KEYFRAMING & INTERPOLATION

Keyframing

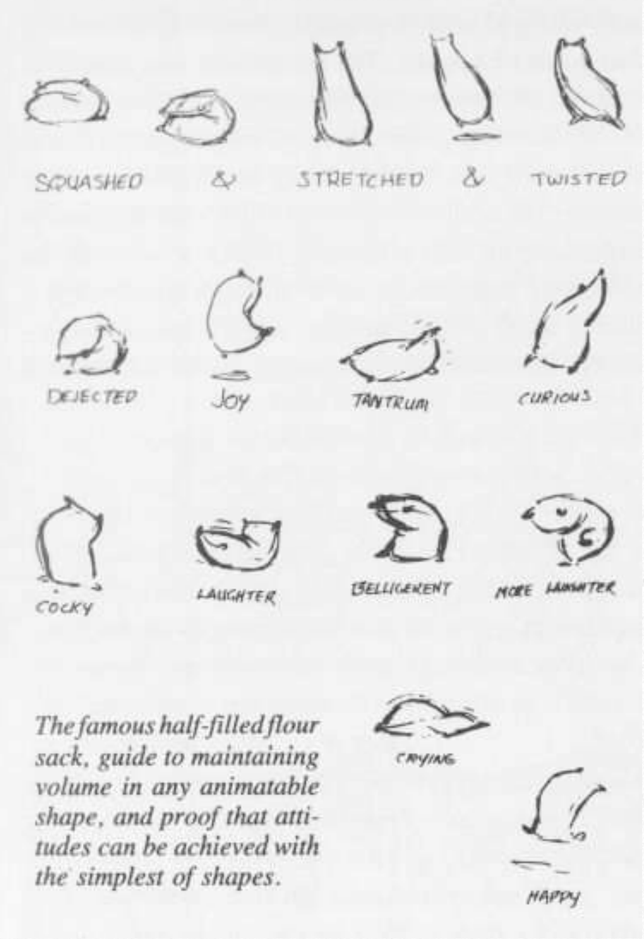
- Principles of traditional animation [Lasseter, SIGGRAPH 1987].
- Stylistic conventions followed by Disney's animators and then taken as industry standards.
- Determined from experience built over many years:
  - Squash & Stretch - use distortions to convey flexibility.
  - Timing - speed conveys mass, personality.
  - Anticipation - prepare the audience for an action.
  - Followthrough and overlapping action - continuity with the next action.

