

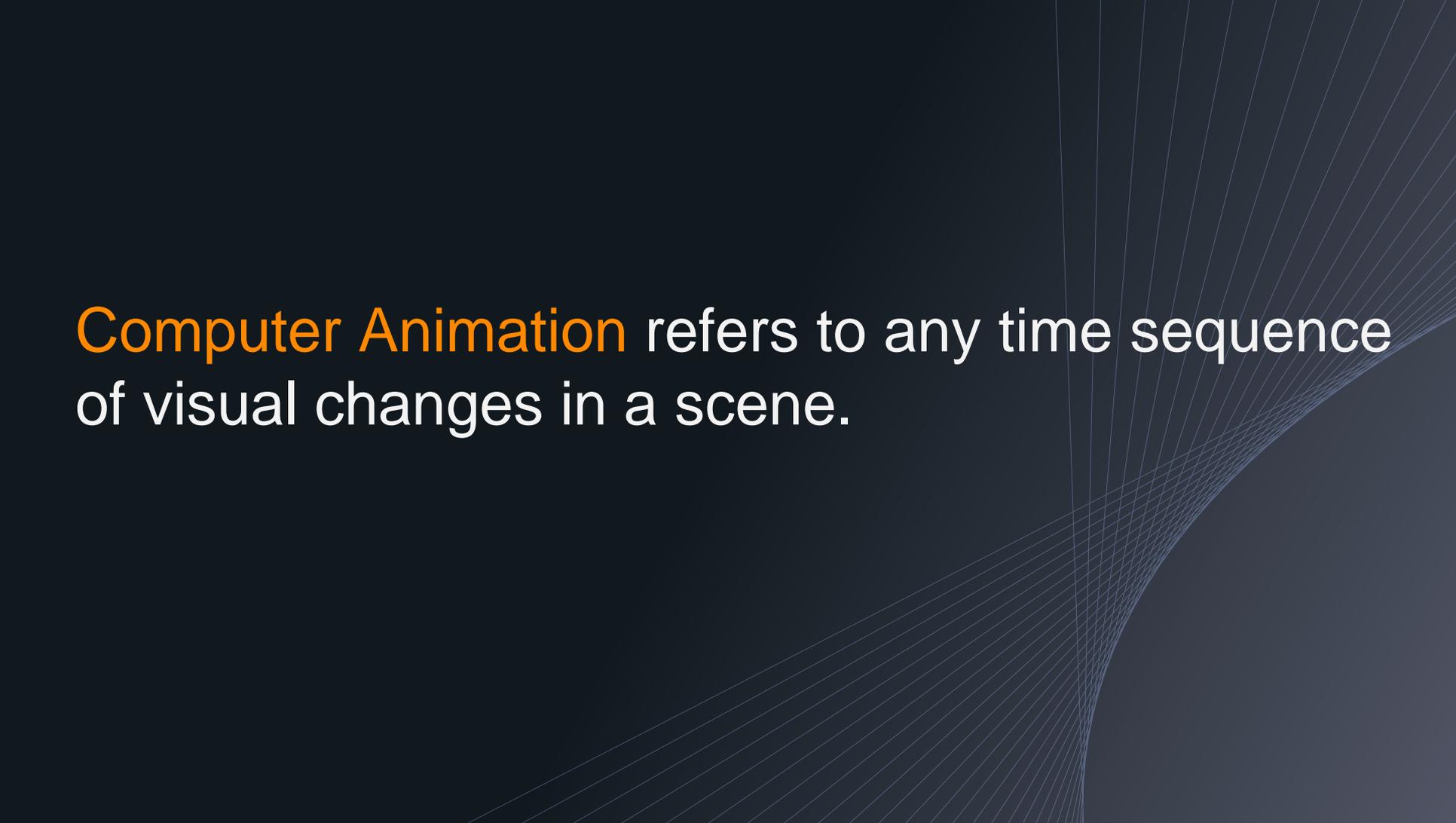
Chapter 16

Computer Animation

References/Resources:

Computer Graphics, C Version (2nd Ed.), D. Hearn, M.P. Baker, Pearson Education

Computer Animation refers to any time sequence of visual changes in a scene.

The background is a dark blue gradient. On the right side, there is a decorative graphic consisting of a series of thin, light blue lines that form a grid. This grid curves inward from the right edge towards the center of the slide, creating a sense of depth and movement.

Steps to Design an animation sequence

1. Storyboard layout (basic idea/draft)
2. Object definitions (object's use, their shape and movement)
3. Key-frame specifications (detailed drawing at a certain time)
4. Generation of in-between frames (intermediate frames between the key frames)

Storyboard Layout

- The storyboard is an outline of the action.
- It defines the motion sequence as a set of basic events that are to take place.
- It consist of set of rough sketches or a list of basic ideas for the motion.

