

Live Human Scent Simultaneous Discrimination Training Plan

Ellen Hale

trailaway56@gmail.com

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Introduction

This paper will first present the background and reasons why to train human scent discrimination, and then outline a three-phase plan for live human scent (LHS) simultaneous discrimination training.

In an in-depth review of animal discrimination learning Sutherland and Mackintosh (1971) convincingly argued that successful performance signifies the unification of a two-stage process in that animals must learn both about what features of the situation to attend to and about what responses to make. If successful performance depends upon both learning about what to attend to and what responses to make, then the speed and ease of learning a particular task will depend on the amount of each type of learning that is needed and on the amount that has previously been learned that will transfer to that particular task. Many experiments have shown that after training a discrimination between stimuli of the same dimension, it makes it easier for animals to learn another task or discrimination involving novel stimuli from the same dimension than one involving stimuli from a different dimension. Discrimination learning between a particular stimulus dimension increases the animal's attention to that dimension and decreases attention to other stimuli, which can transfer to new tasks or discriminations that require attention to that stimulus dimension.

In this training plan, the stimulus dimension that the dogs will be required to learn to discriminate between is human scent. Many service dog activities require attention and response to human scent. It has been proposed that since many working dogs are required to locate and alert on live people, it might be better to train human scent discrimination using live people as the scent source so the dogs can learn about the complete scent picture. Therefore, this training plan has been prepared for training simultaneous discrimination between the scents of live people. It is an adaptation from part of my human scent discrimination-training curriculum involving the use of scent articles for human scent discrimination training.

This is the first draft and is subject to change. I encourage trainers to keep me informed of their findings and ask questions so adjustments can be made.

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Background

In order to respond to human scent accurately and reliably the dog's choice behavior must be predominantly controlled by the relevant stimulus. The process of establishing control by the relevant stimulus over behavior often involves discrimination training. It is not uncommon for people to think they can establish stimulus control or discrimination from single stimulus training. For example, pairing a single stimulus, such as human scent, with reinforcement over a number of trials until discrimination is established. Pavlov (1927, pp 117) even thought that if he paired a single stimulus or conditional stimulus (CS) with food often enough his dogs would ultimately respond only to the CS and no other, which would be discrimination. Interestingly, in some cases even after over a thousand pairings of a single CS followed by food, his dogs never mastered complete discrimination of the CS from the other stimuli. His dogs would salivate in the presence of the CS but in some cases, the response would fall to zero when a new stimulus was added.

In Pavlov's experiments and others, failure to discriminate is not because the subjects were incapable of detecting the difference between the training and test stimuli. Pavlov reported that on the first occasion that the test stimulus was presented it would elicit little or no salivation or no response. The point here is that no response to the test stimulus can occur only if it is discriminated from the training stimulus. If the subject starts responding to the test stimulus on subsequent trials, it cannot be due to a failure of discrimination.

Eventually Pavlov discovered if his dogs were exposed to two or more CS that were correlated with different schedules of reinforcement the dogs would rapidly learn the discrimination. In this procedure the [positive] discriminative stimulus was randomly presented and always followed by the reinforcer. The other stimulus [the negative discriminative stimulus] was also randomly presented but never followed with reinforcement. After just a few random presentations of this type, the dogs responded only to the positive discriminative stimulus during testing.

Due to its rapid learning effect the procedure of randomly presenting one stimulus that is always reinforced and another that is never reinforced has come to be known as the "discrimination learning procedure".

In stimulus discrimination training procedures, subjects initially respond similarly in the presence of both the positive (S+) and negative (S-) stimulus. However, as learning proceeds, responding in the presence of the S+ persists and responding in the presence of the S- diminishes. The effect of differential reinforcement, that is, reinforcement in the presence of the S+ and the omission of reinforcement in the presence of the S-, is that the subject comes to respond differently in the presence of the S+ and S-. For instance, by virtue of their correlation with the motivationally significant reinforcer, the S+ will come to elicit responses, such as, approach and contact, while the S-, signaling the omission of the reinforcer, will elicit avoidance. Thus, stimulus discrimination training procedures establish stimulus control when the S+ and S- come to signal when reinforcement is and is not available. Once the S+ and S- have gained control over behavior, they are called discriminative stimuli.