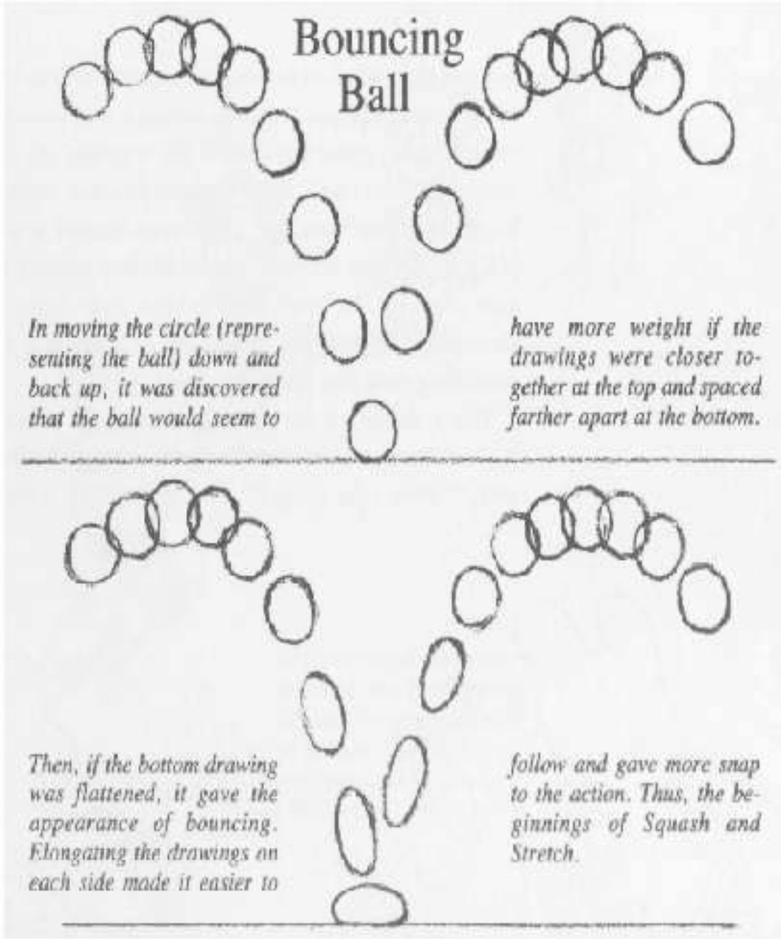
Keyframing

- Slow in & slow out - speed of transitions conveys subtleties.
- Arcs - motions are usually curved.
- Exaggeration - emphasize emotional content.
- Secondary action - motion ocurring as a consequence.
- Appeal - audience must enjoy watching it.

