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Training methods of military dog handlers and their effects on the team's performances

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Abstract

While only a few studies have analysed training methods used on working dogs, a recent survey in 303 Belgian military handlers revealed the use of harsh training methods on military working dogs (MWD). The present work aims at analysing the training methods used on Belgian MWD and the behaviour of handlers to objectify the performances of the dog handlers teams (DH teams) and the welfare of the animals.

A standardized evaluation, including obedience and protection work exercises, was conducted on DH teams ($n = 33$). Every evaluation was done twice to assess the reliability of the observation methods. The behaviours of MWD and handlers were recorded on videotape and subsequently analysed. Results showed that handlers rewarded or punished their dogs intermittently. Stroking and patting the dogs were the most frequently used rewards. Pulling on the leash and hanging dogs by their collars were the most commonly used aversive stimuli.

The team's performance was influenced by the training method and by the dog's concentration: (1) low-performance dogs received more aversive stimuli than high-performance dogs; (2) dog's distraction influenced the performance: distracted dogs performed less well.

Handlers punished more and rewarded less at the second evaluation than at the first one. This suggests that handlers modified their usual behaviour at the first evaluation in view to present themselves in a positive

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light. During the second evaluation the dogs reacted to this higher frequency of aversive stimuli as they exhibited a lower posture after aversive stimuli. The authors cannot prove that the welfare of these dogs had been hampered, but there is an indication that it was under threat.

Low team performances suggest that DH teams should train more regularly and undertake the usefulness of setting a new training system that would rely on: the use of more positive training methods, an increased training frequency, the elaboration of a course on training principles, and an improvement of dog handler relationship.

Keywords: Working dogs; Operant conditioning; Human–animal interaction; Distraction; Training

1. Introduction

The communication between pet dog and owner (Gasci et al., 2004; Miklosi et al., 2003; Soproni et al., 2001; Viranyi et al., 2004) and the efficiency of some stimuli and their consequences on behaviour (Hiby et al., 2004; Schilder and Van der Borg, 2004) have recently received some attention. Few studies have been conducted on human–animal communication in service dogs (guide-dogs for the blind in Naderi et al., 2001; search dogs in Lit and Crawford, 2005; military working dogs in Lefebvre et al., 2007). Human–dog communication can be studied through dog training (Schilder and Van der Borg, 2004). In this case, the most usual method of training is operant conditioning: the animal learns that its response to a command (i.e. discriminative stimulus) has consequences (i.e. appearance or disappearance of appetitive or aversive stimulus) (Reid, 1996). For instance, after the command Sit, the dog sits and receives a treat: the dog has established a link between the command Sit and the relation ''to sit means that I receive a treat.'' Depending on its response, four scenarios are possible: the dog will be reinforced positively (i.e. receiving a treat), reinforced negatively (i.e. stop pulling on a choke collar), punished positively (i.e. giving an electric shock), or punished negatively (i.e. withdrawal of a treat). Traditional dog training techniques have mainly used aversive stimuli. Though the use of those stimuli can be efficient in some situations (Christiansen et al., 2001), serious negative consequences have been observed: well-being problems (Beerda et al., 1998; Schilder and Van der Borg, 2004) and an increase in the number of behavioural problems (stereotyped behaviour, fear, intra- and inter-specific aggression, Tortora, 1983; Roll and Unshelm, 1997; Hiby et al., 2004). Bibliographic review (e.g. Hiby et al., 2004; Adams and Johnson, 1994; Johnston, 1995) and field observations suggest that positive training might be more efficient than aversive training. Positive training methods use positive reinforcement through the presentation of rewards in response to desired behaviours. Purely positive training can be defined as a training method where aversive stimuli, either in the form of positive punishment or negative reinforcement, are not used (Booth, 1998). This move towards more positive training methods has been observed in some institutions using working patrol dogs. In the Belgian army, preliminary studies in the field did not observe these tendencies among DH teams. On the contrary, it seems that the dogs that failed an exercise were punished (change in the tone of voice, pulling on the leash, hitting the hindquarters with the leash, using the choke or the prong collar, when dogs did not release their bite during protection work: hanging them by their collar, attaching a second leash around their hindquarters, using the electric collar, etc.), whereas dogs that carried out an exercise correctly were generally not rewarded (A.H., personal observation). Moreover, the training frequency of these DH teams is less frequent than expected from the military standards (dogs must officially train twice a month).

The primary aim of this paper was to analyse the different stimuli that operational MWD ($n = 33$) received from their handlers during dog training. The authors want to answer the three following questions: (1) Does the actual training system used for Belgian MWD provide DH teams up to military standards? (2) Is the team's performance influenced by handler's behaviour and/or dog's behaviour? (3) What is the welfare status of these dogs during the training sessions?

