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The University of Southern Mississippi

DIFFERENCES IN LATENT FINGERPRINTS OF CAUCASIAN CHILDREN

by

Jessica D. Hill

A Thesis
Submitted to the Honors College of
The University of Southern Mississippi
in Partial Fulfillment
of the Requirements for the Degree of
Bachelor of Science
in the Department of Criminal Justice

May 2013

Approved by

_____

Dean Bertram
Assistant Professor of Forensic Science

_____

Lisa Nored, Chair
Department of Criminal Justice

_____

David R. Davies, Dean
Honors College

Abstract

It is already known that the latent fingerprints of adults and the latent fingerprints of prepubescent children are different from each other in chemical makeup. This study compares the latent fingerprints of prepubescent children to each other—specifically attempting to determine if there are any noticeable differences between the latent prints of Caucasian male and female children using the processing methods of ninhydrin and indane dione. The latent fingerprints included in the study were processed and graded. Two independent t-tests as well as a factorial ANOVA were performed on the acquired data. It was found that there is not a significant difference between the fingerprints of the males and the females with either method. As well, no significant difference was found between the two processing methods. Thus, according to this study, a latent fingerprint of a Caucasian prepubescent child, regardless of gender, should develop equally well with ninhydrin or indane dione.

Keywords: Ninhydrin, Indane dione, Latent fingerprints, Prepubescent

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Chapter 1 – Problem Statement

According to Hill in 1997, it was determined that prepubescent children's fingerprints are different from those of adults. The investigation into these differences started when a young Tennessee girl was abducted and murdered. The young girl had been seen entering the car of the suspect; however, none of the child's fingerprints were found in the vehicle. The investigator contacted Michelle Buchanan of the Chemical and Analytical Sciences division of Oak Ridge. Buchanan was then involved in a study which supports the presence of differences between children's and adults' fingerprints. Children's prints were found to "contain more volatile chemicals," while the fingerprints of adults have "longer lasting compounds" (Hill, 1997).

Multiple other studies have taken and branched off of Buchanan's work (Antoine, Mortazavi, Miller, & Miller, 2010; Schuette, 2005; Stewart & Downing, 1990; Williams, Brown, & Bruker, 2011). One of these studies, completed by Williams et al. (2011), focused on characterizing children's latent fingerprint residues by infrared microspectroscopy and the forensic implications of such. While the aforementioned study was not primarily focused on doing so, Williams et al. found that in prepubescent children, gender and ethnicity "play a role in the amounts of residues that are deposited" (Williams et al., 2011). Following the gender and ethnicity variables that have arisen from the study completed by Williams et al., the purpose of this study is to determine, in Caucasians, if there is a significant difference between the latent prints deposited by male and female prepubescent children.

Chapter 2 – Literature Review

It has been shown that children's fingerprints "disappear" more quickly than fingerprints of adults. Buchanan, Asano, & Bohanon's study (1997) found that "lower levels of higher molecular weight, less volatile materials" were found in children's prints.

Other studies have expanded on Buchanan et al.'s and support differences in the chemical composition of children's versus adults' fingerprints (Antoine et al., 2010; Schuette, 2005; Stewart & Downing, 1990; Williams et al., 2011). In the study by Antoine et al. (2010), there were three components of fingerprint residue—skin, sebum and sweat—visible through light microscopy. Particularly it was found that children's fingerprints contain a large amount of volatile fatty acids that attribute to the disappearance of child prints over time; however, because of certain parts of their sebum composition, children's prints can still be differentiated between those of adults even after a four week time period.

In a later study done by Williams et al. (2011), children's prints were studied with the variables of time and temperature. It was found over the time period studied, which was near but below 100 hours according to the graph provided, that the amount of ester residue declined by 95% from a five year old female. When the acid salt droplets were studied from the same five year old female, it was found that unlike the esters, the salts were much more consistent and stable. It was also determined that the esters degraded more quickly than the salts at higher temperatures (70^{o}C for 72 hours). These results support that different methods of collecting prints that focus on detecting salts could be much more useful on children's prints than current methods.

