Pleading for the principle of negative reinforcement

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Actual situation

At the end of the 80s in the last century, in the methodology of dog training the application of the learning principle of positive reinforcement was increasingly favoured. This means that the dog receives a treat or something pleasant after a desired behaviour or correct reaction to a command. The work with unpleasant stimuli was increasingly suppressed and is today mostly regarded as frowned upon and even animal protection law relevant. The bans on electronic training equipment that have been issued and those still being sought in various European countries is only one result of this development.

In the same period, as a consequence of a series of biting incidents caused by dogs, some of which were fatal for the victims, demands for effective dog laws became louder and louder in politics and society and were also implemented in practice. In Switzerland, for example, a dog owner, regardless of his experience, must now complete a federally recognised practical course for each newly acquired dog in order to obtain a certificate of competence. The aim is to ensure that dog owners have their dogs under control in everyday situations in such a way that they pose no danger or annoyance to the public.

Due to decades of my practical experience in dog training and in solving behavioural problems, I consider it unrealistic that this objective can be achieved with methods based exclusively on positive reinforcement. Reliable behaviour control requires procedures based on a combination of positive and negative reinforcement.

Definition

The term "negative reinforcement", which originates from learning psychology, describes the following situation: An already existing stimulus, which is perceived as discomfort, disappears when a certain behaviour occurs and thereby causes an increase in behaviour in the same situation. The temporal relationship between stimulus and behavior is shown in Figure 1.

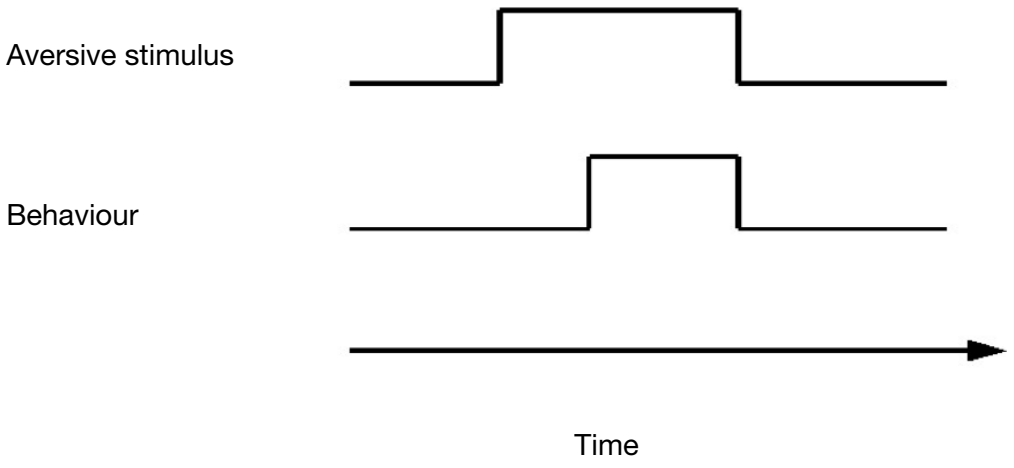

Fig. 1: Temporal relationship between aversive stimulus and behavior during negative reinforcement.

Three examples may illustrate this fact. First a situation from our everyday life. You are on a walk. Suddenly rain begins to soak your clothes (unpleasant stimulus). You accelerate your gait and go under a nearby shelter (behaviour). The rain stops wetting you (reinforcement). The second example shows that unwanted behaviour of the dog can be unintentionally intensified by negative reinforcement. You manipulate your dog to remove a bitten tick (unpleasant stimulus for the dog). Your dog growls and you pull your hand away and leave him alone. Your dog will be more likely to threaten you next time you try to remove a tick. You have negatively reinforced his growl. Last example: Your dog finds a nasty smelling object that you want to take away from him. To do this, you press the dog's lips against his molars with two fingers and create an unpleasant feeling for him. He opens the muzzle and the stinking object falls to the ground. Immediately you stop pressing. You have negatively reinforced the opening of the mouth. The dog's willingness to open the mouth next time increases.

