



## Understanding the difference between Animation and Simulation

In the age of computer generated special effects where scenes are so visually acceptable that the impossible has become believable, it is critical to distinguish between the terms animation and simulation. Although often used interchangeably in conversation and even in legal context, there are important distinctions which must be made when using animation and simulation for accident reconstruction. It is within these distinctions that the credibility and accuracy of accident reconstruction lays.

In engineering, kinematics is the study of the motion of bodies without reference to the forces causing that motion or the mass of the bodies. In contrast, dynamics is the study of physical systems (particles, rigid bodies and deformable bodies) in motion subject to the laws of physics and motion including work, energy, impulse, momentum, mass and inertia characteristics.

Simulation of dynamic systems involves the formulation of mathematical models that employ initial conditions, physical properties and governing laws of physics to predict or model motion reproducing a sequence of events.

Simulation is an analysis method involving a variety of mathematical algorithms and solution techniques to solve the many governing equations subject to initial conditions, boundary limits and constraints. Simulation programs output volumes of data which must be available for scrutiny. Traditionally, the simulation results were depicted by large tables of values and graphs exhibiting numerical relationships. The results of simulations must pass validation tests. In vehicle accident reconstruction, validation data includes vehicle performance and handling studies, staged crash tests, industry recognized data, tire model parameters extracted from tests, measured coefficients of friction for tires and varied road surfaces, braking tests, statistical analysis and comparison of repetitive model testing against known events and outcomes. Through repetitive modeling and results testing the accuracy of the simulation method and system is validated.

To animate is to make or design in such a way as to create apparently spontaneous lifelike movement. The appearance of fluid motion may be created by photographing or graphically depicting successive positions of inanimate objects. In most entertainment forms of animation, the motion of the scene components are at the discretion of the director or animator, limited only by creativity and the bounds of visual acceptance.

In accident reconstruction, animation is a presentation method employed to visualize the results of a simulation. Unlike the entertainment forms of animation, dynamic accident reconstruction is constrained by all of the underlying bounds of the mathematical models employed within the simulation. Multiple scenes and simulation scenarios may be simulated to determine which is physically reasonable and most closely corresponds to the known parameters (measurements, crash results, witness testimonies and observable conditions).

The animation of accident reconstruction is a valuable tool for the otherwise very difficult understanding and assessment of the simulation results providing the viewer with a feel for the events including variable perspective, relative characteristics of size, spatial relationships and motion, visually displaying position, velocity and acceleration as well as energy dissipation from friction, skid marks and metal deformation. Although the simulation is founded on knowledge-based assumptions made by the engineer, it is not subject to the creativity of entertainment animation but constrained by laws of physics and science.

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