Though the study completed by Williams et al. (2011) was not intended to focus specifically on the variables of gender and ethnicity, they found that gender and ethnic background did play a role in the amounts of residues that were deposited. They specifically noted that females tended to leave more sebaceous residue than males within the same group.

Those children who are most likely to be prepubescent are those who are under seven years of age for Caucasian girls, those who are under six years of age for African American girls, and those who are under nine years of age for boys of all ethnicities (Kreiter, 2005).

The correlation of ethnicity and type and/or amount of residue has not been studied in the fingerprints of prepubescent children from the literature studied. As well, the correlation of gender and fingerprints has not been studied with the prints of children; however, it has been supported to some extent in the fingerprints of adults (Liappis & Jäkel, 1975, as stated in Croxton, Baron, Butler, Kent, & Sears, 2010; Smith, 2007). According to Jacobi, Gautier, Sterry, and Ladermann (2005) as stated in a study done by Giacomoni et al., what has also been studied in adults is the amount of sebum production of Caucasian males and females. It was found on average that Caucasian men produced more than four times the sebum of Caucasian women per square centimeter of skin (Giacomoni, Mammone, & Teri, 2009). It has also been stated in Croxton et al.'s study (2010) that in a combined group of those listed as either '20 years and younger' or '21 years and over,' individual amino acid levels were higher in the fingerprints of females than in the fingerprints of males. While the prints of the females had higher levels in all individual amino acid tests, only one of the amino acids tested, asparagine, was

significantly different between the genders ($P < 0.05$); (the asparagine amounts were only found to be significant in the 'natural' group of prints rather than also in the 'groomed' prints). Similar to the females having higher amino acid levels, in the same group, it was found that males generally had more of most fatty acids in their fingerprints than females had in their fingerprints; the results were not found to be significant between male and female prints for any fatty acid ($P > 0.05$) (Croxton et al., 2010).

Having noted that adults of different gender deposit different amounts of sebum, it is interesting to note in the previously mentioned study by Antoine et al. (2010) supports that theirs and other studies have found that children produce less sebum than adults (Downing, Stewart, & Strauss, 1986; Ramasastry, Downing, Pochi, & Strauss, 1970; Stewart & Downing, 1985; Stewart, Steele, & Downing, 1989; Yamamoto, Serizawa, Ito, & Sato, 1987; 1990).

Although there is some information available on adults and some information comparing those under 21 years of age with those 21 years of age or older, there is not any solid information that has been found specifically for prepubescent children in relation to gender and ethnicity. It is still important to remember that prepubescent children's fingerprints have been found to be specifically different from the fingerprints of those who have already gone through puberty (Buchanan et al., 2007). Given the lack of studies on prepubescent children's prints dealing in ethnicity and gender, it is reasonable to ask: Is there a significant difference between the latent fingerprints of prepubescent children of different genders and ethnicities?

There have been multiple papers compiled by the United States Department of Justice that are part of the National Incidence Studies of Missing, Abducted, Runaway,

and Throwaway Children, NISMART. One of the papers, *National Estimates of Missing Children: An Overview*, includes an estimate of those children who are missing. Two groups from the NISMART overview include those children who fall into the prepubescent age group. The two groups are the 0-5 year olds, and the 6-11 year olds. The ethnicities of missing children are also listed. The majority listed are White, non-Hispanic children (Office of Juvenile Justice and Delinquency Prevention, 2002).

As supported by Lee and Gaensslen, (2001) when dealing with latent fingerprints, it is generally beneficial to have some kind of processing method by which to better visualize the fingerprint. These methods include powder dusting, small particle reagents, chemical fuming, ninhydrin, physical developers, along with others that are discussed Lee and Gaensslen's work. There are specific development methods that react to the amino acids in a latent fingerprint; two of these methods are ninhydrin and indane dione (Smith & Associates, 2009). As fingerprints have been found to contain multiple amino acids (Croxton et al., 2010), these two methods of development should be valid to develop latent fingerprints.

