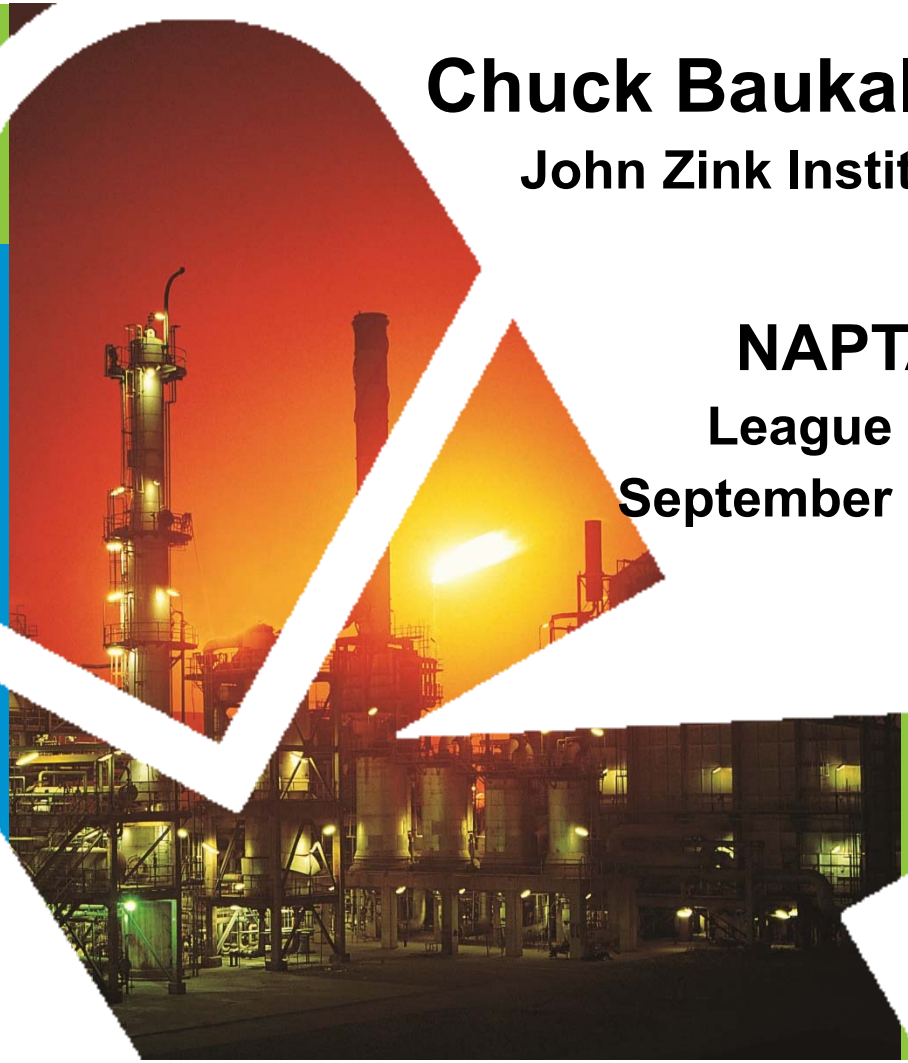
Selecting Multimedia for Presentations



Chuck Baukal, Ph.D., Ed.D.
John Zink Institute (Tulsa, OK)

NAPTA ISC
League City, TX
September 25-27, 2018

Multimedia Categories

- Verbal (e.g., text, narration)
- Static graphics (e.g., photos, drawings)
- Non-interactive dynamic graphics (e.g., videos, animations)
- Interactive dynamic graphics (e.g., virtual reality)

static

dynamic

Assumption: will be presented via computer

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Group Discussion

What kind of multimedia do you currently use in your presentations?

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Small Group Discussion

How do you select what types of multimedia to include in a presentation?

What are some of the key factors you consider?

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Learning Objectives

At the conclusion of this session, the participant should be able to:

- Discuss the importance of prior knowledge
- Discuss key multimedia theories
- Select appropriate multimedia for a presentation

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Outline

- Introduction
- Prior Knowledge
- Multimedia Theories
- Examples
- Conclusions & Recommendations

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Corporate Headquarters

- Headquarters in Tulsa, OK
- 85+ years of reliability and innovation
- Engineered solutions for emissions control
- 1,400+ employees worldwide

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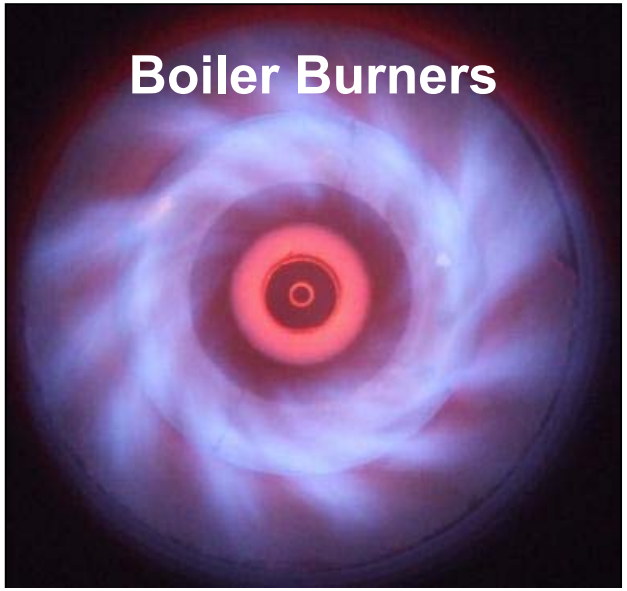
Paid Pyromaniacs

Vapor Combustors



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Knowledge Sharing & Training

Thousands of professionals around the globe attend combustion training at the John Zink Institute, learning about safe and efficient operations of equipment in their plants, with hands-on learning in our test center. *The John Zink Hamworthy Combustion Handbook* is not only the Institute text book, but also the text for some college combustion courses.

Outline

- Introduction
- Prior Knowledge
- Multimedia Theories
- Examples
- Conclusions & Recommendations

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Prior Knowledge (Expertise)

According to Litzinger, Lattuca, Hadgraft, & Newstetter 2011:

- Prior knowledge = critical factor in learning
- Novices & experts differ in:
  - qualitative & quantitative knowledge of a subject
  - how they construct knowledge

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Prior Knowledge Determination

Important step in instructional design (Mayer, 2009):

- Don't want to teach what students already know
- Determine if students have any misconceptions
- Determine where to start content

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Prior Knowledge Principle

Instructional materials should be tailored to the knowledge level of the learners (Naryanan & Hegarty 2002)

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Outline

- Introduction
- Prior Knowledge
- Multimedia Theories
  - Dale's Cone of Experience
  - Mayer's Cognitive Theory of Multimedia
  - Multimedia Cone of Abstraction
- Examples
- Conclusions & Recommendations

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Multimedia

- Definition: “presenting of material using both words and pictures, with the intention of promoting learning”
- Important element in instructional design

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Learning Effectiveness

- Some studies show no difference with or without (e.g., text only) multimedia
- Static media hypothesis: *static* visuals better than *dynamic* visuals
- Dynamic media hypothesis: *dynamic* visuals better than *static* visuals
- Currently no consensus on which is better
- *Learner preferences* should be important as higher interest may motivate learner & increase learning (Renninger, Hidi, & Krapp 1992)