2. Methods

2.1. Subjects

The studied group consisted of 33 DH teams of the Belgian Defence. Dogs were selected as representative of the Military canine population regarding sex (26 males, 7 females), breed (27 Belgian shepherds, 6 German shepherds) and housing conditions (18 living in a military kennel, 15 living at the handler's home). The animals had at least belonged to the army 3 months before the study and were used as operational working dogs for maximum 3 years (1.26 ± 0.14 years). The dogs were between 1 and 5 years old (3.06 ± 0.21 years). According to this sample constitution, effect of sex, breed and duty time have not been tested. The only factors that have been analysed are age and the housing conditions. Because of the difficulty in documenting the origin of many dogs acquired by the Belgian Defence, no attempt was made to distinguish dogs on basis of their provenance. All the dogs were subjected to a clinical examination and were declared in good health and ready to take part in this study. The average time handlers were operational was 7.92 ± 1.00 years. In this study, all handlers were men.

2.2. Standardized evaluation

A standardized evaluation was worked out to assess the team's performances. The evaluation was conducted on a fenced field (length 15 m, width 10 m; Fig. 1). The evaluation included 8 obedience exercises (Walk-at-heel, Sit, Down, Stand, Positions-at-distance, Recall-to-heel, Down-out-of-view-of-the-handler, Jump) followed by five protection work exercises (Handler's-defence, Attack, Attack-with-gun-shots, Attack-with-threatening-behaviour, Stand-off). These exercises are similar to those given during the instruction course and the monthly training sessions. The Walk-at-heel exercise (exercise 1) goes as follows: the handler conducts the dog on leash to cone 1 and stops there. After the Sit command, the dog sits to heel. After Heel command, the team walks at a normal pace from cone 2 to cone 3 until it arrives back again at cone 1. At cone 2, the handler gives the Turn command and the dog follows the handler from cone 1 to 3: the team walks at a slow pace between cone 1 and 8, at a normal pace between 8 and 5 and at a fast pace between 5 and 4. Between cones 3 and 2, the team turns right at a 90° angle and stops in middle of line A. After the Sit command, the dog sits to heel. Descriptions of the other exercises (Annex 1) are available online. Dogs were held on leash by the handler and wore leather or choke collars. Both evaluations were presented to handlers as additional training sessions. Authors expected that handlers would behave just like they were used to as they did not receive any guidelines. Every evaluation was done twice, with 20 days in-between, to assess the reliability of our observation methods. No training has been realized between these evaluations.

2.3. Observed parameters

The observed parameters were team's performance, handler's behaviour, and dog's behaviour. To analyse the team's performance, the number of correct and incorrect exercises, and the score of the team for the different exercises were calculated. An exercise was considered as correctly done when the team obtained at least half of the score at the exercise. The scoring method used by the Belgian army was applied (Annex 2).

To analyse handler's behaviour, the number of appetitive stimulus employed, the number of aversive stimulus employed and the number of times without a reaction from the handler after dog's response were identified per exercise. The term appetitive stimulus was used to define positive reinforcements. The term

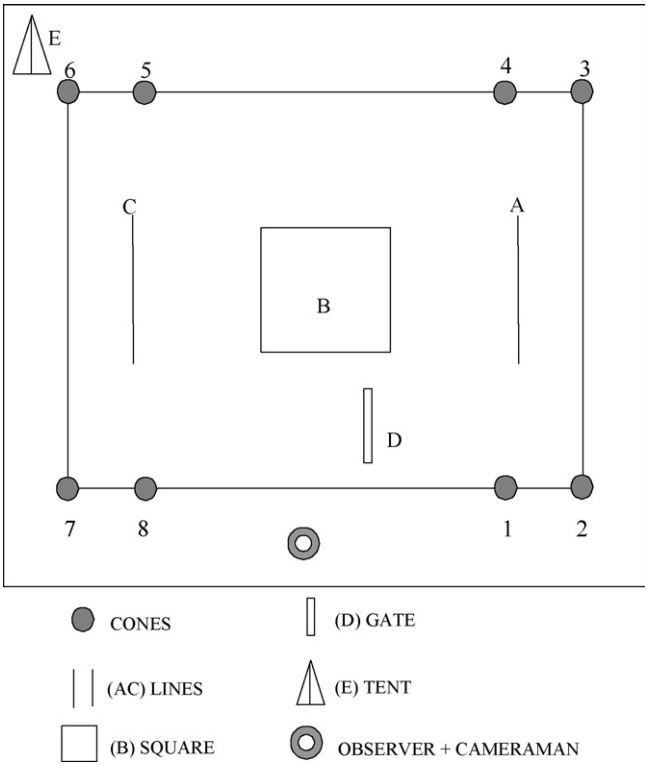

Fig. 1. The evaluation was conducted on a fenced field (length 15 m, width 10 m). Specific material was used (eight plastic cones, two rope lines, a rope square, a wooden gate and a tent). The observer and the cameraman were in the field.

aversive stimulus combines both negative reinforcements and positive punishments. Negative punishment was never observed during these trainings.

To analyse the dog's behaviour, their distraction, body posture and training-related behaviours were identified.