http://www.cs.cmu.edu/afs/cs.cmu.edu/user/jkh/www/462_s07/19_keyframing.pdf

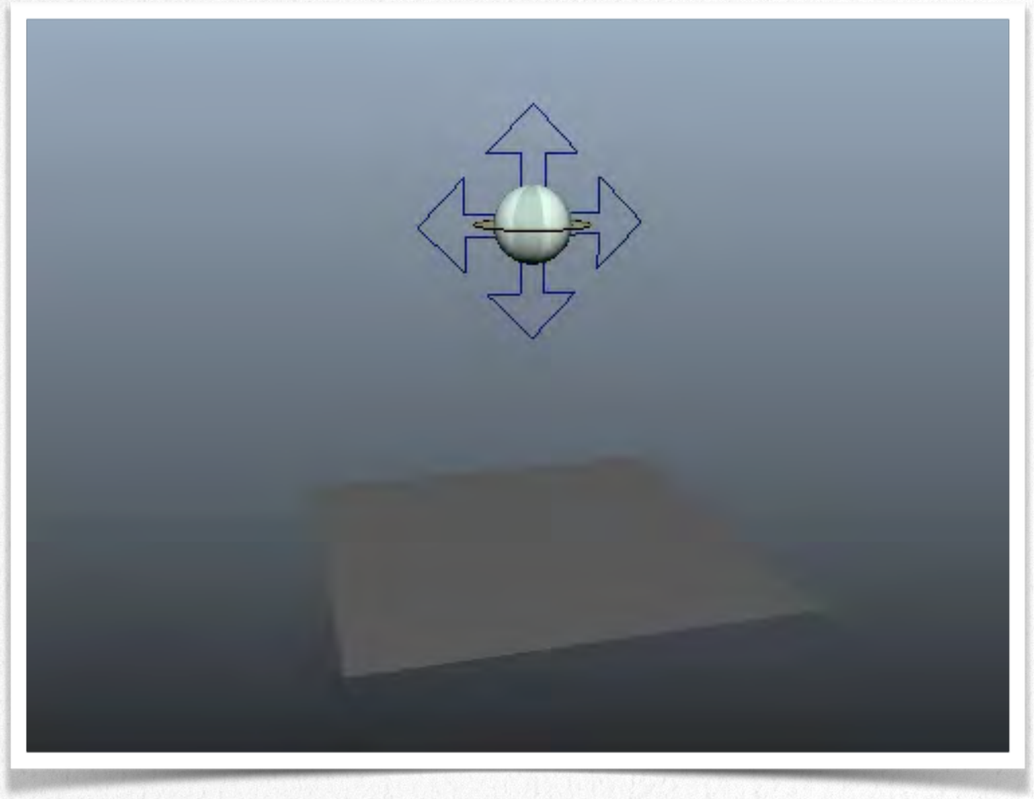
Keyframing



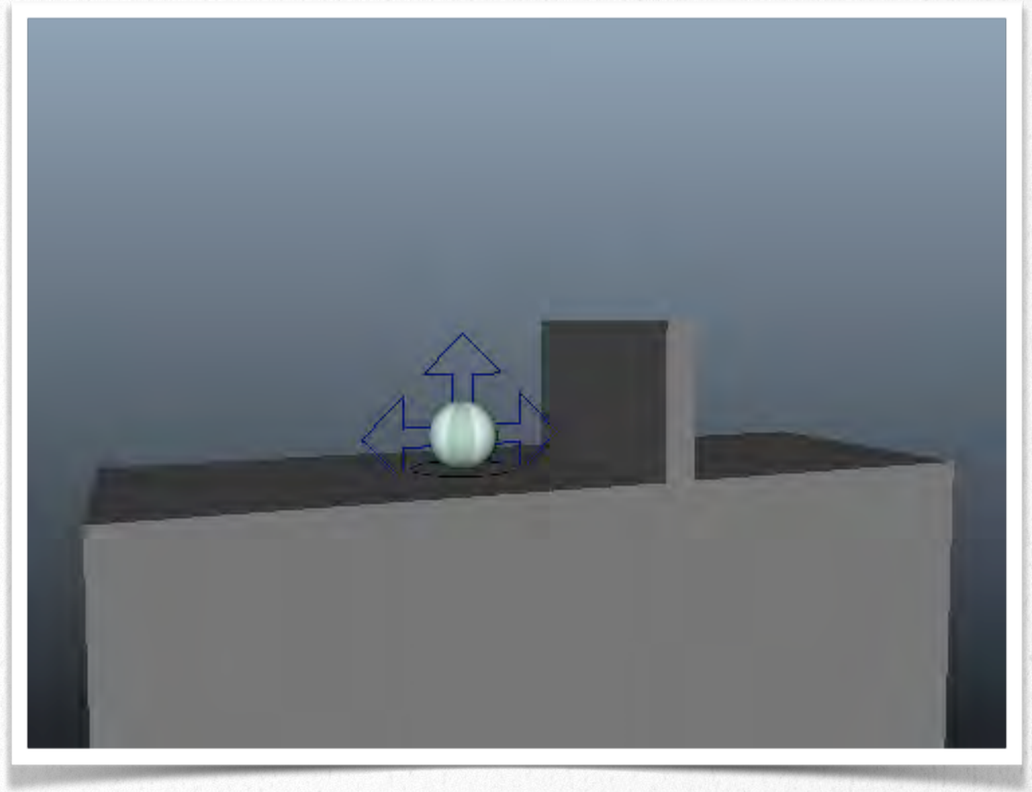


http://www.cs.cmu.edu/afs/cs.cmu.edu/user