

TECHNICAL NOTE

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The Effect of Feeding Enrichment upon Reported Working Ability and Behavior of Kenneled Working Dogs

ABSTRACT: It is widely recommended that kenneled dogs are provided with environmental enrichment such as toys or feeding devices. However, the adoption of enrichment for military working dogs is impeded by a widespread belief that it reduces their motivation to work. Handlers of 22 working German Shepherd dogs were asked to rate their dogs on 11 attributes pertaining to working ability, related behavioral traits, and health. Eight of the dogs were then provided with daily feeding enrichment for 4 months, while the remainder were given equivalent human attention. The same 11 traits were scored again following the enrichment period: 10 changed little over the period while handlers' reports of their dogs' *Ability to learn from being rewarded* increased significantly. Changes for all attributes were virtually identical in enriched and control dogs. We conclude that if correctly managed, feeding enrichment can be introduced to kenneled working dogs without any reported detrimental effects upon working ability, health, or behavior.

KEYWORDS: forensic science, environmental enrichment, feeding enrichment, military working dogs, animal welfare, working ability, behavior, health, aggression

Military working dogs, employed in the United Kingdom for tasks such as patrolling, policing, and olfactory substance detection, are commonly housed in kennels. Kenneling may be challenging for some individuals due to limited opportunities for social contact with both humans (1,2) and dogs (3,4), unpredictability of events (5), lack or loss of control over the environment (6), low temperatures (7), and high levels of noise (8). Indeed when first introduced into a kenneled environment, many individuals exhibit physiological indicators of stress such as elevated cortisol (6), which can persist (9) and may reflect compromised welfare. Thus, several attempts have been made to establish how best to provide stimulation or enrichment within the kenneled environment and thereby improve welfare (for review see 10).

Due to their low cost and need for little investment of time by human carers, enrichment devices, such as toys, have been widely used, and their effects upon welfare documented within laboratory (11–13) and rescue dog populations (14,15). Yet, these studies have shown that dogs habituate to toys within a few days and interact little with them thereafter (15). Research suggests, however, that many dogs exhibit a preference for, and are slower to habituate to, items which encourage feeding and chewing behaviors (12,15) and thus feeding enrichment may be especially beneficial. The effect of feeding enrichment does not appear to have been evaluated in laboratory or rescue dogs but has received some attention in military working dog populations (7). Individuals from two populations of military working dogs—gundogs and German Shepherd dogs (GSD)—were each provided daily with a Kong™, a hollow rubber cone-shaped device that can be filled with food which the dog can

extract (Kong Company, Golden, CO). While behavioral and physiological measures did not confirm any measurable effect upon welfare, dogs did not habituate to the devices and some dogs exhibited positive anticipatory behaviors prior to its provision. For example, when the person delivering the device entered the kennel, the dogs followed at a trot, very animated and interested in the person's movements (7).

Furthermore, there was a trend towards decreased stereotyping (repetitive behaviors indicative of frustration and compromised welfare; 16) during the period of enrichment, and when enrichment was discontinued. Those dogs which had used their device the most showed an increase in cortisol levels, and then a decrease when it was re-introduced, indicating that the feeding devices were valued by the dogs, and that the welfare of some individuals had been enhanced during enrichment provision.

In spite of the potential benefits for welfare, there is often reluctance to provide enrichment of any kind within the kennels of military working dogs. In a survey of 92 military working dogs housed at 16 different stations, only 33% were given continual access to any form of enrichment, while 61% were never given enrichment; the remaining 6% were provided with enrichment some of the time (Gaines and Rooney, unpublished data). In the U.K. military, most working dogs are trained, both initially and throughout their working life, using a reward of play with their handler. This play usually centers around a toy (usually a ball), hence a high level of playfulness is desirable in military working dogs (17). Consequently, many trainers and handlers believe that access to any form of enrichment inside the kennel could decrease a dog's motivation to play with a toy during training, and would ultimately decrease their working ability. Furthermore, it is widely believed that the uncontrolled provision of enrichment may lead to increased guarding behavior manifested as aggression towards kennel assistants and handlers within the kenneled environment, or may lead to health problems, as dogs may chew and choke on pieces of the

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enrichment device (Gaines and Rooney, unpublished data). In this paper we report the first investigation of whether these concerns can be substantiated.

We asked handlers to rate their working dogs on criteria relating to working ability, health, and behavior, using a questionnaire. Subsequently, some of these dogs were provided with an enrichment device, a food-filled Kong™, every weekday evening over a period of 4 months. The remaining dogs were provided with a biscuit only, to provide equivalent contact with husbandry staff. At the end of this period, handlers were asked to rate their dogs again using the same criteria as previously. These ratings were then compared with those made prior to enrichment provision, to gauge the effect of prolonged enrichment on reported working ability. A subsample of dogs was videotaped for 60 min, on one occasion, immediately following provision of the enrichment device to determine the extent to which they utilized the Kongs.

