digital multimedia

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Graphics and Colour
Video and Animation
Sound
Text and Typography
Hypermedia
Flash and DOM Scripting
Multimedia and Networks

Third Edition

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Animation

Based on material from
***Digital Multimedia*, 3rd edition**
published by John Wiley & Sons, 2009
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Image Sequences

Animation is the creation of moving pictures one frame at a time.

Traditional animators have developed many techniques, including cel animation, stop motion and claymation.

Animation made using these techniques can be captured one frame at a time using a camera connected to a computer, instead of being recorded on film.

Animation can be created digitally.

Individual frames can be created in a graphics program.

Using layer comps to represent the contents of a frame can streamline the animation process.

A sequence of images can be stored in consecutively numbered image files, which can be imported into video editing programs or Flash.

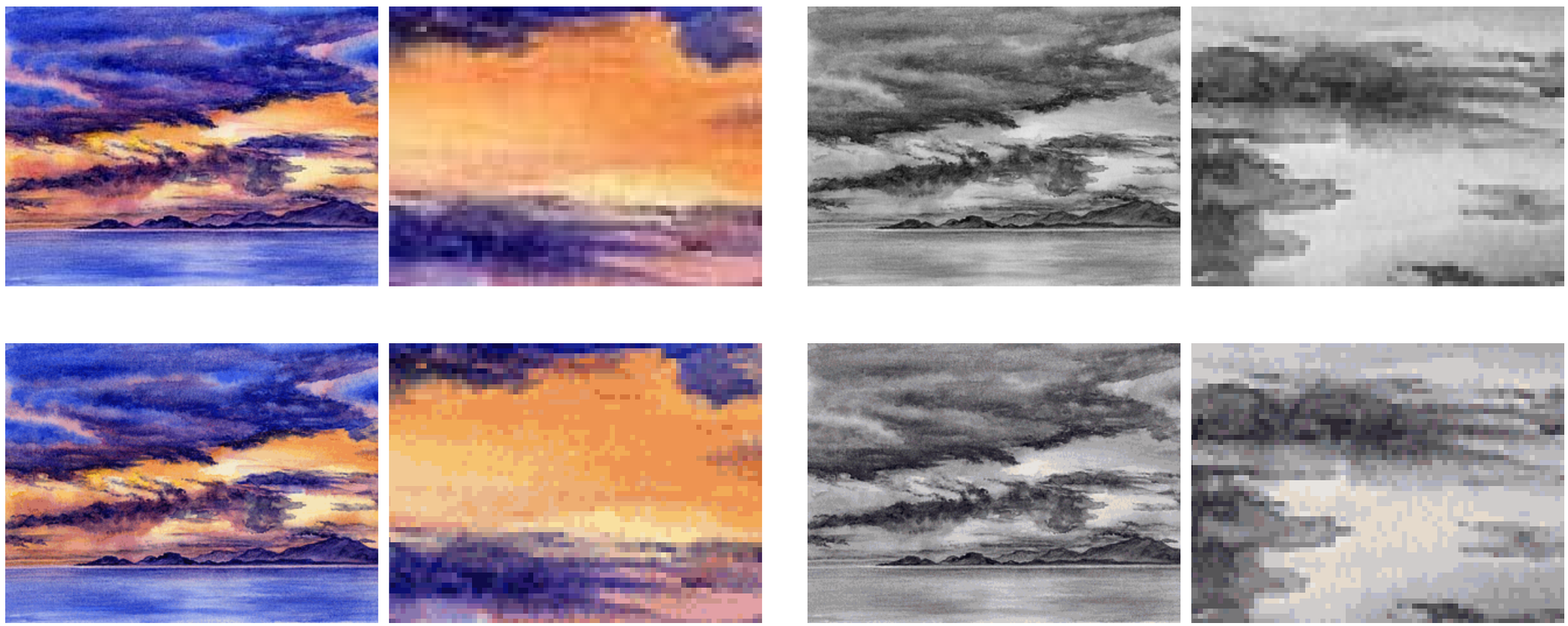
An animated GIF contains multiple bitmapped images in a single file. The individual images can be displayed in sequence by Web browsers and other programs, without the need for a plug-in.

Animated GIFs are only suitable for short simple animations.

Animated GIFs use indexed colour and lossless intra-frame compression, whose effectiveness depends on the nature of the images in the animation.

Animated GIFs cannot have a soundtrack or player controls.