Chapter 3 – Methodology

Section 3.1 – Overview

The intention of this research is to determine if there are any consistent differences in the fingerprints of six-year-old, Caucasian males and females using the AFIX Tracker® system and the processing methods of ninhydrin and indane dione. I would like to determine if either of these processing methods might help determine the gender of the child who left the print. It is already known that prepubescent children have different chemistry in their fingerprints than people who have reached puberty; however, it is hoped that this study will help determine if there could be a way to help investigators more accurately identify the gender of a child they are dealing with in an abduction or other similar case.

Children will be sought as research participants through a local elementary school. The consent forms will be distributed to the entirety of the first grade. Those included in the study are to be between approximately 30 and 50 Caucasian male and female children. The ethnic factor is to be generally observed by the researcher. The age and gender of each participant will be recorded. Care is to be taken to keep personal information of the individual anonymous aside from the factors of age and gender.

Section 3.2 – Sample Collection

The method of gathering prints would be simple and would not pose any risk to the children. It would involve either myself or a helper collecting a fingerprint or fingerprints onto a piece of paper after the child has rubbed his or her finger across his or her forehead. This process may take between 15 to 30 seconds per student participant. Any time waiting in line will be added to the time necessary for the study. I will be

collecting the prints of not only those within the chosen ethnic and age group who return a properly completed consent form, but also those who do not fit ethnic or age criteria who return a properly completed consent form. I will simply group the prints that are not to be used separately from those that are to be used for the study. I will destroy the prints that will not be used after leaving the premises of the elementary school. With this being the case, I will discuss in the consent form that not all children's prints will be used in the study, and that there are certain criteria that will be used to determine whether I use a child's print or prints. I will not specifically discuss which ethnic group and age that will be used for the study, in the consent form. Neither the collection of the samples, nor any other part of the thesis should cost the participants and/or the school district anything monetarily.

Section 3.3 – Sample Testing

Section 3.3.1 – Overview. The collected prints will be transported from the elementary school collection site by the researcher to the University of Southern Mississippi to be stored until they are processed, scanned/imported, scored, and/or destroyed. All prints that are stored at the University of Southern Mississippi are to be located in a white paper envelope(s) which will be stored in the envelope box(es) in a drawer in the fingerprint lab. Once the fingerprints are collected, they will be processed within two weeks using either ninhydrin or indane dione. Approximately half of the collected prints are to be tested using ninhydrin and the other half are to be tested with indane dione. (Approximately half of the collected prints from each gender will be tested using each method.) Soon after processing, the fingerprints will be scanned/imported and scored using the AFIX Tracker® system. Actual processing of the prints may take

around 30 seconds to a minute per print. Entering and running the prints on the AFIX system will be done individually and should take only long enough to scan the print (ninhydrin) or take a photograph of the print (indane dione), enter it into the system, and use various tools to better view and learn about the image. The computerized prints will then be graded/scored by the researcher as to their usefulness as a potential piece of forensic evidence (Kent, 2010). Once the physical prints have been processed and entered into the AFIX Tracker® system, the prints will be destroyed.

Section 3.3.2 – Processing By Ninhydrin. According to Lee and Gaensslen (2001), the ninhydrin process was patented as a "latent fingerprint technique" by Oden in 1955. There are multiple methods that can be used to apply the ninhydrin solution to the substrate that contains the print. The solution "may be applied by spraying, swabbing, or dipping," (Lee & Gaensslen, 2001).

When developing prints with ninhydrin, the final state of the latent print usually has a purple color, according to Almog (2001). As well, heat and moisture are capable of speeding up the development (Almog, 2001). There is a study by Connor that is mentioned by Almog (2001) that studied "the effects of a steam iron on ninhydrin treated prints on bond and newsprint papers." Connor's study showed development of prints using ninhydrin and a steam iron took only minutes and, as stated by Almog (2001), "that the mode of the ninhydrin application has very little effect on the results," (Connor, 1976). Also stated by Almog (2001), it was established in the 1970s and 1980s by Morris (1978) and Jones et al. (1980, 1981) that "heating after ninhydrin treatment of papers can lead to significant increase in the quality and contrast of the marks revealed," (Jones & Pounds, 1981; Jones, Pounds, & Reed, 1980; Morris, 1978).

