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Efficacy of drug detection by fully-trained police dogs varies by breed, training level, type of drug and search environment

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ABSTRACT

Some recent publications claim that the effectiveness of police canine drug detection is uncertain and likely minimal, and that the deterrent effect of dogs on drug users is low. It is also claimed that more scientific evidence is needed to demonstrate to what extent dogs actually detect drugs. The aim of this research was to assess experimentally, but in actual training and testing environments used by the Polish police, how effective dogs trained by the police were at illicit substance detection depending on factors such as type of drug, dog breed, dog experience with the searching site, and drug odor residuals. 68 Labrador retrievers, 61 German shepherds, 25 Terriers and 10 English Cocker Spaniels, of both sexes in each breed, were used. Altogether 1219 experimental searching tests were conducted. On average, hidden drug samples were indicated by dogs after 64 s searching time, with 87.7% indications being correct and 5.3% being false. In 7.0% of trials dogs failed to find the drug sample within 10 min. The ranking of drugs from the easiest to the most difficult to detect was: marijuana, hashish, amphetamine, cocaine, heroin. German shepherds were superior to other breeds in giving correct indications while Terriers showed relatively poor detection performance. Dogs were equally efficient at searching in well-known vs. unknown rooms with strange (i.e., non-target novelty) odors (83.2% correct indications), but they were less accurate when searching outside or inside cars (63.5% and 57.9% correct indications respectively). During police examination trials the dogs made more false alerts, fewer correct indications and searching time was longer compared to the final stage of the training. The drug odor may persist at a site for at least 48 h. Our experiments do not confirm the recent reports, based on drug users' opinions, of low drug detection efficiency. Usefulness of drug detection dogs has been demonstrated here, even if their effectiveness may not be 100%, but different factors have to be taken into consideration to assure maximum effectiveness.

1. Introduction

Out of several kinds of biological organisms used as volatile compound detectors the most known and widely used are canines [1]. There are at least 30 different sets of detection tasks that trained dogs perform [2]. The most common use of detection dogs by law enforcement all over the world is for narcotics and explosives detection [3]. Although detector dogs still are the most recognized, fast, mobile, flexible and durable real-time detectors, there are a limited number of peer-reviewed scientific studies showing how reliable and efficient canine detection of illicit materials is [1,2,4–10]. There are different opinions as to the practical importance of drug detection by canines. Whereas some authors (e.g. Ensminger [11]) cite police accounts concerning the effectiveness of dogs in sniffing out narcotics, giving an example of 12 drug-sniffing dogs at the US Border Patrol Station in El Paso, Texas, that detected $100 million in narcotics in a nine-month period, some recent papers argue that detection and deterrence rates using canines may be lower than law enforcement authorities like to believe [10,12]. In an Australian study, two thirds of regular Ecstasy users interviewed said that they had drugs in their possession when in close proximity to drug detection dogs but only 7% of the time did the dogs positively indicate to them [10]. There are many uncontrolled variables in such a study, however, including whether the dogs were trained to recognize Ecstasy specifically or only trained on methamphetamines, how close the dogs got to the interviewees, whether the interviewees possessed or were under the influence of drugs when the dogs were near

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them, and whether it would have been legal to let a dog sniff a person under the specific circumstances. In another Australian study, interviews collected by Dunn & Degenhardt [12] suggest no significant impact either from police using drug detection dogs to identify and apprehend drug suppliers, or in addicts seeing detection dogs as an obstacle to using drugs.

Dray et al. [13], using agent-based simulation models, found that only very high detection rates by passive-alert detection dogs reduced the intensity of drug use, and noted that use of dogs may have also unintended health consequences for drug users who ingest their drugs upon seeing a police dog. Authors of some recent and earlier papers [2,10,13] note that up to now there has been limited evidence of the efficacy of drug detection by canines and many accounts of efficacy are only anecdotal [12]. It has also been argued that inaccuracies in the performance of detection dogs may be introduced because of expectations their handlers have that illicit substances will be found at a particular location [14]. Although dogs are regarded by some as the gold standard of detection technology [9], the question of dogs' exact detection performance is difficult to measure in spite of some studies on a diverse array of detection tasks. According to Helton [9], for instance, problems in assessing canine detection performance in the published research include lack of uniformity in how performance is measured and in testing conditions and a lack of information regarding canine training. Such concerns have, of course, encouraged some organizations to attempt to set national standards, such as the Scientific Working Group on Dog and Orthogonal Detector Guidelines (SWGDOG, http://swgdog.fiu.edu) in the U.S.