Dogs were not considered as distracted when their head and/or body were oriented towards the handler or towards a direction that had an angle inferior to 10° compared to the exercise direction. Dogs were considered as distracted when their head and/or body were oriented in any other direction for more than 1 s (Fig. 2). The distraction was scored in percentage (duration of distraction/duration of exercise × 100). This was taken into account for all the obedience exercises except the exercise Down–out-view-of-the-handler. Dog's posture was scored after the first appetitive and aversive stimulus during every obedience exercise. Dog's posture (described by Beerda et al., 1998, Annex 3) was observed for 3 s and the lowest observed position was scored as an event (Schilder and Van der Borg, 2004). The training-related behaviours were scored in a number of occurrence/minute during every obedience exercise, as the duration was not the same for the exercises (min: 10 s; max: 60 s). The observed behaviours were mouth-licking, tongue out, yawning, lifting front paw, replacement behaviour (including shaking and replacement sniffing), jumping, opening, and closing mouth (Beerda et al., 1998).

2.4. Statistical analysis

The behaviours of handlers and dogs during the two evaluations were recorded on videotape (Digital Video Camera Recorder, DCR-TRV27E, Sony®). Data were analysed by non-parametric tests (Wil-

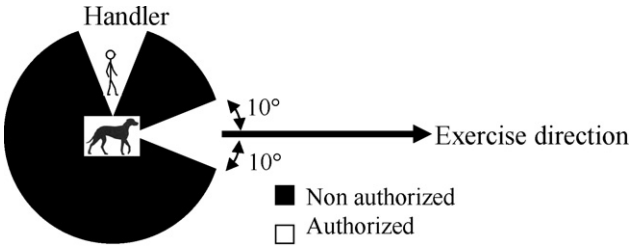

Fig. 2. Dogs were not considered as distracted when their head and/or body were oriented towards the handler or towards a direction that had an angle inferior to 10° compared to the exercise direction. Dogs were considered as distracted when their head and/or body were oriented in any other direction for more than 1 s.

coxon and Kruskal-Wallis signed rank tests) on the 33 dogs without consideration of sex, breed and duty time. Deviations are expressed as ± S.E.M. All the analyses were done by SAS (SAS Institute, 2002–2005).

Results of the first evaluation (team's performance, handler's behaviour, dog's behaviour, and their link) are first presented then compared to those of the second evaluation.

3. Results

3.1. Team's performance

Teams obtained an averaged score of 54.97% ± 3.00 (327/595 points ± 17.84). Teams performed significantly better on obedience exercises than on protection work exercises (respectively 65.79% ± 3.24 and 38.96% ± 4.10, Wilcoxon: $z = 4.27$, d.f. = 1, $p < 0.001$). Only 21% of the dogs did loose their grip after the first Out command and 19% of the dogs carried out the Stand-off correctly. Authors could not find any significant influence of age and housing conditions on the performance of the team.

3.2. Handler's behaviour

Handlers used significantly more appetitive stimuli (57.12%) than aversive stimuli (21.88%) or no stimulus (20.98%) (KW: $\chi^2 = 37.94$, $p < 0.001$). The appetitive stimuli were in decreasing order: tactile stimuli (stroking dog (42.51%), patting (12.86%)), verbal praise (24.14%), toy (2.89%), and food (1.04%). They were frequently observed in combination (16.53%: stroke and verbal praise, toy and verbal praise, etc.). The aversive stimuli were in decreasing order: pulling on the leash (47.94%), hanging the dog by its collar (35.61%), verbal scolding (10.27%), hitting (2.73%), or other (3.42%). No combinations of those stimuli were observed to punish a dog.

The number of appetitive stimuli did not differ significantly between obedience and protection work: handlers rewarded correct responses in 67% of both cases. But handlers punished more the incorrect responses of their dogs during protection work (in 80% of the cases) than during obedience (in 60% of the cases) (Wilcoxon: $z = 4.05$, d.f. = 1, $p < 0.001$). Consequently, there were fewer situations where the handler did nothing instead of punishing or rewarding during protection work.

Fig. 3. Identification of the aversive stimuli. Mean of each aversive stimuli used by the handlers per exercise (eight obedience exercises, five protection work exercises) ($n = 33$ teams) during the first evaluation. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

During protection work handlers used more aversive stimuli (pulling on the leash (Wilcoxon: $z = 3.50$, $p < 0.001$) and hanging by the collar (Wilcoxon: $z = 4.10$, $p < 0.001$)) than during obedience (Fig. 3).

Authors could not find any significant influence of age and housing conditions on handler's behaviour.

3.3. Dog's behaviour

Dog's distraction (average: $3.71 \pm 0.69\%$) was observed in decreasing order during following obedient exercises: Positions-at-distance ($7.09 \pm 2.81\%$), Recall-to-heel ($6.59 \pm 2.40\%$), Jump ($3.79 \pm 2.42\%$), Walk-at-heel ($3.11 \pm 1.45\%$), Down ($2.67 \pm 0.82\%$), Sit ($1.72 \pm 0.76\%$), and Stand ($0.91 \pm 0.47\%$). No differences of dog's distraction have been observed between the obedience exercises (KW: $\chi^2 = 9.40$, d.f. = 6, $p > 0.05$).