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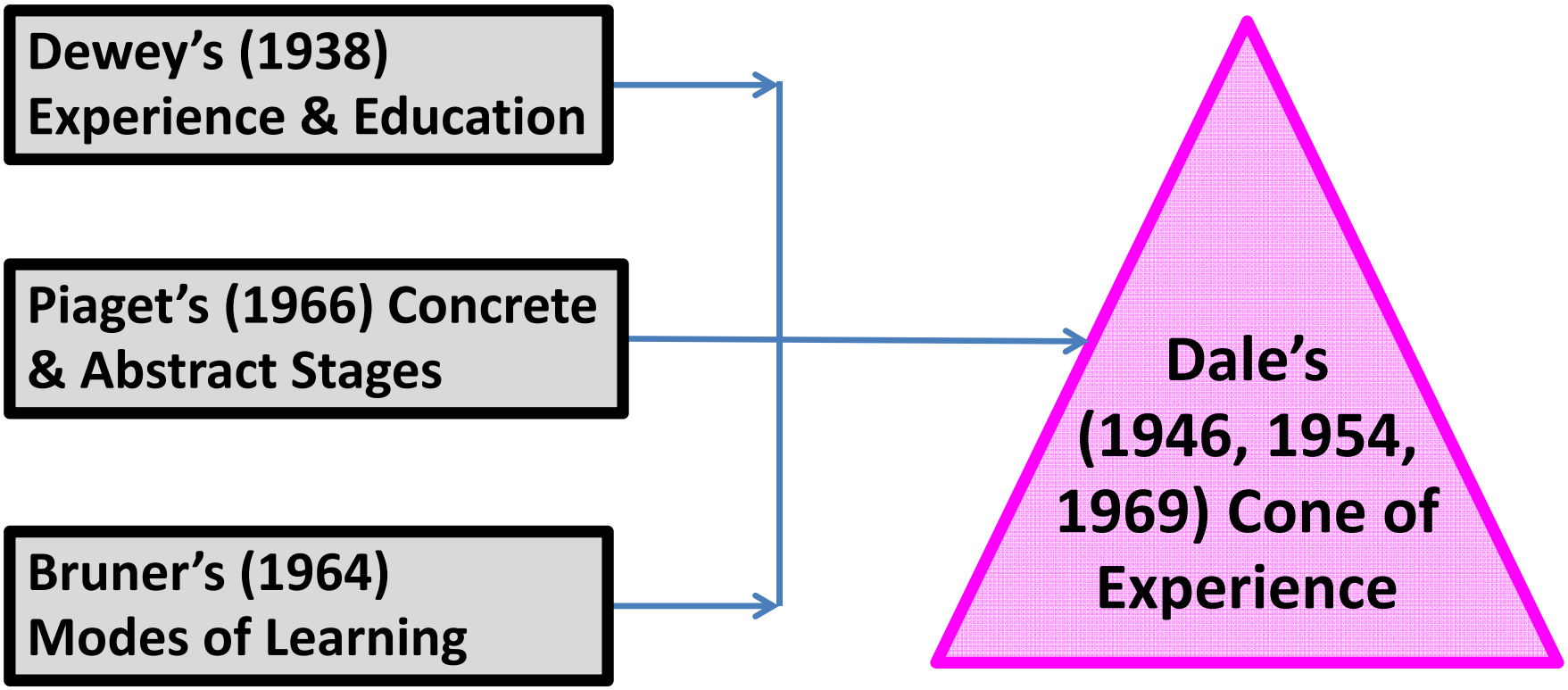
Dale's Conceptual Framework



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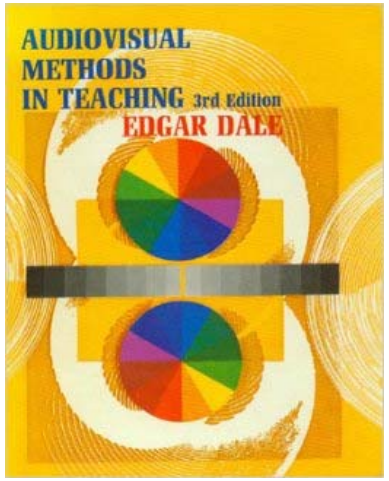
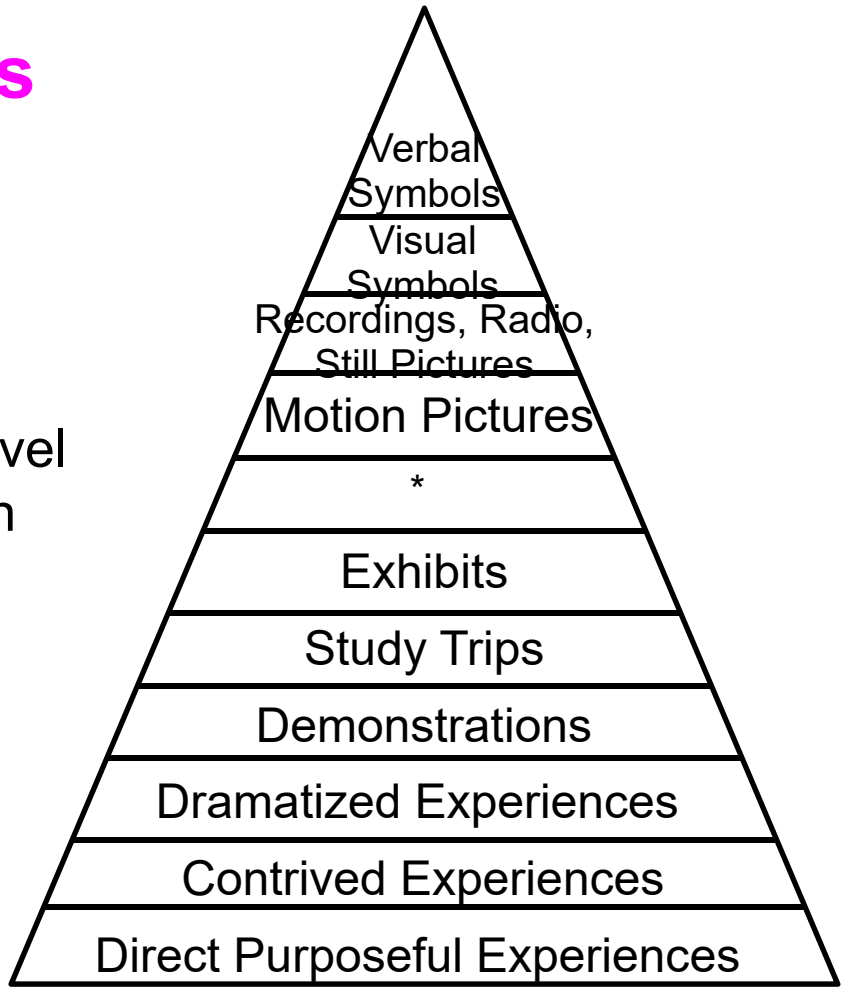
Dale's Cone of Experience
(1946, 1954, 1969)

11 levels



Increasing level of abstraction



- **Originally developed for K-12 teachers**
- **Not intended to rank**

* Not in 1946, "Television" in 1954, & "Educational TV" in 1969

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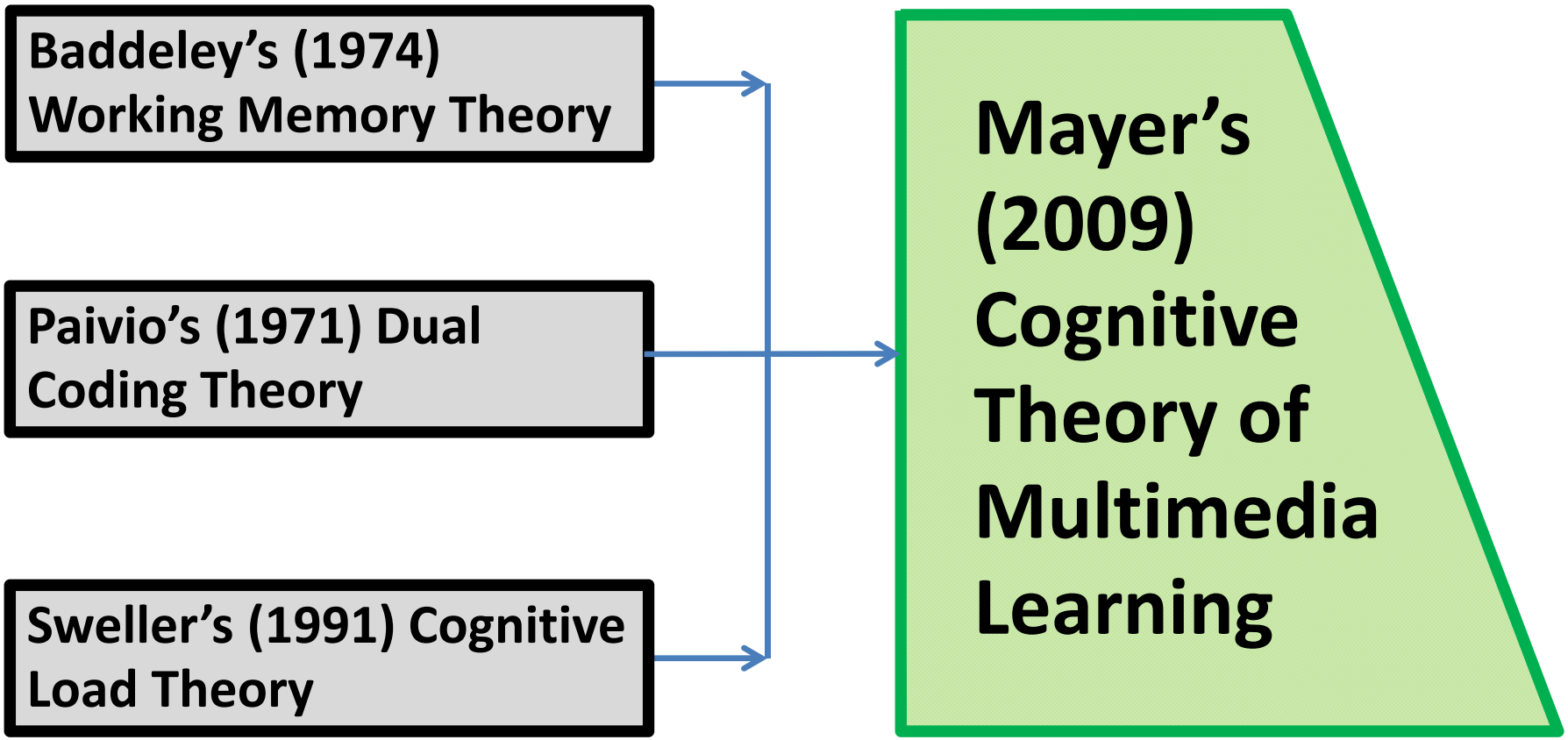
Mayer's Conceptual Framework



