to slightly novel contexts rather than performing it robotically.

Further Reading

[Operant conditioning \(Wikipedia\)](#)

[B. F. Skinner \(Wikipedia\)](#)

[Keller, F. S. \(1958\). The definition of psychology: An experimental analysis.](#)

[Shaping \(psychology\) \(Wikipedia\)](#)