

Just a Curious Case of Print Persistence 1

Introduction [00:00:05] Now this is recording RTI International Center for Forensic Science Presents Just Science.

Voiceover [00:00:19] Welcome to Just Science, a podcast for justice professionals and anyone interested in learning more about forensic science, innovative technology, current research, and actionable strategies to improve the criminal justice system. In episode one of our Case Studies Part 1 mini season, Just Science sat down with Michael Fagert, a certified latent print examiner at the Kansas Bureau of Investigation, to discuss a latent print phenomenon that is not often seen in casework. There are very few instances of identifiable fingerprints on cartridge cases recovered from crime scenes, as the firing process introduces adverse physical and thermal stressors to fingerprint residues. Several processing methodologies have been investigated for the development of latent prints on spent ammunition like gun blue solutions, but only a few studies reported success on case work samples. Listen in as Michael discusses his published case report on how an untreated latent print encountered on a cartridge case was subsequently identified to the suspect in the case. This episode is funded by the National Institute of Justice's Forensic Technology Center of Excellence. Here is your host, Jaclynn McKay.

Jaclynn McKay [00:01:21] Hello and welcome to Just Science. I'm your host, Jaclynn McKay with the Forensic Technology Center of Excellence, a program of the National Institute of Justice. On today's episode, we will discuss a case study published in the Journal of Forensic Identification related to an identifiable fingerprint found on a cartridge case at a crime scene. Here to discuss this case is Michael Fagert. Welcome, Mike. Thank you for taking the time to talk with us today.

Michael Fagert [00:01:46] Thanks for being interested in this case study and allowing me to share with the audience.

Jaclynn McKay [00:01:51] Yeah, absolutely. Can you discuss your professional background a little bit and how you became involved with this case study?

Michael Fagert [00:01:57] I'm a certified latent print examiner with over seven and a half years of experience. I currently work at the Kansas Bureau of Investigation at their Forensic Science Center. I've been with the KBI for a little over a year now. Prior to that, I was at the Kansas City Missouri Crime Laboratory in their latent print section. I worked there for about six and a half years, and that's where I was employed at the time that this case came about.

Jaclynn McKay [00:02:22] Do you mind providing a little bit of background of the case for our listeners?

Michael Fagert [00:02:25] Yeah, so in December of 2019, the K.C.P.D. responded to the scene of a homicide where they found a victim in between two residences in a neighborhood. They secured the scene and they talked to some witnesses. The witnesses indicated that they heard some gunshots and then they observed a male leaving the scene in a black hoodie and black pants. And so while the officers were holding the scene, they noticed an individual at a nearby residents that matched those descriptions. So they took that individual into custody for further investigation. At the same time, our CSI technicians responded to the scene to process that scene. Part of their scene processing they collected four cartridge cases, one being near the victim's body, one near the door to the

victim's residence, one near the driveway and one near a nearby street. This is the evidence that was then collected and brought back to the lab and submitted for us for examination.

Jaclynn McKay [00:03:27] So based on the evidence that was collected in this case, was there anything interesting about it?

Michael Fagert [00:03:31] The crime scene technician who responded to the scene, she was notorious for always reviewing her photos when she got back to the lab to see, am I capturing everything in focus? Is there anything that you could do better going forward? And one thing that she noticed while reviewing her photographs was a visible latent print on one of the cartridge cases that happened to be the one near the street. But this cartridge case had already been swabbed on the scene by the crime scene technician. So she brought those photographs to our latent print supervisor, and he thought it was something that we could definitely look into and do some more work. And so he brought it back to the examiners in our section and looked to see if somebody was able to work on it. Fortunately for me, I wasn't in the middle of anything and thought it was super interesting, so I volunteered to work the case.

Jaclynn McKay [00:04:20] So after the cartridge case was swabbed, could you guys still find a print on the cartridge case?

Michael Fagert [00:04:26] Yes. So kind of how it worked was I got these crime scene photographs and I analyzed the photograph of the cartridge at the scene and was able to determine that that print was of value and was able to compare it to a suspect and identify that suspect. But still interested to see if there was anything remaining on the cartridge case or anything that still remained there, so I was able to request that evidence from our firearms section and that impression was actually still intact on the cartridge case.

Jaclynn McKay [00:04:58] Previously, I worked as a crime scene investigator for several years, and I don't ever recall getting latent print impressions of value on cartridge cases. This instance is quite unique. So as luck would have it, the crime scene photograph actually depicted the latent print, and as we know, the fingerprint probably didn't go all the way around the cartridge case so had the fingerprint not shown up in the photo, this case may have never happened. Does that sound accurate?