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Baddeley's Working Memory Theory

- Humans have a limited capacity to process information in memory channels
- Learning materials should not overload a learner's memory channels or learning will be reduced

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Paivio's Dual Coding Theory

- Text & graphics encoded into 2 different memory channels
  - Verbal
  - Nonverbal
- Verbal & visual information can collaborate to enhance learning, but can also compete & reduce learning if not properly designed

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Sweller's Cognitive Load Theory

- Instructional materials should not overload a learner's mental processing
- Example: comparing figures on 2 different slides increases mental integration required by learner which increases cognitive load that could reduce learning

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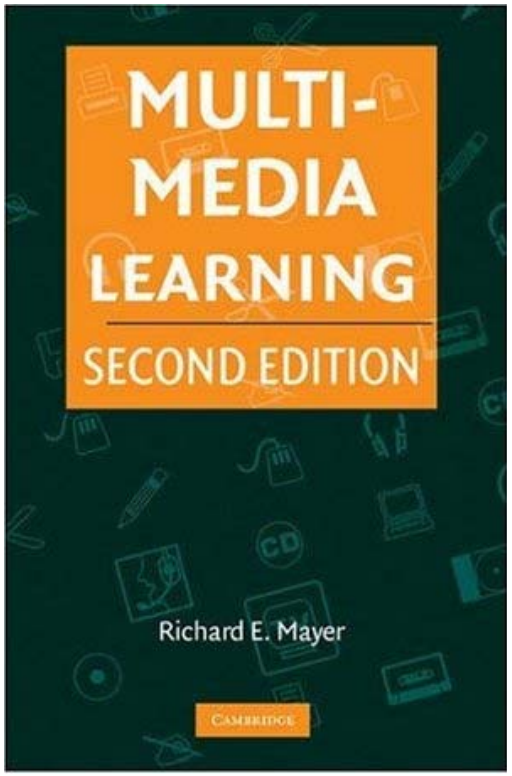
Mayer's Cognitive Theory of Multimedia Learning

1. **Coherence:** exclude extraneous words, pictures, and sounds
2. **Signaling:** use cues to highlight the organization of the essential material
3. **Redundancy:** use graphics + narration, rather than graphics + narration + text that repeats the narration
4. **Spatial Contiguity:** corresponding words & pictures should be located close to each other
5. **Temporal Contiguity:** corresponding words & pictures should be presented simultaneously rather than successively
6. **Segmenting:** presentations should be divided into segments rather than in long continuous units
7. **Pre-training:** present the names and characteristics of the main concepts before the actual multimedia presentation
8. **Modality:** graphics + narration are better than graphics + text
9. **Multimedia:** text + pictures are better than text only
10. **Personalization:** text should be in conversational, rather than formal, style
11. **Voice:** narration should be in a friendly, standard accent, human voice rather than in a foreign accent or machine voice
12. **Image:** including a picture of the speaker on the screen does not necessarily improve learning



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Mayer's Cognitive Theory of Multimedia Learning

1. Coherence Principle: exclude extraneous words, pictures, and sounds
2. Signaling Principle: use cues to highlight the organization of the essential material
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Mayer's Cognitive Theory of Multimedia Learning

7. Pre-training Principle: present the names and characteristics of the main concepts before the actual multimedia presentation
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12. Image Principle: including a picture of the speaker on the screen does not necessarily improve learning

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Multimedia Cone of Abstraction Conceptual Framework

Dewey's (1938) Experience & Education

Piaget's (1966) Concrete & Abstract Stages

Bruner's (1964) Modes of Learning

Dale's (1946, 1954, 1969) Cone of Experience

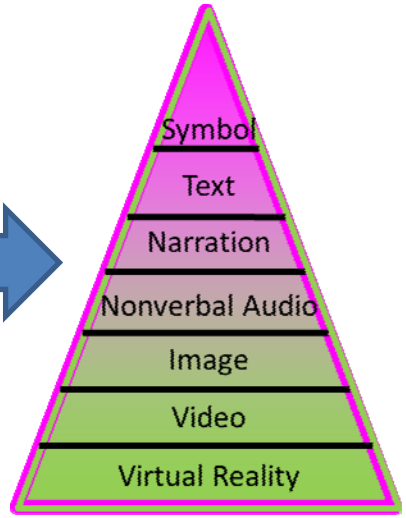
Baddeley's (1974) Working Memory Theory

Paivio's (1971) Dual Coding Theory

Sweller's (1991) Cognitive Load Theory

Mayer's (2009) Cognitive Theory of Multimedia Learning

Multimedia Cone of Abstraction



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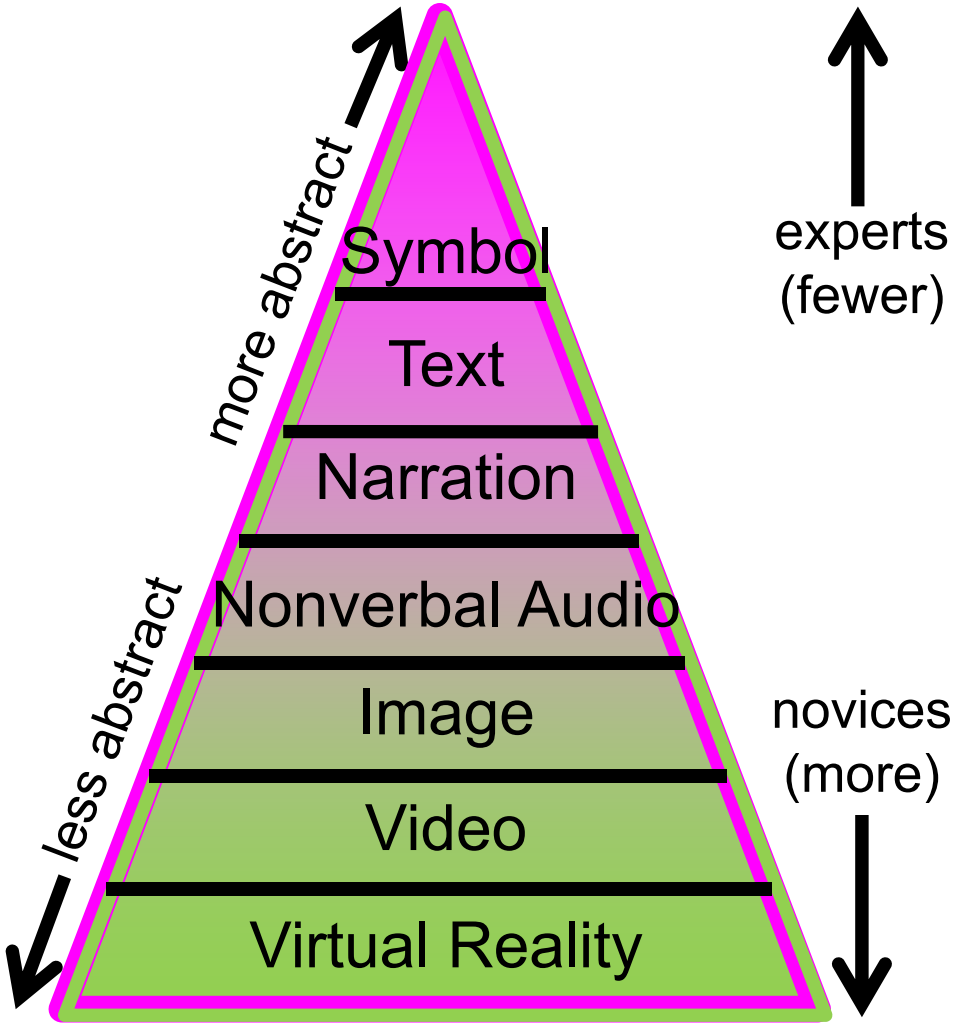
Multimedia Cone of Abstraction

