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Practical relevance of pattern uniqueness in forensic science

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ABSTRACT

Uniqueness being unprovable, it has recently been argued that individualization in forensic science is irrelevant and, probability, as applied for DNA profiles, should be applied for all identifications. Critiques against uniqueness have omitted physical matching, a realistic and tangible individualization that supports uniqueness. Describing case examples illustrating pattern matches including physical matching, it is indicated that individualizations are practically relevant for forensic science as they establish facts on a definitive basis providing firm leads benefitting criminal investigation. As a tenet of forensic identification, uniqueness forms a fundamental paradigm relevant for individualization. Evidence on the indeterministic and stochastic causal pathways of characteristics in patterns available in the related fields of science sufficiently supports the proposition of uniqueness. Characteristics involved in physical matching and matching achieved in patterned evidence existing in the state of nature are not events amenable for counting; instead these are ensemble of visible units occupying the entire pattern area stretching the probability of re-occurrence of a verisimilitude pattern into infinity offering epistemic support to uniqueness. Observational methods are as respectable as instrumental or statistical methods since they are capable of generating results that are tangible and obviously valid as in physical matching. Applying the probabilistic interpretation used for DNA profiles to the other patterns would be unbefitting since these two are disparate, the causal pathways of the events, the loci, in the manipulated DNA profiles being determinable. While uniqueness enables individualizations, it does not vouch for eliminating errors. Instead of dismissing uniqueness and individualization, accepting errors as human or system failures and seeking remedial measures would benefit forensic science practice and criminal investigation.

1. Introduction

Criticisms against individualization in forensic science appear three pronged: uniqueness is unprovable [1–10], every identification requires probabilistic quantification and hence none can qualify to be conclusive [1,4–6,9–11] and individualization in forensic science is irrelevant as it amounts to fact finding, the prerogative of the jury and the judge [5,7,9,10]. It has been insisted that DNA type probabilistic model be adapted for interpreting the match in the other patterns as well [1,5–7,9,10]. Lack of proof 'to the exclusion of all others in the world' [1,4,7–10] and the possibility that a verisimilitude pattern may accrue via a different set of causal pathways [7,10] are the grounds cited for denouncing uniqueness and individualization.

The response from the forensic science practitioners is seen to vary – some supporting the critics on all grounds [12,13], some agreeing with the critics in recommending probabilistic interpretation similar to that of DNA for the other patterns [12–15], some defending uniqueness based morphological analysis and arguing that qualitative analysis cannot be interpreted following the DNA model [16,17], and the others defending specific observational methods such as in firearm analysis [17,18], glass comparison [19], handwriting examination [20], hair comparison [21], fingerprint identification [22] and footwear analysis [23].

The critics as well as the defenders are seen to have omitted physical matching, a realistic evidence that supports the proposition of uniqueness and individualization.

This article describes case examples illustrating physical matching and other pattern matches to support the practical relevance of individualization based on the premises of uniqueness. Arguably, proving uniqueness or individuality by exhausting examination of every other related object in the world would never be possible. Such an argument devoid of scientific basis is shown as insufficient to support a call for abandoning individualization which has remained a fundamental tenet of forensic science practice for over 100 years and has proved robust benefitting criminal investigations. Uniqueness, as a paradigm for forensic science practice, is proposed based on the indeterminacy in the

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causal pathways of patterns as evidenced in the fields of sciences to which these patterns originally belong. The events considered during morphological comparison of patterns existing in the state of nature, both biological and inanimate, are argued as uncountable warranting the philosophy of interpretation to fundamentally differ from the probabilistic type applicable for DNA profiles.

2. Practical relevance of uniqueness in physical evidence analysis: case examples

The cases chosen for description here share two commonalities: the patterns illustrated are manifestations of causal pathways that are multiple and indeterministic, and in every case, the individualizable evidence can be compared with the other evidence types having lesser probative value to bring out the practical relevance of individualizations. The physical evidence in these cases were examined by the author in Tamil Nadu state in India, either as field investigator investigating crime scenes (Cases 1 and 2) or as expert anthropologist identifying skulls in the forensic science laboratory (Cases 3 and 4).

2.1. Case 1

A hither to unknown group sabotaged a river bridge by exploding improvised explosive devices (IEDs) one of which failed to detonate. Bicycle tire impressions in the soil of the riverbed were photographed and preserved as plaster cast. The IED container (Fig. 1a) was a tin sheet folded to hold gelatin and two ordinary detonators. The edges of the tin sheet container were irregular and hence characteristic. The surface characteristics of the tin sheet revealed its source from a 15 kg oil tin, indicating that the remaining cut pieces of tin sheets would possibly be found in the premises of manufacture of the IED. About a week after the explosion, examination of the premises of a suspect revealed, in addition to other items, cut pieces of tin sheet (Fig. 1b) that, when reconstructed, showed a missing area (Fig. 1c) that corresponded to the size of the tin sheet container of the IED. Comparison of the cut edges in the pieces of tin sheets recovered from the suspect's premises with the cut edges in the tin sheet recovered from the defused IED indicated physical matching (Fig. 1d) offering proof of association that provided the breakthrough in the investigation. A bicycle found in the suspect's house revealed tire pattern that matched the tire pattern in the scene of explosion enabling class level identification [Case: Thiruvaiyaru Police Station Crime Number 53/1986 (29.1.1986), Sections 3 of Indian Explosive Substances Act and 427 of Indian Penal Code].

