A STUDY ON FORMATION OF HAMMER TRANSFER STAINS IN A CRIME SCENE

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ABSTRACT

It is difficult to interpret hammer transfer strain in a crime scene. This paper lies in the argument that proper analysis of hammer transfer stains in crime scene may indicate the possibilities of proper incidence.

Indexing terms/Keywords

Murder weapon; bloodstain pattern analysis(BPA); hammer; head hit; and free fall.

Academic Discipline And Sub-Disciplines

Criminology, Forensic Science, Crime Science, Physics

SUBJECT CLASSIFICATION

Applied Physics, Social Science

TYPE (METHOD/APPROACH)

Hammer Head Hit Simulation at a crime scene(Simulation of blunt force trauma), Experimental Study of Hammer Transfer Stains

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INTRODUCTION

It is true that the criminal leaves something at the crime scene andit is expected that he takes something away from the scene with him[1]. On a very loose connect it might be said that when killing an individual with a hammer hit the criminal might take away the murder weapon with him but at the same time he might end up leaving behind bloody stains of the blood bearing hammer at the crime scene . 'A bloodstain resulting from contact between a blood-bearing surface and another surface' has been termed as 'Transfer Stain' by the International Association of Bloodstain Pattern Analysts (IABPA)[2]. Thus this work is particularly directed at studying hammer transfer stain patterns at a crime scene. When analyzed in relation to suspect, eyewitness testimony or other relevant circumstantial evidence, weapon transfer stains could actually give criminal juridical proceedings a new dimension[3], a new perspective.The paper aims at studying hammer transfer stains in particular because of the easy availability and usability of hammer round the world. This very reason probably makes hammer a murder tool of choice among criminals over the world like Adam Moss(Sioux City, Iowa, USA)[4], Alexander YuryevichPichushkin(Moscow, Russia)[5], Brian Blackwell (Merseyside, England, UK)[6], Christine Schürrer(Arboga, Västmanland County, Sweden)[7], KampatimarShankariya(Jaipur, India)[8], Ma Jiajue(China)[9], Maoupa Cedric Maake(Johannesburgo area, South Africa)[10]. It might be interesting for the reader to know that as per the FBI chart figures the number of individuals killed by hammer or club hit by far outnumbered the number of individuals killed by rifle or shot gun[11].

REVIEW WORKS

In BPA, the contributions of Professor MacDonell to the research and interpretation of bloodstain patterns at a crime scene since 1971 stand integral[12]. T. Bevel and M. Gardener in their book on 'Blood Stain Pattern Analysis 3rd edition- An Introduction to Crime Scene Reconstruction' is taxonomy based classification of bloodstain patterns[13]. As per Dr. R. R. Ristenbatt III, a new terminology as also bloodstain pattern classification system was totally unnecessary[14]. This study is particularly based on the work undertaken by Barksdale, Sims and Vo[19]. They developed a reference array of knife impressions and compared them with the knife transfer stains obtained from two real life crime scenes[19].The document put together by the University of Western Australia on Blood Spatter[20] and Dr. J.J. Nordby's 'Basic Bloodstain Pattern analysis Text'[21] give a precise yet lucid description of the different forces that control the formation of the different bloodstain patterns in a crime scene. A lucid scientific explanation on the free fall of elongated and elongated top heavy objects based on the principles of physics was provided by Rod Cross[22]. Hammer physics in Mollett reports highlight the physics that underlie hammer hit incidents in a crime scene[23].

PROPOSED METHOD

The authors used porcine blood for the experiments because porcine blood is quite similar to human blood[24]. A hollow coconut with a hair wig (refer Figure 1) was used to simulate the head hit event in a crime scene. The authors particularly attempted to reconstruct the event of back head hit in a crime scene. The hair wig was soaked in 20cc. of pig blood in order to create the bloody hammer transfer stains one might expect to see after head hit.

Figure 1: Experimental Setup replicating the event of a head hit. As the authors were not inclined towards recording the stains (particularly cast off patterns) formed on the walls and ceilings for a particular height of the victim, perpetrator, number of hits made by the perpetrator, hence this setup was constructed. The height of the victim/perpetrator was not taken into account in the study as the authors did not want to record the cast off, fingerprint transfer stain patterns that might be formed as a result of head hit.

CONCLUSION

When the hammer is dropped face down into a 30 cc. blood pool, a greater surface area of the hammer comes in contact with blood molecules. So as compared to a hammer that has been used for approximately 10 head hits one can logically expect more blood molecules to be stuck to a piece of hammer that has been used for 10 simultaneous head hits followed by being dropped into a 30cc. blood pool and then picked up. Now again when these two bloody hammers having similar dimensions were allowed to drop from the same height, the blood spatter marks for the bloody hammer that had been initially used to hit the head 10 times were found to be much less pronounced as compared to the stains produced by bloody blood pool soaked hammer when it was dropped bloody face down. As the quantity of blood stuck to the blood pool soaked hammer as compared to the head hit bloody hammer was more, hence the blood in the first case forms a more significant spatter. Again, blood spatters only when other forces exceed the surface tension that holds the blood molecules together. The gravitational force with which the bloody hammer hits the surface exceeds the surface tension. Given the comparatively larger quantity of blood attached to the bloody face of the blood pool soaked hammer, blood was found to spatter more in its case. Thereby it can be concluded that the quantity of blood or blood molecules attached to the hammer , the surface area of hammer exposed to blood, the angle of inclination at which the hammer falls as also the edge , face or other part of the hammer that first strikes the surface influence the formation of the transfer stain.

ACKNOWLEDGMENTS

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Author' biography with Photo

Prof.(Dr.) Samir Kumar Bandopadhyay

Dr. Samir Kumar Bandopadhyay has been conducting research for the last 22 years in Image processing, particularly in the field of Biomedical Engineering, Biomedical Imaging and Forensic Science. He has worked on a wide array of projects such as Pattern recognition/identification in Disease Diagnosis, Graph Algorithms, Application of Neural Networks in Graph Algorithms, Mobile Computing, Hand-written signature verification, Graphical Password Verification, Steganography and Water-marking.

He has published over a hundred and three(103) Research papers in reputed International Journals including IEEE Transactions, Springer, Elsevier, ACM etc. in Computer Science and Engineering.He also has fourty four(44) and ten(10) Research papers papers published in International and National conferences respectively, organized by IEEE Society, Springer and other reputed Universities and Institutes etc., to his credit.

Till date sixteen scholars(16) who have worked with him have received PhD degrees. At present , twelve scholars(12) are completing their PhD dissertation under his able guidance. He has examined several PhD theses in India and abroad. He holds 25 years of teaching experience at both the Undergraduate and Post-Graduate level at the University of Calcutta. At present he teaches, (a) Software Engineering,(b) Object Oriented System, (c) Research Methodology etc.

Ms. Nabanita Basu

Nabanita Basu completed her B-Tech in Computer Science and Engineering from West Bengal University of Technology in 2010. She also completed her Bachelor of Arts in Journalism and Mass Communication in the same year itself. During her short work tenure of 6 months at Capgemini India Private Limited, she got herself certified as a Java Developer (Sun Certified Java Programmer). It was during this period that she also completed certification in Pegasystems(Certified System Architect Pega PRPC v6.1). In October, 2012, she completed Master of Advanced Computer Science program at the University of Manchester, UK. Thereafter she completed her Master of Research in Security and Crime Science from University College London, UK. In the course of the program she also got herself certified as a Bloodstain Pattern Analyst(Basic Course) by the International Association of Bloodstain Pattern Analysts, USA(IABPA).