

Article

**Sniff Test: Utilization of the Law
Enforcement Canine in the
Seizure of Paper Currency**

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Abstract: This paper examines the police canine's role in creating a nexus between confiscated currency and drugs. Additionally, this paper examines the roles that the canine handler and evidence collector play in the collection of currency and in maintaining a chain of evidence. Suggestions are presented for the creation of new policy for police agencies that utilize a canine to seize money allegedly involved in the sale of drugs.

Background

A comparison of olfactory cell counts between humans and canines indicates that a dog's sense of smell should be at least 44 times better than a human's [1]. Other researchers estimate the dog's sense of smell as 100,000 times greater than that of a human's [2]. It was found that training dogs to detect as many as ten odors did not cause deterioration in performance [3]. According to Williams et al. [4, p 1], "the dog and its handler remain the most widely used, broadly sensitive, accurate, fast, mobile, flexible, and durable system available for detecting illegal drugs and explosives." Because a canine has the ability

to distinguish one scent from another, canines have become a valuable tool in law enforcement. A trained dog's alert can be used as probable cause to search or obtain a search warrant [5]. The key issue in the establishment of probable cause is the documented reliability of the canine and handler [6, 7]. The drug detection ability may include (but is not limited to):

- Marijuana (*cannabis sativa*)
- Cocaine hydrochloride
- Crack cocaine (cocaine freebase)
- Heroin
- Methamphetamine

Waggoner et al. [8] set out to determine the threshold for detection of odor. Four of five dogs in the study detected the odor of cocaine successfully in 80%-90% of the attempts at .1 ppb, but success rates declined rapidly below .05 ppb. Waggoner et al. stated that their article should "help maintain the well deserved credibility of the dog as a detection technology competitive with or superior to other detection technologies" [8, p 225].

Forfeiture

The concept of forfeiture has been in existence for thousands of years. References to forfeiture can be found in the Old Testament as well as in early English common law [9]. As it appears today, forfeiture can be a powerful tool for seizing the profits of drug enterprises. Unlike criminal violations, forfeiture of property is a civil action. Probable cause is all that is needed to begin the forfeiture process [9, 10]. Once the government has met the probable cause requirement, the burden shifts to the claimant of the property. In most civil cases, the legal standard requires a preponderance of the evidence, unlike the rigorous standards of criminal law, which require a "beyond a reasonable doubt" conclusion.

However, some states have gone beyond the federal standard, forcing the government to prove its case by a clear and convincing standard before forfeiture is upheld. In *Florida v White* [11],

police officers seized a vehicle that had been previously used in a narcotics transaction, and during the inventory search, they discovered additional narcotics evidence. Fortunately, the Supreme Court upheld the search by stating that there is no difference between seizing contraband found inside the vehicle and seizing the vehicle itself when it is the contraband.

Probable Cause

According to the Department of Justice Asset Forfeiture Manual, the probable cause requirement in forfeiture means that the government must "have reasonable grounds to believe that the property is subject to forfeiture that is supported by more than mere suspicion" [10, p 76]. Two methods can provide probable cause: direct evidence and circumstantial evidence.

Direct evidence, unarguably the strongest, can be shown through eyewitness testimony and the documented admissions made by the defendant. Unfortunately, the whole picture of a drug enterprise is rarely available for close scrutiny by law enforcement. These gaps in knowledge substantially weaken the case for the government.

Circumstantial evidence is permitted in civil hearings. However, it is imperative that a nexus can be shown between the item seized and a crime, and this link can often be found in street level drug enterprises [10]. This exchange of drugs for money by drug dealers in cities across the country is a well-known fact [12]. However, linking large amounts of suspect currency back to an illegal transaction is often difficult. The courts have found that the mere possession of an unusually large amount of paper money is not in itself indicative of criminal activity [13]. Therefore, an additional step is necessary to link the money back to illegal drugs. One way to show the required nexus is through the use of trained dogs that are able to detect the odor of drugs on paper currency. The dog handler, as an expert, may testify on behalf of the government and explain the importance of facts that might have appeared insignificant [14].