7 levels



More prior knowledge

Less prior knowledge

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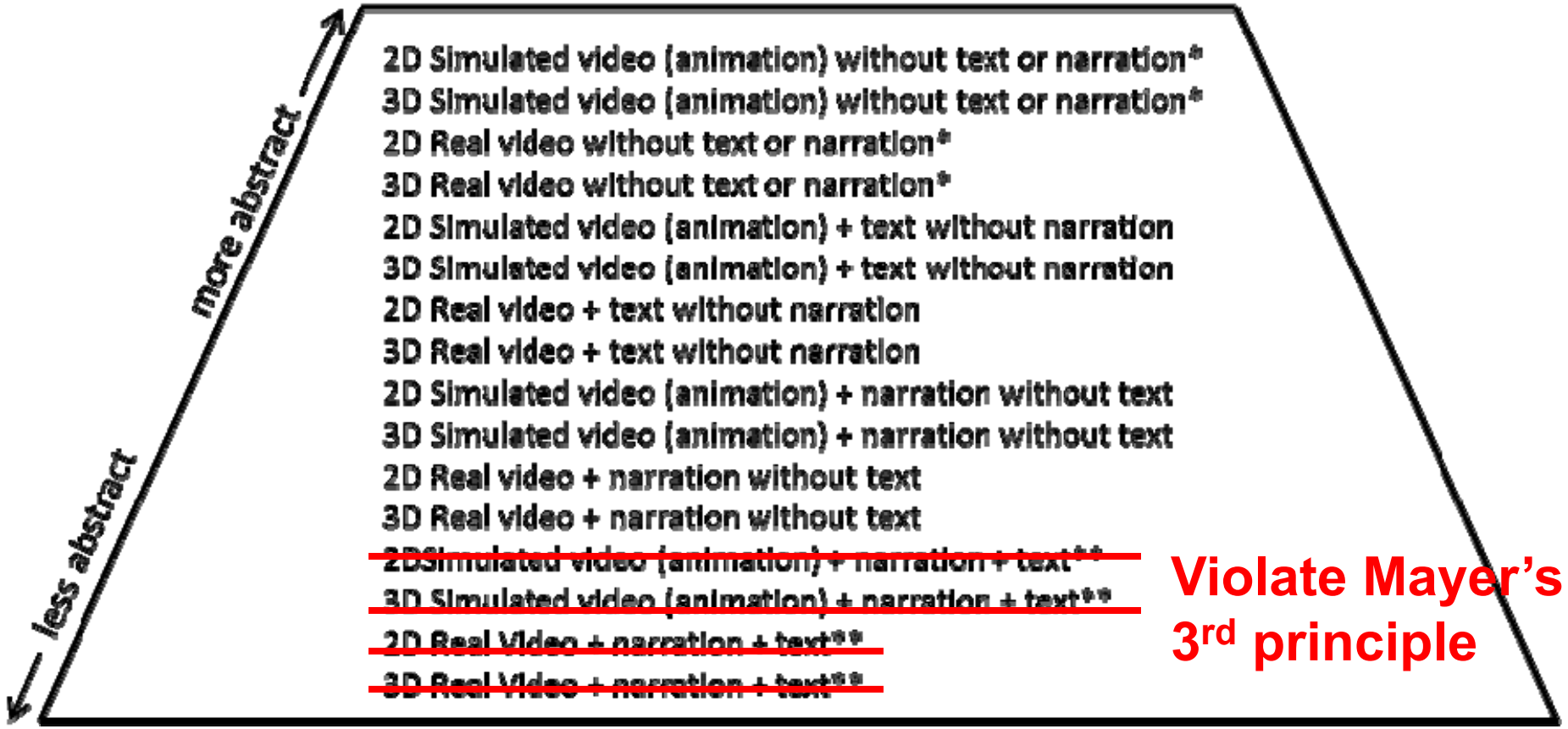
Multimedia Cone of Abstraction – Many Possible Sublevels

Video Level



Violate Mayer's 3rd principle

* Less effective because does not take advantages of both memory channels.

** Less effective if text is extensive or duplicates narration because of cognitive overload.

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Outline

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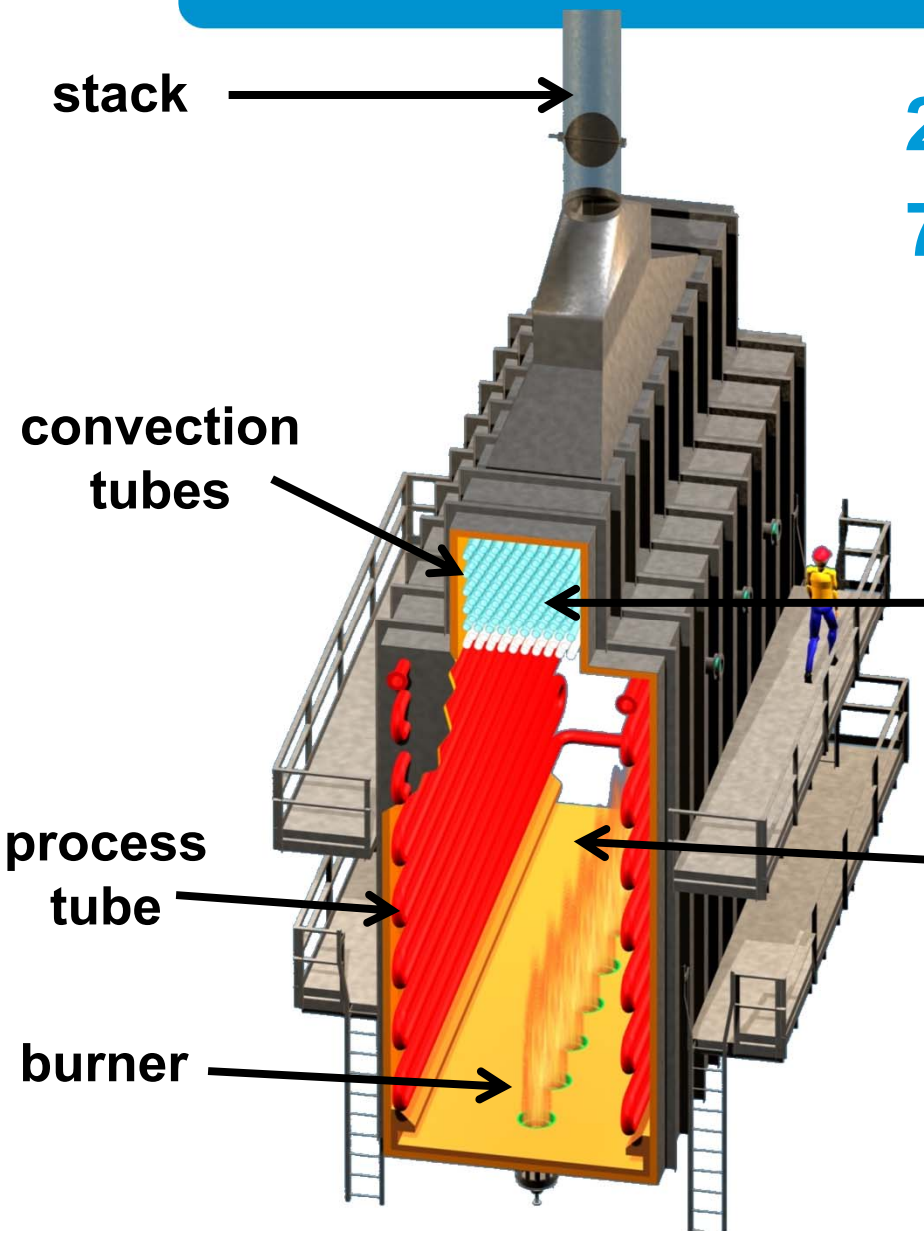
Typical Process Heater



2. Signaling
7. Pre-training

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Cabin Heater Animation

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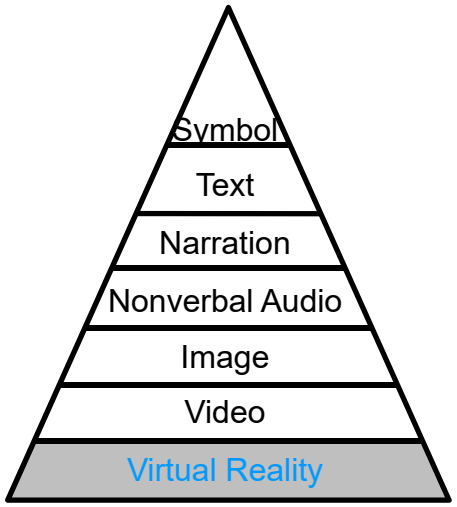
Simulated Virtual Reality



(run Quicktime “video” COOLstar ARIA Simulated VR)

