A review on the effects of sensory stimulation in shelter dogs

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Abstract: Millions of dogs enter public and private shelters every year. Shelters are often very stressful environments to dogs, which are kept in very limited space and are impeded to appease their social motivations. Furthermore, the environmental stimuli provided are generally quantitatively – hyper/hypo-stimulation – and qualitatively inadequate. In such conditions dogs are likely to develop abnormal behaviors as maladaptive coping strategies that are not only a symptom of low welfare, but they also drastically decrease their chances of being permanently adopted. Environmental enrichment, such as training sessions, additional cage furniture and food-filled toys have been shown to decrease levels of stress in confined dogs. However, many of these programs require a noticeable financial and time commitment. Unfortunately, many shelter running institutions lack necessary funds, personnel and time to provide their dogs with complex environmental enrichment programs. In this light, sensory stimulation may represent a scientifically valid, low-cost and no time-wasting instrument to enhance the average level of welfare of shelter dogs, limit the development of behavioral problems and increase dog adoptability.

Key Words: dog; shelter; sensory stimulation.

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Introduction

Dog straying still is a very diffuse problem worldwide. The number of dogs entering, every year, public and private shelters is still very high. For instance, in 2015, 100.194 dogs entered a public shelter, in Italy only (LAV, 2015). In 2016 approximately 3.3 million dogs entered a shelter in the U.S. (ASPCA, 2016) and other 45.256 entered an RSPCA shelter in Australia (RSPCA, 2016). Despite the efforts made to guarantee their adoption some of these dogs may spend all their life in confinement. Due to the lack of funds and personnel, shelters are rarely capable of providing adequate levels of welfare to the dogs housed (Wells, 2004; Protopopova, 2016), which are therefore forced to live in highly stressful environments (Rooney et al., 2007; Rooney et al., 2008) until they are either adopted, euthanized or die due to natural causes. Environmental enrichment has been widely investigated as a tool to reduce physiological and behavioral signs of chronic stress induced by confinement in laboratory dogs (Hubrecht, 1993) and dogs housed in rescue shelters (Wells et al., 2002a). The currently acknowledged classification of the types of enrichment for dogs, as well as for other species, identifies two major categories of enrichment, namely animate and inanimate. Animate enrichment may as well be defined as social enrichment and comprises any type of social stimulation whether intraspecific – other dogs in the case of kennelled dogs – or interspecific – humans or other species (Wells, 2004). On the other hand, inanimate enrichment entails four subcategories that can be addressed as follows: occupational enrichment – or enrichment through the provision of toys (Doring et al., 2016) –, feeding or nutritional enrichment (Bosch et al., 2007; Schipper et al., 2008), physical enrichment – described as

Dog Behavior, 1-2018, pp. 25-35
doi 10.4454/db.v4i1.71

Submitted, 01/09/2018
Accepted, 03/15/2018

cage furniture by some authors (Wells et al., 2004) –, and sensory enrichment, which comprises auditory, olfactory and visual stimulation (Wells et al., 2004; Ellis, 2009), but also tactile and taste stimulation. Recently, the use of pheromones as enrichment tool has gained interest among scientists, especially as far as companion animals are concerned (Kokocinska et al., 2016). While none of these aspects should be overlooked to achieve optimal welfare standards, reality shows that shelters rarely have the means to provide their dogs with complex enrichment programs. In this light, sensory stimulation protocols based on population preferences may represent a feasible and inexpensive way to enhance the average level of welfare of shelter dogs, limit the development of behavioral problems and increase dog adoptability. This approach may also allow shelters to employ their resources for the treatment of the most problematic individuals. This paper aims to provide an updated review on the effects of sensory stimulation as enrichment tool in shelter dogs, with a focus on auditory, visual, olfactory and pheromone stimulation. Scientific studies that investigated taste and tactile enrichment in shelter dogs have not been found. Indeed, some level of sensory stimulation is part of any type of enrichment. However, it may be difficult to assess the effects induced by the stimulation of a single sense when providing dogs with complex enrichment protocols that operate on more than one sensory channel at the time. For this reason, this review will follow the abovementioned classification and will consider only those studies that investigated the effects of a pure sensory stimulation. Finally, the effects of sensory stimulation on the rate of adoption success will be discussed.