Contaminated Money Studies

Researcher	Date	Methodology	Contamination	Findings
Hudson	1989	400 bills	10 ppb	Gross contamination of seized money
Orlando Sentinel	1992	9 bills	6 of 9 tested positive	Weakened value of K9 alert
Jourdan & Donnelly	1995	Unknown (ongoing currency study)	13 ppb	Determined background level
Oyler, Darwin & Cone	1996	Samples from 14 cities	.1 ppm on 79% of samples	Contamination widespread
Argonne National Lab	1997	Samples from 3 major cities	70-80% tested positive	Older bills more contaminated
Negrusz, Perry & Moore	1998	18 bills	.14 to 10.02 ppm 2.86 ppm mean	All \$20 bills were contaminated
Sleeman et al.	2000	5000 notes	Not stated	Contamination was widespread

*Figure 1
Chronology of Contaminated Money Studies.*

It is not disputed that paper money is severely contaminated. The studies represented in Figure 1 and Appendix B (scholarly and otherwise) document this fact. The results of recent studies focusing on cocaine contamination of paper money within the United States have severely reduced the perceived usefulness of the canine sniff test. The results of these studies may alter public opinion and ultimately eliminate one of the best tools available.

The Sniff Test

Canines are an integral part of money sniff tests that law enforcement agencies use to seize, under forfeiture laws, monies used in conjunction with drugs and drug dealing. The mixed opinions regarding the value of conducting sniff tests on currency, because of the findings regarding cocaine contamination, require that strict protocols be observed in order to demonstrate a crime-drug-money nexus. Case law and scientific findings in this field provide the foundation for the development of a universal sniff test protocol that can be replicated, should the court so desire.

Scientific Findings

When a canine is required to perform a sniff test on currency, it is simply conducting a narcotics sweep. If the odor of narcotics is associated with the money, the dog alerts. The fact that money is a part of the test has no impact upon the abilities of the dog. The court, however, has disagreed.

In *US v \$30,060* [15], the court's opinion cited reports showing that 75% to 90% of all circulated currency in Los Angeles is contaminated with cocaine residue. The court stated: "If greater than seventy-five percent of all circulated currency in Los Angeles is contaminated with drug residue, it is extremely likely a narcotics detection dog will positively alert when presented with a large sum of currency from that area."

However, recent research has shown that dogs will not alert on large amounts of currency [16]. This is perplexing because the threshold for detection for canines is documented at .1 ppb [4, p 223] and currency in circulation has a contamination level ranging from 10 ppb [17] to 10 ppm [18]. This places the contamination of a single bill well within the estimated detection ability of the canine.

It would appear that the drug odor on which the dogs are trained to alert dissipates over time, leaving only trace amounts on currency, which forensic scientists are able to detect when bills are tested in a laboratory [16]. This theory is corroborated by the work of Furton, who found that "drug detector dogs alert to the common volatile cocaine byproduct methyl benzoate

rather than to cocaine itself” [19]. Methyl benzoate was found to evaporate rapidly from the surface of paper currency at a rate of approximately 90% in 120 minutes. Although it has not been proven that methyl benzoate is the detection odor signature for cocaine, research does suggest that methyl benzoate may be one of the components of the odor that dogs are trained to detect [8].

These findings restore the credibility of the canine sniff. As time passes, the odor of drugs on money diminishes the longer it is away from a contaminating source. Realistically, several days should be long enough for this odor to dissipate. However, a number of other factors may come into play. The length of time that the money was exposed and the quantity of drugs in proximity would likely have roles in the rate of dissipation. Additionally, money stored in areas with minimal airflow (e.g., safes or safety deposit boxes) and differing environmental conditions might tend to retain odor longer.

Signal Detection Theory

Previous studies in explosive detection have based their theories on Signal Detection Theory (Figure 2). Green et al. [20] found that detection was based on two stages of information processing:

1. Sensory evidence is collected about the presence or absence of the signal.
2. A decision is made regarding whether this evidence indicates a signal or not.

		Signal	Noise
		Yes	Hit
Response	No	Miss	Correct Rejection

Figure 2

Single Detection Theory.