Negative reinforcement thus leads to an increase in behaviour as well as positive reinforcement. The two principles differ, however, in that positive reinforcement provides a pleasant stimulus and negative reinforcement removes an unpleasant stimulus (Tab. 1). For comparison, Table 1 shows the two other possibilities that can be used to influence the behaviour of dogs. Both the principle of extinction and the principle of punishment result in a decrease in behaviour. Extinction occurs when the reinforcement of a learned behaviour is omitted. In punishment an unpleasant stimulus is added.

Tab. 1: Comparison of operant learning principles.

	Increase in behaviour	**Decrease in behaviour**
Adding of stimulus	Positive reinforcement	Punishment
Withdrawal of stimulus	Negative reinforcement	Extinction

In contrast to negative reinforcement, in which the aversive stimulus appears before the (desired) behaviour (Fig. 1), in punishment training the aversive stimulus begins during or immediately after an unwanted behaviour (Fig. 2).

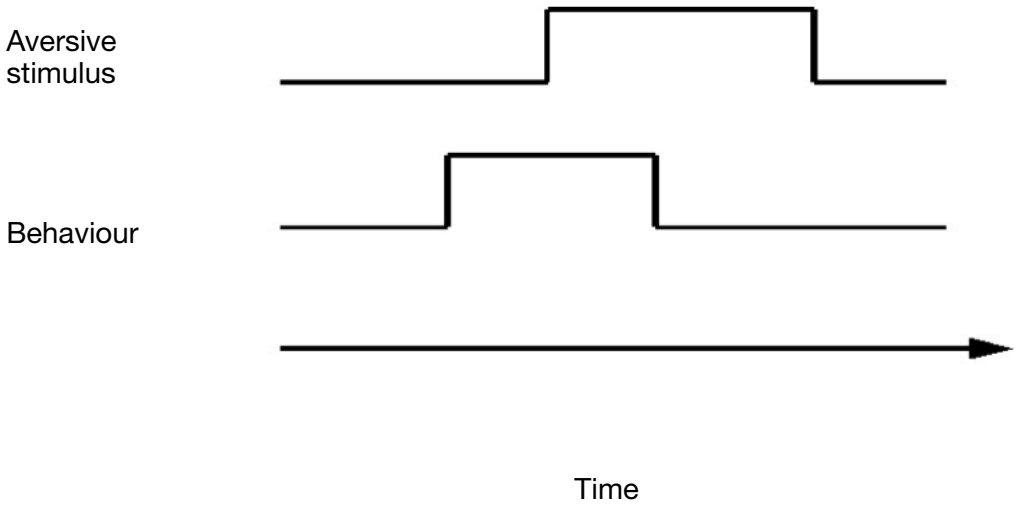

Fig. 2: Temporal relationship between aversive stimulus and behaviour during punishment.

Aversive stimuli and animal welfare

In order to clarify the question whether and under what conditions the use of aversive stimuli in the handling of dogs is animal-friendly, we consider the conditions in natural living environment. Wild wolves can be exposed to a multitude of painful events. During the hunt for the large prey animals moose and musk ox, antler and horn kicks as well as hoof kicks can occur and social conflicts among wolves can lead to bites by conspecifics. In order to avoid serious injuries, wolves can terminate the respective contact by escape. In addition, they are able to learn to recognise impending unpleasant events by certain behaviours, such as head-sinking with the musk ox or growling and teeth-showing with another wolf and to avoid the contact thanks to such warning or threatening signals. In learning psychological jargon one would say that for wolves in their natural habitat unpleasant events are "predictable" and "controllable". The effects of the lack of predictability and controllability of aversive stimuli on animals have been studied in a variety of experiments. It was shown that animals preferred an environment in which they were exposed to a signalised electrical stimulus to an environment in which the shock was not announced. The predictability of the stimulus was obviously judged to be more acceptable. Furthermore, animals that are unable to escape or avoid an unpleasant electrical stimulus by their own behaviour develop stomach ulcers and are increasingly struggling to successfully cope with new unpleasant events. This is called "learned helplessness" (SELIGMAN et. al, 1971). The observations from the natural habitat and the findings from the laboratory experiments thus allow the following statement to be made about the animal welfare of aversive stimuli during the training of dogs: The use of unpleasant stimuli is animal-friendly if their intensity is appropriate and their appearance is announced to the dog and it is offered the possibility of ending or avoiding the stimuli by a certain behaviour (SCHWIZGEBEL, 1996).