Auditory stimulation

Using auditory stimulation as a means for enrichment in dogs kept in very noisy environments, as shelters usually are, is a very delicate task. Since high noise levels have been identified as a possible cause of poor welfare in kennelled dogs (Sales et al., 1997), it is important, when providing auditory enrichment, to choose the right stimulus and avoid adding even more noise to the environment. Noisy machineries and procedures in laboratory environments have been proven to alter cardiovascular, endocrine and reproductive systems as well as affect communicative behaviors of kennelled animals (Turner et al., 2007). However, Sales et al. (1997) reported barking rather than routine procedures as the main source of noise inside kennels. Regardless the source, ambient noise may be altered by using other auditory stimuli with relaxing effect (Overall & Dyer, 2005). One may think that auditory stimulation operates by muffling a meaningful arousing stimulus (i.e. people talking or other dogs barking) with a less, if at all, species-significant stimulus (i.e. music). However, as Wells (2009) points out, if it were the only process involved, one would expect any types of auditory stimulation to have the same efficacy at reducing barking. But this is not the case. A study by Wells et al. (2002b) investigated the effect of five types of auditory stimulation (human conversation, classical music, heavy metal music, pop music, and a control) on the behavior of 50 shelter dogs. Results showed that dogs spent more time in activities indicative of relaxation (more time resting, less time standing, less time vocalizing) when classical music was played. On the contrary, behaviors suggestive of anxiety (i.e. body shaking and barking) increased during heavy metal music sessions than when any other stimulus was played. A more recent study by Kogan et al. (2012) led to similar results as dogs spent less time vocalizing when one of the four classical music selections was played, and more time shaking when heavy metal music was played. Differences were found in the time spent vocalizing, which was longer during control periods than during any other stimulus, heavy metal included. Interestingly, a modified soundtrack, psychoacoustically designed with the purpose of inducing a soothing effect on dogs elicited minimal behavioral changes. Similarly, Bowman et al. (2015) found that, when classical music was played, dogs spent more time lying, less time standing and less time vocalizing. They also deeply investigated the effects of music on physiological indicators of stress, such as HRV (heart rate variability)

and salivary cortisol. Mean heart rate decreased in the initial response of dogs to music. Changes in HRV parameters were suggestive of an increased activity of the parasympathetic system and a decreased activity of the sympathetic system as a consequence of environmental enrichment. Also, lower cortisol levels were associated with the initial phase of auditory stimulation, although this latter result was not statistically significant. Furthermore, they found out that dogs rapidly habituated to the enriching stimulus, so that music lost its calming effect within two days of exposure. This finding suggests that, in practical application, the music playlist used should be frequently varied or perhaps alternated with other types of enrichment in order to be effective in the long term. In confirmation of that, a more recent study by Bowman et al. (2017) demonstrated that the habituation process can be minimized by alternating different genres of music.

Although both of these studies were set inside actual shelters with hundreds of dogs, the terms "no music" and "silence" are used interchangeably by the authors (Kogan et al., 2012; Bowman et al., 2015). Because of the presence of so many dogs within the experimental setting it is likely that the two captions do not correspond, unless the subjects included in the study had been acoustically isolated during the "silence" period. However, no mention of such a procedure has been found in their papers. This may also explain why dogs spent the most time vocalizing during control periods in the study by Kogan et al. (2012). A hypothesis may be that the absence of music, allows background noises, supposedly barking, to be better heard by other dogs, which in turn, respond to the triggering stimulus.

Recently, Brayley & Montrose (2016) investigated the effects of audiobooks on the behavior of 31 shelter dogs. Their study revealed that audio-book stimulation was more effective than pop, classical and psycho-acoustically designed music, at reducing barking behavior. In addition, it resulted in dogs spending more time resting or sleeping and less time sitting or standing than in any other condition and less time walking than in other conditions except classical music. These findings are somewhat contrasting with those by Wells (2002a) in which shelter dog behavior was not affected by human conversation. This may be explained by the fact that shelter dogs are likely to be hearing human voices in the form of conversation, everyday. On the contrary, they are not used to hear human voices with the typical features of the narrative style, which is characterized by a "clear and strong enunciation, a steady pace and tempo and a non-monotonous or stilted delivery" (Brayley & Montrose, 2016). Therefore, it seems plausible that, in a shelter context, human voice is not an enriching stimulus per se, but its efficacy at reducing behavioral signs of stress in dogs is strictly linked to the way it is presented. Since the mechanism with which auditory stimulation affects dog behavior is not thoroughly understood, a more rigid experimental setting that allows to rule out background noise intensity and type variables, should be used in future studies (Kogan et al., 2012). For instance, by artificially altering the intensity of the background noise, it may be possible to understand how much of the effect of classical music is due to its own relaxing properties and how much is due to its buffering effect on arousing noises. Moreover, since barking has a proven communicative function (Yin & Mc Cowan 2004), reducing the perception of barking to a level that it loses its communicative significance may have welfare implications in itself (Sales et al., 1997). This aspect should be carefully considered when providing shelter dogs with enriching auditory stimuli.

Visual stimulation

While it has been widely investigated in other captive species, especially in non –human primates (Brent & Stone, 1996; Lutz & Novak, 2005; Ogura, 2012), sight-based enrichment in dogs has never been studied in depth. There are three key issues that obstacle the use of this type of enrichment in dogs. First, as they do not have a trichromatic vision – as humans do –, the choice of proper colors becomes challenging for researchers and shelter operators (Pongracz et al., 2003).