/jkh/www/462_s07/19_keyframing.pdf

Principles of animation



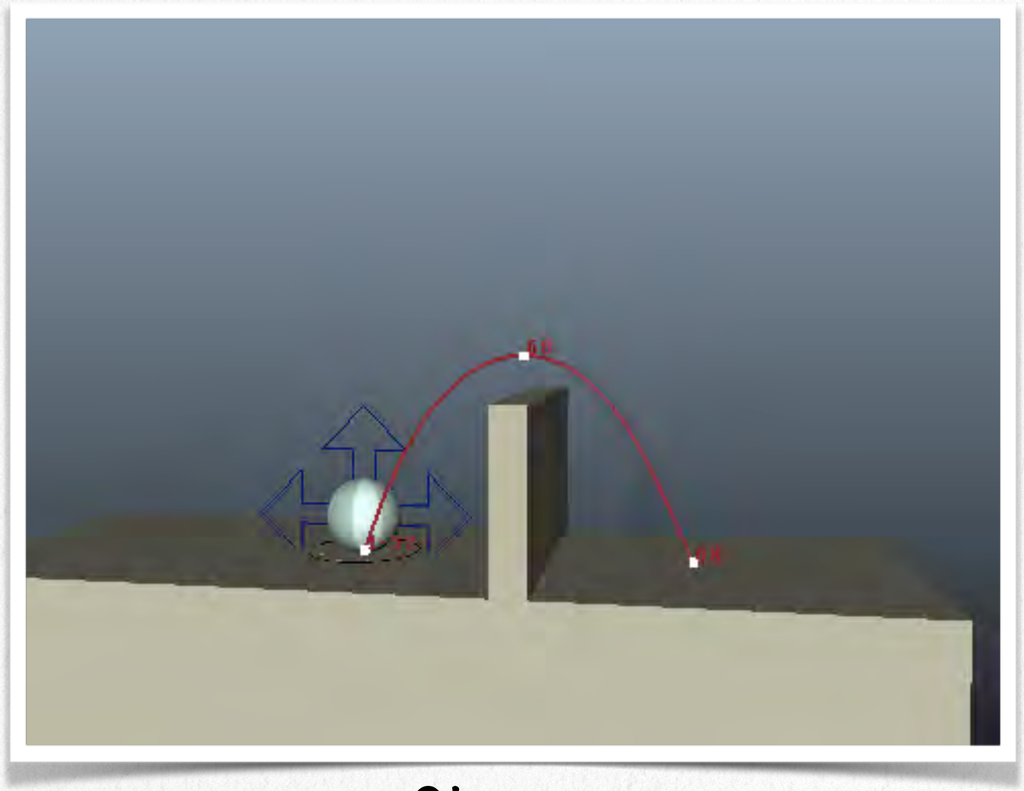
Squash & Stretch



Anticipation

How to chat in Maya 2013: Tools and Techniques for Character Animation.