In this study, the substrate will be paper, and the method of ninhydrin application will be dipping the substrate containing the print into the ninhydrin solution. A steam iron will also be used in this study to accelerate the development process of the latent fingerprints on the paper. The fingerprints will then be visible to the naked human eye.

The chosen solution composition and concentration for the ninhydrin solution used in this study will be from the book produced by Ron Smith (Smith & Associates, 2009). The ninhydrin stock solution will be made during the semester in which the latent fingerprints are processed. The working solution, the solution in which the latent prints will be dipped, will then be made from the stock solution. Those chemicals included in the stock solution are ninhydrin crystals, ethanol, ethyl acetate, and acetic acid. To make the working solution, 57 mL of stock solution is added to 1 L of HFE7100. (Smith & Associates, 2009)

Section 3.3.3 – Processing By Indane Dione. Indane dione reacts with certain amino acids that are found in fingerprint deposits. As stated by Spindler, Shimmon, Roux, & Lennard (2011), multiple studies have been completed to "determine the suitability of 1,2-indanedione as a luminescent alternative to ninhydrin for fingermark detection on paper substrates," (Almog, Springer, Wiesner, Frank, Khodzhaev, Lidor, Bahar, Varkony, Dayan, & Rozen, 1999; Roux, Jones, Lennard, & Stoilovic, 2000; Wiesner, Springer, Sasson, & Almog, 2001). As stated in the abstract of the Spindler et al. study (2011), it has been shown that "the reaction between 1,2-indanedione and the amino acids present in latent fingermark deposits is highly susceptible to ambient humidity," (Spindler et al., 2011). As well, Spindler et al. states, "The addition of catalytic amounts of zinc chloride to the 1,2-indane dione working

solution…significantly improves the colour and luminescence of fingermarks treated under dry conditions but appears to have a negligible effect on fingermarks treated in humid environments," (Spindler et al., 2011).

Just as for ninhydrin, the chosen substrate is paper. The method of application of the working solution is spraying, and an iron will be used in the development process. The chosen solution composition and concentration for the indane dione solution, which includes zinc chloride, used in this study will be from the book produced by Ron Smith. Ron Smith & Associates state that this solution information was received from the Australian Federal Police (Smith & Associates, 2009). The indane dione and zinc chloride stock solutions that will be used were made during September of 2011. The working solution, the solution with which the latent prints will be sprayed, was made during September of 2011 as well. Those chemicals included in the stock solution of the indane dione are indane dione solid, ethyl acetate, glacial acetic acid, and zinc chloride stock solution. The chemicals that are included in the zinc chloride stock solution are solid zinc chloride and absolute alcohol (Smith & Associates, 2009). The paper containing the prints will be sprayed with the working solution, allowed to dry, then covered. A hot iron will be applied to the covering of the paper for a short period of time (potentially around ten seconds), such that the heat of the iron, but not the iron itself, comes into contact with the fingerprints. The fingerprints will then be visible when placed under an alternate light source and viewed through an orange filter.

Section 3.3.4 – AFIX Tracker® System. The AFIX Tracker® System is an "automated fingerprint and palm print identification system," (AFIX Technologies, Inc.) This system allows fingerprints to be entered through a digital camera and multiple types

of scanners. The system also allows for searches of matching prints, and comparison of those prints. (AFIX Technologies, Inc.) The only capabilities of the AFIX Tracker® System that are to be used during this study will be its ability to store the fingerprints in a local file for fingerprint grading purposes of the study, (The fingerprints will not be entered into any kind of database.), its ability to enhance the images of the fingerprints by altering variables such as color and shadow, and its ability to locate minutiae in the individual prints.

