Case Report

The Efficacy of Blue Star Forensic on Wood Floors Coated with Lacquer and Shellac: A Cold Case in Progress

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Abstract: Blue Star Forensic is used to locate trace amounts of human blood at crime scenes. This experiment was constructed as the result of research into a cold case from 1963, where the victim was stabbed to death in her home. Primary information indicated that attempts were made by family members to clean areas of pooled and dripped bloodstains four days after the crime. Years later, the floor was refinished. Viewing of crime scene photos, case documents, and access to the remaining physical evidence, including the victim's clothing, assisted the author in the development of a reconstruction theory and this experiment to test the possibility of finding remaining bloodstains at the original scene. Blue Star Forensic proved valuable in uncovering new forensic possibilities for this case.

Introduction

In July of 1963, a female victim was stabbed to death in her home and was subsequently found by a neighbor three days later. There were no signs of forced entry, and investigators at the time followed broken leads, ultimately questioning three men close to the victim: her brother, her recently estranged fiancé, and a male acquaintance. None were ever listed as suspects in the crime, and the case went cold soon thereafter. Community residents have spoken of the case for more than 51 years, and some continue to harbor hope for resolution, regardless of the fact that all persons involved are no longer living.

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Crime scenes during that era were not always secured from casual spectators, rather they were viewed as a spectacle for anyone and everyone with an "in" to traipse through. At the original scene, newspaper reporters, friends of the investigators, neighbors, and other onlookers walked across, over, and past items of forensic evidence that may have provided the leads necessary to bring the crime to closure. Luckily, the victim's clothing and several other items with evidentiary value were packaged and preserved for future reference. The chain of custody is as solid as one would expect after as many years have passed, and a recent viewing of the items by the author revealed their remarkable condition.

The victim had collapsed in the dining room, leaving a large blood pool on the finished wood floor. The blood stains dried over the course of four days. A relative of the victim attempted to clean the floor with a rag, reporting that some of the staining would not fade. Current photographs of the wood floor show an area of discoloration consistent with the area where the victim was found. Investigators very familiar with the case have reported the possibility of a blood trail leading down the basement stairs and possibly down the hallway toward a rear bedroom. Ten years ago, one of the original scene investigators stated that he recalled a drop of blood on the bedspread of the victim's bed. This claim cannot be corroborated nor refuted because photographs of the original crime scene do not exist. (The photographer at the original scene reported a camera malfunction, and the only surviving photographs were taken the day after the victim was removed from the scene.) The blood patterns can be seen in the black and white photos, but because they were taken from an angle and not with the film plane parallel to the floor, distinct stain shapes cannot be discerned other than the large pool, a transfer pattern (presumably of a shoe), and ambiguous drip stains overlying the area where the victim had been located, most likely gravitational drops from the removal of the victim onto a stretcher.

The report that drip stains on the basement stairs and down the hallway did exist at the time of the incident is of critical importance in this case. These stains cannot belong directly to the victim because these areas were far removed from the place where she was found. The use of a sharp instrument in a homicide often results in the perpetrator wounding himself or herself during the commission of the crime, and this hypothesis forms the basis of the following experiment. Information from primary sources indicated that the wood flooring had

been refinished in the intervening years. This experiment was conducted to detect the practicality of using Blue Star Forensic on refinished wood flooring to detect minute quantities of blood that may have been left behind by the perpetrator.

Materials and Methods

The following materials were used to facilitate this experiment:

- Clear lacquer (Watco Clear Lacquer, Rust-Oleum Corporation, Vernon Hills, IL)
- Clear shellac (Zinsser Bulls-Eye Shellac, Rust-Oleum Corporation, Vernon Hills, IL)
- Generic 1½″, polyester filament paint brushes
- 4 sections of 2¼″ red oak hardwood flooring (Nantahala Flooring Outlet, Franklin, NC)
- Whole horse blood, preserved with CPDA-1 (citrate phosphate dextrose adenine) to prevent clotting
- Glass container
- 2 oz sterile syringe
- Standard measuring scales
- Nikon D3200 digital camera
- Clean brown paper
- Blue Star Forensic (Monte Carlo, Monaco)

This experiment took place at the CSI Academy of Florida in a secure section of the building on a covered down-draft table.

The procured sections of hardwood flooring were unfinished and were retrieved from the same flooring company that installed the wood floors in most of the homes in Franklin, North Carolina, during the time that the victim's home was built. The most popular selection of flooring at that time was red oak, which was used in this experiment.