Dog's posture after aversive stimulus (-0.22 ± 0.19) was significantly lower than after appetitive stimulus (0.49 ± 0.09) (W: $z = 3.20$, d.f. = 1, $p < 0.01$). No differences of body postures have been observed between the obedience exercises after appetitive (Walk-at- heel: 0.20 ± 0.24; Sit: 0.67 ± 0.29; Down: 0.62 ± 0.29; Stand: 0.75 ± 0.25; Positions-at-distance: 0.25 ± 0.22; Recall-to-heel: 0.41 ± 0.23; Down-out-of-view-of-the-handler: 0.82 ± 0.18 (KW: $\chi^2 = 5.66$, d.f. = 6, $p > 0.05$)) nor after aversive stimulus (Walk-at-heel: 0.20 ± 0.26; Sit: -1.00 ± 0.00; Down: -1.00 ± 0.00; Stand: -1.00 ± 0.00; Positions-at-distance: -1.00 ± 0.00; Down-out-of-view-of-the-handler: -0.40 ± 0.40 (KW: $\chi^2 = 7.33$, d.f. = 5, $p > 0.05$)).

Different training related behaviours (TRB), scored in number of occurrence/minute, were observed during obedience (average: 1.13 ± 0.09). Mouth licking (5.03 ± 0.37), tongue out (2.76 ± 0.43) and fast open and close the mouth (2.27 ± 0.31) were the three most frequent TRB, followed by yawning (1.73 ± 0.20), replacement behaviour (1.22 ± 0.27), jump (1.12 ± 0.29), shake (0.30 ± 0.11), lift front paw (0.19 ± 0.10), redirection aggression (0.12 ± 0.07), and snap (0.09 ± 0.09). No differences of TRB have been observed between the obedience exercises (KW: $\chi^2 = 6.89$, d.f. = 6, $p > 0.05$).

Authors could not find any significant influence of age and housing conditions on dog's behaviour.

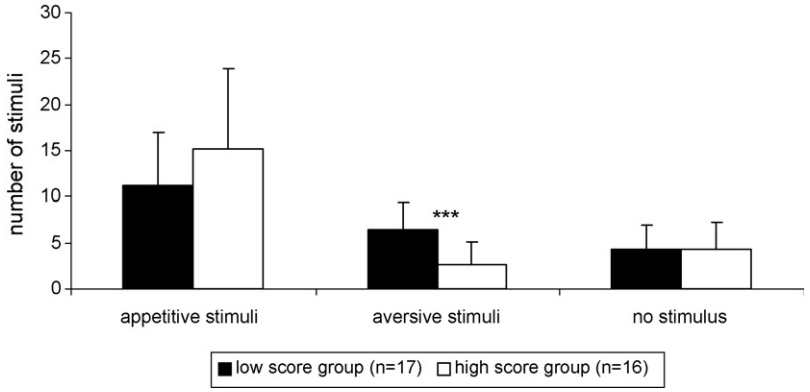

Fig. 4. Interaction between performance and handler's behaviour. Mean number of stimuli (appetitive, aversive, no stimulus) received by dogs of each score group (low-score group and high-score group), during the first evaluation (eight obedience exercises + five protection work exercises). $*p < 0.05$, $**p < 0.01$, $***p < 0.001$.

3.4. Link between team's performance, handler's behaviour, and dog's behaviour

Teams were ranked according to their performance and divided into high-score group (the 16 first teams, average score = 69.41% ± 11.95) and low-score group (the 17 remaining teams, average score = 41.38% ± 7.41). Dogs in the high-score group received less aversive stimuli from their handlers than dogs in the low-score group (Wilcoxon: $z = 3.32$, d.f. = 1, $p < 0.001$, Fig. 4). There was no significant difference between groups for appetitive stimuli (Wilcoxon: $z = 0.93$, d.f. = 1, $p > 0.05$) or no stimulus (Wilcoxon: $z = 0.00$, d.f. = 1, $p > 0.05$). Furthermore dogs in the high-score group exhibited more training-related behaviours than dogs in the low-score group (Wilcoxon: $z = 1.99$, d.f. = 1, $p < 0.05$).