Section 3.3.5 – Grading of the Fingerprints. The grading of the fingerprints will follow a modified version of a method suggested in an article by Thomas Kent (2010). The fingerprints will be graded from their computerized versions using the AFIX software. They will be graded on a five-point scale as follows:

0 = No Sign of Fingerprint
1 = Obviously a Fingerprint, but Ridge Detail is Nonexistent or Almost Nonexistent
2 = Some Detail Over a Small Area of the Fingerprint Showing Ridge Detail
3 = A Major Portion of Fingerprint Showing Ridge Detail
4 = Full Development of Whole Fingerprint Area with Ridge Detail.

Section 3.4 – Analysis

The statistical analyses that have been chosen for this study are two independent t-tests which will compare the two processing methods, and a factorial Analysis of Variance (ANOVA) which will determine if there are any differences between the fingerprints of the males versus the females.

Chapter 4 – Results

An independent t-test was run on the grades that were obtained from the processed latent fingerprints. The test was comparing the mean score of the latent prints that were processed using ninhydrin to the mean score of the latent prints that were processed using indane dione. No significant difference was found ($t(38) = -0.603$, $p > 0.05$). The mean of the latent prints that were processed with ninhydrin ($m = 2.10$, $sd = 0.91$) was not significantly different from the mean of the latent prints that were processed with indane dione ($m = 2.25$, $sd = 0.64$). These results are reflected in the table listed below.

Table 1

Group Statistics

Technique	*N*	Mean	*SD*
Ninhydrin	20	2.10	0.91
Indane Dione	20	2.25	0.64

Another test was also run on the grades that were obtained from the processed latent fingerprints to compare the two independent variables of gender and technique. A 2 (gender) x 2 (processing technique) between-subjects factorial ANOVA was calculated comparing the gender of the contributing individuals and the fingerprint processing technique for the collected latent fingerprints. The main effect for the gender was not significant ($F(1,36) = 0.67$, $p > 0.05$). The main effect for the technique was also not significant ($F(1,36) = 0.15$, $p > 0.05$). The interaction between the gender and the technique was also not significant ($F(1,36) = 0.15$, $p > 0.05$). Thus, it appears with this study, that the gender of the contributors nor the processing technique has any effect on the grade of a fingerprint. These results are reflected in tables 2 and 3.

Table 2

Descriptive Statistics

Gender	Technique	Mean	*SD*	*n*
Male	Ninhydrin	2.33	0.82	6
	Indane Dione	2.33	0.52	6
	Total	2.33	0.65	12
Female	Ninhydrin	2.00	0.96	14
	Indane Dione	2.21	0.70	14
	Total	2.11	0.83	28
Total	Ninhydrin	2.10	0.91	20
	Indane Dione	2.25	0.64	20
	Total	2.18	0.78	40

Table 3

Tests of Between-Subjects Effects

Source	Type III of Sum of Squares	*df*	Mean Square	*F*	*Sig.*
Corrected Model	0.75[a]	3	0.25	0.39	0.76
Intercept	165.63	1	165.63	258.98	0.00
Gender	0.43	1	0.43	0.67	0.42
Technique	0.10	1	0.10	0.15	0.70
Gender*Technique	0.10	1	0.10	0.15	0.70
Error	23.02	36	0.64		
Total	213.00	40			
Corrected Total	23.78	39			

Note: a. R Squared = 0.032 (Adjusted R Squared = -0.049)

Chapter 5 – Conclusion

From this study, it has been seen that there are no significant differences between the fingerprints of Caucasian male and female six-year-old children using ninhydrin and indane dione as development techniques. Unlike the study by Williams et al. (2011) which found that gender and ethnic background played a role in the amounts of residues that were deposited and thus showed differences between gender and ethnicity, this study found no differences between the genders using its methodology. As well, whereas the study completed by Croxton et al. (2010) was able to tell some differences between the fingerprints of the different genders, this study did not show any significant difference between the genders in the latent fingerprints that were studied.

There are certain limitations that were involved in this study that may account for the findings. These include a relatively small number of studied prints, a much smaller number of male prints to female prints—six to fourteen respectively per processing method, and all of the contributors came from the same geographical area. As well, only one print was taken for the study from each individual. Because of this, the two processing methods were tested with completely different fingerprints whereas it may have been beneficial to take two prints from each individual to have a more accurate comparison of the development methods. It would also be potentially beneficial for this study to be run on a much larger group that is made up of children from a more widely spread area.

