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Individual human scent as a forensic identifier using mantrailing

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ABSTRACT

Specially trained dogs have long been used by law enforcement agencies to help in criminal investigations and in searching for missing persons. Still, it is unclear which components of human scent released into the environment contribute to successful searches of individuals. In this study, saliva and axillary sweat samples were taken from a total of 190 people. Additionally, DNA was extracted from whole blood of seven different people and used as an odour sample as well. Overall 675 tests (trails) were performed during a period of 18 months. The ability to track individuals with the odour samples mentioned above was examined with seven dogs, four of which were specially-trained dogs (mantrailer) from the Saxony Police. Results indicated that specially-trained police dogs can track a person with an average success rate of 82% and correctly identify the absence of an odour track with an average success rate of 97% under various conditions. Private rescue dogs were less successful with an average success rate of 65% and 75% respectively. These data suggest that the potential error rate of a well-trained handler team is low and can be a useful tool for law enforcement personnel. Saliva, as a reference odour source, was found to be particularly suitable for the search. The results of the study suggest that the components contained in axillary sweat, saliva and DNA extracted from whole blood are sufficient, serving as a key stimulus for individualized searches.

1. Introduction

In police investigations, it is often necessary to prove the previous presence of a of a known suspect at the crime scene, or to find evidence for this. Many suspects deny ever having been at the crime scene. This is particularly true in cases of severe criminal offenses, such as theft, gang violence, arson, or homicide. Furthermore, in some cases physical evidence, such as dactyloscopic traces or DNA traces, was not yet found nor was available. In such cases, the police (e.g. in Germany or USA) use special trained dogs — mantrailer. Mantrailing is the search for and the tracking of (individual) human scent by using these specially-trained dogs. The mantrailing canine does not follow mandatorily precise the footstep-to-footstep track of the individual. This distinguishes a trailing dog from a tracking dog [1].

Rather, it is of interest whether the dog actually traces an odour trail of the absent person exclusively, which corresponds to the reference odour presented on a so-called scent article. If there is no matching odour, the mantrailer is expected to refuse to trail. The same is expected if a scent is presented from an individual who is known to have never been there. This aforementioned procedure or use a blank scent article is a so called “negative check” or “negative”. In this “negative” case, the canine will typically try to follow a trail in close vicinity of the starting point. Performing the negative correctly requires the canine not to trail and show his handler a corresponding individual behaviour. Examples for individual behaviours are, that one dog may jump at his handler while another dog moves only a few steps around the starting point, yet another remains in place and some check a larger area and stop or return to the starting point. Finally, only the dog handler can interpret the dog’s behaviour correctly and is able to testify the results in court. Thus, the district courts of Dresden, Chemnitz (both in Saxony) and Lüneburg (in Lower Saxony) have already accepted the evidential value of Mantrailing evidence provided by the mantrailers of Saxony Police Force [2–4].

In principle, a trailing canine can only find and follow a trail from the starting point if a searched person was there and has moved away from this location in a manner which allows an exchange of the released human scent trace with the environment [5–9]. This is in accordance with the Locard’s exchange principle, which states that a perpetrator cannot leave a crime scene without leaving numerous traces [10].

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From experience in the field, it is known that various body fluids, such as sweat, saliva or blood are suitable as scent articles for trailing. Previously sterile gauze pads are used to collect perpetrators' individual scent. The suspect is required to open the sterile package and to wipe himself, e.g. over the forehead or the neck. Subsequently, this gauze pad is sealed by the suspect in an airtight plastic bag, which in turn is stowed in a special jar. After that the dog is confronted with this scent article at the crime scene. Otherwise, the collection sets for DNA samples are especially practical for police work. They include cotton swabs for a swab of the buccal mucosa. Considering this, the suitability of saliva as scent article is also of interest, since making a swab of the buccal mucosa to get a suitable scent article can be carried out with comparatively little effort.

