Chapter 2

Current linear methods

Blood spatter analysis currently makes use of two methods, known as the stringing and tangent method respectively, to determine the point of origin by using the assumption of linear trajectories (Wells 2006).

2.1 String method

For the stringing method at a crime scene, the forensic experts use the directional blood stains and draw imaginary straight lines through them in the direction of fall (Wells, 2006). The point where all the lines intersect, is the point of convergence as illustrated in figure 2.1.

The point of convergences is a 2D representation. The 2D presentation can be transformed to a 3D representation by taking the height into consideration (Behrooz, 2009; Nordby, 2006; Nowack, Collins, Li, Carter, Illes, Gorman, Larocque, Stotesbury, Yamashita, 2011). The intersection point with height added is then the point of origin (see figure 2.2).

In figure 2.2 AO is the area of origin, C is the point of convergence and D the distance from the stain to the point of convergence.
Figure 2.1: String method: Point of convergences (Cecchetto & Heidrich, 2011)

Figure 2.2: Point of origin (Bevel & Gardner, 2008, 184)
2.2 Tangent method

For the tangent method the point of convergences is determined by forming an ellipse on the directional bloodstain as illustrated in figure 2.3. The width and length of the ellipse are calculated as shown in figure 2.4 and figure 2.5.

Figure 2.3: Form an ellipse on the bloodstain (Bevel & Gardner, 2008, 175)

Figure 2.4: Measuring of the width of the ellipse (Bevel & Gardner, 2008, 176)

The angle of impact is an acute angle \( \theta \), related to the width and length of the directional bloodstain as follows:

\[
\theta = \sin^{-1} \left( \frac{W}{L} \right)
\]

with \( W = \text{width} \) and \( L = \text{length} \) of the ellipse (see figure 2.6). This formula is known as Balthazard’s formula (Wells, 2006; Akin, 2004; Behrooz, 2009; Nordby, 2006; Bevel & Gardner, 2008, 171-173).
Figure 2.5: Measuring of the length of the ellipse (Bevel & Gardner, 2008, 176)

Figure 2.6: Balzard’s Formula (Cecchetto & Heidrich, 2011)
The height or the point of origin can then be determine. Referring to figure 2.2

\[ \text{height} = D \tan \theta \]

where $D$ is the distance from the point of convergence to the stain and $\theta$ the angle of impact.

### 2.3 Results

In these calculations drag and gravitational forces are neglected, as only a pure geometrical derivation is used. In the next chapter the principles of fluid mechanics as used for falling water droplets/rain droplets, are extended to blood droplets originating from an impact.