Future research in this area of forensics could lead to more information regarding the way in which child fingerprints are understood. As this research is a very small piece in the research puzzle of children's fingerprints, there are multiple different directions in

which future research is possible. Some of the possibilities include the study of the differences in latent prints within other ethnic groups, the study of differences in latent prints among multiple ethnic groups, the study of the differences in latent prints within other ethnic groups using different types of fingerprint development procedures, the study of differences in latent prints among multiple ethnic groups using different types of fingerprint development procedures, and studies involving different substrates. This is by no means an exhaustive list of potential future research as the fingerprints of children are a relatively new area of research. The more that is discovered about children's fingerprints, the more questions that may arise involving deeper information about the use of their fingerprints and what role they play in the large picture of safety and law enforcement. This could lead to even more studies on topics that no one even knows of yet.

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Appendices

Appendix I – Approval Letter from Lamar County School District

LAMAR COUNTY
SCHOOL DISTRICT
P.O. Box 609
Purvis, MS 39475

BOARD MEMBERS
Dr. Kyle Hill
Mr. Steve Lampton
Mr. Buddy Morris
Mr. Mike Pruitt
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BOARD ATTORNEY
Richard D. Norton
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June 27, 2012

Jessica D. Hill
23 Hill Rd
Hattiesburg, MS 39402

Ms. Hill:

This letter is to officially acknowledge permission for you to complete your thesis study with 1st grade students at Sumrall Elementary School. I understand that you will be collecting fingerprints for your study during school hours from those children who return a completed consent form. I also understand that you will incorporate the voluntary "Roll with Gold" program that will teach the students about fingerprints and their usefulness for parents and law enforcement. As well, I understand that the "Roll with Gold" program supplies each child's parent/guardian with his or her child's fingerprints, and no fingerprints other than those collected for the study will be kept by anyone for further use. All collected student prints other than those collected for the study will be returned to the homeroom teacher for redistribution to the children so the children may take them home to their parent(s)/guardian(s).

Sincerely,

Ben Burnett
Superintendent of Education

ADMINISTRATION BUILDING • 424 MARTIN LUTHER KING DR. • PURVIS, MS 39475

Appendix II – Letter to Parents

The University of Southern Mississippi
Authorization to Participate in a Field Study Project

Dear Parents:

Hello, my name is Jessica Hill. I am the daughter of second grade teacher, Dr. Darlene Hill. I am an Honors College student at The University of Southern Mississippi. The Honors curriculum at Southern Miss allows me the opportunity to complete a thesis as an undergraduate student. My topic deals with differences in the fingerprints of children. The Lamar County School District has been kind enough to allow me to work with the first grade at Sumrall Elementary to gather the data that I will need to complete my study. Not only are they allowing me to gather data in the form of student fingerprints, but they are also giving the first grade students an opportunity to learn about fingerprints from Southern Miss students studying criminal justice and/or forensic science through the "Roll with Gold" program. Parents may also benefit from this program. Each student will have his or her prints rolled on a fingerprint card that will be sent home for the parents. This allows the parents to have a copy of their child's prints if ever they are needed. (Note: No prints from the "Roll with Gold" program are stored in any way by The University of Southern Mississippi. All prints are taken for the benefit and use of the students and parents. The prints are to be given directly to the homeroom teacher to go home with the students.)

With this letter, you will find a consent form explaining many details of my study. My study is completely separate and apart from the "Roll with Gold" program; however, the collection of fingerprints for my study will happen during the same general time period as the "Roll with Gold" program. Since I wanted to come in and gather data for a study on fingerprints, I thought it only fitting to take the opportunity to teach the children as well using the "Roll with Gold" program. For my study, I will be gathering children's fingerprints that will be anonymously tested two different ways. Through this study I hope to determine if either of the processing methods for fingerprints can help determine the gender of a child by only their fingerprint. If either method is able to do so, it might be of help to law enforcement in child abduction cases. By signing the consent form, you will be giving me permission to collect your child's fingerprints and potentially use them in my study. Some prints that are collected may not be able to be used in the study. The child must also sign giving assent. The consent form discusses the destroying of student prints before for those prints that cannot be used, and after the study for those prints that are used. The fingerprints gathered from the students will be anonymous except to know that the child has permission to provide prints.