Michael Fagert [00:05:24] Yeah. If the crime scene technician didn't review her photos, this is some evidence that we could have missed. And it would be kind of a missed opportunity for me to do some investigation and a missed opportunity to present this to a community of instances in which fingerprints might persist through the firing process.

Jaclynn McKay [00:05:42] Not only is this very rare, it seems like we got lucky in this case.

Michael Fagert [00:05:47] For sure.

Jaclynn McKay [00:05:48] So what made you want to pursue research into figuring out how this print lasted on the cartridge case through the firing process?

Michael Fagert [00:05:56] It was definitely a very rare occurrence. We hear in the field and we've - studies have shown that the firing process of a firearm exerts physical and thermal stressors on any latent impressions that could be on those cartridge cases. So it's

not something that happens very often and something that is very interesting to me, and I have been fortunate enough to do some research while that were able to find that impression still intact on that casing, I thought it would be very beneficial to find out how this happened and then also share with the community because it is such a rare occurrence.

Jaclynn McKay [00:06:31] Can you talk through a little bit more about the trace analysis that was done?

Michael Fagert [00:06:36] So originally I thought that this impression could have been etched into the metal of the cartridge case. I've read about the interactions of fingerprint residue having a corrosive nature on cartridge cases, creating an etched impression. So to test that, I took the end of a DNA swab and just lightly scraped along the edge of the impression and this really easily removed that residue, confirming that it wasn't etched. These nickel plated and nickel composition cartridge cases are corrosion resistant so that explains why the residue is easily removed. So at that point, I took the cartridge case over to the trace evidence section where they collected a scraping of the latent residue that they could run some additional tests on. And so they did an FTIR analysis, which is the Fourier transform infrared spectroscopy, and they also did micro X-ray fluorescence to look at any potential inorganic components that were present in a pyrolysis gas chromatography-mass spectrometry analysis for any organic components of the residue.

Jaclynn McKay [00:07:49] And were there any major findings from those trace analysis?

Michael Fagert [00:07:53] I think there were some significant findings that could indicate what the residue potentially was. The X-ray fluorescence, it didn't reveal any foreign inorganic materials, so no additional inorganic materials were present. The paralysis analysis, the results were too minimal to cross the threshold, so they weren't able to make any definitive analysis of what those components could be. But the FTIR analysis is what provided the most informative information that was present with the spectra that were generated from the FTIER samples of the scraping, the key peaks of the spectra were highlighted by the Trace Examiner, and I compare those peak numbers to a table that I found of known eccrine and sebaceous deposits, so what peaks they have in their spectra, and found a great deal of correspondence between this scraping from the cartridge case and those in that table. So while these components aren't exclusive to fingerprint residues, it is an indication that this very well could have been just natural fingerprint residue that survived through the firing process.

Jaclynn McKay [00:09:08] Okay. So you talked about your theories behind whether the fingerprint was etched into the casing and then you talked about all the trace analysis that was involved with determining whether this was a normal eccrine or sebaceous fingerprint on the casing. Can you maybe talk about some of the other theories that you had as far as ruling out whether anyone had touched the casing after it was fired?

Michael Fagert [00:09:35] Yeah, so there's a potential the something this clear and well-defined could have been deposited post firing. Mentioned the witness statements about observing someone leaving the scene after the gunshots were heard and looking into the reports filed by the officers. These witnesses were in their houses at the time of hearing the shots being fired. So there was a small window of time in which it would take for them to either look out the window or come outside in which that casing could have been handled. We don't know because we weren't there at the time, unfortunately. But it seems odd that somebody might try to pick up just one casing as they're leaving, but there's

definitely a possibility it could have been handled. So it's something that we can't rule out definitively as an option.

Jaclynn McKay [00:10:23] I think your research is very valuable to the field, but I also find it interesting that you were able to do research at a publicly funded laboratory. Can you talk a little bit more about how you had the capability to do that and how supportive your laboratory management was of that?