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The three main discrimination training procedures are successive, simultaneous, and conditional. In successive discrimination training, the S+ and S- are presented successively on consecutive trials. In simultaneous discrimination training, the S+ and S- are presented simultaneously on a single trial. These two simple procedures can be made more complex by adding a conditional cue, such as the scent articles used in mantrailing or lineup detection. In these two conditional discrimination tasks, the dog is required to select from at least two different comparisons, the scent that matches the scent from the previously presented conditional cue. By maintaining a reinforcement contingency upon a correct response to the matching comparison scent, varying the scent sources used, and the locations of the matching scent, accurate performance requires retention of the information obtained from the conditional cue until the matching comparison scent is located. Before the dog is trained on this more complex conditional discrimination task, the dog's choice behavior should be controlled by the relevant stimulus or human scent.

The two discrimination procedures used to establish stimulus control are the successive and simultaneous discrimination training procedures. However, MacCaslin (1954) found that when the difference between the positive and negative stimulus is very small the successive presentation of stimuli results in significantly slower learning than simultaneously presented stimuli. Since human scent is a complex stimulus that is largely comprised of the same body-odor chemicals, I use the simultaneous discrimination training procedure in preference to the successive procedure to start human scent discrimination training.

In simultaneous discrimination, the subject is required to make a choice between two (or more) simultaneously presented stimuli and the trainer measures (records) the distribution of responses between the alternatives. In this procedure, the S+ and S- are simultaneously presented at the same time, one on the left and one on the right. The subject is required to choose between them by responding to one but not the other. The reinforcement contingency is that a response to the S+ should always be followed with reinforcement and a response to the S- should never be followed with reinforcement. Since the S+ but not the S- always yields a reward when chosen, the subject learns to choose the S+ over the S-. The position of the S+ and S- are alternated randomly between the left and the right sides so the positions cannot be used to solve the problem.

In the procedure I will outline here, the position of the S+ and S- will be alternated between the left and right side in a semi random order. The procedural constraints will be that the S+ and S- should never be on the left and right side for more than three consecutive trials and the S+ and S- should be presented equally often on the left and right side over the course of each training session. This means that if there is an even number of training trials in each training session, responses to the left side will be rewarded 50% of the time and responses to the right side will be rewarded 50% of the time. It is well established that a 50% reinforcement schedule is enough to establish and maintain high levels of responding. In fact, partial reinforcement schedules are used to develop and maintain persistent responding.

Why then will the dogs learn to discriminate between human scents and not persist in responding to the left or right side at the expense of learning to discriminate between human scents? The answer is that the positive and negative human scents will be better signals predicting when reinforcement will and will not occur than either the left or right side will. A response to the positive human scent will be reinforced 100% of the time and a response to the negative human scent will never be reinforced 100% of the time. However, during each training session, a response to the left side will yield reinforcement 50% of the time and a response to the right side will yield reinforcement 50% of the time. Relatively speaking, the positive human scent will be a more reliable source of information predicting reinforcement and the negative human scent will be a more reliable source of information predicting no reinforcement than the left or right side. Although the positions are not good predictors of reinforcement, in isolation they would gain associative value. However, the circumstances are changed with the presence of both the positive and negative human scents. The presence of the human scents, both better predictors of the availability of reinforcement, prevents the positions from gaining the predictive or associative value that their schedule of reinforcement would otherwise dictate.