I ask that you please read the attached form and give permission allowing the collection and use of your child's fingerprints. Permission to perform this study has been given by the Lamar County School District and The University of Southern Mississippi's Human Subjects Protection Review Committee. Thank you in advance for your support.

Sincerely,

Jessica D. Hill

Appendix III – Consent Form

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

AUTHORIZATION TO PARTICIPATE IN RESEARCH PROJECT

Consent is hereby given to participate in a study involving:

Differences in the Fingerprints of Children.

Purpose: The goals for this study are to determine if there are any consistent differences in the fingerprints of male and female children of a specific age and a specific race/ethnic group. The results of this study could be useful for law enforcement when working cases involving missing or abducted children of unknown gender. Using a program that can scan in prints and give them a score (AFIX Tracker System), and the processing methods of ninhydrin and indane dione, I want to find if there are any notable differences between the prints of the two different genders. Parents are being asked to consent to the collection and temporary use of their children's fingerprints for the purpose of this study after which the prints will be destroyed and no longer kept on file for any reason. This study seeks to compare the anonymous prints of children which have been separated by gender of the student and processed two different ways.

Description of Study: Fingerprints of students in the 1st grade at Sumrall Elementary with the proper consent and assent will be collected and sorted into three anonymous groups: (1) Prints of males that fit the study criteria, (2) Prints of females that fit the study criteria, and (3) Prints of those who do not fit the study criteria. Prints in the third group, (3), will be destroyed soon after collection once the researcher has left the collection facility while the prints in the other two groups will be stored for study use.

The method of gathering prints will be simple. It will involve either the researcher or a helper collecting fingerprints from each child by guiding the child in rolling his or her print onto a piece of paper after rubbing his or her finger across his or her forehead. The only information that will be gathered from the child is his or her age (from the consent form), his or her race/ethnicity (observed), and his or her gender (observed). Names will not be associated with the prints except to know who has proper consent/assent for contributing prints. The process of depositing fingerprints for each participant may take between 15 to 30 seconds. Any time spent waiting in line would be added to this time. There will be nothing required of the students and parents other than the gathering of the students' prints as described above and the signing of the consent/assent form. As well, the collection of fingerprints for the study, and the study itself, will be of absolutely no monetary cost to the school district, parents, or students.

The collected prints will be processed, scanned, and scored at The University of Southern Mississippi. Once fingerprints are collected, they will be processed within two weeks using either ninhydrin or indane dione, common methods used to develop fingerprints so they can be seen by both the human eye and different lab machinery. Soon after processing (within approximately an hour), they will be scanned and scored using the AFIX tracker system. Once the prints have been processed and run on the AFIX tracker, the prints will be destroyed and no longer kept on file by anyone for any reason.

Participant's Initials _____ page 1 of 3

The maximum number of participants I would like to use in my study is 150 which would include those whose prints meet the criteria for the study. Those whose prints are collected that do not meet study criteria are not included in this number. The planned recruitment procedure for the children includes going through a local public school, namely Sumrall Elementary School in the Lamar County School District. This program is being extended to the entirety of the 1st grade at Sumrall Elementary School. While the collection procedures will be done at the site of Lamar County School District's Sumrall Elementary School, the processing of the prints will be done on the premises of The University of Southern Mississippi, as will the scanning and scoring of the prints.

Benefits: The benefit of this study is two-fold. First, law enforcement may benefit from the knowledge attained, especially if differences are found between the prints of the two genders. Second, this study may help get information out to children about fingerprints and how they are beneficial for identification. The more children understand about how fingerprinting and law enforcement work, the safer they may be in their everyday lives.