Second, televised images may be perceived as rapid flickering by dogs, as they have a flicker fusion frequency 10 to 30 Hz higher than television refresh rates (Coile et al., 1989; Graham et al., 2005b; Wells, 2009). Third, bi-dimensional images may not trigger a response simply because their content is not perceived by dogs as it is by humans (Graham et al., 2005b). As for this latter aspect, there is scientific evidence that dogs do recognize the content of bi-dimensional images. Fox et al. (1971) discovered that dogs would sniff a life-size painting of a conspecific in the same areas as they would sniff a real 3D dog. More recently, Pongracz et al. (2003) found out that dogs correctly respond to gestural and verbal indications given by a life-size bi-dimensional video-projected image of a human. However, the complexity and the dimension of the broadcasted images may play a role at affecting dogs' perception of the image content (Zeil, 2000; Pongracz et al., 2003). The only experiment with televised images as a means of enrichment in shelter dogs was carried out by Graham et al. (2005b). They found out that vocalizations and moving behavior were significantly lower in all four experimental conditions, during which the tv broadcasted either images of moving humans, conspecifics, interspecifics or was blank, than in control condition, during which the tv monitor was moved out of the dogs' sight. Also, dogs spent more time in the front part of the kennel, which was closer to the screen, in all experimental conditions than in the control condition. As the authors point out, these results suggest that the sole presence of a novel object (tv monitor), rather than the nature of the images broadcasted, might have been the reason for behavioral modification (Graham et al., 2005b). However, they did find out that dogs spent more time watching images of moving humans, conspecifics and other species than they did with a blank screen, especially in the two former conditions. This data suggests that dogs are attracted to tv images and that they probably perceive the differences among the image contents, as well. Despite that, in this study dogs spent only 10.8% of the total observation time, looking at the tv screen, suggesting a relatively low interest in the visual stimulation. Perhaps, the small size of the screen, which was only 14'' wide, might have affected dogs' perception and/or interest towards the visual broadcast. Plus, in shelters, humans and conspecifics are a common visual stimulus to every dog, and this might also have influenced dogs' response to the images. Finally, as it was reported for other types of enrichment (Bowman et al., 2015; Bowman et al., 2017), dogs seemed to habituate to the enriching stimulus, as both behavioral changes and interest towards the tv monitor gradually decreased throughout the time of the experiment (Graham et al., 2005b). Despite not completely satisfying scientific results, some shelters already use this type of enrichment, basing their decision on empirical evidence that some dogs react to visual stimuli (Wells, 2004). However, among all types of sensory enrichment, visual stimulation is the least scientifically supported, the most financially demanding and time consuming for shelter staff. In fact, legitimate concern has been raised in relation to the provision of visual stimuli that can be seen but not physically reached by dogs. The impossibility to reach the stimulus may cause frustration rather than positive interest (Taylor & Mills, 2007).

Olfactory stimulation

It is very well known that dog perception of the environment relies mostly on the sense of smell (Horowitz et al., 2013). Depending on management practices, this sense may be either hypo-stimulated or hyper-stimulated in a shelter environment (Taylor & Mills, 2007). Shelter odor sources are mainly represented by other dogs and cleaning products (Taylor & Mills, 2007). Especially the latter are unlikely to be particularly pleasant for dogs. However, it is quite surprising that, to date, the effects of olfactory stimulation as enrichment in kennelled dogs have rarely been studied. Enriching olfactory stimuli may be classified as either biologically relevant, such as blood, urine and feces from other species or biologically meaningless, such as herbs used in aromatherapy (Wells, 2009). Although, biologically relevant odors have been proven to be an effective enrichment tool

in captive species of canids (Nilsson et al., 2014), they have never been scientifically tested in shelter dogs for such a purpose. Indeed, possible transmission of viruses, bacteria, parasites and fungi raises concern for the practical use of biological material as enrichment in shelters. On the other hand, herb odors are safer from this point of view and there is plenty of data that demonstrate their enriching effects in both wild – African lions (Pearson, 2002), black-footed cats (Wells & Egli, 2004) bobcats (Bol et al., 2017), gorillas (Hepper & Wells, 2012), mice (Umezu et al., 2001) birds of prey (Nelson Slater & Hauber, 2017) –, and domestic species – cats (Ellis, 2009; Ellis & Wells, 2010) and dogs (Wells, 2006). Nevertheless, so far only one study investigated the effects of aromatherapy in shelter dogs. Graham et al. (2005a) analyzed the behavior of 55 shelter dogs during exposure to 4 essential oils, namely chamomile, lavender, peppermint and rosemary. According to previous results with studies on humans (Motomura et al., 2001; Amsterdam, 2012) chamomile and, to a greater extent, lavender resulted in dogs spending more time performing behaviors suggestive of relaxation. Specifically, they spent less time moving and more time resting than in any other experimental condition. On the contrary, and always in accordance with studies on humans (Moss et al., 2003) peppermint and rosemary resulted in a greater amount of behaviors suggestive of alertness, like moving, standing and vocalizing. In contrast with the results from studies on acoustic (Bowman et al., 2015; Bowman et al., 2017) and visual stimulation (Graham et al., 2005b), dogs seemed not to habituate to the olfactory stimuli and behavioral changes lasted or even increased throughout the experimental period.

Pheromone stimulation

Pheromones are chemical signals released into and received through the environment by individuals of the same species (Pageat & Gaultier, 2003) These signals are detected thanks to an auxiliary olfactory organ called vomeronasal organ, which is known to be highly developed in dogs (Coli et al., 2016). Specifically, the Dog Appeasing Pheromone (DAP) is a synthetic analogue of the pheromone secreted by the intermammary glands of the lactating bitch, from 3-4 days after parturition to 2-5 days after weaning (Pageat & Gaulitier, 2003).