Methodology

Dogs

Dogs from three Royal Air Force Police Dog (RAFPD) stations were assigned to the study by senior personnel; of the 43 dogs originally recruited, 21 did not complete the study due to death, illness, movement to another station or a change in handler. The dogs completing the study comprised 20 GSDs, one Belgian Malinois, and one GSD, Belgian Malinois crossbreed. Fifteen were male and seven female. Of the 22 dogs, nine were neutered, six were entire, and the neuter status of seven was unknown. The dogs were aged between 26 and 104 months (mean = 56.7 months ± 26.6). Two of the dogs were used as station mascots and for public relations activities, the remainder were PATrol Arm True dogs. These dogs are used by working dog agencies to patrol secure areas, detect and indicate the presence of people, and to chase and apprehend people by biting the lower right arm, releasing it upon command (Cosslett, personal communication).

Housing and Husbandry

The dogs were housed at three separate sites: one in England ($n = 5$), one in Northern Ireland ($n = 8$), and one in Scotland ($n = 9$). The total living area available to each dog ranged from

18.3 to 19.7 m² (mean = 18.9 ± 0.6). Each dog had a wooden kennel (1.1 m²) in the center of the living area. None of the kennels was heated so each dog was provided with a piece of veterinary bedding (Profleece®, Derbyshire, U.K.).

PATrol Arm True dogs received between 0 and 30 min of exercise per day from their handlers, while dogs used as station mascots or for public relation activities were exercised by kennel assistants for between 10 and 25 min per day. Kennels were cleaned out daily in the morning and all dogs were fed once daily in the morning.

Questionnaire Respondents

The data were provided by 22 RAFPD handlers and trainers, 19 males and three females aged between 20 and 42 years of age (mean = 25.5 years ± 5.4). Dog handling experience ranged from 0.5 to 24 years (mean = 4.9 years ± 5.7).

Questionnaire

Questionnaires were distributed to handlers via senior personnel within the dog section. The questionnaire consisted of three pages. The first page described the overall purpose. The second page contained 10 questions that collected information about the handler and their dog, including breed, sex, age, and years in service. On the third page, 11 attributes relating to the dogs' working ability and behavior were listed. These were adapted from characteristics which we derived from interviews with 37 dog experts and used to compare breed and sexes (17,18). Two extra attributes were added to describe the dog's contentment in the kennel environment (Table 1). For each attribute the handler rated the dog as 1 = very low; 2 = low; 3 = intermediate; 4 = high; or 5 = very high.

When handlers first completed the questionnaire at the beginning of the study (pre-enrichment) they were told that its purpose was to determine ratings of dogs' behavior and working ability, but not that the questionnaire formed part of a subsequent study to look at the effects of enrichment. The identical questionnaire completed at the end of the study (post-enrichment) stated that the purpose was to see if the ratings had changed over time. At this point, handlers could have been aware that some dogs within their section, and possibly their own (although they had not been directly informed of this), had been provided with enrichment.

TABLE 1—Mean change in attributes rated by dog handlers before and after enrichment period (score for attribute following enrichment period minus rating made prior to enrichment).

Characteristics	Mean Change in Attribute of Entire Population*			Mean Change in Attribute Comparing Enriched and Control†			
	Absolute Change	Test Statistic Value (<i>t</i>)	<i>p</i> -Value	Enriched	Control	Test Statistic Value (<i>t</i>)	<i>p</i> -Value
Overall work ability	0.14	-0.83	0.42	0.13	0.14	0.05	0.96
Health	0.18	1.3	0.21	0.13	0.21	0.30	0.77
Ability to learn from being rewarded	0.32	2.3	0.03	0.50	0.21	-1.0	0.33
Consistency of behavior from day to day	0	0	1.0	-0.13	0.07	0.45	0.66
Motivation to chase an object	-0.09	-0.44	0.67	-0.13	-0.07	0.12	0.91
Playfulness	0.14	0.9	0.4	0.13	0.14	0.06	0.96
Interest in toys or objects	0.18	0.9	0.38	0	0.29	0.66	0.51
Motivation to retain possession of a toy	-0.14	-0.62	0.54	0	-0.21	-0.46	0.65
Level of aggression towards humans	0	0	1.0	0.25	-0.14	-0.67	0.51
Willingness to enter kennel at end of shift‡	-0.14	-0.8	0.45	0	-0.14	-0.57	0.58
Contentment in the kennel environment‡	0.09	0.49	0.63	0.13	0.07	-0.14	0.89

*Testing changes within the entire population; one sample *t*-test value (*t*) and levels of significance presented.

†Comparing the change in attribute between the two groups, enriched and control; independent *t*-test value (*t*) and levels of significance presented.