On day 1, the flooring sections were placed on clean brown paper along with a standard inch scale. Two sections were designated to be treated with Watco Clear Lacquer and two sections were designated to be treated with Zinsser Shellac.

On day 1, using new paint brushes, the first coat of lacquer and the first coat of shellac were applied to the respective sections in the afternoon. The ambient temperature was 76 °F. On day 2, a second coat of lacquer and a second coat of shellac

were applied to the respective sections in the morning. The ambient temperature was 77 °F. On day 2, a third (and final) coat of lacquer and a third (and final) coat of shellac were applied to the respective sections in the afternoon. The ambient temperature was 77 °F. Notably, the wood coated with Watco lacquer dried with a significantly higher gloss than the Zinsser shellac. The wood sections were then left to dry and harden for 10 days in an ambient environment of 77 °F.

On day 12, the author procured fresh horse blood from a local large-animal veterinarian. The blood was retrieved from the carotid artery and placed into a pint container with CPDA-1 to prevent clotting. The blood was then taken directly to the laboratory and used. It was not refrigerated, cooled, or stored at any point in order to most accurately demonstrate the effect of fresh blood on the substrates. The underlying brown paper was refreshed at this point.

On day 12 , the horse blood was placed into a clean glass container and, using a sterile 2 oz syringe, 0.5 oz of blood was placed onto each section of wood, mimicking both pooled blood and a drip pattern (Figure 1) in an effort to replicate the areas seen in the original crime scene photographs. The ambient temperature was 77 °F. The blood was left to dry for 4 days in an effort to mimic the time frame reported by family members at the original scene. The ambient temperature was 77 °F.

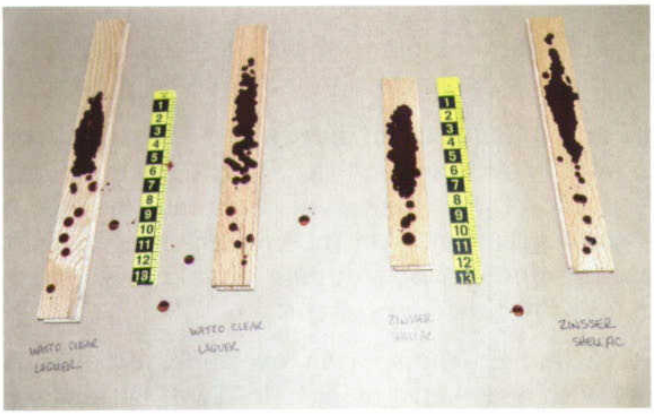

Figure 1

Four sections after blood application.

On day 16, the resulting dried blood patterns were documented and photographed. The following observations were made:

(1) The bloodstains on the Watco Clear Laquer-treated sections were notably lifted from the surface, with significant large cracks throughout the stains (Figure 2).

(2) The bloodstains on the Zinsser Bull-Eye Shellac-treated sections were heavily cracked but adhered more to the substrate and appeared to have been partially absorbed (Figure 3).

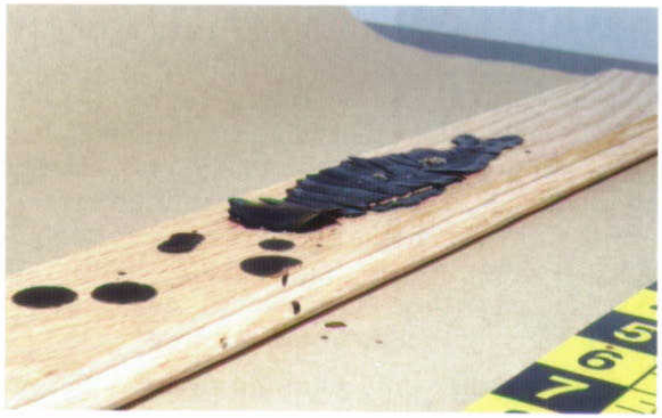

Figure 2

Watco lacquer section showing dried blood lifted from the surface.