Original (top) and animated GIF (bottom) frames, suitable material



Original (top) and animated GIF (bottom) frames, unsuitable material

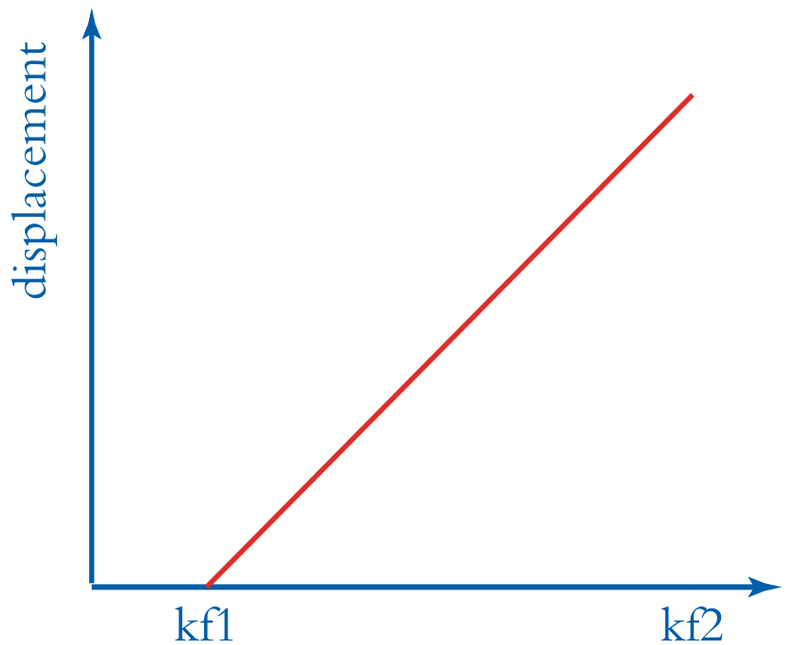
Interpolation

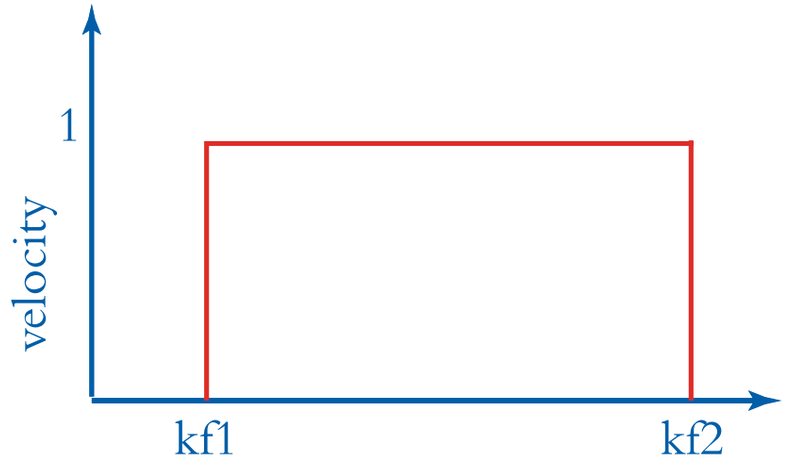
In traditional cel animation, chief animators draw key frames at important points in the animation, and in-betweeners create the intervening frames.

Animation programs perform the equivalent of in-betweening by interpolating the values of properties such as position between key frames.

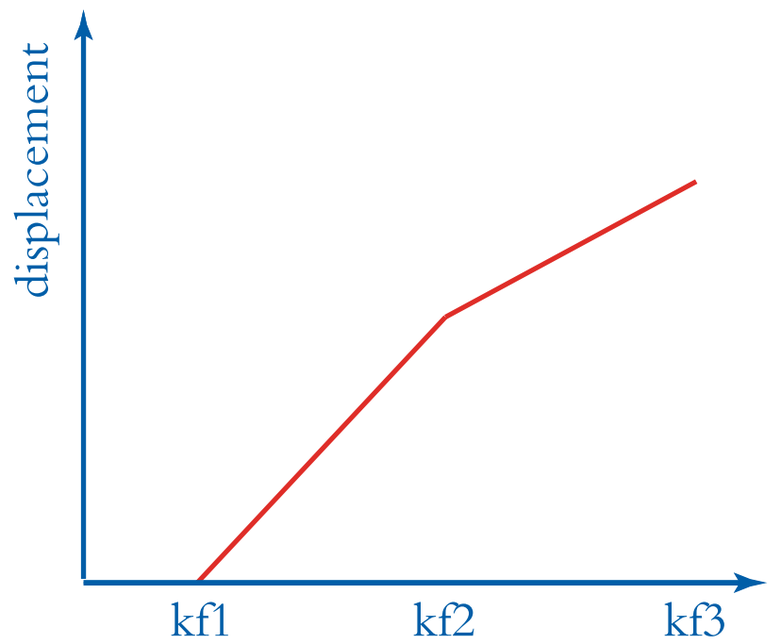
Interpolation can be applied to layers in bitmapped images or to properties of vector objects.