Safety training: escape-avoidance learning with a safety signal

The safety training developed by TORTORA (1982) meets the above criteria for the animal-friendly use of unpleasant stimuli to the highest degree. It is based on the learning principle of escape-avoidance learning. The first learning experiments for escape-avoidance learning date back to the 40s of the last century. In a “jumping” box (Fig. 3), a rat learns to terminate an electrical stimulus that flows through the grid floor by jumping over the hurdle to the adjacent plastic floor. The electrical stimulus is announced by a light.

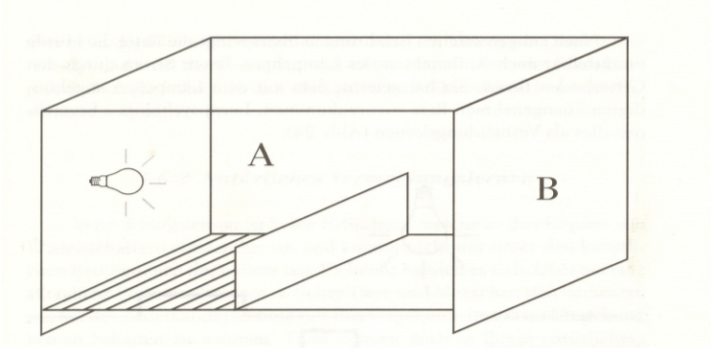

Fig. 3: “Jumping” box with light and hurdle, which divides the chamber into a shock compartment (A) and a safe compartment (B).

After a few such experiences the rat jumps already shortly after the light turns on before the beginning of the electric shock. It avoids the unpleasant effect. Based on such experiments, the trainer designs the training situation during safety training in such a way that the dog experiences

an unpleasant stimulus immediately after a command known to him, which has been established beforehand by positive reinforcement (playing with the trainer). While the dog performs the commanded action, the stimulus is ended, followed by a tone and play. The respective command serves the dog on the one hand as a warning signal for the coming unpleasant stimulus and on the other hand it provides the dog with the necessary information about how to end the stimulus. It is the key to success. Learning psychologists call the associated process escape learning (Fig. 4).