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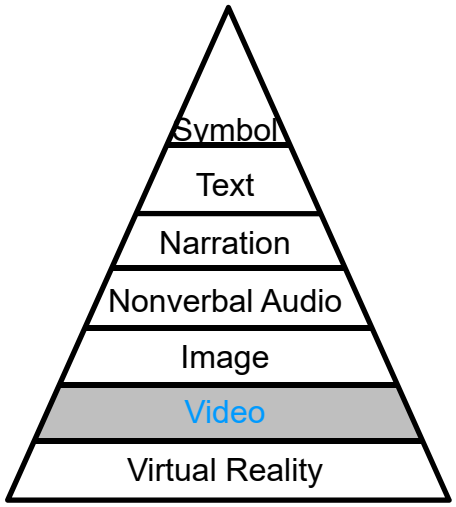
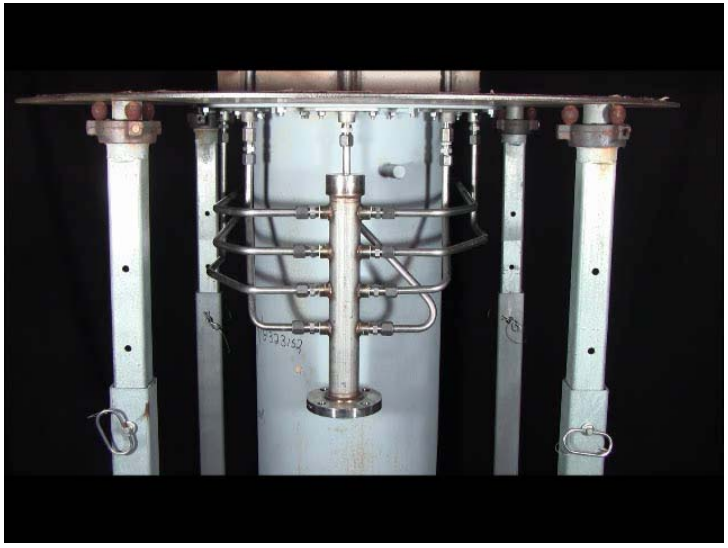
Real Video (no audio)



Upper part of burner



Lower part of burner

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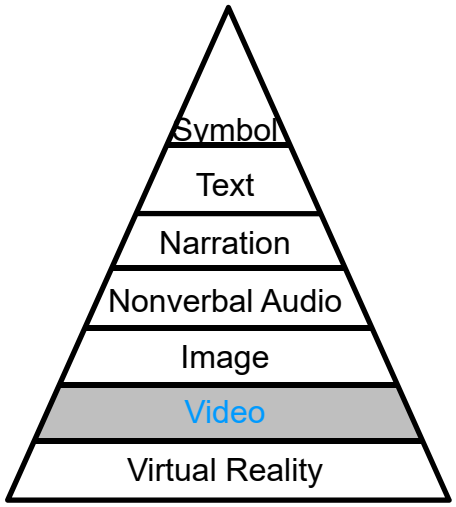
Real Video + Audio



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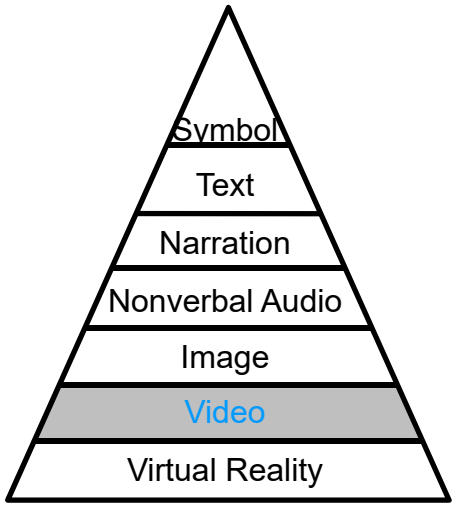
Real Video + Narration



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Comparison of Real Videos

Round Burners
Firing up Wall

Rectangular Burners
Firing up Wall

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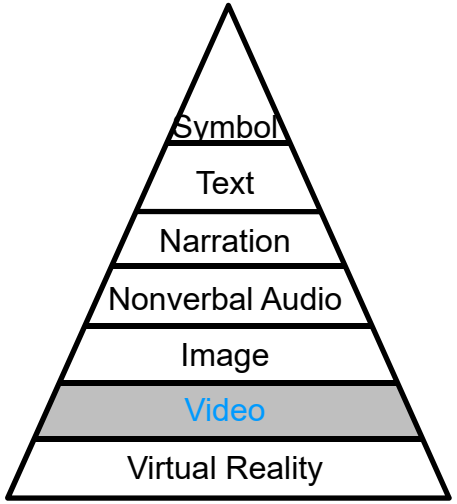
Simulated Video (animation)



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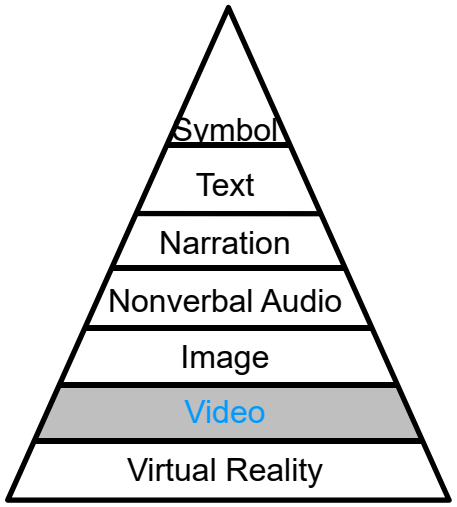
Simulated Video (animation) + Labels + Coloring



Process Burner

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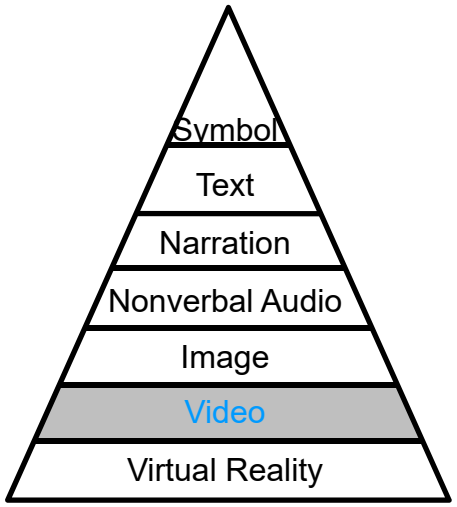
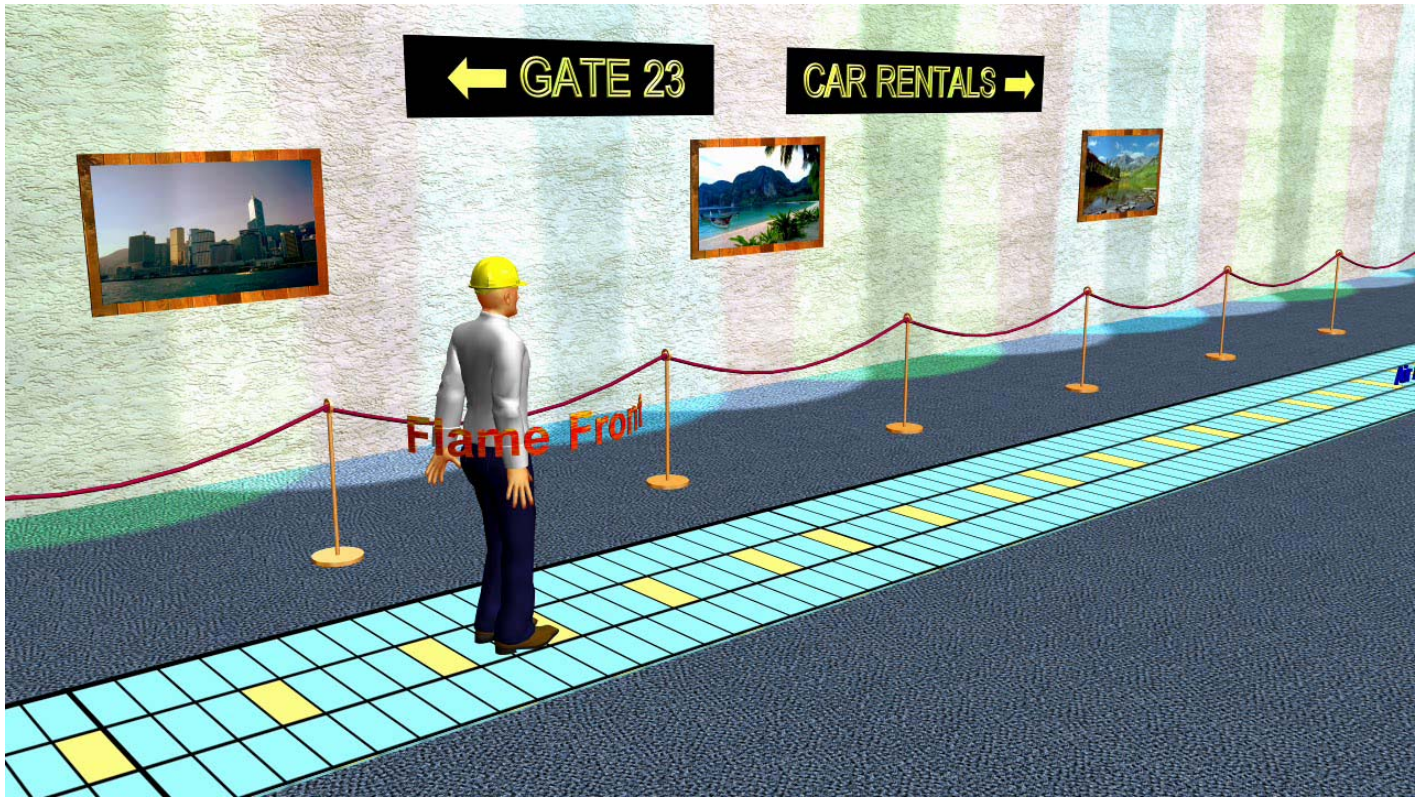
Animation + Text