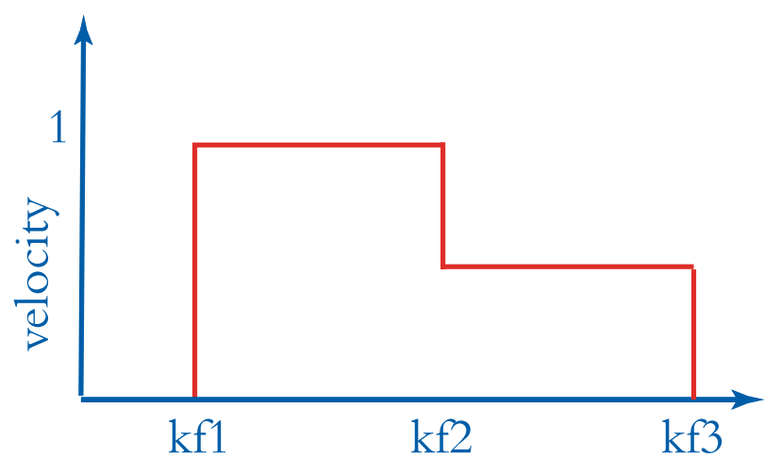
If motion is interpolated linearly, movement begins and ends instantaneously, and there may be unnatural discontinuities between interpolated sequences.