Michael Fagert [00:10:40] Sure. I consider myself incredibly fortunate that so much additional work was able to be conducted on this case. Once that print was identified and I found that it still persisted on that cartridge case, I wanted to know more about how it happened and how it persisted. Was this some sort of foreign material that was present, that was better suited to survive the foreign conditions? Was it something that became etched into the cartridge case or is it just standard fingerprint residue? So I approached our lab director at the time, who was previously the trace evidence supervisor, brought it to his attention, I said, hey, I would like to look into this some more, is there anything you think we can do? And very fortunately he thought it was a great example of something we could look further into. We got with the chemistry supervisor as well to determine what could be the best path to pursue. And we thought that the trace evidence section would have multiple tests that we could run on it and potentially be able to determine what comprised that residue on the cartridge case. And then we're also able to run the DNA swab that was collected as well.

Jaclynn McKay [00:11:52] And when you wrote this case report, you did a literature review. Were you able to find any publications that pertain to identifiable prints found on casings in casework?

Michael Fagert [00:12:04] So I was able to find a few publications involving casework samples. The vast majority of what I encountered were tests on different development techniques and what would work best on groomed samples in the laboratory. But there were only three articles that I found specifically with case work examples. One of those was from a Minneapolis lab where they looked at, I believe it was about 259 casings, and they did find one print of value, but they attributed this to being deposited post-firing. A Denver lab reviewed some cartridge cases over, I believe, a two-year period in which they didn't find any fingerprints of value on those spent casings and then there was a Northern Ireland study where they looked at all the casing submitted from homicides over a two year stretch. And they didn't indicate the number of cartridge cases that they looked at or examined during that time period, but they did find two fingerprints of value. One of those was inadvertently deposited by crime scene personnel during the collection, or post firing phase, and the other one was not identified. So one potential instance where a fingerprint could have been left prior to the firing process in these case work examples.

Jaclynn McKay [00:13:27] So you mentioned that through the use of the crime scene photographs, you were able to find a print still on a cartridge case that had been swabbed and screened for NIBIN entry and when you retrieved the cartridge case for latent print analysis, you saw that the prints still existed on the cartridge case as well. Can you talk a little bit about how you used the photograph and the cartridge case during your latent print analysis and what your results were from that?

Michael Fagert [00:13:58] Yah, so the first thing I did was I received the crime scene photograph and there were some interesting limitations with this. Obviously it was a documentation photograph, so it's from further away, has less resolution when you

zoomed in on the image itself. So there's a little bit of pixelation. And the cartridge case wasn't parallel to the film plane, so it's just lying naturally there on the ground. And so there's some little bit of perspective that was off, but just working with that image and doing a little bit of digital enhancements to help us contrast in Photoshop, there was enough information present there in that latent in the crime scene photo to be able to compare it to the known prints of the suspect. And I was able to identify that impression. After retrieving the cartridge case itself from the firearm section, the latent print was observed in its totality. It didn't look like it was altered or changed from the crime scene photos, which means that area was probably just missed during the swabbing process because it wasn't etched into the cartridge casing or anything. And so additional laboratory photos were taken just to have more exam quality photos of that impression. I looked at it, compared it to the crime scene photo, and it was the same rich detail again. And then also compare that laboratory photo then again to the suspect and was able to identify as well.

Jaclynn McKay [00:15:25] And did the case gain any information from DNA results on the swabbing of the casing?

Michael Fagert [00:15:30] A DNA analyst did run quantification step on the swab taken and they found 0.02 nanograms of human DNA from the swab, 0.01 nanograms being male DNA. And in speaking with the DNA supervisor, she indicated that this was a typical amount of DNA that they would encounter on spent casings, and in this instance, it wouldn't be enough DNA to proceed on to the amplification stage and further on down the line.

Jaclynn McKay [00:16:00] So as a result of this, had any procedural modifications taken place?

Michael Fagert [00:16:06] Prior to me starting at the Kansas City, Missouri crime lab, the latent print section conducted an internal review of firearms evidence, and they looked at their success rate of getting usable fingerprints off of live rounds and spent casings and firearms and they found with the live rounds that they had a 1% success rate in finding any fingerprint detail that was of value for the section. And they determined that that was very low success rate for the sheer quantity of that type of evidence we were receiving so that we wouldn't be conducting any latent print processing of live rounds and spent casings unless there were special circumstances in which it needed done. Then leading up to this case that we encountered, there was an increase or a lot of gun related crimes in the Kansas City area, so the lab was looking into, was there anything more we could be doing to maximize the evidentiary value of this firearms evidence? And so our latent print section was looking into methods such as vacuum metal deposition or using a gun blue solution to process those cartridge cases and DNA was running tests to see how frequently they could get usable genetic profiles. And we found in the latent print session that this modified gun blue solution gave us the best results. But the DNA section was still having significantly higher rates of getting usable profiles than us. So we were prioritizing DNA over latent processing because that processing of ours also was detrimental to DNA, the gun blue solution. So DNA was prioritized for those cartridge cases up until this spent casing was encountered. Once it was encountered, there was just a small modification that was made and those crime scene technicians were now conducting a visual examination of spent cartridge cases at crime scenes prior to swabbing. So that way, if they encountered a very large area of rich detail or something that stood out, it could be directed to the latent print section first, and we could try to find either nondestructive ways to photograph or develop that or work with DNA on how to best proceed with those ones going forward.