Studies have already indicated the ability of trained dogs (*Canis familiaris*) to differentiate humans by their individual scent [11–19]. However, most of these studies do not focus on the pursuit of an odour trail. There are only few studies dealing with the question, whether the human individual scent is traceable in real life scenarios by canines [20–23]. For the use in court, it is therefore of great importance whether the results of police operations are sufficiently reliable in terms of evidence according to legal standards. The Daubert standard provides a rule of evidence regarding on the admissibility of expert testimony during federal legal proceedings in the United States [24]. These criteria include, whether the method in question has been scientifically tested, whether it has been subjected to peer review and publication, its known or potential error rates, and finally, whether it is accepted within a relevant scientific community [25,26]. There are no comparable regulations in Germany. The court is free to choose what to consider as evidence. However, the district court of Nuremberg has set up principles for the applicability of the results of the use of mantrailers as sole evidence in a pioneering judgment. Firstly, the dogs must have the relevant certification level of the police. Secondly, the used scent article must be clearly assignable to a concrete person, therefore, only swabs directly from the body of the person concerned should be used. In addition, the acquisition of the scent article must be documented in a protocol. Thirdly, in each case, two dogs must search for the same trail independently of each other and without the involvement of the other dog handler. Fourthly, each assignment has to be filmed completely, in order to allow a posteriori analysis by the court and an expert [27].

However, this alone does not state the suitability of this investigation tool and the reliability of the results in principle. This must be validated in a variety of tests. Therefore, this study was designed to investigate how reliable the results of mantrailing are under real police operating conditions. This has only been shown twice, so far. Once, each with five attempts of eight dogs. The terrain for each individual trail consisted of a combination of grass, asphalt, cement or dirt [20]. The other time with a large number of attempts. However, thereby the traces were solely laid on grass [28]. Moreover, this study tested for the first time whether saliva as well as DNA samples provide sufficient cues to trail an individual.

2. Methods

2.1. Animals and dog handlers

The study was conducted over a period of 18 months, starting in November 2014 and included seven dogs of different breeds (Table 1). Four dogs are mantrailing police dogs from the Saxony Police and trained according to the method described in a book written by Armin Schweda [29]. Three dogs are private rescue dogs, two of which were also trained according to the Schweda method. The dogs are either certified by the police or a rescue organisation. Those canine team certifications include a scent recognition assessment that evaluate the ability of the canine to detect and use a specific person's scent on a scent article to follow the matching scent trail to this specific person while discriminating from nonmatching scent trails. This trail is aged at least 24 h and approximately 2000–2500 m in length [30,31]. The dogs used in the experiments were trained solely for human scent trailing. All canines, except for the bloodhound/Hanover Hound mongrel, were handled by their handlers and work for the police or were used by rescue organisations. Among the dog handlers were five police officers and two civilian volunteers affiliated with rescue organisations. All handlers have been working with the dogs for at least one year. Everyone had already been deployed to search for missing persons before. Table 1 highlights the variation present among the participating teams which can be divided into eight broad categories, including: breed, sex, institution, canine age, training method, number of years of specific training and certification.

2.2. Subjects

The participation was voluntary, and the subjects were informed about the aims of the study. The appropriate institutional boards, ethics boards and research boards have approved this study (German Institutional Research Board: The Ethics Committee of the University of Leipzig — Faculty of Medicine, reference number 402-14-15122014). Samples were collected from 190 individuals, ages 7–86. Among them were 134 male and 56 female participants (Table 3). Since the study was supposed to imitate real operating conditions, the subjects did not need to use any hygiene articles for the scent collection beforehand. However, the participants were interviewed whether they had consumed body odour-influencing foods (e.g. garlic or onion) before the experiments started.

Table 1
Canine team's general information.

Team	Breed	Sex	Institution	Canine age (yy.mm)	Training method	Training (yy.mm)	Certification
1	Bloodhound	f	Police	4.5	Schweda	4.2	Police
2	Bloodhound	f	Police	5.3	Schweda	4.7	Police
3	Beagle	m	Police	5	Schweda	4	Police
4	Goldendoodle	m	Private	1.7	N/A[a]	1.2	DLRG
5	Brittany spaniel	m	Private	4	Schweda	2.5	DRK
6	Bloodhound	m	Police	6.9	Schweda	5	Police
7	Bloodhound/Hanover Hound mongrel	f	Private[b]	4	N/A[a]	2.1	DRK

The variation is presented among the participating dogs, including: breed, sex, institution, canine age, training method, number of years of specific training and certification.
[a] The training was based on a separate training concept, taking different approaches into account, not one specific training method.
[b] Handled by a police dog handler.