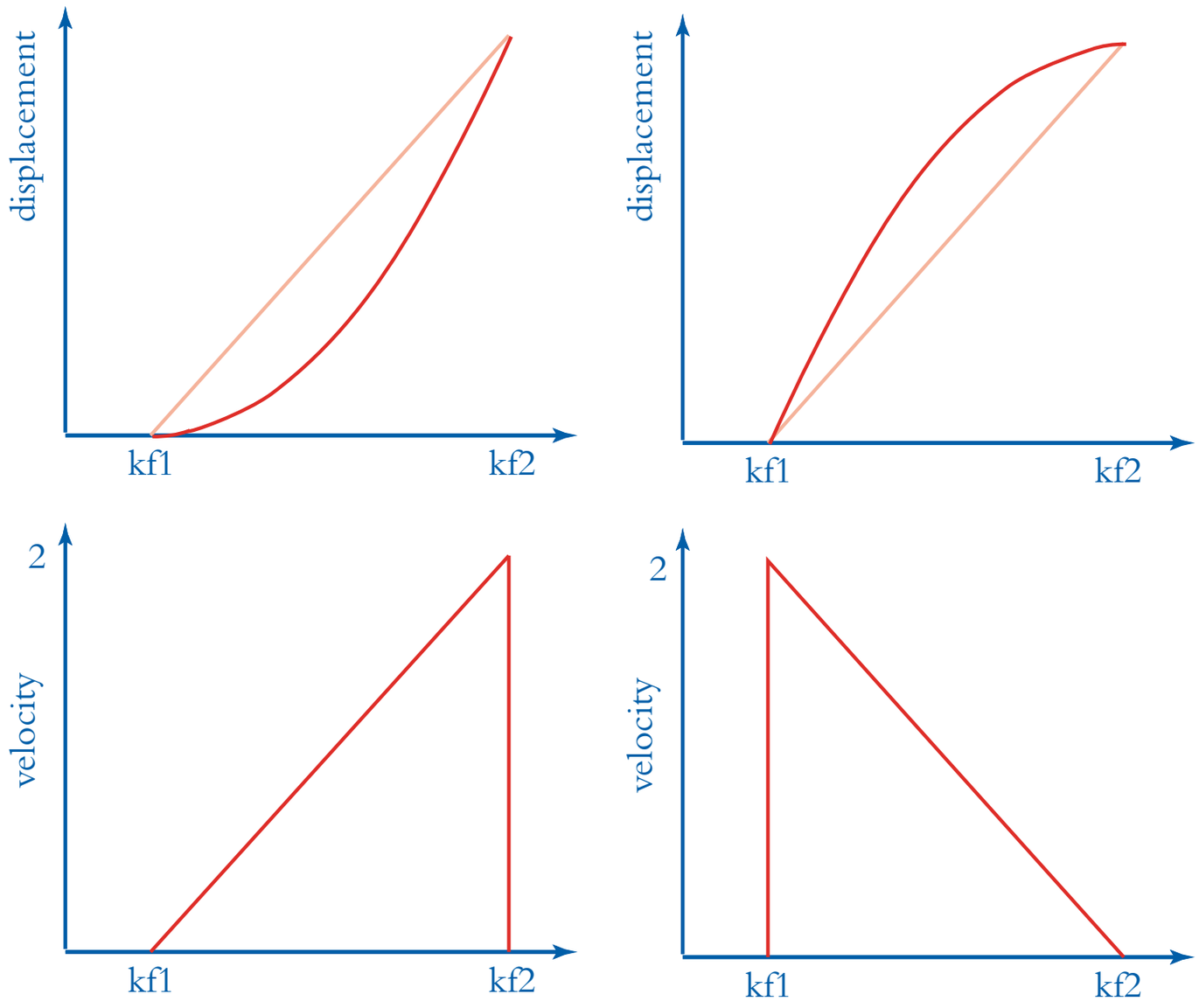
Linearly interpolated motion



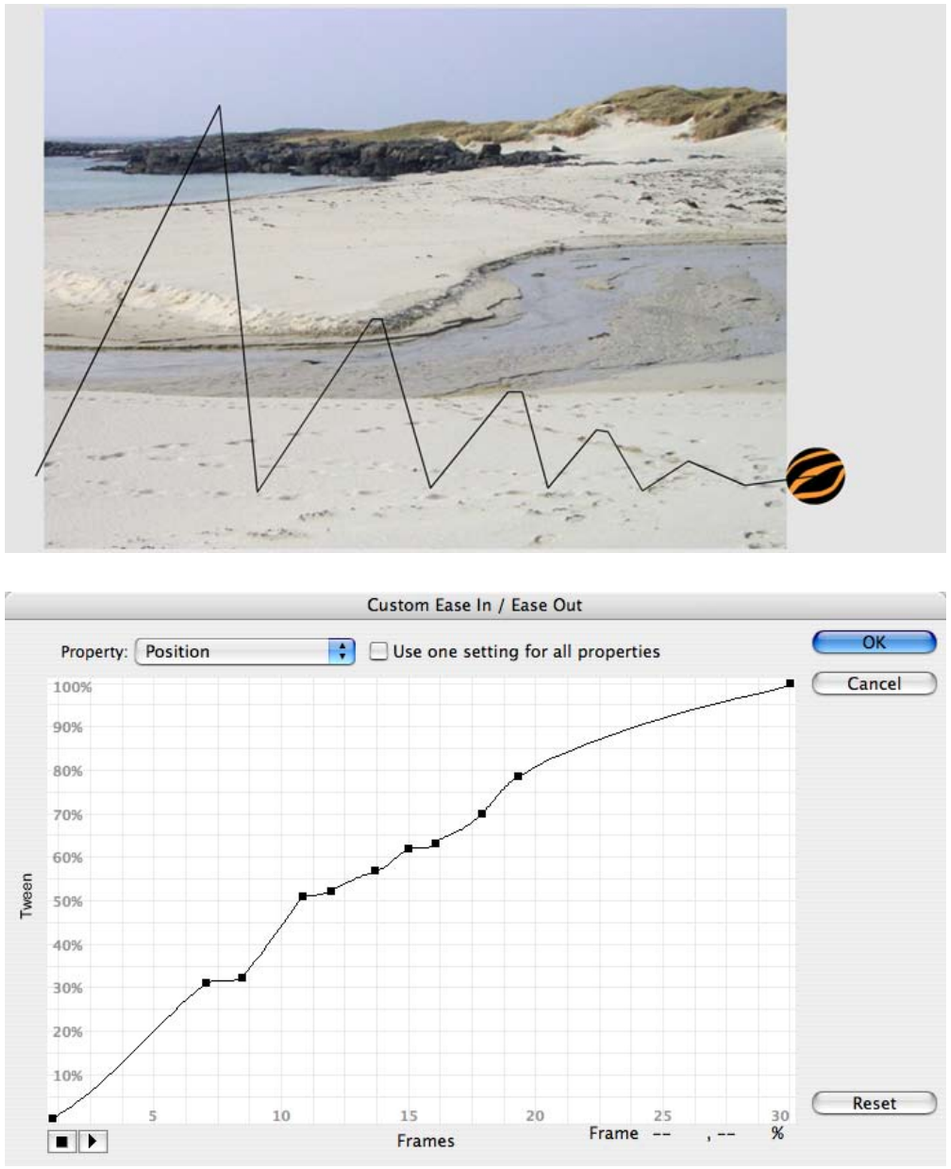


Abrupt change of velocity caused by linear interpolation

Easing in and out can be used to cause the motion to increase or decrease gradually.