Jaclynn McKay [00:18:32] So you would say that your study still supports DNA analysis as the prevailing methodology for evidence collection on cartridge cases?

Michael Fagert [00:18:41] I would say so, yes. We worked through our submissions system and found that almost 3200 casings in shot shells were submitted by crime scene over a one-year time period, and aside from the casing observed in this case, only two additional casings were submitted in which there was a significant amount of rich detail present. So it was just something that says, hey, if you consider this here, and it's valuable to do a visual examination, but there's still going to be greater value in prioritizing the DNA evidence.

Jaclynn McKay [00:19:17] Although this is a very small procedural modification, was there any pushback with the crime scene unit changing the way that they operated at all?

Michael Fagert [00:19:26] Not that I'm aware of. The latent supervisor at the time was a former crime scene supervisor. So I'm assuming I would - we would have heard if they were not a fan of it. I think the way it went fine was it doesn't take a lot of additional time. You're already having to pick them up and the swabbing process takes a little bit of time to do so, just putting a flashlight on something or looking at it in the light prior to the swabbing isn't super time intensive. So it was kind of an easy adjustment to make.

Jaclynn McKay [00:19:53] And at the Kansas City Police Department, the crime scene technicians were the ones that actually swabbed the cartridge cases prior to submission to the lab?

Michael Fagert [00:20:01] Yes, they would swab them on scene.

Jaclynn McKay [00:20:03] Since the publication of your case report, is there any additional testing you wish you could have done or any theories surrounding this case that you're still curious about?

Michael Fagert [00:20:12] I don't think there's any additional testing that I would have done. Fortunately, we were able to be pretty thorough with that residue. Just we're unfortunately limited by the quantity that was present. So that kind of limited our results just there a little bit. I would be interested to know for sure when the impression was deposited and my feeling is that it was before firing, but there is that window in which nobody was present to see if it was handled. So I would like to know for sure when in fact that impression was deposited.

Jaclynn McKay [00:20:44] So this case involved several different departments in your laboratory. We got crime scene trace, latent prints, DNA. How was the experience working with all these different departments and was the process of collaborating pretty seamless?

Michael Fagert [00:21:00] Yeah, I think it was - it went very smoothly. Obviously great job by crime scene, not just identifying and collecting the evidence, but reviewing and being willing to come forward and say, hey, here's something that I missed before I swabbed, putting on to us to be able to work it, and then also the lab director getting other sections involved. There's a very small trace evidence section, so casework can be very extensive for them. It can be short or long based on what's submitted, so the ability for them to work that into their rotation to find out more for something that I would be interested in on a personal level that could potentially benefit the field, I think that was amazing. I think it's

really great when different sections can communicate with each other and work so fully on a case like this.

Jaclynn McKay [00:21:45] Do you have any thoughts that you would like to leave our listeners with?

Michael Fagert [00:21:48] I would just say to always be open minded in looking at how you could improve or modify some of your procedures. There's always weird case examples that come up and modifications aren't always necessary, but being able to look into how you can tweak how you do something to better serve the customer down the line is always a great thing to be able to do.

Jaclynn McKay [00:22:09] Mike, it has been a pleasure discussing your case report today. Thank you for taking the time to chat with me about this interesting phenomenon.

Michael Fagert [00:22:16] Thanks for having me on and giving me the opportunity to talk a little bit more about this case.

Jaclynn McKay [00:22:20] If you enjoyed today's episode, be sure to like and follow Just Science on your platform of choice. For more information on today's topic and resources in the forensics field, visit ForensicCOE.org. I'm Jaclynn McKay and this has been another episode of Just Science.

Voiceover [00:22:38] Next week, Just Science sits down with Stacey Chepren to discuss a case involving trace and digital evidence that solved a pedestrian hit and run. Opinions or points of views expressed in this podcast represent a consensus of the authors and do not necessarily represent the official position or policies of its funding.