A similar argument can be made for the incidental contextual stimuli that will be present during both reinforced and non-reinforced trials. In this case, the positive human scent will be present in compound with the contextual stimuli and the negative human scent will be present in compound with the same contextual stimuli. When the dog responds to the positive scent plus the contextual stimuli, it will be reinforced. When the dog responds to the negative human scent plus the same contextual stimuli, it will not be reinforced. Because the contextual stimuli are present during both reinforced and non-reinforced trials the better predictor of the availability of reinforcement is human scent. The contextual stimuli do not inform the dog when reinforcement will and will not occur. The presence of human scents that reliably predict when reinforcement will and will not occur in each trial effectively abolishes the control by the contextual stimuli. By virtue of its better informative value, attention and associability to human scent will increase whereas the contextual stimuli will suffer a decline in attention and associability during the course of conditioning.

In discrimination training, not every stimulus present during conditioning is associated with the important outcome. Causally speaking, animals learn selectively to attend to the stimuli that are better sources of information predicting an important outcome at the expense of poorer ones. Furthermore, what they are attending to is what they will be learning about. Both of the above are examples of selective association or “relative validity” and how animals learn selectively. Because in these examples human scent is a better source of information, predicting when reinforcement will and will not occur, human scent will gain attention and associability at the expense of the less informative positions and contextual stimuli.

When attention and associability of human scent is increased at the expense of other stimuli that are present during conditioning but incidental or irrelevant, it can transfer to new human scent discriminations between novel people and thus, increase acquisition rate. Additionally, when a new discrimination between novel human scents is introduced, the error rate will be reduced and the

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accuracy rate will be increased relative to the initial learning because simple discrimination training gains attention and associability at the expense of the incidental environmental stimuli. Moreover, the increased attention and associability of human scent can transfer to new tasks that are more difficult to train and learn, such as conditional discriminations that involve a conditional cue.

Because human scent discrimination training establishes stimulus control to the relevant stimulus dimension (human scent) at the expense of incidental or irrelevant stimuli that do not predict the availability of reinforcement as well as the S+ and S-, some form of human scent discrimination training involving differential reinforcement between a S+ and S- of the relevant dimension should be incorporated into all pursuits requiring dogs to respond to human scent.

So far, I have talked about how the dog learns to ignore the stimuli that are not as well correlated with reinforcement as successful discrimination is learned. However, it is possible that there will be stimuli present during discrimination training that are just as well correlated with reinforcement as the positive and negative human scent. If this is the case, the trainer's specifications of what the discriminative stimuli are may not coincide with the dogs. For example, the dimension we want the dog to learn to discriminate between is human scent, not the difference between the various visual dimensions of people. In order to prevent the dog learning to discriminate visually between the positive and negative scent sources we will need to make the scent sources visually the same during the initial phase of human scent discrimination learning. If we do not, and the dog learns to use visual dimensions to discriminate between the positive and negative scent sources, that learning could overshadow or interfere with learning human scent discrimination.

To force live human scent (LHS) discrimination on each trial, the use of boxes was one idea. If boxes are used to hide the LHS sources in, I imagine along with needing to be visually identical, they would also need to be disposable boxes and not be interchanged between the LHS sources because individual scent would remain in or on the boxes. That is, each LHS source should have their own box; the LHS sources should not get out of one box and get into another. Therefore, the bottoms of the boxes would need to be open so the LHS sources can relocate. The boxes would also need to smell the same and be made of the same material. Additionally, there should be some way for LHS to escape from the boxes. Boxes are just one example of what could be used to make the LHS sources visually indistinguishable. It will be up to the trainer to decide what to use. However, for convenience I will use the term "box" in this training plan.

Other confounding factors that could be just as well correlated with reinforcement and the omission of reinforcement and thus predict the availability of reinforcement as well or better than human scent are artificial contaminants such as perfumes used in deodorants, soaps, shaving cream, laundry detergent, or cosmetic products. If these contaminants are more salient or easier to detect and discriminate from one another they can "overshadow" or interfere with learning to discriminate between the non-artificial organic compounds that comprise pure human scent. Other odors from tobacco products or dog treats in the pockets of the LHS sources are other examples that could also interfere with human scent

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discrimination learning. One way to overcome this potential problem would be to arrange for the suspected contaminants to be present during both reinforced and unreinforced trials. That is, have both LHS sources use the same products. Once again, it will be up to the trainer to decide how to address this potential problem.