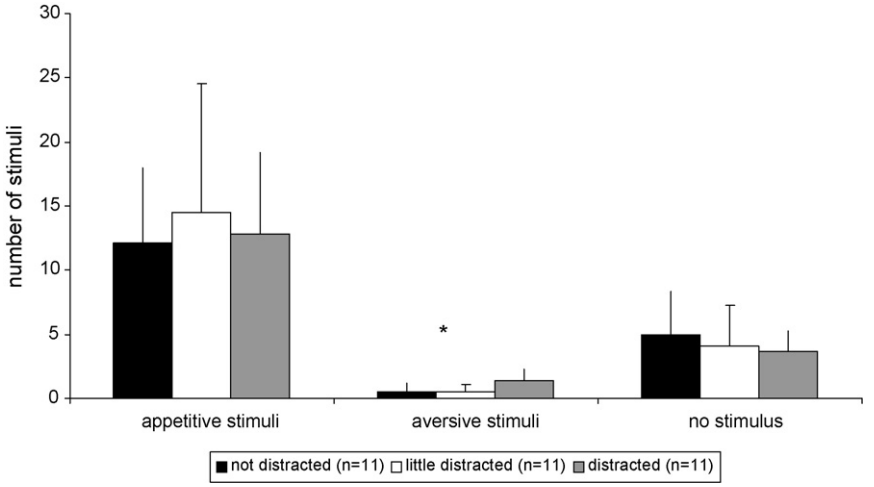

Fig. 5. Interaction between handler's behaviour and dog's distraction. Mean number of stimuli (appetitive, aversive, no stimulus) received by the dogs from the different groups (not distracted, little distracted, distracted) during the first evaluation (eight obedience exercises + five protection work exercises). $*p < 0.05$, $**p < 0.01$, $***p < 0.001$.

Three groups of distracted dogs were identified: not distracted ($n = 11$), slightly distracted ($n = 11$, distracted from 0.8% to 2.7% of the time) and distracted ($n = 11$, from 4.5% to 18.9% of the time). Distracted dogs received more aversive stimuli (KW: $\chi^2 = 7.01$, d.f. = 2, $p < 0.05$) (Fig. 5) and had a lower performance than the others (KW: $\chi^2 = 8.5$, d.f. = 2, $p < 0.01$). No significant differences concerning the number of appetitive stimuli or no stimulus were observed. Age and housing conditions had no effect on the analysed parameters. No interaction between dog's posture and the other parameters were found. Aggression related behaviours (i.e. biting or barking) could not be tested due to a too low number of dogs performing them during obedience (only one handler was bitten by his dog). During protection work, no aggression related behaviours were scored (no handler was bitten) and aggression towards decoy (biting, barking) was considered as acceptable behaviour.

Authors investigated whether handlers used the different stimuli advisedly. Did handlers reward or punish when they had to? No handler used aversive stimuli when the exercise was correctly performed (aversive stimuli wrongly given). Nine out of the 33 handlers rewarded their dog when the exercise was not properly done, once or twice during the 13 exercises (appetitive stimuli wrongly given). These situations were too anecdotal to study their impact on the dog's behaviour. The cases where ''the handler did nothing'' after a correct response for the dog could belong to an intermittent reinforcement training program.

3.5. Reliability of the observations

Team's performances did not differ significantly between both evaluations in total score (Wilcoxon: $z = 0.006$, d.f. = 1, $p > 0.05$), obedience (Wilcoxon: $z = 0.089$, d.f. = 1, $p > 0.05$), and protection work (Wilcoxon: $z = 0.34$, d.f. = 1, $p > 0.05$) (Annex 4).

Differences in handler's behaviour were observed between both evaluations.

Dogs were significantly less rewarded (Wilcoxon: $z = 2.10$, d.f. = 1, $p < 0.05$) at the second evaluation (Fig. 6). Handlers used the same appetitive stimuli during both evaluations and there was no significant difference in their frequency of appearance.

Dogs were more punished (Wilcoxon: $z = 1.91$, d.f. = 1, $p < 0.05$) at the second evaluation (Fig. 6). The same aversive stimuli have been used during both evaluations, and there was

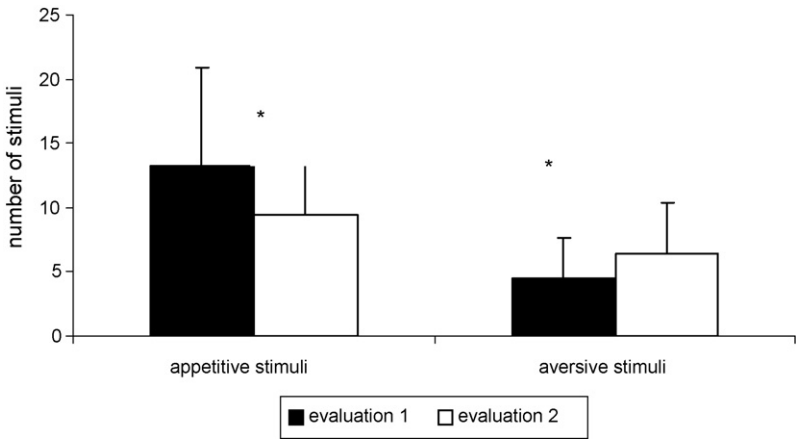

Fig. 6. Comparison of handler's behaviour between evaluation 1 and 2. Mean number of stimuli (appetitive, aversive) received by dogs ($n = 33$) during each evaluation. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