Flashback & Liftoff



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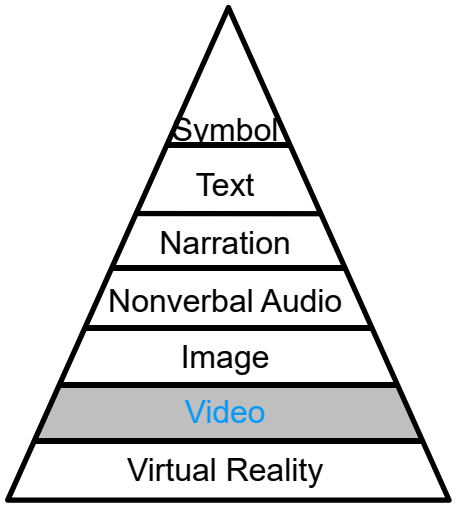
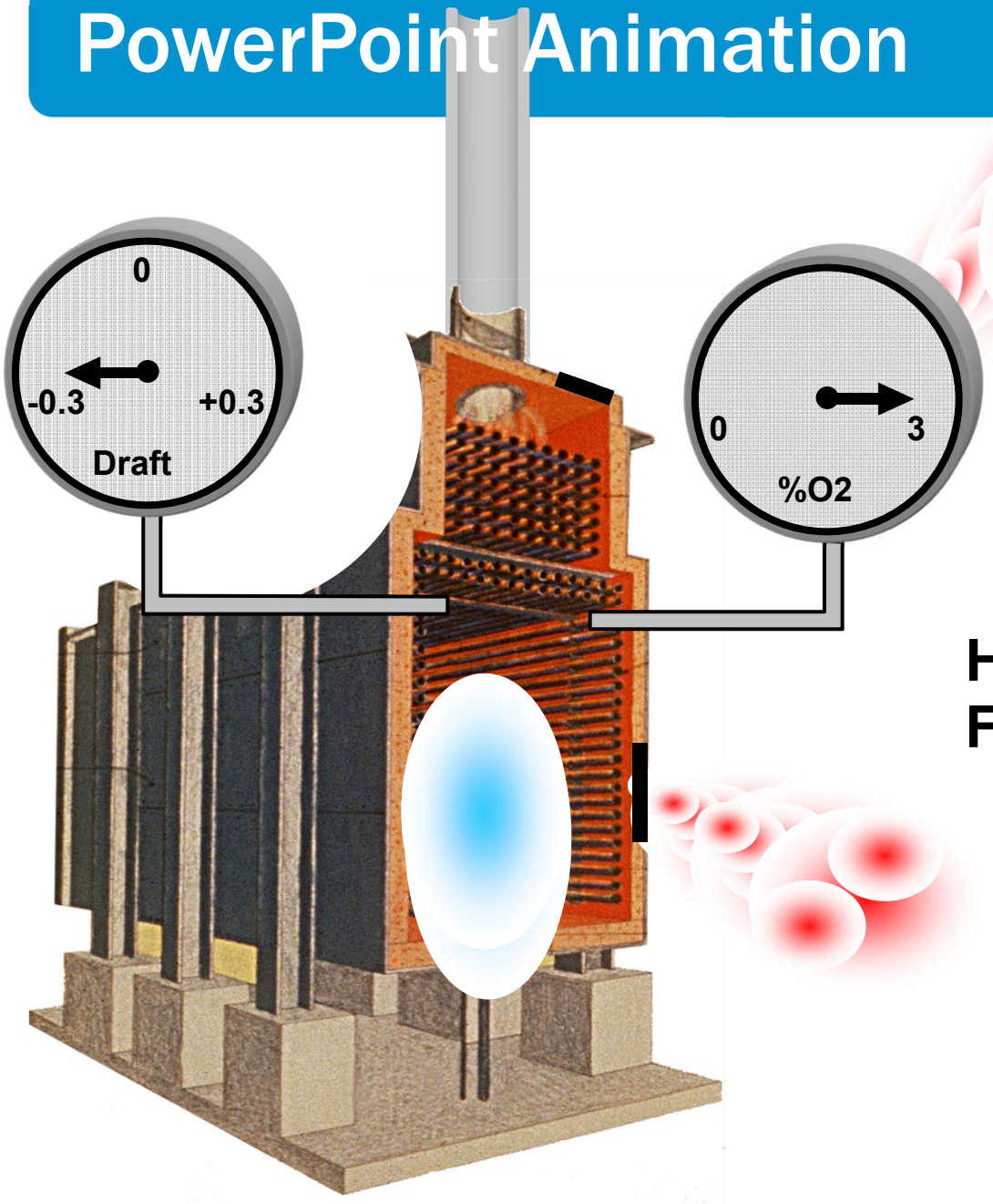
PowerPoint Animation





Huffing Furnace

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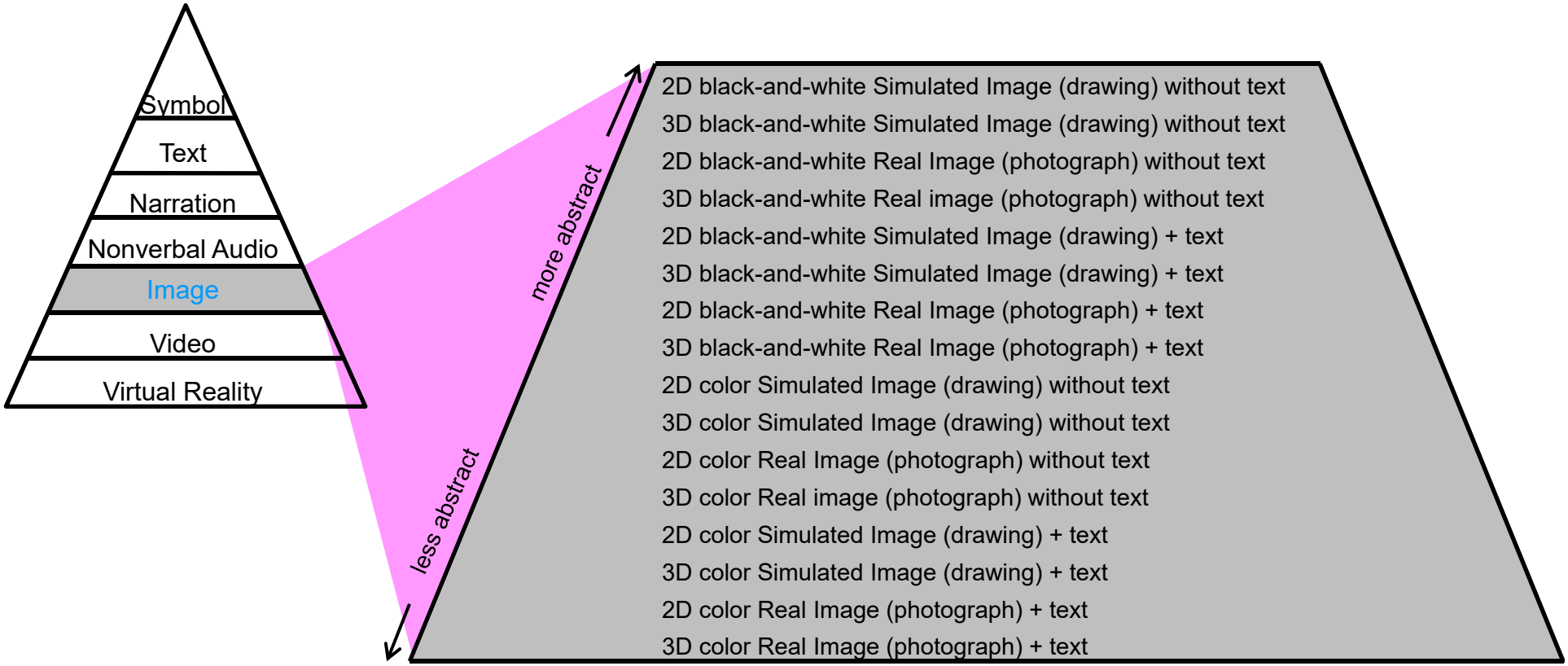
Expanded Image Level



