A POSSIBILITY TO IDENTIFY THE VEHICLE DRIVER THROUGH COMPLEX FORENSIC AND CRIMINALISTIC EXPERTISE – CASE REPORT

G. Păduraru¹, A. Knieling²*, C. Scripcaru³, Diana Bulgaru Iliescu²
¹ National Institute of Criminology - Iasi County Laboratory
University of Medicine and Pharmacy “Grigore T. Popa” - Iasi
Faculty of Medicine
² Department of Preventive Medicine - Interdisciplinarity
³ Institute of Legal Medicine Iasi
*Corresponding author. E-mail: tony_knieling@yahoo.com

A POSSIBILITY TO IDENTIFY THE VEHICLE DRIVER THROUGH COMPLEX FORENSIC AND CRIMINALISTIC EXPERTISE – CASE REPORT (Abstract): Traffic accidents can have more or less dramatic consequences that involve penal and civil responsibility with amplitude extending over long periods of time. In many cases, substitution of the driver with the passenger in order to avoid criminal responsibility is often remarked. The substitution takes place with the passenger’s agreement or, in cases with dramatic consequences (coma or death), without his/her consent. These situations are encountered in civil cases regarding insurance fraud. In addition to forensic medical expertise, to aid the experts, mathematical modeling and computer simulation of the dynamics of vehicle passengers is a tool that completes the criminal expertise of traffic accidents. This paper presents the method of identification of the person driving the vehicle based on the computer simulation of vehicle occupants’ dynamics. Keywords: EXPERTISE, TRAFFIC ACCIDENTS, COMPUTER SIMULATIONS

Identification of the vehicle driver is usually accomplished by correlating the injury panel with the vehicle marks (1). These marks can be shape marks, trace substances, biological traces, imprints, etc.

In some cases, individuals assume the fault for an accident without considering long-term consequences. After the case shapes towards a solution, they realize they must face long-term consequences and restate their initial positions. Since a significant amount of time lapses between the date of the traffic accident and the date of the new investigation, during which the vehicle was repaired, totaled or changed ownership, and also due to the fact that the victims were buried or the wounds healed without marks, an answer is difficult to obtain based solely on forensic medical certificates. There could be cases where one of the occupants of the vehicle was projected from the vehicle, and if deceased, the driver may substitute to the passenger in order to be exonerated. In these circumstances, computer simulation of the traffic accident may offer additional information to strengthen the outcome of forensic expertise, and it may even provide answers in cases where forensic expertise is incon-
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exclusive.

Computer simulations of traffic accidents

Computer simulation of traffic accidents involves correct input of dynamic and physical parameters into a mathematical model. Some parameters are already known while others are found through iterative trials. Mathematical modeling involves a large number of calculations, impossible to accomplish without a computer. If correctly chosen, input parameters, correlated with the shape of the vehicle and the road geometry must yield results coinciding with the real life situation via mathematical modeling. For example, tire marks, final vehicle positions and their trajectories must coincide with those documented by on site investigation.

Here we present a modeling approach using V. Crash 2.2 software. For mathematical modeling of occupant’s dynamics as well as in the case of simulations of pedestrian accidents, the V. Crash software takes into consideration higher rigidity coefficients of the vehicle parts as compared to those of the human body and therefore considers as negligible the vehicle deformations.

The model used is composed of a group of ellipsoid bodies which make up the humanoid somatic structure.

Nagoya University researchers (2) developed a mannequin build up of ellipsoid parts (fig. 1) and a mathematical model based on statistics of Japanese population. Based on these data, a model was developed based on the 50est percentile of an adult man (Polar II (3)) whose height was determined at 175 cm and body weight of 75 kg. The sitting height of Polar II mannequin is 88.4 cm. The mannequin used by V. Crash simulations has 16 joints which interconnect 15 hyper-ellipsoids, corresponding to human body parts and their associated degrees of freedom.

![Fig. 1. Japanese model of test mannequin](image)

CASE STUDY

A group of young individuals were inside a vehicle (make Renault, model Megane) moving on an asphalt county road with shoulders and ditches. The motorway was covered with snow and spots of ice. Suddenly the driver lost control of the vehicle and entered the ditch on the right side of the road where it rolled over on the right side and hit the end of a concrete bridge. Following the accident all four occupants suffered injuries (fig. 2, 3).