To facilitate a comfortable environment in which to collect the fingerprints, the educational and beneficial "Roll with Gold" program will be going on at the same time as the fingerprint collection for the study. This program allows students from The University of Southern Mississippi to teach children about fingerprints and how they can be helpful if a child ever gets taken from his or her parents. The children's prints are rolled by college students after having their fingers pressed onto ink pads. The prints are given to the homeroom teacher of the child, and then they are sent home with the students such that their parents or guardians can have a record of the child's prints if a situation arises in which the child's prints are needed. (The prints collected during this program are given to the children for them to take home to a parent or guardian and are neither kept nor stored in any way by the University of Southern Mississippi.) This program will be extended to the entirety of the 1st grade at Sumrall Elementary School. The aforementioned school and district are in agreement on both the use of 1st grade children's fingerprints for the study (pending parental consent and student assent) and the use of the "Roll with Gold" program. (Those students who are having their prints collected for potential use in the study must have the potential study prints collected before participation in the fingerprinting part of the "Roll with Gold" program as the latter uses ink for the fingerprinting.)

Risks: There is minimal risk in providing permission for children to contribute fingerprints for potential use in the study. As the fingerprints will be destroyed either before or after the study depending on met criteria, and prints are in anonymous groups (with the exception being when the child contributes the print as to know if the child has proper consent/assent and fits study criteria), there is negligible risk in the prints being used to identify any child. The risk of not allowing a child to have his or her prints collected may be to impede beneficial research and/or impede learning experiences of a child.

Confidentiality: Child fingerprints will be destroyed by the researcher either before or after the study depending on whether the fingerprints fit the study criteria. The consent/assent forms will

be kept for three years after completion of the study under lock and key at the researcher's permanent residence. Those with a key will be the researcher and a current teacher from the school at which the prints were gathered. All faculty and staff at the school are under a confidentiality policy and will be the only others that may see the consent forms (i.e. when they collect the forms from the students) other than the researcher. After the three year storage period, the forms will be destroyed. For the results of the study, the students names will in no way be mentioned, and none of the prints will be made available for public viewing.

Alternative Procedures: There are no alternative procedures for the participation in the study.

Participant's Assurance: Whereas no assurance can be made concerning results that may be obtained (since results from investigational studies cannot be predicted) the researcher will take every precaution consistent with the best scientific practice. Participation in this project is completely voluntary, and participants may withdraw from this study at any time without penalty, prejudice, or loss of benefits. Questions concerning the research should be directed to Jessica D. Hill at 601-325-8700. This project and this consent form have been reviewed by the Human Subjects Protection Review Committee, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research participant should be directed to the Chair of the Institutional Review Board, The University of Southern Mississippi, 118 College Drive #5147, Hattiesburg, MS 39406-0001, (601) 266-6820. A copy of this form will be given to the participant.

Signatures: In conformance with the federal guidelines, the signature of the participant or parent or guardian must appear on all written consent documents. The University also requires that the date and the signature of the person explaining the study to the subject appear on the consent form. In instances where the participant is a minor (under the age of eighteen years), a signature line for the minor's assent and a signature line for the parents/guardians' consent is required:

_____ _____

Signature of the Minor Research Participant Date

_____ _____

Signature of Parent/Guardian Date

_____ _____

Signature of the Person Explaining the Study Date

Other Necessary Information:

_____

Birthdate of the minor participant (mm/dd/yyyy)

For Researcher Use Only:

A: ___ yes ___ no

E: ___ yes ___ no

Participant's Initials _____

Glossary

AFIX – AFIX Tracker® system; a finger and palm print identification software program (See www.afix.net for more information on the AFIX Tracker® system.) (AFIX Technology, Inc.)

Indane dione – A chemical processing method for latent fingerprints that, once developed, requires an alternative light source and color shield to be seen

Latent fingerprint – A developed or undeveloped print left by an individual's finger on a substrate of some kind; May also be referred to as a fingerprint

Ninhydrin – A chemical processing method for latent fingerprints that, once developed may be seen with the naked eye

Prepubescent – An individual who has not yet reached puberty. The onset for females includes breast development while onset for males includes enlargement of the testes (Kreiter, 2005).