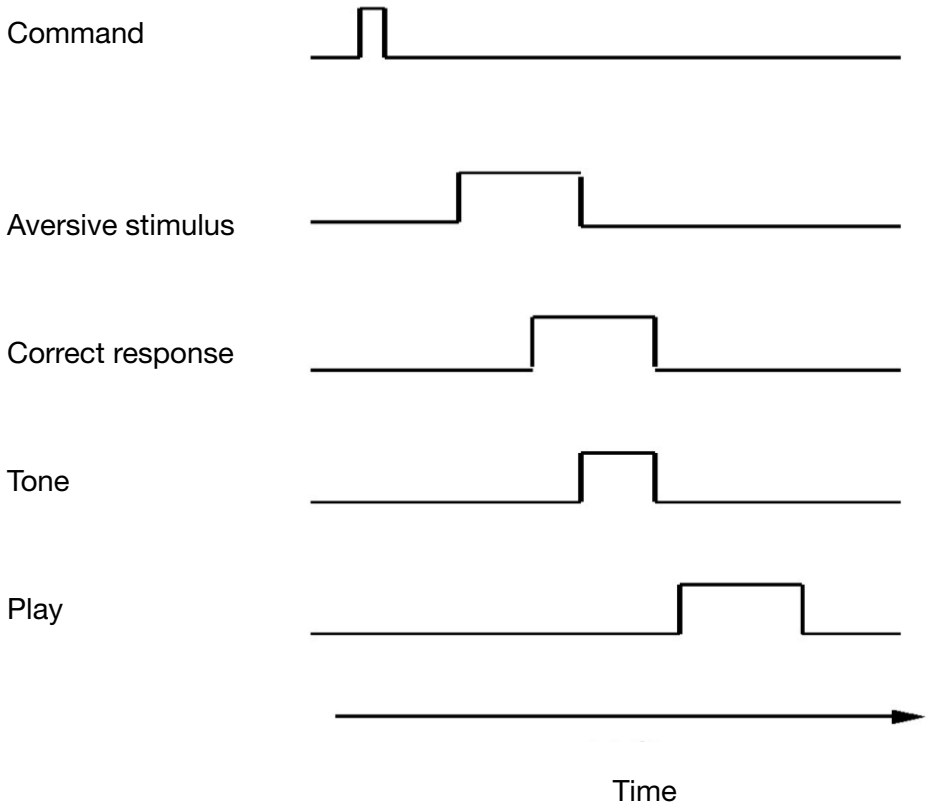

Fig. 4: Components and their temporal relationship in escape training.

The unpleasant stimulus is generated mechanically at the beginning of the training by a leash and collar and later by a radio-controlled electronic training collar. The electric stimulus is introduced in an intensity that is just perceptible for the dog. In the course of the training the stimulus intensity gradually increases until it is perceived as slightly unpleasant by the dog. The electronic device used has an additional sound option, so that the dog hears a high pitched tone after successful completion of the electrical stimulus. As the dog's experience in coping with the electrical stimulus increases, the tone following the electrical stimulation gradually takes on the meaning of a safety signal. It reliably announces a stimulation-free time to the dog. In the course of the training the dog will react faster and faster to a given command and thus avoid the unpleasant effect and achieve safety and play (Fig. 5).

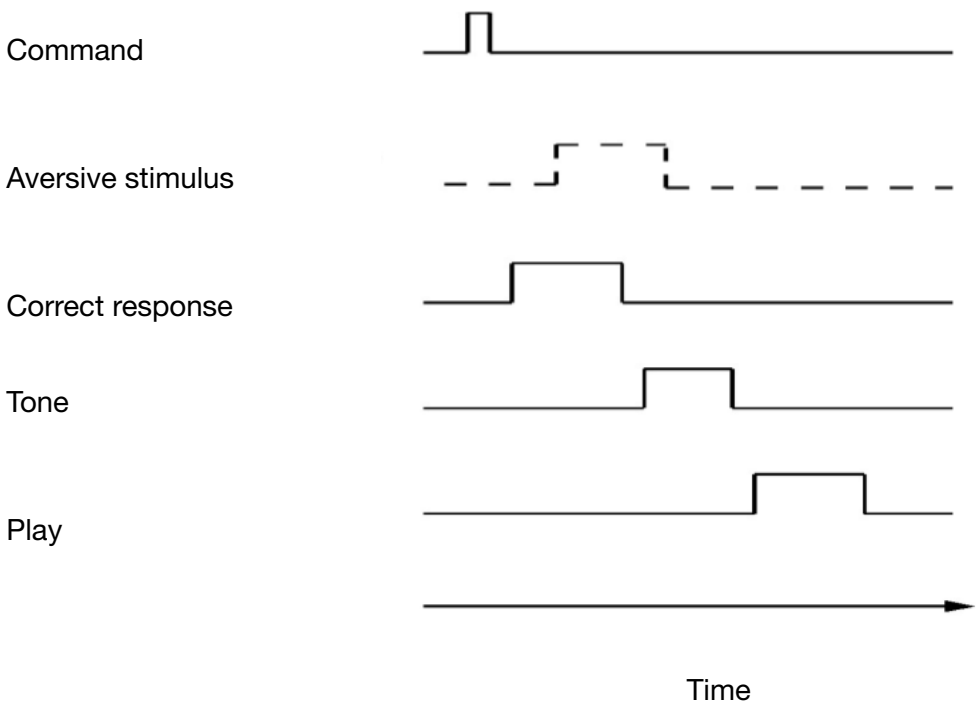

Fig. 5: Components and their temporal relationship in avoidance training. For clarification, the missing aversive stimulus is shown dashed.