Earlier researchers linked this concept to the way that canines function in detection activities. To a large extent, this paradigm is correct. The canine is offered an odor and then must determine whether it is the odor on which he was trained to alert. The signal detection theory visibly illustrates this concept. Unfortunately, the canine is not an autonomous unit. The canine handler brings experience, training, bias, and error to this equation. The existing model does not account for these factors and thus does not represent a fair presentation of the canine search. As a result, a new paradigm is suggested to account for human, as well as canine, factors.

Figure 3 highlights a relatively contemporary scent detection paradigm. Handler error is added in order to illustrate the realistic events of the sniff test. First, the canine is presented an odor and, based upon the training and the ability of the dog, the dog alerts.

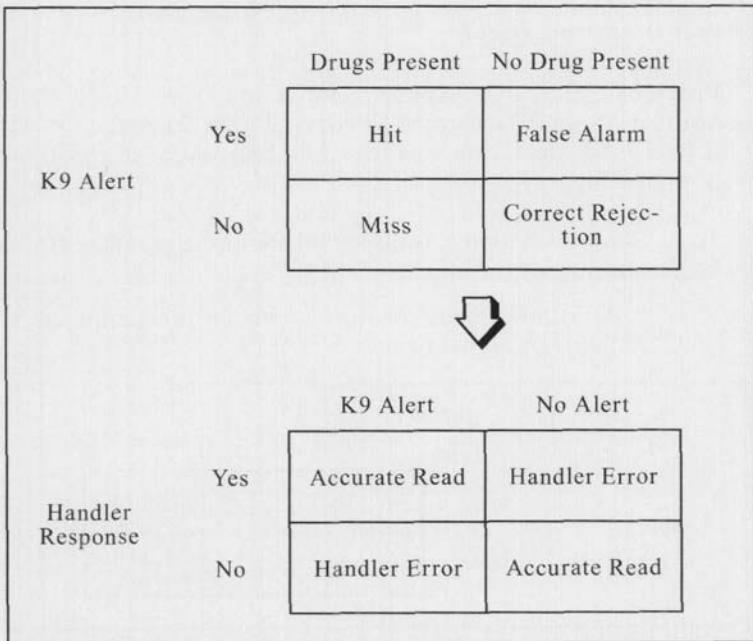


Figure 3
Scent Detection Paradigm.

The recognition of the presence of a controlled substance is articulated through an alert in which the dog is trained. A narcotics detection canine indicates its alert passively by sitting or aggressively by scratching [21].

A hit represents a proper alert when drugs are present; a miss represents a failure to alert when drugs are present. A false alert occurs when the canine alerts when no drugs are present. Handler error occurs when the handler fails to properly interpret the behavior of the dog, leading to misidentification. The response bias on the part of the handler varies as some are more conservative or liberal with their interpretations [22].

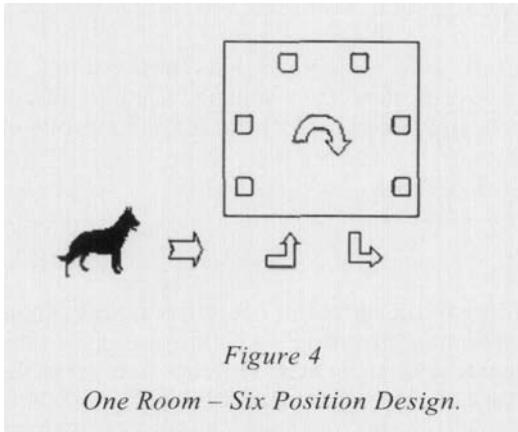
As a result, this additional bias necessitates the second half of the scent detection matrix. The handler is called upon to accurately read the canine for indications of alerts or non-alerts.

Training

The training of the narcotics detection canines should involve a process known as “proofing”, which exposes the dog to uncontaminated currency during drug searches in order to demonstrate that any future alert is not somehow related to the odor of money itself. In preparation for this training, law enforcement agencies often procure a bag of shredded currency from the Treasury Department. In the past, it was thought that this measure eliminated the problem of controlling genuine tender and still allowed the odor of money to be present. However, the use of shredded currency has been negatively addressed in the case law. During the case of *US v One Lot of US Currency Totalling \$14,665* [23], a number of issues were presented:

- How old was the shredded currency?
- How long does it take for the narcotics odor to wear off?
- Does the shredding process in any way cleanse the currency?