Training Plan

Live human scent (LHS) simultaneous discrimination training can be divided into three phases. In phase 1, the dog will learn to make the identifying response. In phase 2, the dog will be required to make the response in the presence of the positive LHS and in phase 3, the dog will learn the task of discriminating between the positive and negative LHS sources.

Phase 1

In phase 1 the dog should be taught to make the trainers preferred response that will be used to identify the positive scent. Since most dogs will ultimately be trained a specific search task involving responses to human scent, it is important to think ahead and decide what the better ID would be for that specific task. I imagine most trainers know how to train IDs so I will not cover that here. Once the dog is performing the response at a level of ten out of ten trials, the dog can be advanced to phase 2.

Phase 2

Phase 2 is a preliminary training procedure in which the dog will learn to perform the identifying response in the presence of the positive LHS and the box. In this phase, the reinforcement contingency is; if the dog responds correctly in the presence of the positive LHS, he or she will be rewarded; if the dog fails to respond correctly, reinforcement will be omitted. Initially, it may be necessary to give the dog a verbal command to elicit the ID. When the dog responds correctly in the presence of the positive LHS, the response should be immediately reinforced. The reinforcement used should be something that is highly motivationally significant to the dog. I recommend training when the dog is hungry and using a highly desirable food. The reason I recommend food is because there will be a number of training trials in each training session and food is more economical time wise and it can be motivationally significant. Some trainers like to use clickers to immediately reinforce the dog prior to the presentation of the primary reinforcer in order to bridge the time interval between the correct response and the primary reinforcer. It is up to the trainer whether to use a clicker or not.

The goal in this phase is to reinforce a probable relationship between the positive LHS, the identifying response, and the reinforcer used and to strengthen the response in the presence of the positive LHS. In phase 3, the dog will be reinforced when the response is performed in the presence of the positive LHS and not reinforced when the response is performed in the presence of the negative LHS. Without the prior establishment of a solid ID in the presence of the positive LHS, the dog will very likely try a variety of different responses to get the reward when reinforcement is omitted after a response in the presence of the negative LHS, which could interfere with or retard human scent discrimination learning. For this reason phase 2 is important.

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Phase 2, procedural constraints

- 1) Training should take place in a location that is well ventilated and provides minimal distractions.
- 2) Since the goal in phase 2 is to strengthen the response in the presence of the positive LHS, only the reinforced trials will need to be recorded. It will depend on the dog, but I am estimating that five sessions consisting of thirty reinforced trials should be sufficient to strengthen the response. Note: The number of training trials in one session should be determined by the dogs continued interest to learn and by its level of satiation if food is used as the reinforcer.
- 3) Previously I explained how the dog learns that the positions of the positive and negative LHS are incidental or irrelevant to the solution. However, while the dog is initially learning the discrimination the dog can develop a position habit. In an effort to reduce the chances of a position habit, the position of the positive LHS should be randomly changed with the constraint that no one position be the same for more than three consecutive trials.
- 4) The same LHS source should be used throughout phase 2 and should also be used as the positive LHS in phase 3.
- 5) The motivationally significant reinforcer should only be offered during these training phases and other training involving human scent. The dog must earn the reward for a correct response and not be offered the reinforcer for free or when not in training.

Phase 3

Phase 3 is the LHS simultaneous training procedure in which the dog will learn to discriminate between the positive and negative LHS sources. The same person that was used to provide the LHS in phase 2 should also be used in phase 3 as the positive LHS. The person that is used to provide the negative LHS should ideally be a stranger to the dog in order to avoid complications from prior associations.