Commanded reactions trained through escape-avoidance learning are very permanent and much more resistant to the process of extinction than actions established through positive reinforcement alone. In the systematic absence of play or food after a correct reaction, the dog can detect the changed rule. As a consequence he will react worse and worse to the command. When avoiding an electrical stimulus, the dog cannot determine whether the stimulus actually occurs or is absent, as he will already react beforehand. Could we ask the dog, "Why do you follow the commands so promptly? You haven't felt an electrical stimulus for months," he would answer, "See it works!

In the course of safety training the dog develops from a beginner to an absolute professional when confronted with an unpleasant stimulus and above all a winner against the stimulus. But the trainer also makes a profit in the form of an outstanding control of the dog's behaviour. In 1983 Dan TORTORA showed in a unique experimental study how effective safety training is in gaining behavioural control and how superior it is to training with play only as a positive reinforcer. Dogs that had undergone the safety training were controllable even under very strong distractions (Fig. 6, training phase 7) - free-running dogs - with almost 100 percent correct responses with 15 different commands. On the other hand, the behaviour control of the dogs trained only with positive reinforcement (play) almost completely collapsed under the same conditions.

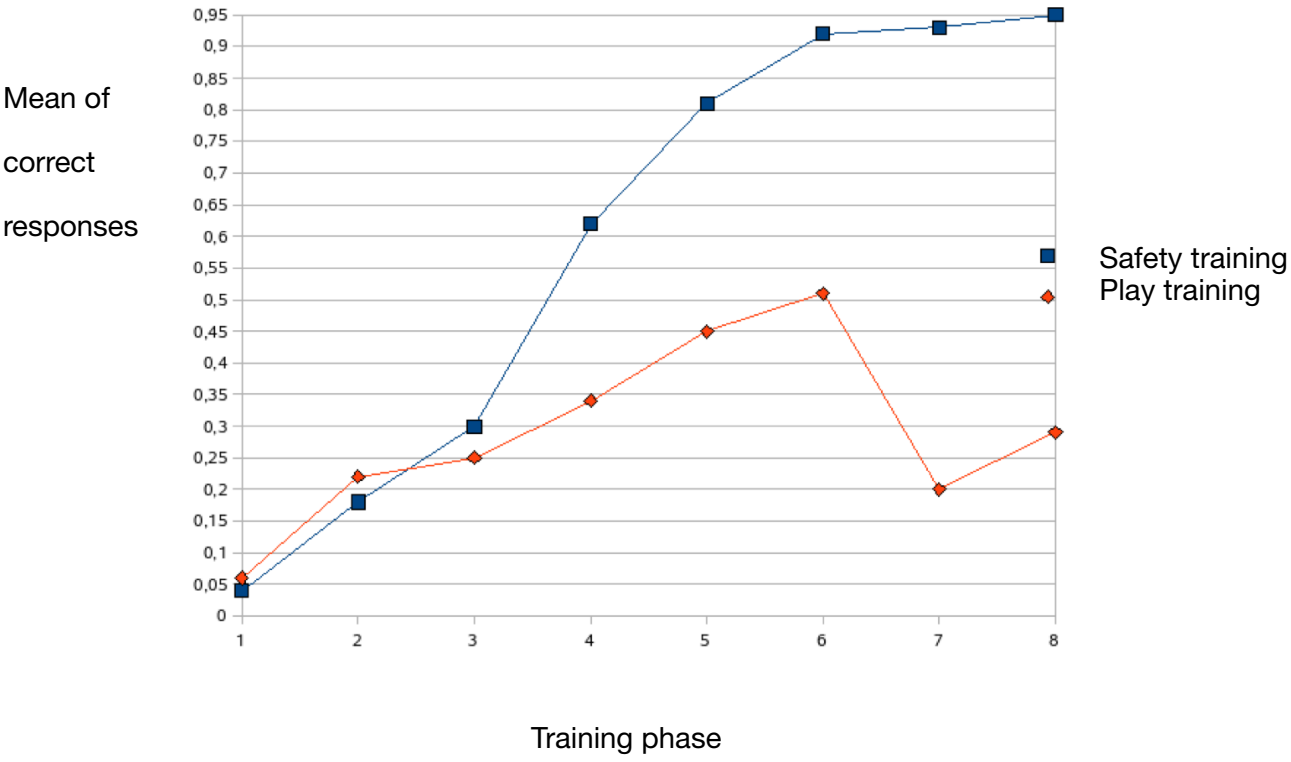

Fig. 6: Average proportion of correct reactions shown within 2 seconds after a command from dogs that had undergone play training over the entire training period or safety training from training phase 4 onwards (source: TORTORA, 1983).

Imagine that there was a study with such a proof of efficiency for the clicker training. It would be highly praised by the dog people, its results would be published in every professional journal and quoted in detail in scientific papers. Not so the investigation of TORTORA. It was hushed up in the popular literature and was not listed in scientific papers even on the subject of electronic collars or, if mentioned, only treated very superficially. Because, as is so often the case, there cannot be what must not be!

The ignoring of TORTORA's work by scientific specialists is all the more astonishing as he could prove in the central question of the study how effective safety training is in solving problems of aggression.

Safety training in behavioural therapy

TORTORA (1983) successfully treated 36 dogs which, according to his definition, showed so-called "avoidance-motivated aggression". The aggressive behaviour, which the dogs had learned to use successfully in unpleasant situations, mainly occurred against the dog owner or family members. Through the safety training procedure the dogs learned to carry out the non-aggressive actions of 15 different commands ("sit", "place", "here", "heel" etc.) and thus to avoid an unpleasant electrical stimulus. They thus acquired a new strategy for coping with an electrical stimulus and transferred this to other unpleasant situations. Parallel to this process, the aggressive behavior gradually decreased and finally disappeared completely, so that the dogs could be returned to their owners.