Several people proceeded to the site and helped pulling the occupants out of the vehicle. Eye witness declarations coincided only in part with the occupants statements. The identity of the occupants on the back seat and their respective positions were confirmed unequivocally, however, regarding the driver and the front passenger, the declarations of the witnesses were contrary to the statements of the vehicle occupants. A forensic medical expertise was ordered in this matter but the investigation did not establish which of the occupants were,
respectively, the driver and the passenger. Therefore, judicial organs ordered a crimi-
nalistic expertise whose sole objective was to establish the identity of the driver.

Fig. 2. The vehicle seen from behind

Fig.3. Overview of accident dynamic

The injury profile of the back seat pas-
senger on the right side showed remarkable similarities with that of one of the front seat occupants. Both had lesions of the right fist and right forearm as excoriations and cut wounds. The passenger in the right back seat had a foreign body at the level of the right distal epiphysis (glass fragment) while the front passenger had a fracture of the distal epiphysis (fig. 4).

The front seat occupant suffered an elongation of the right brachial plexus with right acromial – clavicle disjunction (fig. 5), paresthesia of the right arm and shoulder, jaw wound, multiple excoriated and cut wounds at the level of the face, which required 30 – 35 days of medical care.

Fig. 4. Right distal epiphysis fracture (marked with red line – according to attached Rx)
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The elongation of the brachial plexus is engendered by anterior-posterior hyperextension of the arm that is through front-to-back movement of the arm over the normal limit. This kind of trauma produces the swelling of the shoulder joint with injury of the vascular and nervous bundles with shoulder paresthesia of the shoulder.

![Fig. 5. Diagram of the brachial plexus and its innervation (positions 22-24).](image)

The Rx administered as evidence in the case, obviating the elongation of the brachial plexus and acromial-clavicular disjunction

The injuries suffered by the other occupant were minor and consisted of cut wounds at occipital and upper lip levels. Spots of reddish-brown liquid were found on the vehicles which were later identified as human blood (fig. 6, 7). The blood in the back belonged to the O group while the one in front to group A.

The occupant of the back seat was the brother of one of the front seat occupants and it was assumed that both brothers may have the same blood group. For unknown reasons, until the date of ordering the expertise, the blood group of the brother of the individual occupying the right back seat was not administered as evidence in the case.

![Fig. 6. The front seat where samples of reddish brown liquid were taken.](image)

![Fig. 7. The right back seat where blood traces were sampled.](image)

Starting from the data yielded by the minutes of the site investigation regarding the geometry of the road, computer simulations of the accident was performed using V.Crash software. The speed at the impact with the concrete bridge was relatively low, under 10 km/h, as demonstrated by the integrity of the front bumper (fig. 8)
The injuries suffered by the vehicle occupants were due for the most part to rolling over and not to the impact with the concrete bridge. Following the simulation, starting from a speed of 55 km/h an impact speed of approximately 3.4 km/h was obtained and it was found that the dynamics of the front seats occupants coincides with a dynamic that could produce the injuries suffered by the two occupants, the driver being affected to a minor degree.

Starting from the initial position (fig. 9), front seat occupants were placed and the safety belts were deactivated.

During the first phase of the vehicle rolling over on the right side, it was found that the driver suffered head injuries, due to contact with elements inside the vehicle (fig. 10).

Immediately following the rollover, the passenger on the right suffered injuries at the level of the external aspect of the right hand at the level of the joint (fig. 11). Similarly, these injuries inflicted to the back seat passenger on the right.

Finally it is found that the driver falls over the passenger on the right provoking the brachial plexus dislocation at the level of the right shoulder (fig. 12).
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Although during testimonial investigation the passenger and the driver state that they inversely occupied the places in the vehicle, witnesses declarations proved to be true, with computer simulation through mathematical modeling being a sufficiently solid argument towards this conclusion.

CONCLUSIONS

In cases where the driver of the vehicle is unknown, in addition to the injury panel, computer simulation of the traffic accident becomes a very useful and often essential tool.

REFERENCES