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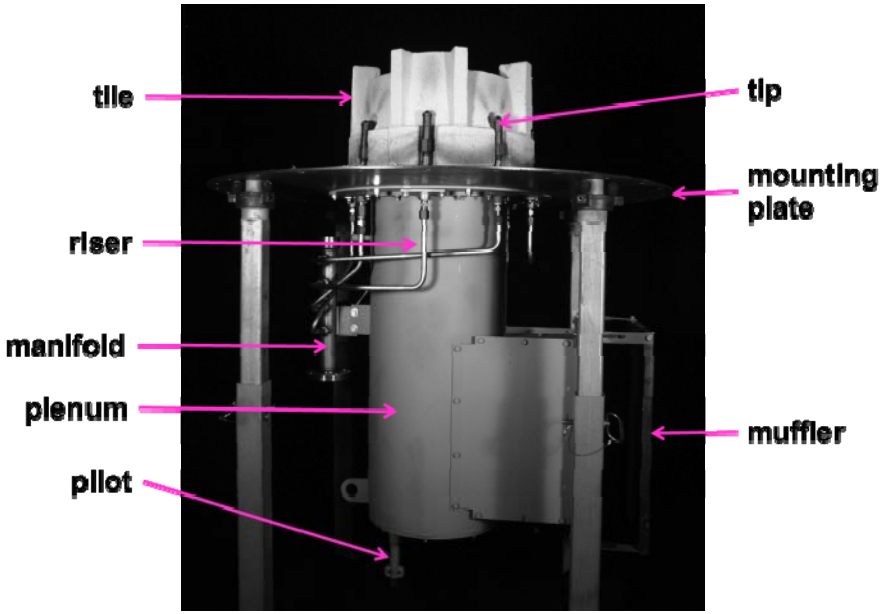
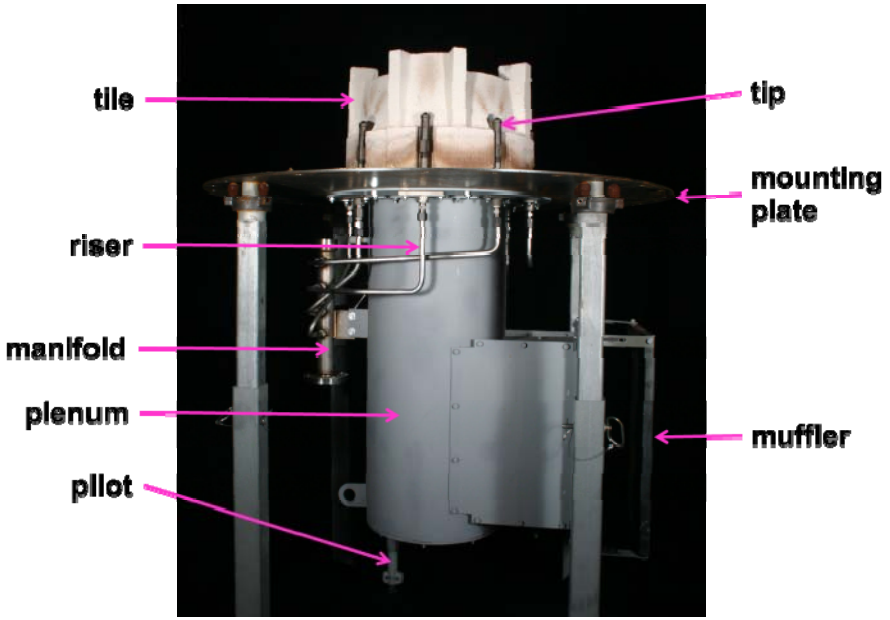
Real Images (photos + labels)



Black-and-white



Color

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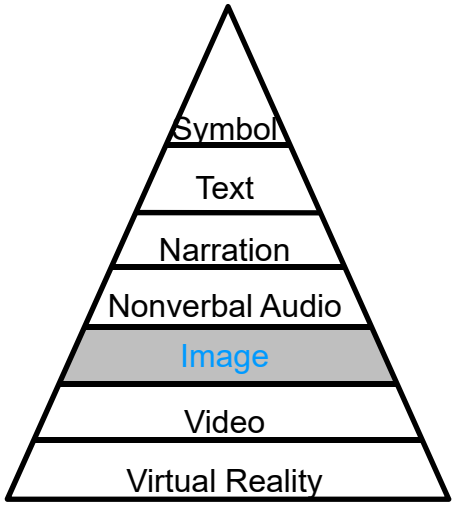
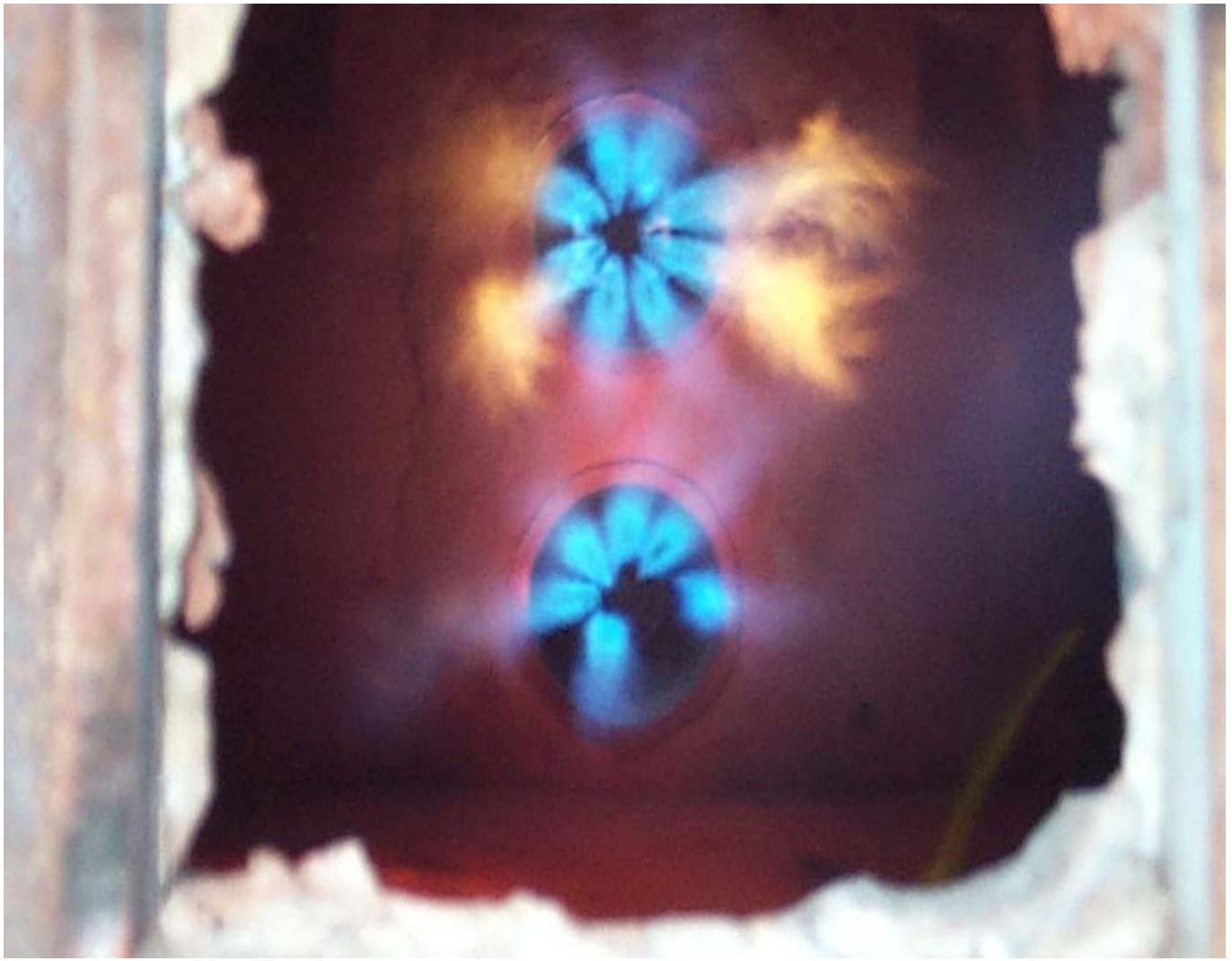
Real Image