Safety training can also be used successfully in the therapy of dogs that behave dominantly aggressive towards humans. By negatively reinforcing the dog for the correct execution of commands, we imitate the behaviour of a dominant dog. Higher ranked dogs can impress or threaten in social disputes, whereupon the subdominant partner shows calming behaviour (e.g. lying down on the side). The dominant then stops imposing or threatening. From the point of view of learning psychology, the dominant dog reinforces the submissive behaviour negatively. With the help of safety training we can establish or consolidate our dominant position without having to interact directly with the aggressive dog. There is no need to use punishment. In behavioural therapy this procedure is called counter-conditioning.

Counter-conditioning instead of punishment together with safety training also offers itself as the first choice for eliminating other behavioural problems, such as chasing cars, game or cats. In contrast to the therapy of aggressiveness problems, it is not necessary to use the electrical stimulus in an unpleasant intensity for the dog. It is only increased to such an extent that it causes rapid reactions to commands without any discomfort being recognisable in the dog's expressive behaviour. The electrical stimulus is perceived by the dog as stimulating and therefore does not correspond in its effect to a negative reinforcer. Interested readers will find comprehensive information on this variant of safety training in my book "Hunde aktivieren statt hemmen" (SCHWIZGEBEL, 2006).

Conclusion

At the end of the last century, the abandonment of hard training methods, which mainly rely on the use of painful punishments, was an urgently needed development in the dog scene. But as is so often the case with such changes, they overstepped the mark. Not only inappropriate hard impacts were banned from dog training, but also two of four learning principles, punishment and negative reinforcement, were outlawed. With the negative reinforcement, however, an extremely effective principle was sacrificed. The faction of the proponents of exclusively positive reinforcement should understand that gaining control of the behaviour of dogs and the therapy of behavioural problems, especially aggression problems, are not philosophical but pragmatic disciplines. Consequently, little efficient methods should be thrown overboard and effective procedures should be promoted, provided they meet the criteria for animal welfare. Without a doubt, safety training is effective and animal-friendly. It makes optimum use of synergies between positive and negative reinforcement and, with increased practical use, could prevent even stricter dog laws.

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