‡Indicates attributes which were added in addition to those used by Rooney et al. (17) and Rooney and Bradshaw (18).

Experimental Design

At the beginning of the study (pre-enrichment), handlers were asked to rate their working dogs using the questionnaire. This was returned to the experimenter within 39 days and then the 22 dogs were split into two groups: enriched ($n = 8$) and control ($n = 14$), initially balanced for sex, age, and working role; the unequal samples were due to loss of subjects. Enrichment devices (Feeding Enrichment section) were provided to each of the enriched dogs for a period ranging from 115 to 125 days (average number of days per dog \pm SE = 120.6 ± 4.5). At the end of this period (post-enrichment), handlers completed a second questionnaire and a sample of dogs was filmed to determine whether Kongs were utilized.

Feeding Enrichment

Each enriched dog was provided with a feeding device, a Kong™ stuffed with gravy soaked biscuits (part of the dog's daily feed allowance). These were placed in the kennel every weekday evening, some time between 4 PM and 5 PM, by the kennel assistant. Kongs were left in the kennel overnight and were removed each morning to allow for cleaning and re-filling. Control dogs received no enrichment, but to balance the amount of contact with husbandry staff and the number of feeding occasions, they were given a biscuit at the same time of day as the enriched group received their enrichment device.

Behavioral Observations

To determine whether the dogs used and interacted with the enrichment device, at the end of the 4-month study period, a single 60-min behavioral observation was recorded from each of four enriched dogs. The kennel assistant provided each dog with a food-stuffed Kong, as usual and its behavior was recorded, using a video camera (Sony Handycam vision CCD TRV78E/59E [Sony, Tokyo, Japan] with an attached wide-angle lens Raynox DVR 5000 0.5× [Raynox, Tokyo, Japan]) placed on a tripod.

Behavior Reported by the Kennel Assistants

To further determine utility, kennel assistants were asked at the end of the study whether each dog's Kong was usually completely empty when collected for cleaning and re-filling each morning.

Ethical Note

All procedures were conducted according to ethical guidelines laid down by the University of Bristol; none required licensing by the U.K. Home Office.

Data Analysis

For each of the 11 working ability attributes (Table 1), the change over the study period was calculated (score for attribute rated following enrichment minus rating made prior to enrichment), for each individual dog. One-sample t -tests (19), comparing the mean change in each attribute (treatment groups combined) against zero, were used to investigate whether any attributes had changed significantly over the study period. A one-way between groups MANOVA (20) was performed to investigate overall differences in working ability attributes between the two treatment groups. Independent t -tests (19) were then used to examine to what extent the

mean change in each individual attribute differed between enriched and control treatment groups.

The video recordings were analyzed using continuous sampling. One variable, describing the time spent interacting with the device, was recorded and was composed of time spent:

- (1) Manipulating device—dog interacts with enrichment device by licking, biting, or chewing it;
- (2) Following device—dog drops Kong and moves behind it, orientated towards it at a distance of no greater than 0.2 m, picking up or manipulating Kong once reached;
- (3) Ingesting food from device—dog eats food or licks floor where food has been dropped from Kong.

One further variable was recorded: latency to stop interacting. This was defined as the time at which the dog did not return to the device again within the observed 60-min period. The range and mean were calculated for the time spent interacting with the Kong and latency to stop interacting.

Results

Scores on the 11 attributes changed very little on average, comparing pre- and post-enrichment for all dogs in the study (Table 1). Only one of the ratings changed significantly over the study; *Ability to learn from being rewarded* rose slightly ($t = 2.3$, $p = 0.03$) (Table 1). Changes in handlers' ratings for the enriched and control groups were virtually identical ($F_{[10,11]} = 0.22$, $p = 0.99$), and the mean change in rating did not differ significantly between treatment groups for any of the 11 attributes individually (Table 1). In particular, the global measure *Overall working ability* was essentially unchanged across the study ($p = 0.42$) and virtually identical between treatment groups ($p = 0.96$).

Behavioral Observation

The time spent interacting with the Kong ranged from 8.2 to 13.0 min (mean = 10.9 ± 3.0) and latency for interaction to end ranged from 13.6 to 17.5 min (mean = 15.2 ± 2.0).

Kennel assistants reported that every dog's Kong was always empty when removed from the kennel in the morning.

Discussion

This study indicates that the provision of feeding enrichment had no discernible effect upon the reported working ability or general behavior of a population of trained military working dogs. The popular claim that the provision of enrichment with manipulable objects results in a decrease in overall working ability has not been substantiated, as the mean change in rating of *Overall working ability* following feeding enrichment was essentially identical between enriched and control dogs.