Object Definitions

- An object definition is given for each participant in the action.
- Objects can be defined in terms of basic shapes, such as polygons or curves.
- The associated movements for each object are specified along with the shape.

Key-frame specifications

- A key frame is a detailed drawing of the scene at a certain time in the animation sequence.
- Within each key frame, each object is positioned according to the time for that frame

Generation of in-between frames

- In-between are the intermediate frames between the key frames.
- The number of in-betweens needed is determined by the media to be used to display the animation.

Eg: For a 1-minute film sequence with no duplication, we would need 1440 frames. With five in-betweens for each pair of key frames, we would need $(1440/5)$ 288 key frames

Animation packages functions

Object manipulation, rendering (rendering is the process of add shading and color to a 2D or 3D images in order to create life-like images on a screen), camera motion and generation of in-between frames.

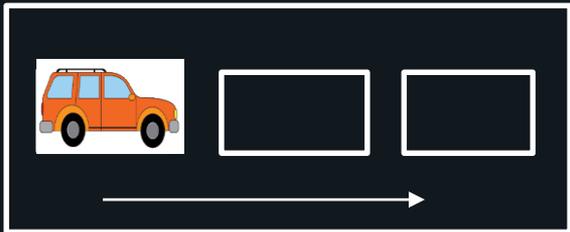
Eg: Animation package(**Wave-front**) functions:-

- to store and manage the object database. Object shapes and associated parameters are stored and updated in the database.
- object functions include those for motion generation and those for object rendering. Motions can be generated according to specified constraints using 2D or 3D transformations. Standard functions can then be applied to identify visible surfaces and apply the rendering algorithms (z-buffer, painter's algo, Warnock's algo).
- camera movements. Standard motions are zooming, panning (panorama) and tilting.
- Given the specification for the key frames, the in-between can be automatically generated.

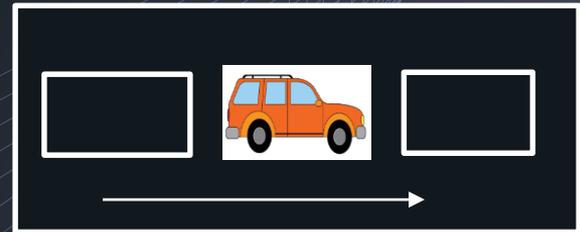
Color Table Transformations

- We can animate objects along 2D motion paths using the color-table transformations.
- Here we predefine the object at successive positions along the motion path and set the successive blocks of pixel values to color-table.
- We set the pixels at the first position of the object to "on" values, and we set the pixels at the other object positions to the background color.
- The animation is then accomplished by changing the color-table values so that the object is "on" at successively positions along the animation path as the preceding position is set to the background intensity

Eg:



Car(object) move forward (path decided)



Empty pixels (empty box) are set to background color

Key-frame Systems: are specialized animation languages designed simply to generate the in –betweens from the user-specified key frames.

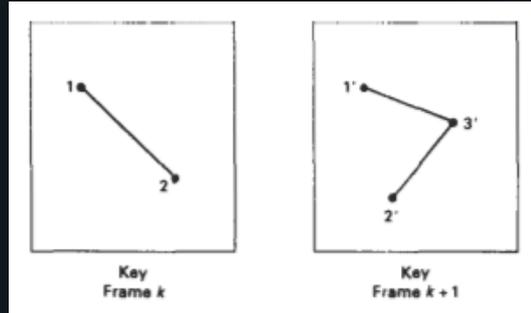
Parameterized Systems: allow object-motion characteristics (such as degree of freedom, motion limitation and allowable shape changes) to be specified as part of the object definitions.

Scripting Systems: allow object specifications and animation sequences to be defined with a user-input script.

Morphing

- Transformation of object shapes from one form to another is called morphing.
- Morphing methods can be applied to any motion or transition involving a change in shape.

Eg1: there are 2 key frames k and $k+1$. key frame k has one line segment and k is transformed into two line segment in key frame $k+1$ as shown below:

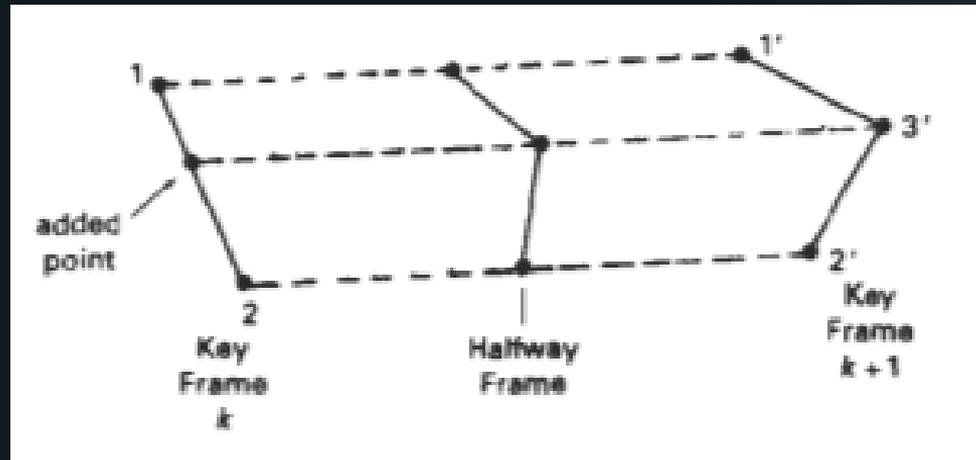


Source (K)