The efficacy of DAP at improving emotional states and reducing stress-related behaviors in anxiety-evoking situations has been repeatedly tested and confirmed. A calming effect has been reported in dogs exposed to loud noises (Levine et al., 2007; Landsberg et al., 2015), car travels (Estellés & Mills, 2006), training sessions (Denenberg & Landsberg, 2008), isolation (Gaultier et al., 2008) and the veterinary clinic environment (Mills et al., 2006; Kim et al., 2010; Siracusa et al., 2010). Only two studies could be found in the literature that investigated the effects of DAP in the shelter environment. Tod et al. (2005) investigated the effects of a DAP diffuser on a group of shelter dogs over a 7-day experimental period, during which they tested the dogs for behavioral responses towards a stranger walking up and down the kennel block, a stranger approaching neutrally and a stranger approaching friendly. Results showed that, when dogs were tested for a distraction – a stranger crossing the kennel block – the mean barking amplitude in the DAP treatment group significantly decreased across the 7 experimental days. However, no differences were found in the peak barking amplitude in the DAP treatment group before and after the 7-day pheromone exposure.

On average, there was a 20dB difference in the mean barking amplitude between the DAP and the placebo group. Also, the dog recovery capability to return to a lower state of arousal after the stimulus, seemed to be enhanced by exposure to DAP. The DAP treatment group showed a significant reduction in the mean barking amplitude during recovery period over the 7-day pheromone exposure, if compared to the placebo group. However, no difference was found in recovery data for the DAP treatment group before and after exposure to DAP. As for the neutral stranger test, no significant differences were found in dog behavioral responses – body posture, motor

activity, sniffing, barking, growling, whining, escape behaviors – between the two groups. On the contrary, a significant increase in the frequency of sniffing and resting behavior and a decrease in barking behavior were found in the DAP treatment group during the friendly stranger test, following 7 days of exposure to DAP. The overall results from this study suggest that DAP may be used to reduce the intensity and the frequency of some stress-related behaviors in shelter dogs (Tod et al., 2005). For instance, as the main source of environmental noise in shelters are the dogs themselves (Sales et al., 1997), decreasing sound pressure levels induced by barking in response to a passing stranger may have important welfare implications (Taylor & Mills, 2007). Furthermore, behavioral responses to arousing stimuli seem to be affected by exposure to DAP. In fact, results from the friendly stranger test show an overall lower level of arousal in dog responses to the experimenter's engaging gestures. However, the frequency of many stress-related behaviors was the same in both the DAP and the placebo group in all the tests. A more recent study on the effects of pheromone collars by Grigg & Piehler (2015) found no significant difference in the proportion of time spent in stress-related behaviors between the experimental and the control group. The only difference reported was a non-significant increase in the proportion of time spent resting by the experimental group when wearing collars. However, this study was conducted on a sample of only eight dogs. Furthermore, each dog was subjected to different manipulation experiences during the experimental period, as they all were used for teaching purposes. Indeed, the absence of significant differences may simply be attributed to the ineffectiveness of DAP collars, however a not complete standardization and the small study sample may have affected the results of their study (Grigg & Piehler, 2015).

As Tod et al. (2005) pointed out in the conclusive paragraph of their study, limited control over some variables, such as husbandry procedures or dog re-homing, destruction or introduction of new dogs in the kennel block, as well as a limited sample size or the use of dogs for teaching labs – as in the study by Grigg and Piehler – should be avoided in future studies in order to obtain more consistent and irrefutable results.

Effects of sensory stimulation on the success of adoption

Sheltered dogs may benefit from the provision of sensory stimulation in two ways. A direct effect is that of improving dogs' welfare during the time spent at the shelter, which is particularly important for those individuals that, due to undesirable aesthetical, behavioral or age features, are destined to spend the rest of their lives inside a kennel (Weiss et al., 2012). On the other hand, for those dogs that do have the chance to find a new owner, sensory stimulation may also play a key role at increasing dog adoptability. Previous studies have reported that relinquishment may induce the dog to progressively develop behaviors that are potential stress indicators, such as whining and scratching doors (Cozzi et al., 2016) as well as excessive barking and panting (Stephen and Ledger, 2005), or symptoms of frustration and depression, such as wall bouncing, repetitive oral behaviors, pacing and circling (Stephen & Ledger, 2005) and apathetic responses to play stimuli (Cozzi et al., 2016). These behaviors may negatively affect the success of adoption (Protopopova, 2014) by 1) reducing the dog perceived desirability when potential adopters visit the shelter, 2) leading to re-kenneling due to behavioral problems.

Sensory stimulation and shelter dog desirability

People looking to adopt a dog from a shelter seem to prefer individuals showing quite specific behavioral features at the moment of adoption (Wells & Hepper, 2000a). Dogs will more likely be selected for adoption if they occupy the front side of their cage, if they are alert but quiet and

if they interact with the potential adopter in a friendly manner (Wells & Hepper, 2000a; Marston & Bennett, 2003). Sensory stimulation has been used to encourage these types of behavior. A decrease in barking behavior has been reported in studies on all types of sensory stimuli (Bowman et al., 2015; Graham et al., 2005a; Graham et al., 2005b; Tod et al., 2005). Alertness in the form of increased sniffing behavior has been reported by Tod et al. (2005) in their study on the effects of pheromones. An increased proportion of time spent in the front part of the cage has been reported by Graham et al., (2005b) after a visual stimulus was placed in the same area. Therefore, the location inside the pen in which the stimulus is placed may be relevant for enhancing dog desirable behaviors and improve adoptability. However, among all the studies on sensory stimulation in shelter dogs, only Graham et al. (2005b) investigated this aspect, so far.