Another training issue is the method that will be used to conduct the sniff test. This involves the packaging of the money to be presented to the canine. In the past, packaging has been shown to be problematic and a cause of false alerts. Previous research in this area determined that dogs trained on one type of container were likely to falsely alert under stress when presented with an alternative container [16]. The one room – six position design utilizing envelopes as packaging is probably the simplest form for a standardized sniff test.



In this design, the room is set up with six identical envelopes containing an equal number of bills. Five envelopes contain money samples taken from general circulation to be used as comparisons to the sixth envelope, which contains the suspected drug money. This design is set up without the knowledge of the dog handler, who later directs his dog to search the room for narcotics. If the canine alerts on the suspect currency, it provides the needed nexus to a crime, allowing the seizure of that money.

The greatest weakness of this design is the fact that the envelopes are movable and light, which may allow the canine to play with or tear the envelopes. A potentially superior design is the scratch box design (Figure 5). The scratch box is used in the formative training of dogs to detect odors. The target odor is randomly placed in one of six positions in the box, allowing the dog to search and eliminate five compartments, while success-

fully alerting on the sixth position. Air holes in the top allow the transfer of narcotic odor for the canine to sample, while dividers on the bottom prevent the odor from traveling lengthwise from compartment to compartment.

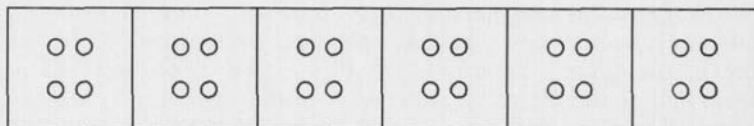


Figure 5
Scratch Box Design.

The suspect currency is placed in one of the six positions. The determination of that position should be random, and the use of a single die is suggested. Money to act as a control or comparison is then placed into the other five positions. Canine error may be greatly reduced using this method. Similarly, if canines can be taught to search without human direction, handler error can also be significantly reduced.

Forensic Considerations

The strength of the canine sniff test can only be as good as the methodology for conducting it. Money should be treated as any other form of forensic evidence. At the point where suspected drug money is encountered, it is imperative to control for contamination factors that would unduly influence later findings.

A likely condition where currency might be found is during a motor vehicle search. If the officer conducting the search has already come into contact with illicit substances, there is a chance that he could contaminate any paper currency that might be later inventoried. Obviously, clean gloves should reduce this problem, but this may still become an issue during forfeiture proceedings. Therefore, a better option is to have two officers assist in the investigation.

Money Officer

The role of this officer is to take possession of the suspect currency. He will maintain chain of evidence until the sniff test has been completed and secured by the property division. This officer should not have handled any illicit substances within the previous 24-hour period. Once in possession of the suspect currency, he may no longer have physical contact with any other piece of evidence. Additionally, this officer takes the role of team leader and manages all aspects of the sniff test by strictly complying with written protocols.

Control Officer

The role of this officer is to collect money from general circulation to act as a control (comparison) in the sniff test. This officer should not have handled illicit substances within the previous 24-hour period prior to the sniff test. The control officer follows the direction of the money officer and physically sets up the sniff test. The last official act of the control officer is to take the suspect money from the money officer and place it in the design. Once the control officer has touched the suspect money, he can no longer handle evidence or the set up of the design. Thus, it is important that all other duties have been addressed prior to handling suspect money.

Role of the Canine Handler

It is presumed for the sake of this proposed analysis that the canine handler and his dog are properly trained and reliable. The handler's duty begins long before the sniff test. Records must be maintained as to the dog's performance over time. Weaknesses should be noted and then addressed. Additionally, if a handler wishes to successfully seize currency, it is imperative that training takes place. Some dogs react differently to different types of packaging for the sniff test [16]. Identification of methodological issues such as these may mean the difference between success and failure.