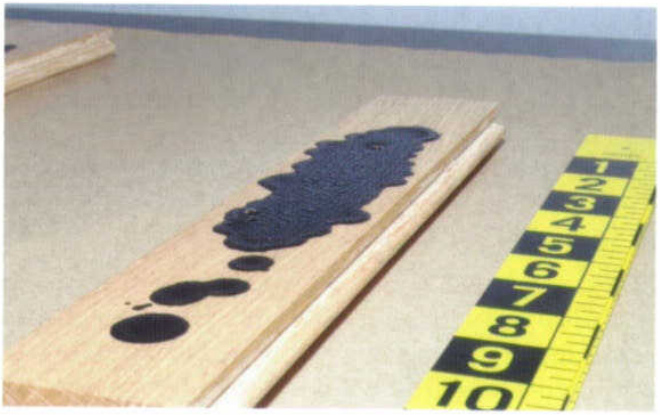

Figure 3

Zinsser shellac section showing dried blood adhered to the surface.

At this point, the bloodstains were cleaned from the surfaces using tap water and a cotton rag. There is no available information regarding any solvents, cleaning solutions, or soap that may have been used by the family member to clean the original scene, so none of these substances were used in this experiment, choosing instead to err on the side of caution instead of guessing at a possible cleansing agent. Standard latex gloves were used. After being cleaned, the wood sections were placed onto a refreshed sheet of brown paper and allowed to dry for 5 days. The ambient temperature was 77 °F.

Information from family members of the victim advised that the original wood floors had been refinished in the intervening years, but no exact information was available as to the time frame or as to the coating that may have been used. I spoke with an employee of the Nantahala Wood Flooring Company, who advised that the predominate coating used during and after the 1960s was clear lacquer or varnish. One family member recalled a strong odor when visiting the victim's home while the floors were being refinished, but could not recall the year or timeline. I can report that Zinsser shellac has a very weak odor and Watco lacquer has a strong odor. Because of this distinction, Watco lacquer was selected as the top coat for all four sections of wood. The top coats were applied as follows:

On day 21, all of the wood sections were divided widthwise into three separate areas, designated by a black Sharpie line (Figure 4). The bottom sections, designated with a θ, were left unfinished as a baseline for the Blue Star Forensic reaction. The middle sections, designated with a 1, were coated with a single coat of Watco lacquer. The top sections, designated with a 2, were treated with two coats of Watco lacquer.

On the afternoon of day 21, a clean paint brush was used to apply a single coat of Watco lacquer to the middle and upper "1" and "2" areas of all four wood sections. The ambient temperature was 77 °F. During the morning of day 22, a second coat of Watco lacquer was applied to the upper "2" areas of all four wood sections. The ambient temperature was 74 °F. The sections were allowed to dry for 4 days.

On day 25, the wood sections were labeled with glow paint along the previously drawn Sharpie lines to delineate the different lacquer-coated areas. Glow paint labels of θ, 1, and 2 were also placed alongside each section for easier viewing. A standard mixture of Blue Star Forensic (2 tablets mixed with 4 oz of distilled water) was applied to all four wood sections. Photography was achieved with a Nikon D3200 camera, which was placed on a tripod (f 3.5 and shutter speed of 20 seconds).

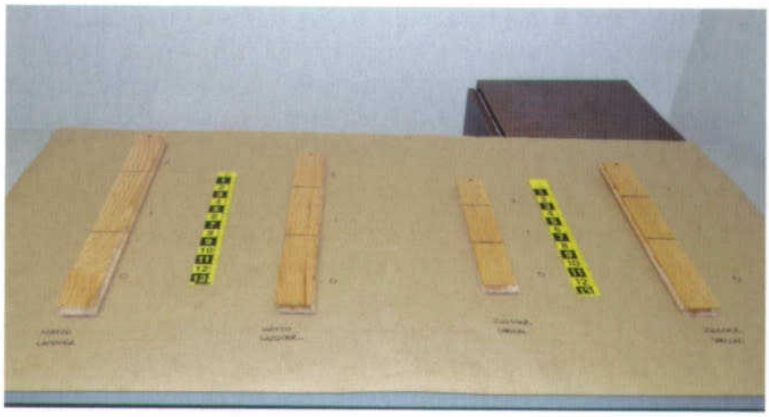

Figure 4

Four sections of wood divided into three areas for top coat of Watco lacquer.

Results and Discussion

Figures 5 through 7 show the reactions that were achieved using Blue Star Forensic. Closer analysis revealed that Blue Star Forensic did indeed have the ability to penetrate both layers of Watco lacquer.

