Animation

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Information

Motion
Action and events
Story and/or process

Overview

Motion

Problems with animation

Techniques for animation

- Fundamental principles

  Disney Animation, F. Thomas & O. Johnston
- Film

  Grammar of the Film Language, D. Arijon
- Sequential art / stills

  Understanding Comics, S. McCloud

Motion and Action

Motion as a Visual Cue

Psi effect
- Discrete frames merge to smooth motion
- Flicker fusion

Dominant (stronger than color, shape, ...)

Pre-attentive / sensitive to motion at periphery

Triggers orientation response

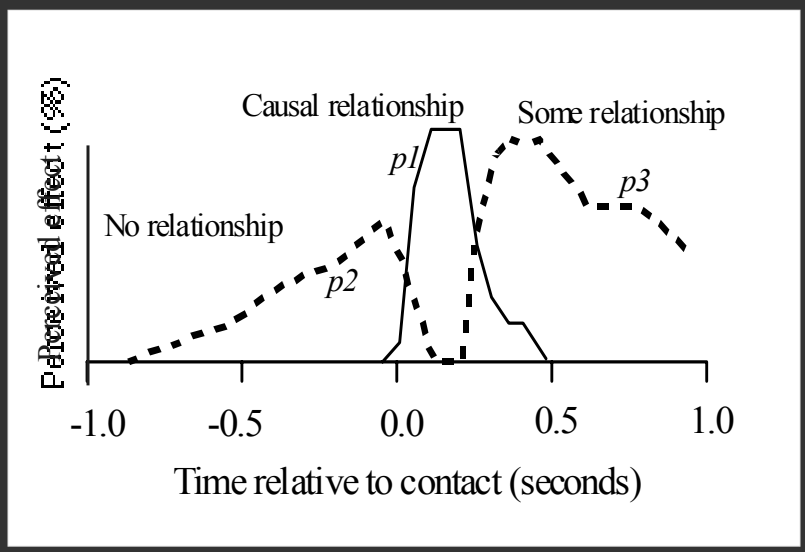
Motion parallax like stereopsis (rocking)

Segments by common affine transformation
- Example: Common fate

Object constancy
- Example: Animated transitions

Motion grouped hierarchically
- Biological motion recognizable

Michotte [1946]



http://www.carleton.ca/~warrent/210/lecture03/A%20Michotte/michotte.htm

Animation

Four-stroke combustion cycle

Four-stroke combustion cycle

http://auto.howstuffworks.com/engine3.htm

Questions

Problems

Cannot simultaneously attend to multiple motions

Segmenting motion into objects, events, actions

Understanding and inferring causality

Difficult to estimate paths and trajectories

Motion is fleeting and transient

Anthropomorphizing physical motion may be confusing or lead to incorrect conclusions

Tversky et al. 2002

Rotary Engine

Rotary engine

http://travel.howstuffworks.com/rotary-engine4.htm

Animation vs. interactive animation

Pythagorean Theorem

Thompson-Riding experiment

- **Group 1: Static diagram**
- **Group 2: Discrete steps**
- **Group 3: Continuous motion**

Group 3 outperformed 1 and 2

Examples

- **Blinn's animation**
- **Interactive proof**

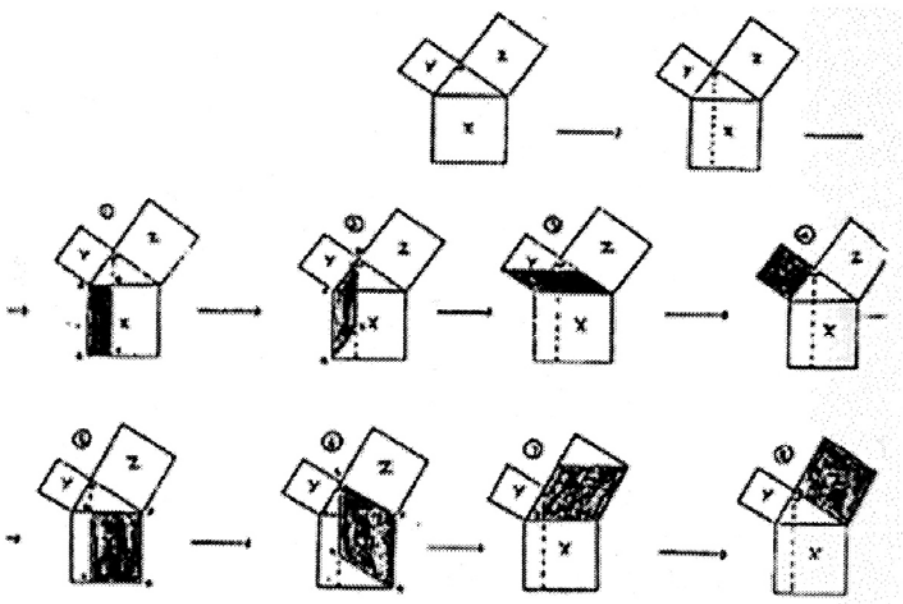
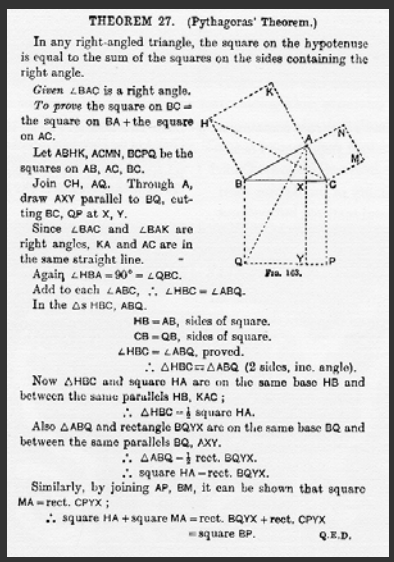


Figure 4: Thompson & Riding's (1990) Shears and Rotations Diagram.