2.2. Case 2

A utility van intended for hire was reported missing. About 9 months later, it came to light that the van, stolen after murdering the driver and the cleaner, was altered to match the registration details of another van in disrepair. The metal plate bearing the punched chassis registration details found fitted in the stolen van revealed particulars that pertained to the van in disrepair. The chassis registration plate in the van in disrepair was missing and the painted metal surface in that location revealed a trickled track of paint (Fig. 2a). The chassis registration plate found in the recovered van was removed and on its reverse was found the contour impression of the trickled track of paint (Fig. 2b) that corresponded to the pattern of the track of paint (Fig. 2c) in the van in disrepair. The match in the pattern indicated two-way transfer,

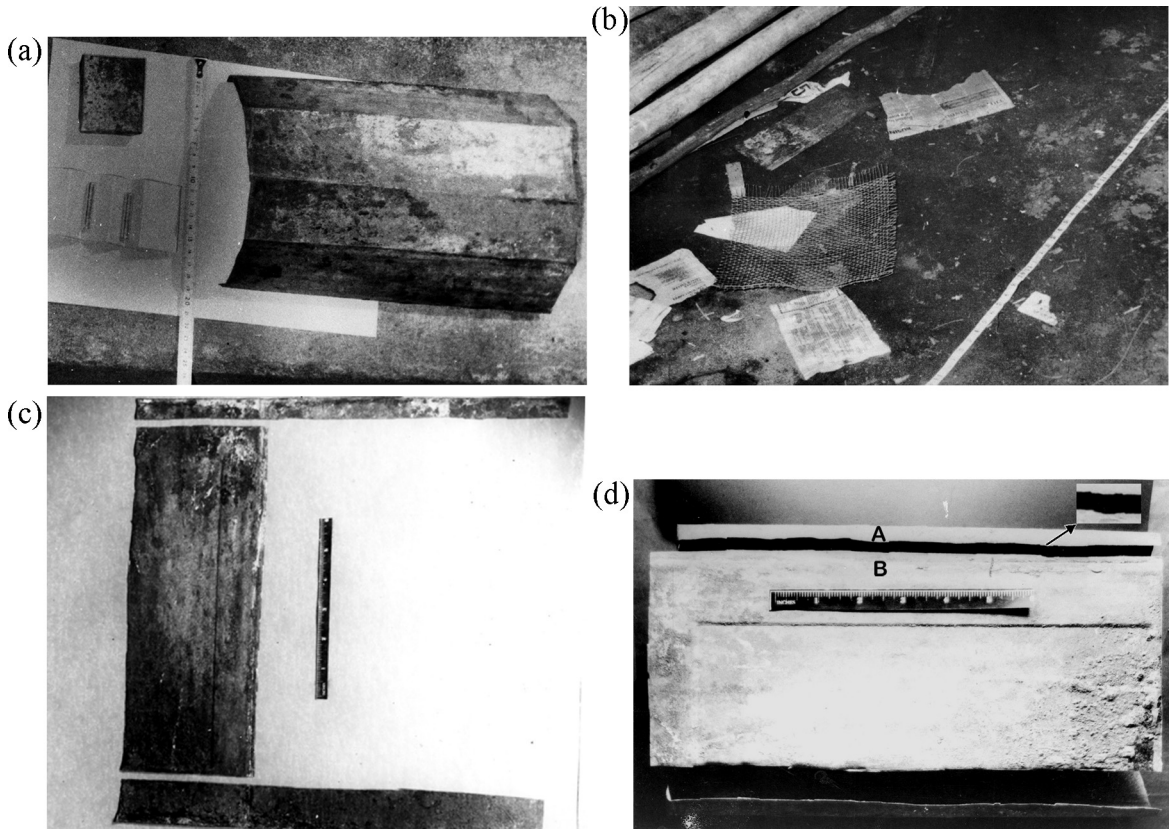

Fig. 1. (a) The tin sheet folded to form the container of the IED along with the lid and detonators. (b) Cut pieces of tin sheets in the suspect's premises. (c) Reconstruction of the pieces of tin sheets from the suspect's premises revealing a missing area corresponding to the size of the tin sheet recovered from the IED. (d) Physical matching between the cut edge of the tin sheet that formed IED container (A) and the cut edge in one of the tin sheet pieces (B) recovered from the premises of the suspect. Inset shows details in enlargement.