When visiting a shelter, potential adopters usually have no more than a few minutes to interact with each dog. Therefore, it is important for dogs to feel comfortable in the presence of humans and show desirable behaviors also in that brief period of time during which the interaction takes place. Regardless the fact that some dogs may perceive visitors as a frightening stimulus while others may perceive them as a craved unreachable stimulus, the best way to promote positive dog-human interactions is to provide the dogs with daily training sessions or dog-human interactions (Conley et al., 2014; Herron et al., 2014). Despite that, sensory stimulation may be used as an adjunctive treatment to reduce the abovementioned states of fear or frustration induced by human presence, as proved by Tod et al. (2005) in their experiment with pheromones.

However, data on the efficacy of sensory stimulation at promoting positive shelter dog-human interactions are still lacking for olfactory, visual and acoustic stimuli.

Sensory stimulation and shelter dog behavioral problems

As a matter of fact, "behavioral problems" are the most common explanation given by owners when returning a dog to the shelter, accounting for 22% to 89% of all the returns worldwide (Marston et al., 2004; Mondelli, 2004; Diesel et al., 2008; Wells & Hepper, 2000a). Furthermore, behaviors displayed inside the shelter have been correlated to problem behaviors in the new household in different ways. For instance, Van der Borg et al. (1991) found that behaviors observed in shelters may predict the display of problem behaviors after adoption and Wells & Hepper (2000) found that dogs adopted from shelters are more likely to present behavioral problems in the new house, such as destructive behavior and hyperactivity. It is plausible that experiencing the shelter environment may induce behavioral changes that persist even after adoption in the form of undesirable behaviors. The efficacy of sensory stimulation at reducing the level of stress and preventing or limiting the development of stress-related behaviors, such as excessive vocalization, hypermotility and hypervigilance during kenneling (Bowman et al., 2015; Brayley & Montrose, 2016; Graham et al., 2005a; Graham et al., 2005b, Tod et al., 2005) may facilitate the integration process into the foster family.

Furthermore, stress induced by passing from a shelter environment to a new home should not be overlooked (Osella et al., 2016). Undesirable behaviors shown by the dog during the first week of adoption may play a critical role in deciding whether it will be re-kennelled or not (Mondelli et al., 2004). When provided in the new household, some types of sensory stimulation may help the dog cope with a totally different environmental and social condition and help build the bond between the dog and the new owner (Osella et al., 2016). For instance, Osella et al. (2016) found that DAP, administered to the dogs immediately after adoption for two consecutive months, had, among others, a positive effect on behavioral signs of fear, such as panting/trembling and hiding in corners, on behavioral signs of separation distress, such as urinating or defecating in inappropriate places, and on behavioral signs of hyper-attachment, such as excessive contact-seeking behaviors and owner shadowing. All these behaviors are likely to be perceived as undesirable by

new owners and negatively affect the success of adoption. To date, no other type of sensory stimulation has been tested in dogs to assess whether they could be supported throughout the initial adaptation phase of the adoption process.

Conclusion

Adequate sensory stimulation is fundamental for an appropriate psycho-physical development and for the maintenance of minimum standards of psycho-physical welfare. When dogs are forced to live in an environment where sensory stimulation is either insufficient, excessive or qualitatively inappropriate, they are likely to develop abnormal behaviors as maladaptive coping strategies (Alberghina et al., 2017). Such behaviors are not only a symptom of low welfare but they also drastically decrease dogs' chances of being permanently adopted (Herron et al., 2014).

In order to be effective, sensory stimulation programs should not let dogs habituate to the stimuli provided (Bowman et al., 2015). This means that different types of stimuli should be alternated or, even better, other types of enrichment like positive dog-dog or dog-human interactions, should be provided (Normando et al., 2009).

In fact, sensory stimulation alone is far from being a sufficient means to achieve optimum welfare standards in shelter environments. Ideally, different types of environmental enrichment should be integrated (Herron et al., 2014) to create specific protocols for each individual. Unfortunately, many shelter-running institutions lack necessary funds, personnel and time to provide each dog with a unique environmental enrichment program. In this light, sensory stimulation may represent a scientifically valid, low-cost and no time-wasting tool to improve the average level of welfare of the shelter population and to allow shelter staff to employ more resources in focusing on individual needs. Visual stimulation may be an exception, since it seems to be neither inexpensive nor supported by enough knowledge on dog perception of bi-dimensional televised images (Graham et al., 2005b). However, despite the fact that current data generally supports the use of sensory stimulation to enrich the lives of shelter dogs, further research is needed in order to assess the effects of a greater pool of stimuli and comprehend the processes through which they modify dog behavior.

References

Alberghina D., Rizzo M., Piccione G., Giannetto C., Panzera M. An exploratory study about the association between serum serotonin concentrations and canine-human social interactions in shelter dogs (Canis familiaris). J. Vet. Behav. 2017; 18: 96-101.