Geometric Proofs



THEOREM 27. (Pythagoras' Theorem.)

In any right-angled triangle, the square on the hypotenuse is equal to the sum of the squares on the sides containing the right angle.

Given ∠BAC is a right angle.

To prove the square on BC = the square on BA + the square on AC.

Let ABHK, ACMN, BCPQ be the squares on AB, AC, BC.

Join CH, AQ. Through A, draw AXY parallel to BQ, cutting BC, QP at X, Y.

Since ∠BAC and ∠BAK are right angles, KA and AC are in the same straight line.

Again ∠HBA = 90° = ∠QBC.

Add to each ∠ABC, ∴ ∠HBC = ∠ABQ.

In the △s HBC, ABQ,

HB = AB, sides of square.

CB = QB, sides of square.

∠HBC = ∠ABQ, proved.

∴ △HBC = △ABQ (2 sides, inc. angle).

Now △HBC and square HA are on the same base HB and between the same parallels HB, KAC;

∴ △HBC = ½ square HA.

Also △ABQ and rectangle BQYX are on the same base BQ and between the same parallels BQ, AXY.

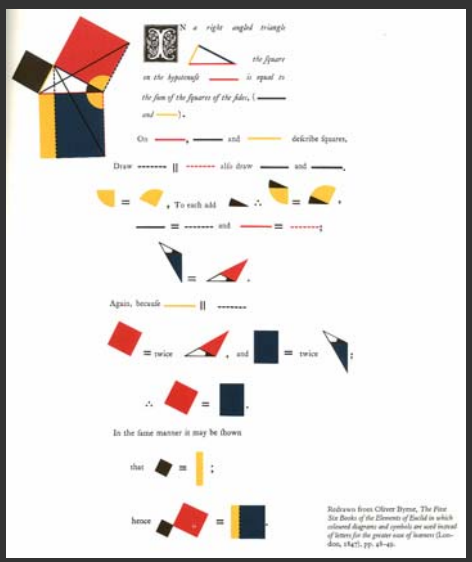
∴ △ABQ = ½ rect. BQYX.

∴ square HA = rect. BQYX.

Similarly, by joining AP, BM, it can be shown that square MA = rect. CPYX;

∴ square HA + square MA = rect. BQYX + rect. CPYX = square BP. Q.E.D.

Fig. 163.



Pythagorean theorem [from Tufte 90]

Film Grammar:

Shots To Sequences

Shots

Definition: A shot is a continuous piece of film

Types:

- **Distance [Figures 3.1-3.6]**
  - **Close-up**
  - **Close shot**
  - **Medium shot**
  - **Full shot**
  - **Long shot**
- **Background, foreground**
- **Over the shoulder**
- **Point of view**

Edits

Types:

- **Single master shot**
- **Master shot inter-cut with shorter takes**
- **Two interwoven master shots**

Parallel action [p. 9]

- **Action and reaction**
- **Question and answer**

Matched Cuts

By position [Figure 3.7]
By movement [Figure 3.8]
By direction of look [Figure 3.9]

Examples

Figure 9.1 – Continuous motion
Figure 10.1 – Cutting after vertical movement
Figure 10.2 – Cutting after downward move.
Figure 10.9 – Cutting before turn
Figure 11.34 – Cutting upon entry
Figure 11.56 – Cutting when going thr. Door
Figure 12.2 – Horizontal motion
Figure 14.2 – Insert cut for recognition
Figure 16.18 – *North by Northwest*

Sequences

Definition: Spatially or temporally contiguous

Snow White [p. 218-220]

1. Introduction: Queen and Mirror; Snow White in courtyard; arrival of Prince.
2. Queen orders Snow White's death; Snow White and huntsman.
3. Panic in the woods; Snow White meets animals; they take her to dwarfs' cottage and help clean house.
4. Dwarfs in mine; match home and find something in their house.
5. Discover Snow White; agree to let her stay.
6. Dwarfs wash up for dinner; scrub Grumpy.
7. Queen turns into a witch.
8. Dwarfs entertain Snow White; she sings for them; dwarfs give her their bedroom.
9. Witch prepares poisoned apple; leaves for cottage.
10. Dwarfs leave for work, after warning Snow White.
11. DROPPED
12. DROPPED
13. Snow White making pies; witch arrives and enters house.
14. Animals warn dwarfs; they return too late; Snow White poisoned; witch falls off cliff.
15. Dwarfs cry at Snow White's bier.
16. Glass coffin; Prince comes; Snow White awakens and goes away with Prince.

Sequential Art

[Comics]

From Frame to Frame [McCloud]

1. Moment to moment
2. Action to action
3. Subject to subject
4. Scene to scene
5. Aspect to aspect
6. Non-sequitur

p. 70-77

Disney Animation

Fundamental Principles

1. Squash and stretch
   - Example of the bouncing ball [p. 19]
2. Anticipation
   - Example of Oswald reaching into his pocket [p. 20]
3. Staging
   - Example of country mouse doing one thing at a time [p. 22]
4. Straight-ahead vs. Post-to-pose
5. Follow through and overlapping action
6. Slow-in and slow-out
7. Arcs
8. Secondary action
9. Timing
10. Exaggeration
11. Solid drawing
12. Appeal

Summary

- Convey motion, action, story, process
- Problems
  - Divided attention
  - Segmentation into actions and events
  - Transient
- Techniques
  - Edit shots into sequences
  - Spatial-temporal montage
  - Sequence of stills very effective

Effective animation? *Slithy*?