The change in *Consistency of behavior from day to day* following enrichment similarly did not differ between enriched and control dogs. Likewise the change in ratings for all of the attributes describing the dog's toy-oriented behavior: *Motivation to chase an object*, *Playfulness*, *Interest in toys and objects* and *Motivation to retain possession of a toy* was virtually identical between enriched and control dogs. As handlers are likely to base their ratings on their dog's performance during regular training sessions, this indicates that the provision of enrichment within a kennel environment does not affect the working dog's motivation to play with, or retain, a toy used as a reward during training, as is often supposed. We suggest that it is unlikely that military working dogs

would associate enrichment in their kennel with a toy provided in a training scenario; in the kennel, we suggest that a feeding device serves as a way of occupying the dog's time, as a source of stimulation, and as an outlet for naturally rewarding behaviors, feeding, and chewing. In contrast, during training, a toy serves as a reward, a focus for play, and a means of obtaining attention and interaction with the handler. Hence, these differing motivations mean that in kennel enrichment, provision should have little or no effect upon a dog's motivation to play or work for a reward, and this is what our results support.

We also propose that, when provided in the way described in this study, dogs do not utilize Kongs as toys but instead as feeding devices. Once emptied, dogs did not return to, or play with, the device within the observed time, and were not observed to play with an empty Kong. This proposition is supported by findings from a similar study which showed that the percentage of time spent interacting with food-filled Kongs was considerably higher immediately following their provision compared with 3 h later (7). Furthermore, previous research suggests that habituation to toys may occur quickly with interest waning considerably over a few days (15). In contrast, in the current study, dogs continued to utilize the food-filled devices even after 4 months, further suggesting that they are not used primarily as play items.

Handlers' reports of aggression levels following enrichment did not differ between enriched and control dogs, and thus the assertion that the provision of enrichment within a kennel can lead to increased aggression towards handlers and kennel assistants appears unsubstantiated. We suggest two reasons for this. First, the guidelines provided to the kennel assistants for the use of the devices, stated how to avoid situations where aggression could potentially occur. Therefore, kennel assistants never tried to remove the Kong when the dog was present, but only in its absence. Secondly, the Kongs were only removed from the kennel once they had all of the food extracted, and so at this point the value of the device to the dog was likely to be very low. Hence the dog would have little motivation to monopolize or display possessive aggression towards the device. We suggest that if feeding enrichment is provided, compliance to similar guidelines is advisable to ensure its safe use.

Similarly, concerns regarding dangers to health were seen to be unfounded, as the mean change in handler's ratings of *Health* did not differ between the two treatment groups. Furthermore, no detrimental incidents were reported (by handlers or kennel assistants), to occur during the trial, e.g., choking on small pieces of the Kong™. We suggest that this is a result of the close monitoring conducted by kennel assistants who checked each device daily to ensure it was not fragmenting.

The provision of enrichment did not appear to affect the handlers' ratings of their dog's *Contentment within the kennel* or its *Willingness to enter the kennel at the end of the shift* which might suggest that the feeding device had little effect upon enriching the kennel environment and no marked effect on welfare. However, previous experimental studies (7) have shown that feeding enrichment is beneficial for certain individuals, but not others. In addition, observations of some of the subjects used within this study revealed an increase in time stereotyping and a decrease in time grooming after the feeding enrichment was discontinued (21). This suggests that welfare of some individuals was compromised by deprivation of the device. Furthermore, there are many factors within a kennel environment which can greatly decrease welfare, e.g., social isolation, high noise levels, low temperatures, unpredictability of events, lack of control of the environment, and the impact of these may well have masked any effects of enrichment on these two ratings (21).

Ability to learn from being rewarded was the only attribute which changed significantly over time, and while not significant, the increase was slightly higher in enriched dogs than in control dogs, which is the opposite of what would be expected if enrichment had interfered with training, or if the handlers of the enriched dogs had discovered that their dogs had been enriched, and down-rated their dogs according to the perception that enrichment is detrimental to training. This suggests that learning ability increased over the duration of the study, potentially due to ongoing training, and that possible beneficial effects of feeding enrichment on learning ability may warrant further investigation on a larger sample of dogs. The enriched dogs tended to score higher, and as ability to learn is a desirable trait in working dogs, this may suggest a beneficial effect of enrichment on working ability. Links between enrichment and enhanced learning ability have previously been found in both rodents (22) and dogs (23). Discrimination and reversal learning is significantly improved in environmentally enriched laboratory beagles (23) and we would therefore suggest that this is an area worthy of further research in military working dogs.

We conclude that, if correctly managed, feeding enrichment can be offered to kennel working dogs without any detrimental effects upon reported working ability, health, or general behavior. Other studies suggest that feeding enrichment, so long as it is provided regularly, improves the welfare of at least some of the animals concerned. Direct observation of working ability (24) could be conducted to further validate the handlers' reports.

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