Conclusion

After a review of the literature and the preceding training issue considerations, it is clear that any agency that is intent on conducting drug money forfeiture must be aware of its obligations to scientific rigor. The preceding analysis demonstrates that it is possible to initiate a successful money seizure procedure using canines. However, strict protocols must be maintained. Methods for conducting a rigorous and successful seizure are detailed in Appendix A, in which recommendations are also made. It is imperative that agencies develop standards in their procedures and training. Consequently, the following policy recommendation also details considerations in training and canine proofing.

If the following policies are implemented and maintained, a department will ultimately stand to benefit from the value of the property that has been seized and from more effective and cost efficient defenses of the seizures during judicial review.

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Appendix A

Proposed Currency Sniff Policy

1. Utilization and General Information

- A. Because the dog is endowed with a superior sense of smell, the trained law enforcement canine is a valuable resource in drug enforcement seizures.
- B. Proper utilization of the canine in the sniff test function requires adherence to procedures that are based upon scientific and legal standards.

2. Definitions

Sniff Test: a quasi-experimental design that allows a trained dog to sample air to determine whether currency seized by officers has been involved in narcotics trafficking.

Proofing: a validation that the canine does not alert to the scent of currency in general.

Control money: money collected from general circulation to be used as a comparison during the sniff.

Alert: positive indication by canine.

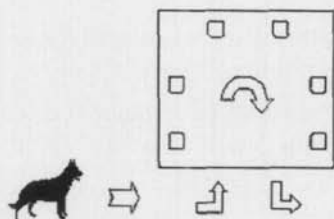
Test design: how the currency will be presented to the canine (e.g., one room – six position or three room – six position).

Positioning: where the suspect money is placed in the design.

3. Training

- A. All canines used for sniff tests shall be certified through a regional, state, or national canine association (e.g., National Police Canine Association, North American Police Workdog Association, United States Police Canine Association).

- B. All canines will have been proofed with paper currency.
 - C. All handlers are responsible for maintaining documentation of all training.
 - D. All canines will have been trained for sniff tests using envelopes as the packaging method.
4. Forensic Principles
- A. Currency seized will be treated as any other type of forensic evidence.
 - B. Any officer who has come into contact with illegal drugs during the inventory search shall not handle money.
 - C. The officer who takes control of the money at the scene maintains chain of custody until the conclusion of the sniff test. Accordingly, this same officer will be responsible for coordinating the sniff test. However, since the money officer is likely to be contaminated with narcotics residue, he should not be allowed to handle any other objects in the sniff test.
 - D. The control officer gathers money from general circulation; it can be from officers' wallets, petty cash or an ATM. However, it is important that the same denomination and same number of bills be provided for each position in the lineup.
5. The Sniff Test
- A. One Room – Six Position
 - 1. Using identical envelopes, place the control money in five envelopes and the suspect money in the sixth.
 - 2. Determine the position of the suspect currency in the lineup by a roll of a single die. A suggested room layout is provided below.



One Room Design.

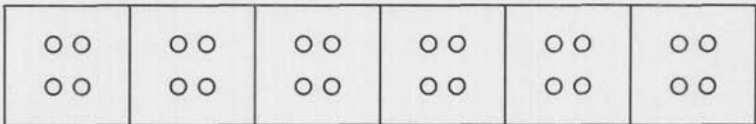
3. Distance between envelopes should be enough to ensure that airflow does not move the scent, initiating a false alert.
4. Once the room has been set up, document the layout prior to beginning the test.
5. The handler should then release the canine into the room with the instruction to search for drugs. This is an off-lead search and the handler should direct the canine past each envelope. The handler should not know the position of the suspect currency.
6. At the point where the canine alerts, the test is concluded and the handler and the dog must leave the room. If the alert was on the control money and no other probable cause exists for seizure, the suspect's money should be returned as quickly as possible. If the alert was on the suspect money, the money officer should place it into evidence as outlined in departmental general orders. The canine handler must document the performance of his dog (regardless of outcome), including a brief review

of the dog's previous performance and training. The money officer will document all phases of the investigation including (but not limited to):

- Circumstances of the seizure
- Evidence collection techniques
- Method of collecting control money
- Set up, design, and positions of the money sniff
- Any observations from the sniff test
- Chain of custody

B. Scratch Box Design

1. Using the scratch box, place the control money in five compartments and the suspect money in the sixth.
2. Determine the position of the suspect currency in the lineup by a roll of a single die. A suggested box layout is provided below.