Destination (K+1)

To balance the no. of vertices (and edges) in k and $k+1$, we add an extra vertex between vertex 1 and 2 in key frame K .

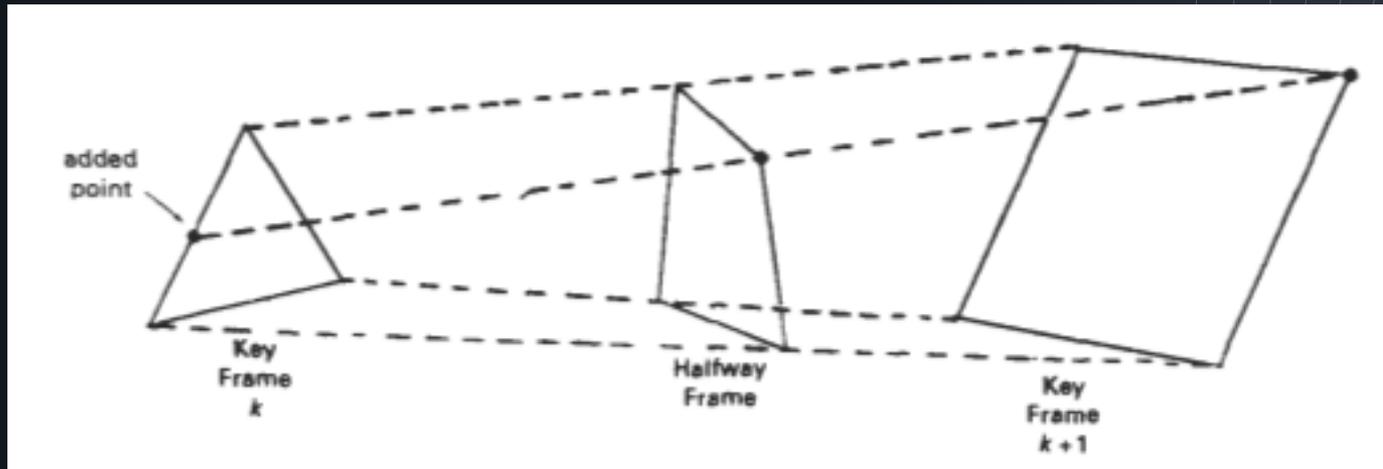
To generate an intermediate/in-between frame for the example we use linear interpolation, we transition the added vertex in key frame K into vertex 3' along the straight line path as below:



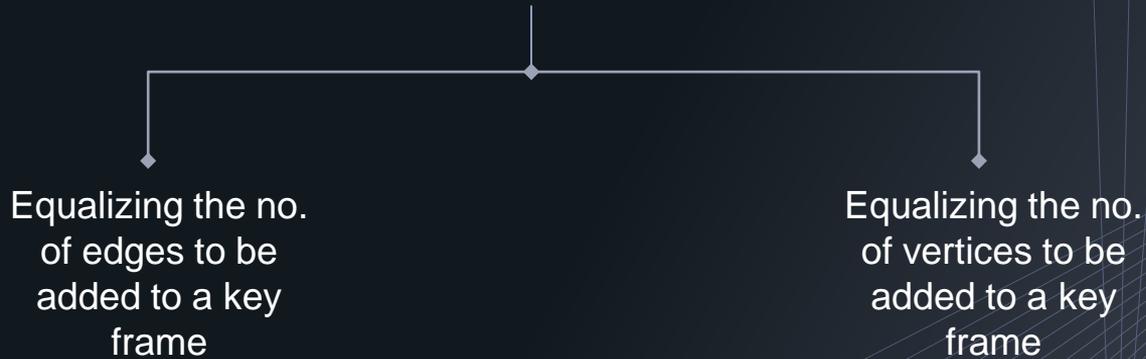
Eg2: Triangle linearly expanding into a quadrilateral.

Since triangle (key frame K) has 3 vertex and quadrilateral (key frame K+1) has 4 vertex.

We add an extra vertex in Key frame K.



General preprocessing rules for equalizing key frames



Three ways in which motion of object can be specified in an animation system