Principles of animation



Slow-in

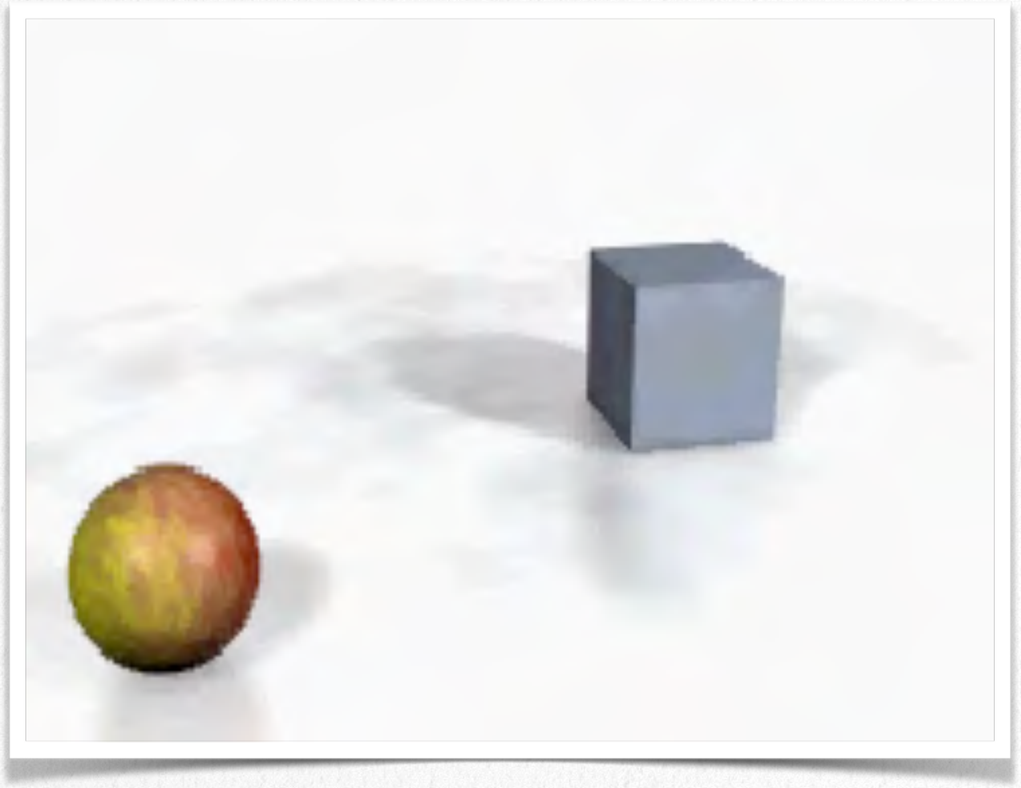
Exaggeration

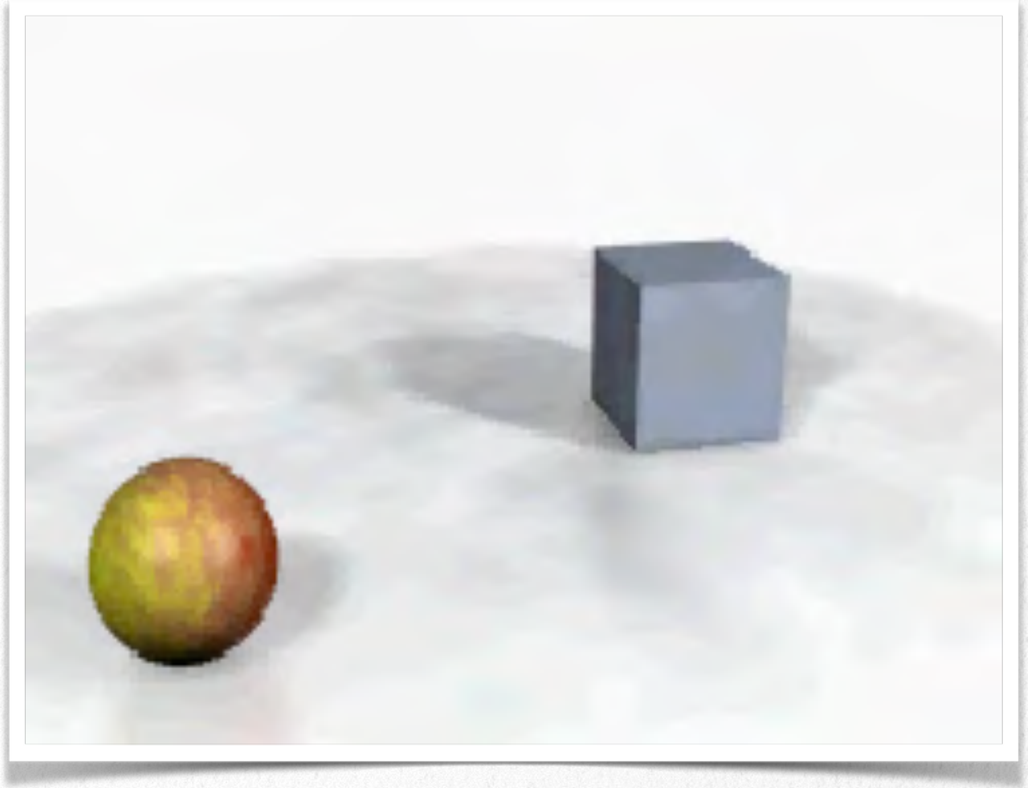
How to chat in Maya 2013: Tools and Techniques for Character Animation.

Timing and motion

- Speed conveys mass, personality.
- A heavier object takes a greater force and a longer time to accelerate and decelerate.
- A larger object moves more slowly than a smaller object and has greater inertia.
- Motion also can give the illusion of weight.
- www.siggraph.org/education/materials/HyperGraph/animation/character_animation/principles/timing.htm