Amsterdam J.D., Shults J., Soeller I., Mao J.J., Rockwell K., Newberg A.B. Chamomile (matricaria recutita) may have antidepressant activity in anxious depressed humans-an exploratory study. Altern. Ther. Health Med. 2012; 18(5): 44.

ASPCA (American Society for the Prevention of Cruelty). https://www.aspca.org/animal-homelessness/shelter-intake-and-surrender/pet-statistics. Last access: 11/12/2017

Bosch G., Beerda B., Hendriks W.H., Van der Poel A.F.B., Verstegen M.W.A. Impact of nutrition on canine behaviour: current status and possible mechanisms. Nutr. Res. Rev. 2007; 20: 180-194.

Bol S., Caspers J., Buckingham L., Anderson-Shelton G.D., Ridgway C., Buffington C.T., Bunnik E.M. Responsiveness of cats (Felidae) to silver vine (Actinidia polygama), Tatarian honeysuckle (Lonicera tatarica), valerian (Valeriana officinalis) and catnip (Nepeta cataria). BMC Vet. Res. 2017; 13: 70.

Bowman A., Scottish S.P.C.A., Dowell F.J., Evans N.P. 'Four Seasons' in an animal rescue centre: classical music reduces environmental stress in kennelled dogs. Physiol. Behav. 2015; 143: 70-82.

Bowman A., Scottish S.P.C.A., Dowell F.J., Evans N.P. The effect of different genres of music on the stress levels of kennelled dogs. Physiol. Behav. 2017; 171: 207-215.

Brayley C., Montrose V.T. The effects of audiobooks on the behaviour of dogs at a rehoming kennels. Appl. Anim. Behav. Sci. 2016; 174: 111-115.
Brent L., Stone A.M. Long-term use of televisions, balls and mirrors as enrichment for paired and singly caged chimpanzees. Am. J. Primatol. 1996; 39: 139-145.
Coile D.C., Pollitz C.H., Smith J.C. Behavioral determination of critical flicker fusion in dogs. Physiol. Behav. 1989; 45: 1087-1092.
Coli A., Stornelli M.R., Giannessi E. The vomeronasal organ: a review. Dog Behavior 2016; 2: 24-31.
Conley M.J., Fisher A.D., Hemsworth P.H. Effects of human contact and toys on the fear responses to humans of shelter-housed dogs. Appl. Anim. Behav. Sci. 2014; 156: 62-69.
Cozzi A., Mariti C., Ogi A. Sighieri C., Gazzano A. Behavioral modification in sheltered dogs. Dog Behavior 2016; 2: 1-12.
Denenberg S., Landsberg G. M. Effects of dog-appeasing pheromones on anxiety and fear in puppies during training and on long-term socialization. J. Am. Vet. Med. Assoc. 2008; 233: 1874-1882.
Diesel G., Pfeiffer D.U., Brodbelt D. Factors affecting the success of rehoming dogs in the UK during 2005. Prev. Vet. Med. 2008; 84: 228-241.
Döring D., Haberland B.E., Bauer A., Dobenecker B., Hack R., Schmidt J., Erhard M.H. Behavioral observations in dogs in 4 research facilities: Do they use their enrichment? J. Vet. Behav. 2016; 13: 55-62.
Ellis S.L. Environmental enrichment: practical strategies for improving feline welfare. J. Fel. Med. Surg. 2009; 11: 901-912.
Ellis S.L. & Wells D.L. The influence of olfactory stimulation on the behavior of cats housed in a rescue shelter. Appl. Anim. Behav. Sci. 2010; 123: 56-62.
Estellés M.G. & Mills D.S. Signs of travel-related problems in dogs and their response to treatment with dog-appeasing pheromone. Vet. Rec.-English Edition 2006; 159: 143-147.
Fox M.W. Socio-infantile and socio-sexual signals in Canids: A comparative and ontogenetic study." Ethology. 1971; 28: 185-210.
Gaultier E., Bonnafous L., Vienet-Legué D., Falewee C., Bougrat L., Lafont-Lecuelle C., Pageat P. Efficacy of dog-appeasing pheromone in reducing stress associated with social isolation in newly adopted puppies. Vet. Rec. 2008; 163: 73-80.
Graham L., Wells D.L., Hepper P.G. The influence of olfactory stimulation on the behavior of dogs housed in a rescue shelter. Appl. Anim. Behav. Sci. 2005a; 91: 143-153.
Graham L., Wells D.L., Hepper P.G. The influence of visual stimulation on the behavior of dogs housed in a rescue shelter. Anim. Welf. 2005b; 14: 143-148.
Hepper P.G. & Wells D.L. Olfactory discrimination in the western lowland gorilla, Gorilla gorilla gorilla. Primates 2012; 53: 121-126.
Herron M.E., Kirby-Madden T.M., Lord L.K. Effects of environmental enrichment on the behavior of shelter dogs. Journal J. Am. Vet. Med. Assoc. 2014; 244: 687-692.
Horowitz A., Hecht J., Dedrick A. Smelling more or less: Investigating the olfactory experience of the domestic dog. Learn. Motiv. 2013; 44: 207-217.
Hubrecht R.C. A comparison of social and environmental enrichment methods for laboratory housed dogs. Appl. Anim. Behav. Sci. 1993; 37: 345-361.
Kim Y.M., Lee J.K., Abd El-aty A.M., Hwang S.H., Lee J.H., Lee S.M. Efficacy of dog-appeasing pheromone (DAP) for ameliorating separation-related behavioral signs in hospitalized dogs. Can. Vet. J. 2010; 51: 380.
Kogan L.R., Schoenfeld-Tacher R., Simon A.A. Behavioral effects of auditory stimulation on kenneled dogs. J. Vet. Behav. 2012; 7: 268-275.
Kokocińska A., Barłowska K., Jezierski T. Olfactory stimulation as an element of environmental enrichment preventing mental disorders in animals. JDOS 2016; 4(1).
Landsberg G.M., Beck A., Lopez A., Deniaud M., Araujo J.A., Milgram N.W. Dog-appeasing pheromone collars reduce sound-induced fear and anxiety in beagle dogs: a placebo-controlled study. Vet. Rec. 2015; 177: 260.
LAV (Lega Antivivisezione Italiana). http://www.lav.it/news/dati-randagismo-2017. Last access: 11/12/2017
Levine E.D., Ramos D., Mills D.S. A prospective study of two self-help CD based desensitization and