Additionally, since the dog will learn that the negative LHS predicts the omission of reinforcement, which will come to elicit avoidance responses, initially the negative LHS source should not be someone who will subsequently be used as a positive LHS source. That said, once human scent attention and associability is increased and the dog learns the significance of human scent, if the negative LHS source is subsequently used as the positive LHS source the dog should be able to overcome the contradiction.

Begin each training session with only the positive LHS source present but hidden in their box. That is, without the negative LHS source present. When the dog responds correctly, reinforce the dog with the reinforcer, or reinforcers if a clicker is used.

In all of the remaining trials in each training session, both the positive and negative LHS sources should be present simultaneously side by side; one on the left and one on the right about eight feet apart from

each other. While remaining in their boxes, the positive and negative LHS sources should be switched from the left to the right side in a semi random order over the course of each training session. The constraint is that the LHS sources never be on the same side for more than three consecutive trials and that they be present on both sides equally often in each training session. If the positions are not switched in a random order, the dog could learn to solve the problem by responding to a side rather than to the positive LHS. Note: In order for the LHS sources to remain in their boxes, the bottoms of the boxes will need to be open for relocation.

The exception to the above constraint is that on the occasions the dog responds to the negative LHS source, the positive and negative LHS sources should remain in position until the dog responds correctly to the positive LHS source. This exception is to prevent responses from being reinforced on just one side.

When the LHS sources change position from left to right and vice versa, some of their scent will remain in the locations the LHS sources had previously been. To avoid complications, when the LHS sources randomly switch positions from the left and right they should also advance to a new location.

There should be 10 to 30 correct training trials in each training session. All responses should be recorded, whether they are correct or incorrect. Once the dog has reached a criterion of 18 out of 20 consecutive correct responses the dog should then be overtrained an additional 200 training trials before another pair of LHS sources are used for more discrimination training. Thereafter, all subsequent simultaneous LHS discriminations can be trained only to the criterion of 18 out of 20 consecutive correct responses.

Note: Overtraining of human scent discrimination is important for the development of an attention habit so when the dog is subsequently required to learn a new task to human scent involving new responses the dog will continue to attend to human scent. The main effect of overtraining discrimination is to strengthen attention to the stimulus dimension being trained when complex discriminative stimuli such as human scent are used (simple stimuli do not need to be overtrained, see for example Sutherland and Mackintosh, 1971). Therefore, when the overtrained dog is subsequently required to learn a new task to human scent the dog will continue to attend to human scent and will thus, learn the new responses required relatively fast. Whereas, dogs trained only to the criterion of 18 out of 20 consecutive correct responses may cease to pay attention to human scent when they fail to obtain reinforcement after an incorrect response and will thus, take longer to learn the new task.

Phase 3, procedural constraints

- 1) Ideally, during the dog's initial conditioning, strangers to the dog should be used for LHS discrimination training.
- 2) The positive LHS source must remain positive and the negative LHS source must remain negative. Do not switch the positive to a negative and vice versa.

- 3) The positive and negative LHS sources should be presented simultaneously, one on the left and one on the right about eight feet apart. No attempt should be made to fade in the negative LHS source. When training with more difficult to discriminate complex stimuli such as human scent the dog needs to attend not only to the positive stimulus but also to the negative stimulus for more accurate discrimination to be established.
- 4) The positive and negative LHS sources should be on the left and right side equally often over the course of each training session.
- 5) The positive and negative LHS sources should be present on the left and right side in a semi random order with the constraint being that the positive or negative LHS never be on the same side for more than three consecutive trials.
- 6) If the dog IDs the negative LHS source, the LHS sources should remain in place until the dog correctly IDs the positive LHS. This is to discourage the development of a position habit. If the LHS sources were switched to the other sides, the dog could ultimately be reinforced only on a preferred side and consequently develop a position habit at the expense of learning human scent discrimination.
- 7) Record all responses (IDs), whether they are correct or incorrect.
- 8) The reinforcer used should only be used to reinforce correct responses to the positive LHS. The dog should not receive the reinforcer during other occasions when not in training.

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