Timing and motion



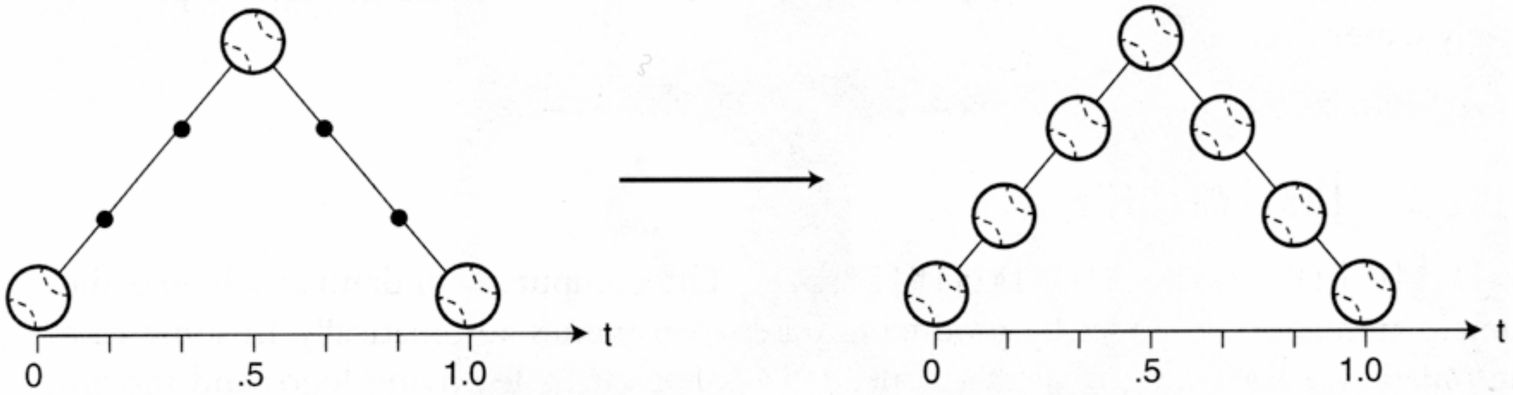


The process of key framing

- Specify the keyframes.
- Specify the type of interpolation: linear, cubic, parametric curves ...
- Specify the speed profile of the interpolation: constant velocity, ease-in, ease-out, etc.
- Computer generates in-betweens.
- One keyframe is then described as a set of parameters that describe one configuration.