Quadratic easing in (left) and out (right)

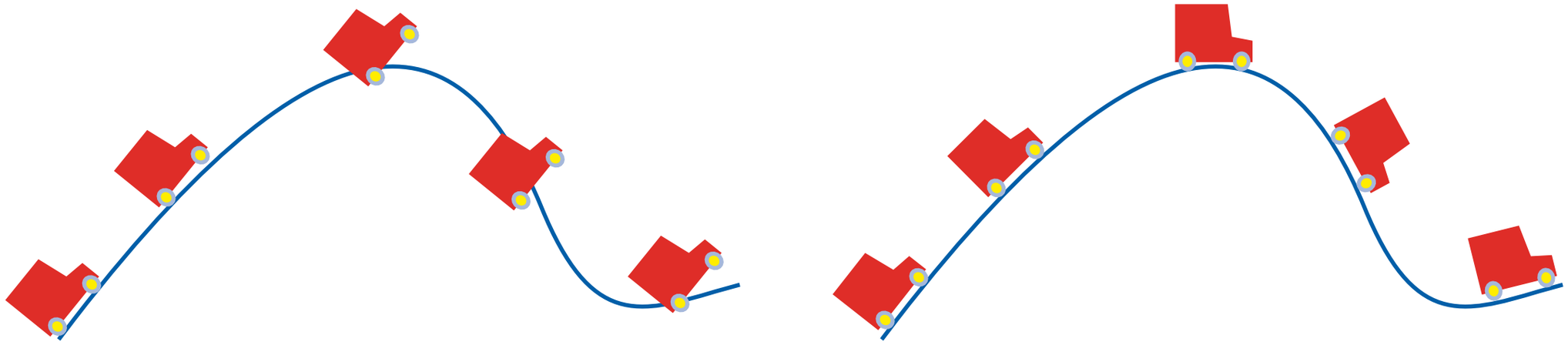


Interpolating motion along a path with custom easing

Custom easing using Bézier curves is used to control the rate of change in arbitrarily complex ways.

Objects or layers can be made to move along motion paths.

When using motion paths, it is usually necessary to orient the moving object to the path to achieve a realistic effect.



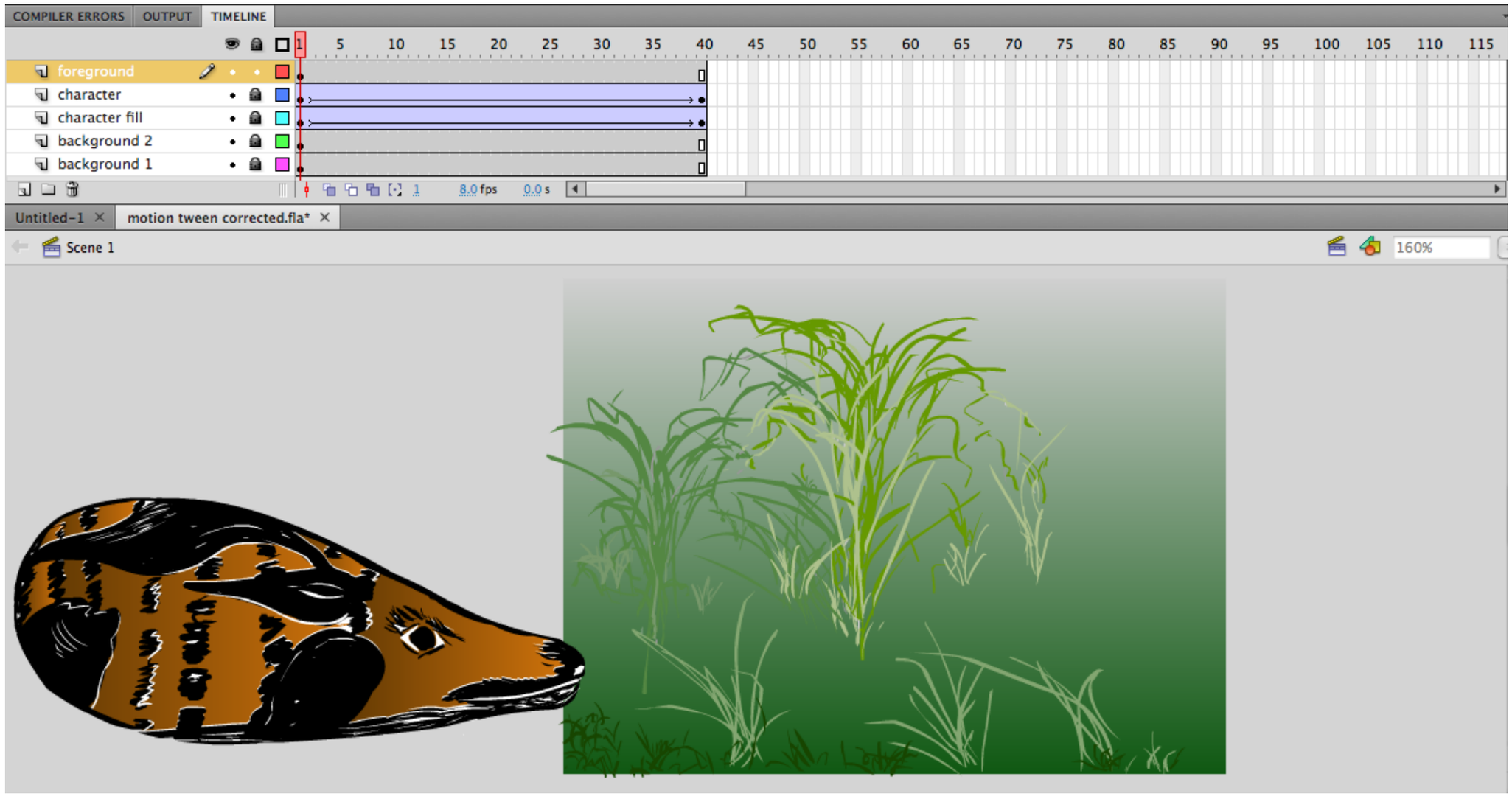
Fixed orientation (left) and orientation to the motion path (right)