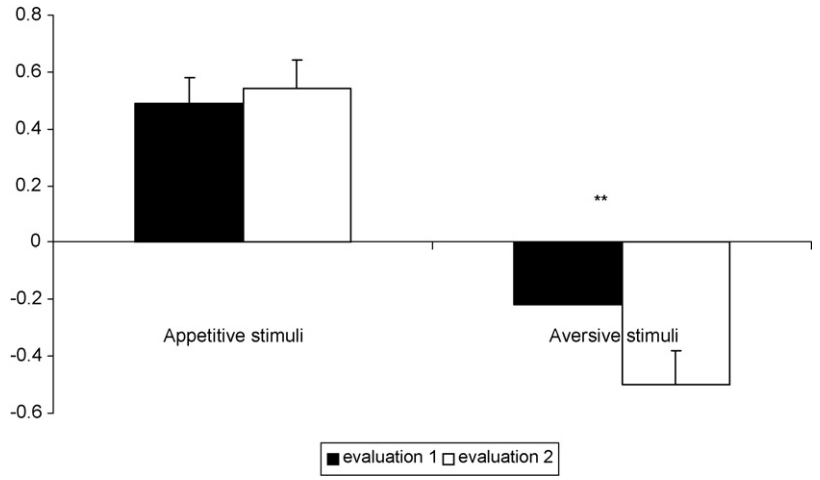

Fig. 7. Comparison of dog's posture between evaluation 1 and 2. Mean number of dog's posture after a stimulus (appetitive and aversive) received by dogs ($n = 33$) during each evaluation. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

significantly more pulling on the leash (Wilcoxon: $z = 3.18$, d.f. = 1, $p < 0.01$) and hanging the dog by its collar (Wilcoxon: $z = 3.57$, $p < 0.001$) during the second evaluation. The situations where the handler did nothing instead of punishing or rewarding did not differ between both evaluations (W: $z = 0.30$, d.f. = 1, $p > 0.05$).

At the second evaluation, dogs showed a significant lower posture after aversive stimulus (Wilcoxon: $z = 2.91$, d.f. = 1, $p < 0.01$) (Fig. 7). Neither dog's distraction (Wilcoxon: $z = 0.79$, d.f. = 1, $p > 0.05$) nor dog's training-related behaviours (Wilcoxon: $z = 1.57$, d.f. = 1, $p > 0.05$) differed significantly between both evaluations.

4. Discussion

The analysis of the handler's training methods revealed that they rewarded their dogs on an intermittent reinforcement program (67% of correct responses were rewarded), probably involuntary, without any intention to make these behaviours more resistant to extinction (Chance, 1979; Landsberg et al., 2003). Should the performance of these teams have been better, then this program would have been appropriate. But knowing the low performance of the dogs, it seems appropriate to shift back to a continuous reinforcement program as it was obvious that some dogs did not know the correct behaviours yet. Concerning aversive stimuli, an intermittent program was also observed as 60% of incorrect responses were punished during obedience and 80% during protection work. According to Chance (1979), an intermittent program of punishment is inefficient to lower the rate of an acquired behaviour.

Appetitive stimuli were significantly more used than aversive stimuli. Stroking and congratulating the dog have been shown to guide dogs to perform better and to rapidly learn simple exercises (sitting, lying, paw giving; Fonberg and Kostarczyk, 1980). Only four handlers used toys to play with their dog after every correct exercise. This reward seems efficient as those DH teams ranked first, third, fifth and ninth at the total score. Authors conclude that the use of toy could help to diminish dog's distraction, parameter affecting the performance negatively.

Handlers used more aversive stimuli (pulling on the leash; hanging dogs by their collar while biting the decoy, etc.) during protection work than during obedience. Hanging dogs by the collar

to force them to release the sleeve is a rather ''reactive'' training method: rather than forcing the dog to loose its grip, this stimulus incites the dog to maintain this behaviour. Hanging by the collar is considered inefficient for the following reasons: (1) low scores of the dogs at protection work where the stimulus was more often observed; (2) long duration of hanging (several seconds) before releasing the decoy. This stimulus' lack of effect can be due to an individual insensitivity to be hanged or to a high motivation to perform biting (Landsberg et al., 2003). For the training to be more efficient, authors would first suggest to improve the dog handler relationship to drive dogs to stand off next their handlers (rather than far away). Secondly to encourage the dog to release the sleeve (=''real'' sleeve) more rapidly, it is recommended to present another object (frequently another sleeve (=''decoy'' sleeve) or toy) next to the dog's head so that the dog would release the ''real'' sleeve to bite the ''decoy'' sleeve. The dog's motivation for releasing the first sleeve being that he is allowed to bite again (''decoy'' sleeve).