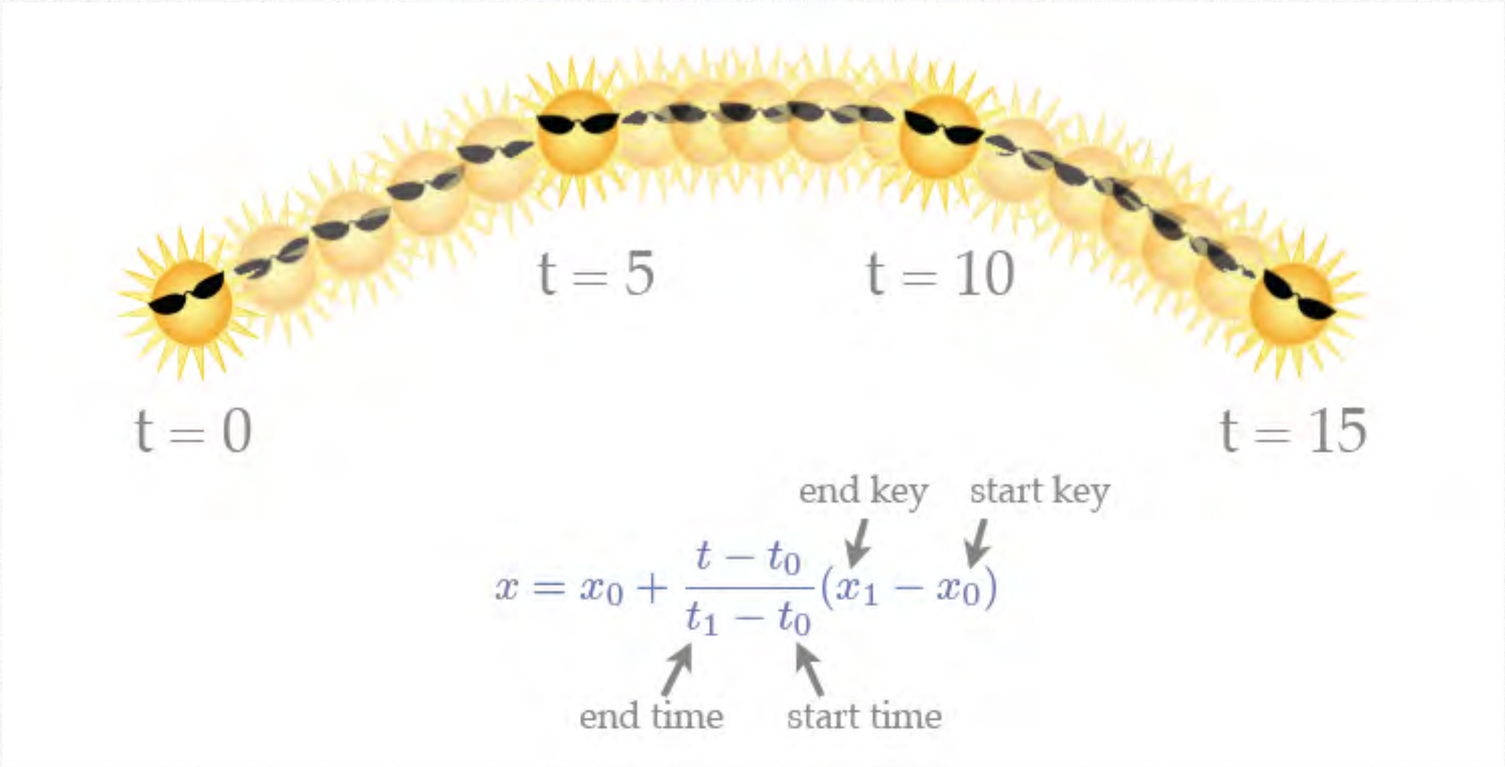
Linear interpolation

Figure 10.5 Inbetweening with linear interpolation. Linear interpolation creates inbetween frames at equal intervals along straight lines. The ball moves at a constant speed. Ticks indicate the locations of inbetween frames at regular time intervals (determined by the number of frames per second chosen by the user).



http://www.cs.cmu.edu/afs/cs.cmu.edu/user/jkh/www/462_s07/19_keyframing.pdf

Linear interpolation



http://www.cc.gatech.edu/classes/AY2012/cs4496_spring/slides/Keyframe.pdf

CURVAS PARAMÉTRICAS

Forma de la matriz geométrica

- Para construir una curva polinomial a partir de puntos de control, necesitamos restricciones geométricas que serán los coeficientes de G:
  - coordenadas de las posiciones de los puntos de control.
  - coordenadas de las derivadas de la curva en los puntos de control.
  - restricciones de continuidad y amarre con otras curvas en el caso de curvas polinomiales por pedazos.
- Para una curva cúbica y dado que G es de 4x3, necesitamos 12 restricciones para determinar G.

Algunos tipos de curva

- Curvas Hermitianas o de Hermite definidas por dos puntos de control y las derivadas en estos puntos.
- Curvas de Bézier definidas por dos puntos de control en los extremos y otros puntos que determinan las derivadas en los extremos.
- Curvas Splines definidas por cuatro puntos de control.
- Una vez que tenemos la matrix M para un tipo de curva, se utiliza como constante y podemos calcular los puntos Q(t) para diferentes valores de t con Q(t) = T.M.G.

CURVAS DE HERMITE

Restricciones geométricas en las curvas de Hermite

- Determinadas por
  - dos puntos de control en los extremos de la curva: $P_1(x_1,y_1,z_1)$ y $P_4=(x_4,y_4,z_4)$.
  - las derivadas en esos puntos $R_1=(x'_1, y'_1, z'_1)$ y $R_4=(x'_4, y'_4, z'_4)$ que son vectores en R^3.
- Es la curva cúbica $Q:[0,1] \rightarrow R^3$ tal que
  - $Q(0) = P_1$ y $Q(1) = P_4$.
  - $Q'(0) = R_1$ y $Q'(1) = R_4$.
- Usar estos elementos para construir la matriz geométrica.