Vector Animation in Flash

Flash movies, also known as SWF files, are the most popular Web animation format. They are usually created in Flash, but SWFs may also be exported from other programs.

An animation being created in Flash is organized using a timeline.

The vector objects used in the animation are created on the stage, using conventional vector drawing tools and techniques.



The timeline (top) and stage (below) in a simple Flash movie

Onion-skinning can be used to help align and change objects in consecutive frames.

Key frames are drawn in their entirety on the stage. Ordinary frames have no content, they just hold the picture from the preceding key frame.

Graphical objects can be stored in a library as symbols.

Instances of symbols can be created on the stage, allowing objects to be reused.

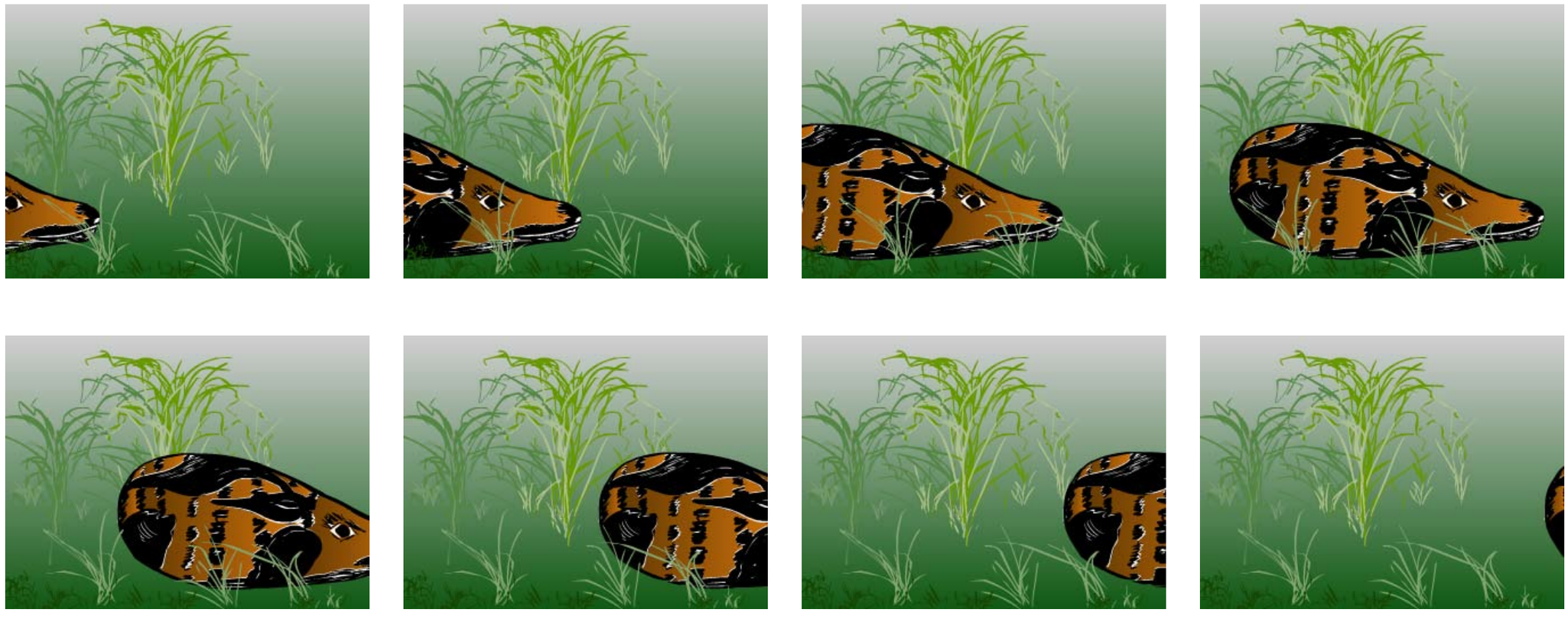
Instances can be transformed independently and have different visual effects applied to them.