Performance of detection dogs can be assessed by two objective measures: detection speed and accuracy. Although detection speed may be considered a less important metric of performance compared to accuracy, it should be not underestimated [9]. In real scenarios detection dogs should be sufficiently quick, for example in sniffing cars at border checkpoints, to keep traffic flow at a reasonable level.

Also, too rapid a search may, in certain circumstances such as searching for explosives, contain risks such as pulling tripwires or triggering improvised explosive devices. Speed is usually quantified as search time, which entails speed of orientation, speed of movement and speed of appropriate response [9]. Of interest is also the time between initial scent detection and an overt signal to the handler. This interval may differ depending on the detection threshold of a substance that a dog is trained to recognize [15,16]. Detection accuracy involves measuring correct hits, false alerts, misses and correct rejections, from which two main parameters can be calculated: (1) sensitivity = proportion of hits to (hits + misses) and (2) specificity = proportion of correct rejections to (false alerts + correct rejections). Perfect detection sensitivity and specificity would guarantee that no target material remains undetected, and no other materials than the target are falsely indicated by dogs, the latter of which becomes a reason for complaints by people falsely suspected of possessing illicit material. It should be noted that false alerts and misses may not always be the dog's fault, but may instead be the result of human error. While false alerts can result from poor training of a dog, it has been argued that many false alerts result from actions of handlers [14,17].

Knowledge of how particular drugs differ in ease of detection by dogs and how some factors influence the detection parameters may be useful for training dogs and improving their skills such as determining amounts of target odor materials properly used in detection training, training for detection in unusual locations, and developing improved search tactics, all of which allow for evaluating proficiency and lead to increased reliability in the field. The aim of our research was to fill some gaps in the scientific literature on canine efficacy of drug detection by assessing performance of trained police dogs in tests conducted in different settings actually used by the police that are designed to closely model real world situations, taking into account different drugs and different breeds of dogs.

2. Materials and methods

Experimental drug detection tests were conducted using 68 purebred Labrador retrievers, 61 German shepherds, 25 Terriers (Fox, Welsh, Jagd- and Jack Russell Terriers) and 10 English Cocker Spaniels, all breeds of both sexes. The dogs were tested shortly before the first certification of their operational proficiency, during Polish police certification exams or during an annual recertification exam confirming proficiency. All dogs were considered to be fully trained drug detection dogs under Polish police training protocols [18], including those that were in the pre-certification stage but had not formally passed the examination of operational proficiency.

Drugs used for the training and testing were not of pharmaceutical grade but street materials. Although dogs detect substances by vapor concentrations, we chose to use samples based on weights of 10–15 g of hashish, marijuana, amphetamine ($C_9H_{13}N$ – a mixture of dextroamphetamine and L-amphetamine), cocaine and heroin, which were hidden approximately 1 h before searching rooms either known to the dogs (where training was usually conducted), or unknown rooms with odors new (and possibly distracting) to the dogs (stables for farm animals, storerooms), and inside and outside cars. The presence of such additional odors meant that tests were partially conducted in real-world sweep conditions.

During each test only one drug sample was used and each was placed in an unsealed plastic bag in the search area. In rooms known to the dogs tests were conducted at least a month apart to avoid confusing dogs by the presence of drug odor residuals from previous tests. Handlers were blind to the places where drug samples were hidden, while the experimenters present were not. The dogs moved independently (off leash) while searching, except for searching outside cars where they were on leashes. Handlers were allowed to encourage dogs to keep searching and to guide the dogs to search in specific locations.

All tests were recorded by a video camera. According to training protocols of the Polish police, a dog indicated a site where the drug odor was found primarily by scratching at the site (sometimes called an "active alert"). Another manner of indicating, sitting or lying down in front of the site (sometimes called a "passive alert"), was acceptable depending on individual training. If a dog's handler interpreted the dog's reaction as an indication, he/she signaled to the experimenter that a target material was found, and the experimenter confirmed the correctness of the dog's indication by saying "OK." The dog could not see the experimenter's face because the experimenter held a video camera. The experimenter did not interpret an alert as having been given until told by the handler that one had occurred. For a correct indication the dog was immediately rewarded by throwing the dog's favorite toy to retrieve and to play with. A false alert was not rewarded and the dog was mildly rebuked by saying "No".

As detection parameters the following were recorded: time from start to correct indication; number of false alerts (FA); number of passes of the dog closer than 1 m from the sample without indicating as recorded after the trial upon reviewing the video. The time limit for searching was 10 min. If a dog made a false alert, it was allowed to search further, so during a searching with a FA a dog had a chance to get reward if it eventually found the target odor. Such a trial, however, was not considered a correct indication. If a dog was not able to indicate a site where the drug