counter-conditioning programmes with the use of Dog Appeasing Pheromone for the treatment of firework fears in dogs (Canis familiaris). Appl. Anim. Behav. Sci. 2007; 105: 311-329.
Lutz C.K. & Novak M.A. Environmental enrichment for nonhuman primates: theory and application. Ilar Journal 2005; 46: 178-191.
Marston L.C., Bennett P.C., Coleman G.J. What happens to shelter dogs? An analysis of data for 1 year from three Australian shelters. J. Appl. Anim. Welf. Sci. 2004; 7: 27-47.
Mills D.S., Ramos D., Estelles M.G., Hargrave C. A triple blind placebo-controlled investigation into the assessment of the effect of Dog Appeasing Pheromone (DAP) on anxiety related behaviour of problem dogs in the veterinary clinic. Appl. Anim. Behav. Sci. 2006; 98: 114-126.
Mondelli F., Prato Previde E., Verga M., Levi D., Magistrelli S., Valsecchi P. The bond that never developed: adoption and relinquishment of dogs in a rescue shelter. J. Appl. Anim. Welf. Sci. 2004; 7: 253-266.
Moss M., Cook J., Wesnes K., Duckett P. Aromas of rosemary and lavender essential oils differentially affect cognition and mood in healthy adults. Int. J. Neurosci. 2003; 113: 15-38.
Motomura N., Sakurai A., Yotsuya Y. Reduction of mental stress with lavender odorant. Percept. Mot. Skills 2001; 93: 713-718.
Nelson Slater M. & Hauber M.E. Olfactory enrichment and scent cue associative learning in captive birds of prey. Zoo Biol. 2017; 36: 120-126.
Nilsson S., Sjöberg J., Amundin M., Hartmann C., Buettner A., Laska M. Behavioral responses to mammalian blood odor and a blood odor component in four species of large carnivores. PloS one 2014; 9: e112694.
Normando S., Corain L., Salvadoretti M., Meers L., Valsecchi P. Effects of an enhanced human interaction program on shelter dogs' behaviour analysed using a novel nonparametric test. App. Anim. Behav. Sci. 2009; 116: 211-219.
Ogura T. Use of video system and its effects on abnormal behaviour in captive Japanese macaques (Macaca fuscata). Appl. Anim. Behave. Sci. 2012; 141: 173-183.
Osella M.C., Bergamasco L., Odore R., Beck A., Gazzano A. Adaptive mechanisms in dogs adopted from shelters: a behavioral assessment of the use of a synthetic analogue of the canine appeasing pheromone. Dog Behavior 2015; 1: 1-12.
Overall K.L. & Dyer D. Enrichment strategies for laboratory animals from the viewpoint of clinical veterinary behavioral medicine: emphasis on cats and dogs. Ilar J. 2005; 46: 202-216.
Pageat P. & Gaultier E. Current research in canine and feline pheromones. Vet. Clin. N. Am. Small Anim. Pract. 2003; 33: 187-211.
Pearson J. On a roll: novel objects and scent enrichment for Asiatic lions. Shape Enrich. 2002; 11: 7-10.
Pongracz P., Miklosi A., Doka A., Csanyi V. Successful application of video-projected human images for signalling to dogs. Ethol. 2003; 109: 809-821.
Protopopova A., Mehrkam L.R., Boggess M.M., Wynne C.D.L. In-Kennel Behavior Predicts Length of Stay in Shelter Dogs. PLoS ONE 2014; 9: e114319.
Protopopova A. Effects of sheltering on physiology, immune function, behavior, and the welfare of dogs. Physiol. Behav. 2016; 159: 95-103.
Rooney N.J., Gaines S.A., Bradshaw J.W.S. Behavioural and glucocorticoid responses of dogs (Canis familiaris) to kennelling: investigating mitigation of stress by prior habituation. Physiol. Behav. 2007; 92: 847-54.
RSPCA (Royal Society for the Prevention of Cruelty to Animals). https://www.rspca.org.au/facts/annual-statistics-2015-16/dogs. Last access: 11/12/2017.
Sales G., Hubrecht R., Peyvandi A., Milligan S., Shield B. Noise in dog kennelling: is barking a welfare problem for dogs? Appl. Anim. Behav. Sci. 1997; 52: 321-329.
Schipper L.L., Vinke C.M., Schilde M.B., Spruijt B.M. The effect of feeding enrichment toys on the behaviour of kennelled dogs (Canis familiaris). Appl. Anim. Behav. Sci. 2008; 114: 182-195.
Siracusa C., Manteca X., Cuenca R., del Mar Alcalá M., Alba A., Lavín S., Pastor J. Effect of a synthetic appeasing pheromone on behavioral, neuroendocrine, immune, and acute-phase perioperative stress responses in dogs. J. Am. Vet. Med. Assoc. 2010; 237: 673-681.
Stephen J.M. & Ledger R.A. An audit of behavioral indicators of poor welfare in kenneled dogs in the United Kingdom. J. Appl. Anim. Welf. Sci. 2005; 8: 79-95.