The first question about the quality of the actual training system has a negative answer as the present study reveals that this system does not provide DH teams up to military standards. While the regulations of the Belgian Defence require that a dog must (i) interrupt his bite after handler's command, only 20% released their bite after the first command and (ii) stop his attack, only 19% of the dogs carried out the Stand-off correctly. Suggestions to improve teams performances are (1) more regular training with emphasis on obedience. As authors have observed, dogs are highly motivated during protection work and will not be alert to handlers' commands unless the handler has a perfect control over the dog. This control can only be obtained with a lot of obedience training; (2) to elaborate theoretical and practical skills on learning principles patrol dogs are faced to; (3) to improve the dog handler relationship and the handler motivation to train his dog with more positive training techniques.

Several factors influencing the team's performance were identified. This study revealed that team's performance, use of aversive stimuli and dog's distraction are related. Handlers that used less aversive stimuli on dogs obtained a higher score. Authors know according to their previous field observations, that these high-performance dogs had been trained with lots of aversive training methods except for the only four dogs trained with toys (positive training). Those aversively trained dogs know the exercises of our evaluation and do not need to be punished anymore (intermittent training program: the dog has learnt that he will be punished if the correct answer has not been given).

Distracted dogs were more punished and got a lower performance score. Attention reflects dog's disposition to learn and vice versa (Lindsay, 2000). In this study, distraction might be explained by the young age of the dog population (Vas et al., 2006) or by novelty as the training field was unknown to most of the dogs; or by any other highly motivating stimulus (i.e. the presence of the decoy). Obviously, motivating and controlling dog's attention is of huge interest to the trainer/behaviourist. There are different ways to influence dog's attention. Vas et al. (2006) found that training can improve attention skills, as trained dogs were less distracted than the untrained dogs. McConnell (1990) showed the importance to train in function of dog's specific preferences, as some dogs prefer some stimuli to others when learning tasks. Finally it is also possible to act on dog's motivation: for example for dogs that enjoy chasing animals ''natural rewards'' (like a rabbit) are difficult to control. Motivationally equivalent rewards may need to be identified and given to the dog instead (e.g. tug and retrieve games). Finally, authors observed that dog's concentration is related with the dog handler relationship: a dog attached to his handler will be very attentive to everything his handler does or asks (A.H., personal observation). Knowing the importance of dog's concentration during training, it remains astonishing to consider how little studies have been conducted on this topic. More studies on dog's distraction vs. attention need to be carried out.

In the present study, dogs with the highest scores presented more ''training-related behaviours''. Previous authors have defined these behaviours as stress-related behaviours (Beerda et al., 1998). Though, in the present study, these behaviours could all be a result of the dogs being positively stimulated or aroused rather than stressed. Arousal has been described by Strain (2004) as a state of general wakefulness and responsiveness of the environment and implies a generalized increase in the activity of the cerebral cortex.

Henry and Stephens (1977) suggest that there is only stress when there is loss of control and a reduced predictability of what will happen. So far as there is some action to obtain control with a high probability of success, there is arousal, but no stress.

The increase in the activity of the cerebral cortex, due to the arousal (Strain, 2004), has contributed positively to dog's performance as shown in this study: dogs with high performances have shown a high number of arousal behaviours, but no stress, which is exactly what is expected from these working dogs.

Dogs with lower performances are still distracted and show less arousal behaviours. Some dogs exhibited a very low posture during training. Contrary to author's expectations, no link between the postures and the other parameters has been found among this dog population. It might be interesting to compare this group of dogs to other populations like for example civilian patrol dogs.

The third question wondered about the welfare status of these dogs during the training sessions. The comparison between both evaluations shows that handlers punish more and reward less at the second evaluation. The ''Socially Desirable Responding'', described in social psychology as being the human tendency to give other people a good image of themselves (Paulhus, 2002), can be one explanation of this phenomenon. Ignoring the professional consequences of these assessments, handlers may have modified their usual behaviour in order to present themselves in a positive light. To ensure that handlers would show the usual behaviour, no preliminary details on the aim of the project were given. This might have stressed the handlers. At the second evaluation, handlers realized that these evaluations had no professional consequences and they showed their usual behaviour by punishing more frequently. Though, a range of other factors other than SDR could explain these results like e.g. handlers might also be upset to observe that within 20 days, their dog had not improved his performance and therefore they punished him more.

Although the comparison between both evaluations showed that dogs exhibited a lower posture after aversive stimulus at the second evaluations, no increase of other behaviours were observed. Therefore, authors could not prove that the welfare of these dogs was hampered. But there is an indication that it was under threat.

This study has shown the necessity to improve the actual training system used in this population of Belgian Military Working Dogs (DH teams not responding to standards according to military regulations; use of aversive training methods influencing dogs' posture negatively; training principles not known; training frequency too low; no stable relationship between handlers and their dogs). The suggestions of improvement, brought during the discussion, will form the basis of a new training system and rely on: the use of more positive training methods, an increase of the training frequency, the elaboration of a course on training principles, and an improvement of dog handler relationship.

5. Conclusion

This study has identified the different appetitive and aversive stimuli used during training with working dogs. Moreover, this study reveals that (1) these DH teams are not efficient according to

the military regulations, (2) team's performance, dog's behaviour and handler's behaviour are related, and (3) the welfare status of these dogs was not hampered during the training, but there is an indication that it was under threat.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.applanim.2007.11.010.

