A26 Assessing the Degree of Similarity Between Accidental Patterns on Shoeprints Associated With Wearers That Participate in Shared and Independent Activities

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After attending this presentation, attendees will understand the degree of similarity between accidental characteristics based on the context in which footwear is used, how accidental characteristics change with wear over time, and how imaging science and semi-automated numerical methods can assist with comparisons.

This presentation will impact the forensic science community in three ways. First, it will comment on how rapidly, and to what extent, wear-derived random accidental characteristics develop on the outsoles of individuals that participate in shared versus independent activities. Second, it will assess the divergence of an accidental pattern with continued wear, taking into account the fact that new accidental characteristics may randomly develop, while existing accidental characteristics may randomly erode. Third, this research illustrates the utility and reliability of using imaging science and semi-automated numerical methods to quantify the similarity in accidental patterns that vary with continued use and wearer-context.

The goal of this research is to address the similarity and rate at which wear-derived random accidental characteristics develop on the outsoles of individuals that participate in shared versus independent activities. To carry out this research, two groups of volunteers were solicited and provided with new, approved footwear. The first group was asked to wear the footwear while repeatedly participating in shared group activities over a three-month period of time; the second group was permitted to wear the approved footwear while carrying out daily independent activities. At predetermined step-intervals, participants submitted their footwear for analysis which consisted of data: (a.) acquisition; (b.) registration; (c.) segmentation; (d.) processing; and finally, (e.) comparison.

The actual data in this experiment consisted of 600 pixel-per-inch (PPI) scans of footwear outsoles and impressions acquired using an established Magna brush method. Once acquired, the digital scans were registered to a common two-dimensional coordinate system, removing translational and rotational variations from the footwear impressions that cannot be avoided during the data acquisition step. Once registered, the digital images were examined for the presence of individualizing characteristics that represent the accidental pattern associated with the footwear. Once identified, these individualizing characteristics were segmented from the background invariant class characteristics that are shared by all footwear in this study. Next, each image was divided into small pixel blocks to generate a one-dimensional feature vector. Using the position and area associated with each identified accidental characteristic in the segmentation image, a feature vector representative of each shoe was automatically populated. The resulting accidental pattern was then compared to itself, thereby generating a known-match distribution. Each accidental pattern was also compared to all other impressions generating a known non-match distribution. The known-match and known non-match distributions generated by wearers that participated in shared versus independent activities were compared to determine how wearer-context impacts the degree of similarity in accidental patterns. The within and between group known-match and known non-match distributions associated with a given step-interval were also compared with each other and over time to investigate the rate at which the similarity in accidental patterns diverge with continued wear, including an assessment of the rate at which accidental characteristics randomly develop and erode.

Footwear, Correlation, Semi-Automated

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