Instances of a symbol

Interpolation (“tweening”) is applied to symbol instances.

Easing can be applied to tweened motion.

An object's size, orientation, opacity and colour may also be interpolated.



Simple tweened motion of a symbol instance

Shape tweening ("morphing") is used to transform one shape into another.

There are three sorts of symbol in Flash.

Graphic symbols are reusable vector objects.

Movie clip symbols are self-contained animations with their own timelines, that play within the main movie and can be controlled by scripts.

Button symbols have now been superseded by UI components.

Both graphic symbols and movie clip symbols can be animated.

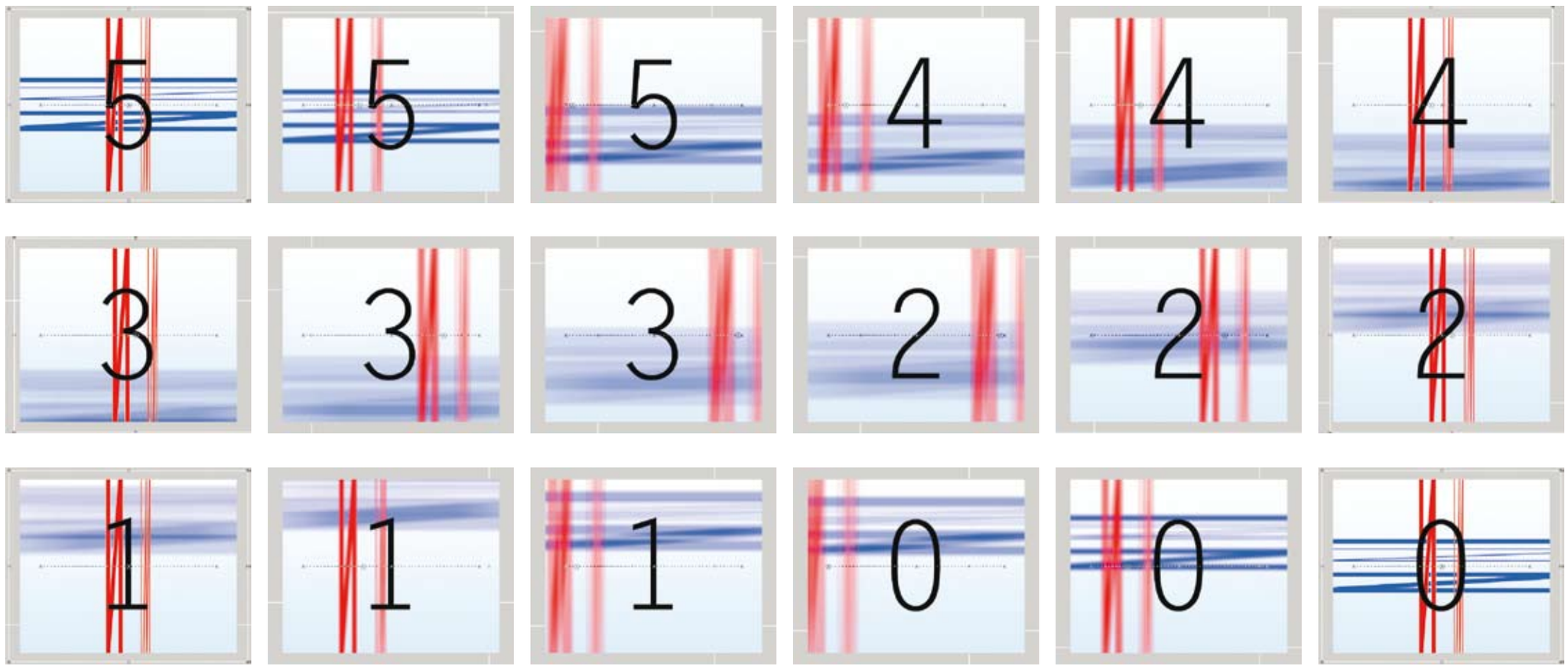
Motion Graphics

Motion graphics is animated graphic design.

After Effects is the leading desktop application for creating motion graphics, and offers the most sophisticated controls.

Simple motion graphics can be achieved by repositioning and altering other properties of the layers of a bitmapped image independently.

Layers may be moved along motion paths.