References

Adams, G.J., Johnson, K.G., 1994. Sleep, work and the effects of shift work in drug detection dogs *Canis familiaris*. Appl. Anim. Behav. Sci. 41, 115–126.

Beerda, B., Schilder, M.B.H., Van Hooff, J., De Vries, H., Mol, J., 1998. Behavioural, saliva cortisol and heart rate responses to different types of stimuli in dogs. Appl. Anim. Behav. Sci. 58 (3–4), 365–381.

Booth, S., 1998. Purely Positive Training—Companion to Competition. Podium Publications, Ridgefield, USA, fourth print.

Chance, P., 1979. Learning and behavior. Wadsworth, Belmont, CA.

Christiansen, F., Bakken, M., Braastad, B., 2001. Behavioural changes and aversive conditioning in hunting dogs by the second-year confrontation with domestic sheep. Appl. Anim. Behav. Sci. 72 (2), 131–143.

Fonberg, E., Kostarczyk, E., 1980. Motivational role of social reinforcement in dog-man relations. Acta Neurobiol. Exp. 40, 117–136.

Gasci, M., Miklosi, A., Varga, O., Topal, J., Csanyi, V., 2004. Are readers of our face readers of our minds? Dogs (*Canis familiaris*) show situation-dependent recognition of human's attention. Anim. Cognit. 7, 144–153.

Henry, J.P., Stephens, P.M., 1977. Stress, Health and the Social Environment. A Sociobiological Approach to Medicine. Springer Verlag, New York.

Hiby, E.F., Rooney, N.J., Bradshaw, J.W.S., 2004. Dog training methods: their use, effectiveness and interaction with behaviour and welfare. Anim. Welf. 13 (1), 63–69.

Johnston, B., 1995. Harnessing Thought. Queen Anne Press, London, UK.

Landsberg, G., Hunthausen, W., Ackerman, L., 2003. Handbook of Behavior Problems of the Dog and Cat, 2nd Edition. Saunders.

Lefebvre, D., Diederich, C., Delcourt, M., Giffroy, J.M., 2007. The quality of the relation between handler and military dogs influences efficiency and welfare of dogs. Appl. Anim. Behav. Sci. 104 (1–2), 49–60.

Lindsay, S.R., 2000. Handbook of Applied Dog Behavior and Training, vol. 1. Adaptation and Learning. Iowa State Press, Iowa, pp. 273–276.

Lit, L., Crawford, C.A., 2005. Effects of training paradigms on search dog performance. Appl. Anim. Behav. Sci. 98 (3–4), 277–292.

McConnell, P.B., 1990. Acoustic structure and receiver response in domestic dogs *Canis familiaris*. Anim. Behav. 39, 897–904.

Miklosi, A., Kubinyi, E., Topal, J., Gasci, M., Viranyi, Z., Csanyi, V., 2003. A simple reason for a big difference: wolves do not look back at humans, but dogs do. Curr. Biol. 13, 763–766.

Naderi, Sz., Miklosi, A., Doka, A., Csanyi, V., 2001. Co-operative interactions between blind persons and their dogs. Appl. Anim. Behav. Sci. 74, 59–80.

Paulhus, D.L., 2002. In: Braun, H.I., Jackson, D.N. (Eds.), The Role of Constructs in Psychological and Educational Measurement. D.E. Wiley, p. 49.

Reid, P.J., 1996. Excel—Erated learning. Explaining How Dogs Learn and How Best to Teach Them. James and Kenneth Publishers, Oakland, CA.

Roll, A., Unshelm, J., 1997. Aggressive conflicts amongst dogs and factors affecting them. Appl. Anim. Behav. Sci. 52, 215–242.

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Schilder, M.B.H., Van der Borg, J.A.M., 2004. Training dogs with help of the shock collar: short and long term behavioural effects. Appl. Anim. Behav. Sci. 85, 319–334.

Soproni, K., Miklosi, A., Topal, J., Csanyi, V., 2001. Comprehension of human communicative signs in pet dogs (*Canis familiaris*). J. Comp. Psychol. 115, 122–126.

Strain, G.M., 2004. Dukes' Physiology of Domestic Animals, chapter 53: Consciousness and Higher Cortical Function, 12th Edition. Comstock Publishing, pp. 935–951.

Tortora, D., 1983. Safety training: the elimination of avoidance-motivated aggression in dogs. J. Exp. Psychol. Gen. 112 (2), 176–214.

Vas, J., Topal, J., Pech, E., Miklosi, A., 2006. Measuring attention deficit and activity in dogs: a new application and validation of a human ADHD questionnaire. Appl. Anim. Behav. Sci. 103 (1–2), 105–117.

Viranyi, Z., Topal, J., Gasci, M., Miklosi, A., Csanyi, V., 2004. Dogs respond appropriately to cues of humans' attentional focus. Behav. Process. 66, 161–172.