Scratch Box Design.

3. Once the room has been set up, document the layout prior to beginning the test.
4. The handler should then release the canine into the room with the instruction to search for drugs. This is an off-lead search and the handler should direct the canine past each compartment. The handler should not know the position of the suspect currency.
5. At the point where the canine alerts, the test is concluded and the handler and the dog must leave the room. All phases of the sniff test as outlined in previous sniff test policy should be documented.

Appendix B

Contaminated Money Studies

Hudson [17] examined four samples of 100 bills of paper Canadian currency, which were obtained from the Bank of Canada. He determined, using sophisticated forensics-testing equipment (GS/MS), that cocaine was present at a background level of less than 10 ng per note. Currency that had been seized as evidence in criminal investigations was "grossly contaminated" with cocaine in a range of 50 to 1000 times that of the previously identified background level of contamination.

The Orlando Sentinel [24] conducted a study of the contamination of paper currency by collecting bills in various denominations from local community leaders. Six of nine samples tested in a gas chromatograph/mass spectrometer (GS/MS) contained detectable levels of cocaine. As with research previously discussed, this study suffers from lack of scientific methodology and rigor. We are of the opinion that many of the current studies are more useful for their dramatic impact than for their contributions to social science research.

According to Jourdan et al., who have been engaged in the ongoing study of currency in general circulation, "a person who has handled the drug and then handles currency transfers residue in the low hundreds of nanograms range to the bill(s), and that this amount over the course of subsequent handling and manipulation is reduced to a steady state 'background' level" [25]. Jourdan et al. consider 13 ng per bill (more than 95% of the background samples analyzed) as the upper limit for background contamination for cocaine on money. Their research shows that money seized during criminal drug investigations has nearly four times the level of contamination than currency in general circulation.

Oyler et al. [12] sampled paper currency from fourteen US cities. Cocaine was present at the .1mg level in 79% of the samples. At the 1.0 mg level, cocaine was still present in 54% of the currency. They concluded that currency contamination was widespread and was likely the result of cross-contamination from other contaminated currency or contaminated money

counters. Although their research is invaluable in determining the levels of contamination of currency, their research lacks field application.

The Argonne National Laboratory and the Houston Advanced Research Center collected bills from areas within US cities including Houston, Miami, and Chicago. Their study demonstrated that "70-80% of the money in the major cities studied is contaminated with cocaine" [26]. Of the 278 bills collected in the Chicago area alone, 78% tested positive for cocaine: older bills were found to be more contaminated and fewer than 10% had very high levels of cocaine. The implications of this study are of importance, because currency that has been in circulation longer tends to have higher levels of illicit substance contamination. This is an important conclusion that certainly needs further research. The implication of this conclusion for sniff tests begs the question: Do canines have a greater likelihood to alert on older currency?

Negrusz et al. [18] analyzed paper bills from Chicago and Rockford, Illinois. Cocaine was found to be present on 92.8% of the bills tested. All of the bills in \$20 denomination were contaminated, and the level of contamination on them ranged from between .14 mg to 10.02 mg (significantly high concentrations). The mean level of contamination in this study was 2.86 mg (also a relatively high concentration). On the basis of these results, the researchers concluded that all currency in circulation was contaminated to a significant degree with drug residue.

Sleeman et al. [27] conducted a study of 5000 English, Scottish, and Northern Irish banknotes. Cocaine contamination was found to be widespread. The presence of heroin, marijuana (THC), Methylenedioxymethylamphetamine (MDMA "Ecstasy"), and amphetamine was found on less than 3% of the bills tested. This study further reemphasizes the levels of contamination of paper currencies. Although it must be stated that their study may only be generalizable in the countries in which it was conducted, it still serves as an important piece of corroborating evidence suggesting that paper currency circulating in the US or otherwise seems to be contaminated to some degree. The authors do make a note of commending canines on their ability to detect and locate illicit substances. However, they do not conduct any field testing with canines. Rather, their research is predominantly located in the laboratory.

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