Blue Star Forensic revealed its ability to penetrate two layers of lacquer on finished wood flooring. As shown in Figures 6 and 7, the reaction became progressively more exiguous as the lacquer coats grew thicker. However, there were several minute areas in the two-coat sections that became visible after Blue Star Forensic application (highlighted with arrows). Additionally, and not surprisingly, the grooved areas sitting below the surface reacted heavily along the entire length of the wood sections because of the lack of shellac or lacquer deposition.

The author concedes the following possible flaws with this experiment:

1. The blood that was used was fresh horse blood and had not been subjected to foot traffic, normal wear and tear, and dirt deposited over 51 years. In the interest of time, it is not practical to devise an experiment to duplicate the exact scenario.
2. The use of cleansers at the original scene remains unknown and, if used, may have had a negative impact on the original stains. Because there have been no reports of cleanup in the hallway or on the basement stairs, it is the hope of the author that some remnants of deposited blood remain.

3. Blue Star Forensic was used based on past experimentation showing a brighter reaction than traditional luminol [1]. However, luminol has been used successfully on crime scenes since 1937, so additional testing along these lines is warranted.
4. The use of Zinsser shellac and Watco lacquer was based on primary source information as well as discussions with a seasoned flooring expert at Nantahala Flooring Outlet who was in the business in 1963 and remembers the types of floor finishes used during that era. If other floor coatings were used at the original scene, it is the hope of the author that Blue Star Forensic would perform in a similar fashion.
5. Because it is not known whether the original wood floors were sanded prior to the refinishing process, the wood planks in this experiment were not sanded. There is still an area of staining that is present in the dining room area that is consistent with the staining in the original scene photographs. It is my opinion that no or minimal sanding was completed prior to the refinish application.

Conclusion

This experiment showed that Blue Star Forensic not only has essential forensic use for crime scenes involving cleanup, but also for detecting bloodstains after the application of floor finishes. The possibility exists for detection of trace bloodstains left behind at the original homicide scene of this victim in both the hallway and on the basement stairwell, if indeed they were deposited on the day of the crime as reported. It is the hope of the author that further testing on these bloodstains will reveal Y-STRs and the identity of the contributor.

The author has not been able to test the results of the experiment at the original crime scene as of the date of publication. However, the case file has been reopened, and currently assigned investigators are exploring the possibilities of the use of this information to further the investigation.

For further information, please contact:

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Reference

1. Dilbeck, L. Use of Blue Star Forensic in Lieu of Luminol at Crime Scenes. *J. For. Ident.* **2006**, *56* (5),706–720.

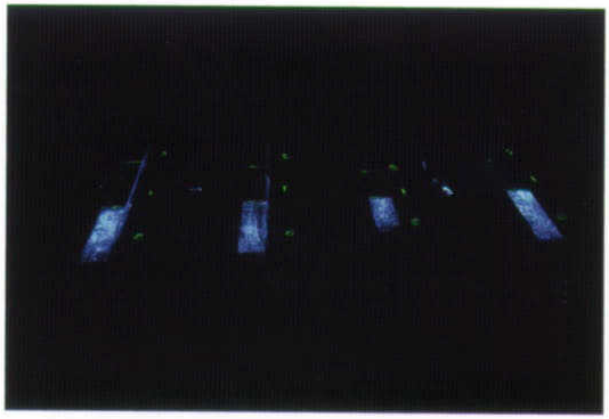

Figure 5

Blue Star Forensic reaction to four wood sections divided into three areas.

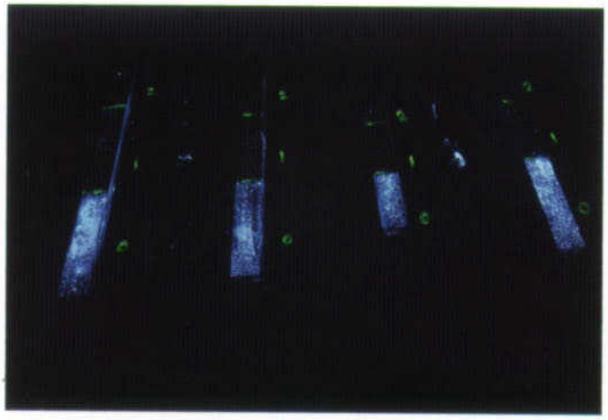

Figure 6

Bottom coat of Watco lacquer; top coat of Watco lacquer.

Figure 7

Bottom coat of Zinsser shellac; top coat of Watco lacquer.