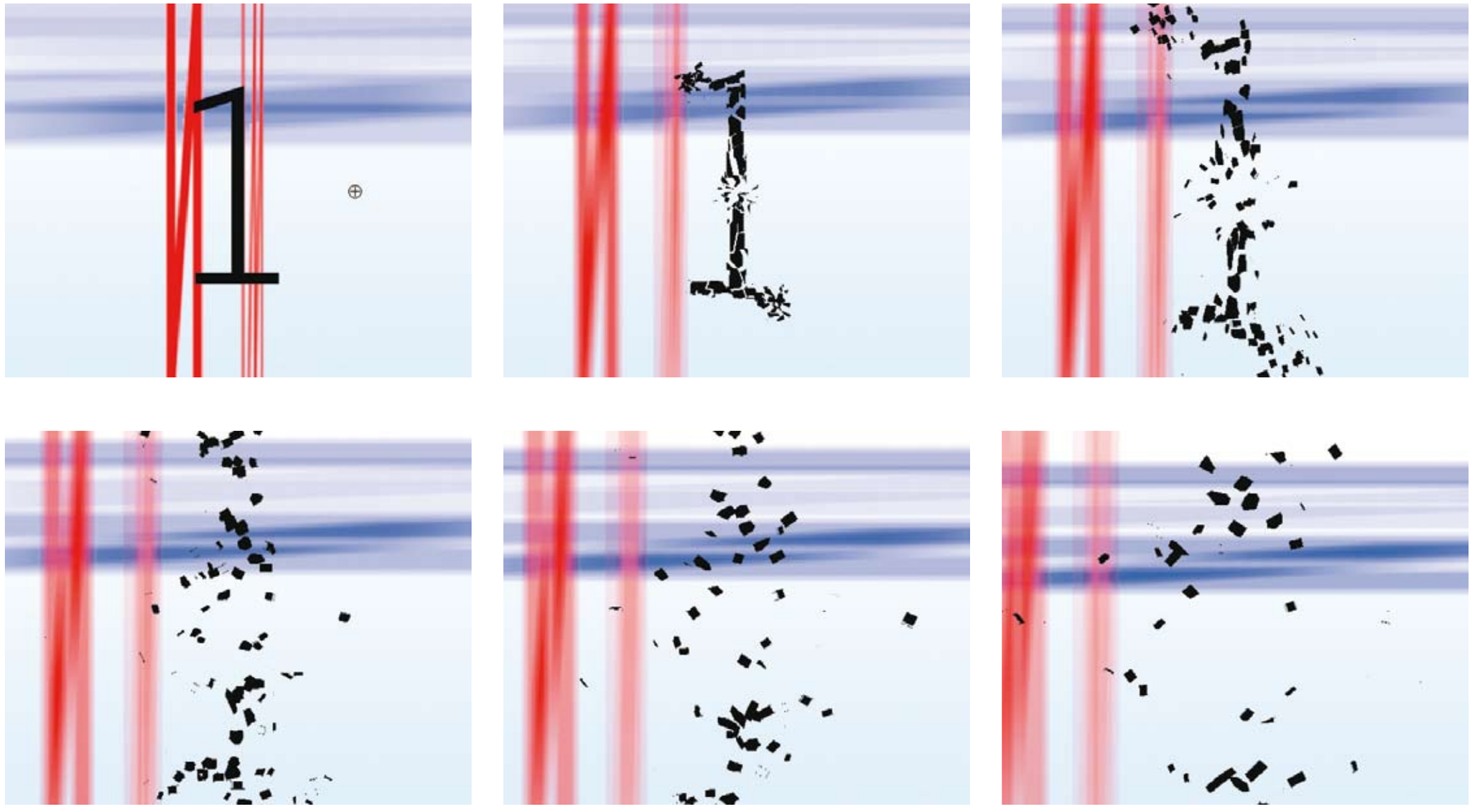
Simple motion graphics

Interpolation may be used to control the rate of change of properties as well as their values.

Parameters of filters and effects may be interpolated.

Time-varying colour adjustments

Purely time-based effects, such as shattering, may be applied.



A purely temporal effect

Delivering Animation

The three predominant formats for delivering digital animation are animated GIF, Flash (SWF) and video.

Video must be used for animation that will be played on a television.

If animation is delivered as video a soundtrack can be added, player controls can be used and high compression can be achieved using modern video codecs.

Flash is superior for vector animations.

For bitmapped animations, animated GIF may be used without a plug-in, but video provides the best quality.

Flash should be used for interactive animation requiring scripting.

The Flash movie file format is a compressed binary format that provides an efficient way to deliver animation over a network.

Tags in a Flash movie are of two sorts: definition tags, which identify data blocks containing descriptions of objects, and control tags, which contain instructions for placing and moving those objects.

Alternative formats for animation include APNG, JPEG sequences displayed by JavaScript, scripted SVG and canvas animation. These formats are rarely used.