Tod E., Brander D., Waran N.Efficacy of dog appeasing pheromone in reducing stress and fear related behaviour in shelter dogs. Appl. Anim. Behav. Sci. 2005; 93: 295-308.
Turner J.G., Bauer C.A., Rybak L.P. Noise in animal facilities: why it matters. J. Am. Assoc. Lab. Anim. Sci. 2007; 46: 10-13.
Umezu T., Sakata A., Hiroyasu I. Ambulation promoting effect of peppermint oil and identification of its active constituents. Pharm. Biochem. Behav. 2001; 69: 383-390.
van der Borg J.A., Netto W.J., Planta D.J. Behavioural testing of dogs in animal shelters to predict problem behaviour. Appl. Anim. Behav. Sci. 1991; 32: 237-251.
Yin S. & McCowan B. Barking in domestic dogs: context specificity and individual identification. Animal Behav. 2004; 68: 343-355.
Weiss E., Miller K., Mohan-Gibbons H., Vela C. Why did you choose this pet?: Adopters and pet selection preferences in five animal shelters in the United States. Animals 2012; 2: 144-159.
Wells D.L. A review of environmental enrichment for kennelled dogs, Canis familiaris. Appl. Anim. Behav. Sci. 2004; 85: 307-317.
Wells D.L. Aromatherapy for travel-induced excitement in dogs. J. Am. Vet. Med. Assoc. 2006; 229: 964-967.
Wells D.L. Sensory stimulation as environmental enrichment for captive animals: a review. Appl. Anim. Behav. Sci. 2009; 118: 1-11.
Wells D.L. & Egli J.M. The influence of olfactory enrichment on the behaviour of black-footed cats, Felis nigripes. Appl. Anim. Behav. Sci. 2004; 85: 107-119.
Wells D.L., Graham L., Hepper P.G. The influence of length of time in a rescue shelter on the behaviour of kennelled dogs. Anim. Welf. 2002a; 11: 317-325.
Wells D.L., Graham L., Hepper P.G. The influence of auditory stimulation on the behaviour of dogs housed in a rescue shelter. Anim. Welf. 2002b; 11: 385-393.
Wells D.L. & Hepper P.G. The behaviour of dogs in a rescue shelter. Anim. Welf. 1992; 1: 171-186.
Wells D.L. & Hepper P.G. The influence of environmental change on the behaviour of sheltered dogs. Appl. Anim. Behav. Sci. 2000a; 68: 151-162.
Wells D. & Hepper P.G. Prevalence of behavior problems reported by owners of dogs purchased from an animal rescue shelter. Appl. Anim. Behav. Sci. 2002b; 69: 55-65.
Zeil J. Depth cues, behavioural context, and natural illumination: some potential limitations of video playback techniques. Acta Ethol. 2000; 3: 39-48.

Effetti della stimolazione sensoriale nei cani di canile

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Sintesi

Ogni anno milioni di cani entrano in canili pubblici e privati, luoghi spesso molto stressanti per gli animali che sono tenuti in spazi ristretti e privati della possibilità di soddisfare le loro motivazioni sociali. Inoltre, gli stimoli ambientali forniti sono in genere quantitativamente (ipo o iperstimolanti) e qualitativamente inadeguati. In queste condizioni è probabile che i cani sviluppino comportamenti anomali come strategie mal adattative di coping che non sono solo un sintomo di scarso welfare ma anche la causa di una drastica riduzione della possibilità che questi animali siano adottati.

L'arricchimento ambientale, come le sessioni di training, gli elementi aggiunti ai box, i giocattoli pieni di cibo, si sono dimostrati in grado di ridurre i livelli di stress nei cani ospitati in canile

Tuttavia, molti di questi programmi richiedono un notevole sforzo finanziario e di tempo. Sfortunatamente, molti canili non possiedono i fondi, il personale ed il tempo necessari per fornire ai propri cani un programma complesso di arricchimento ambientale. In questa luce, la stimolazione sensoriale può rappresentare uno strumento scientificamente valido, di basso costo, che non richiede un impiego considerevole di tempo per migliorare il livello medio di benessere del cane di canile, limitando, inoltre, l'insorgenza di problemi comportamentali ed aumentando l'adottabilità degli animali.