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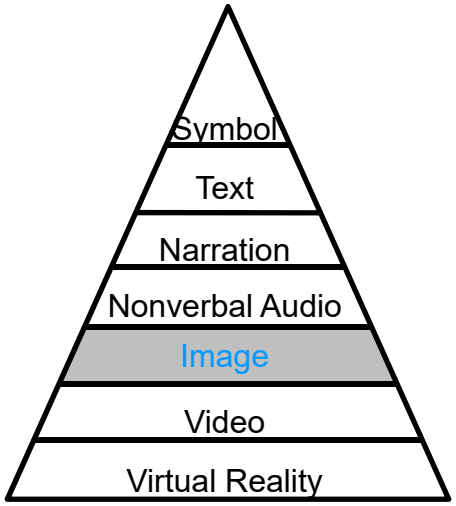

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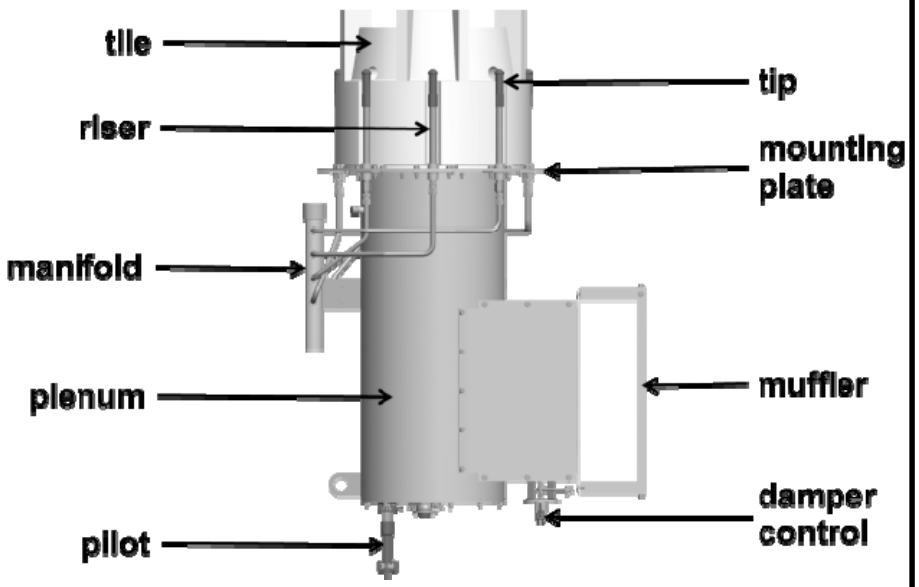
Simulated Images (2D Drawings + labels)



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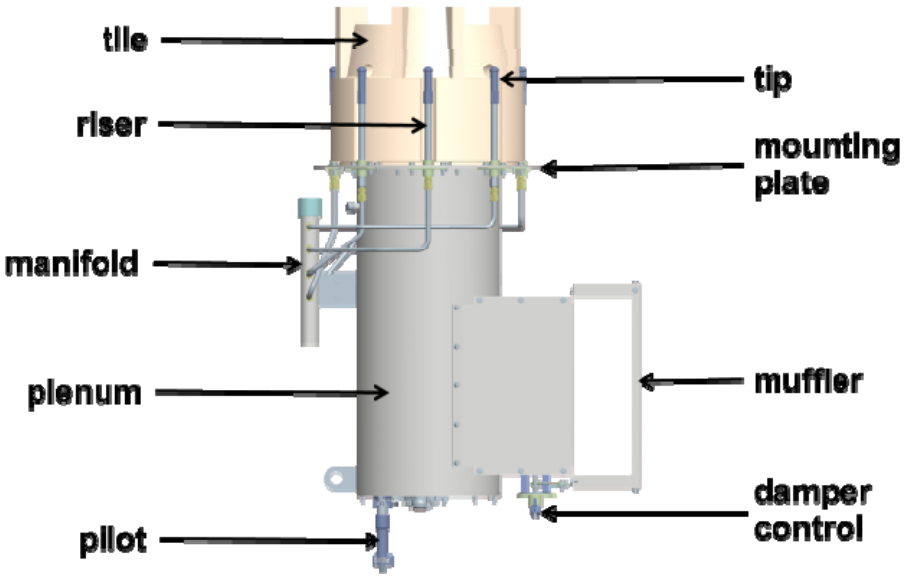

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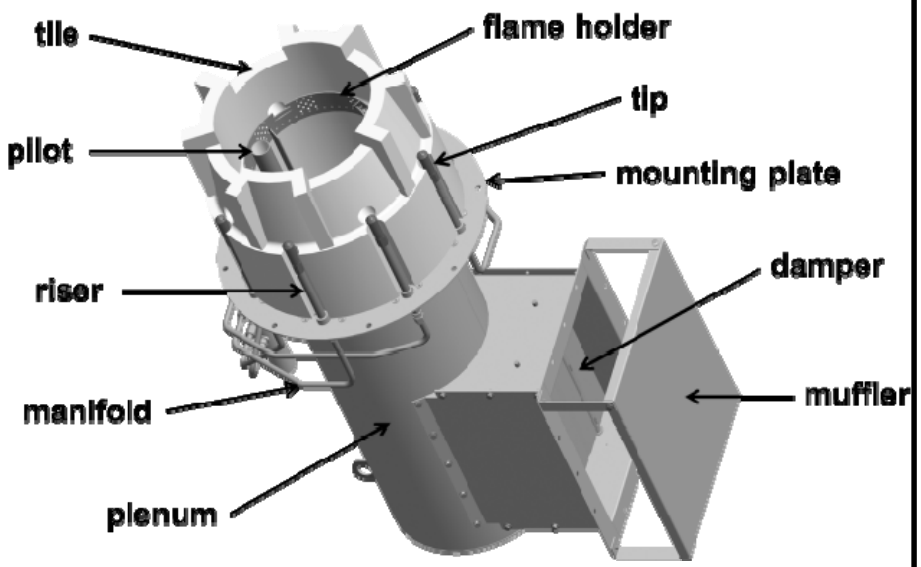
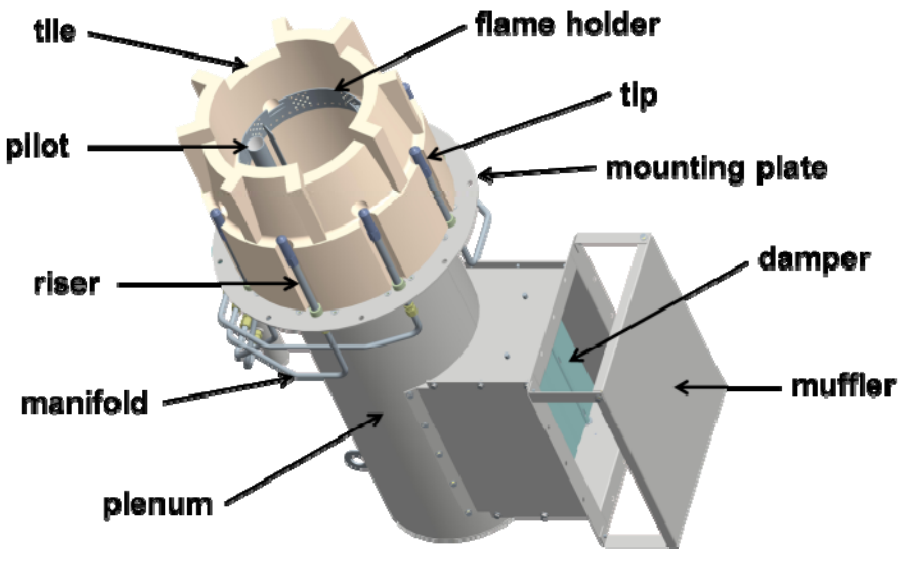


Black-and-white



Color

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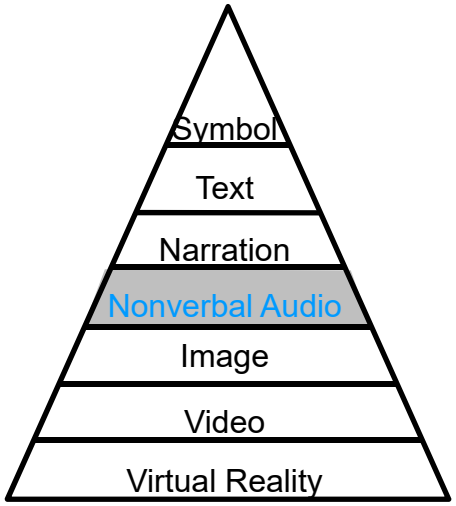
Video + Non-Verbal Audio



Process Burner Flashing Back

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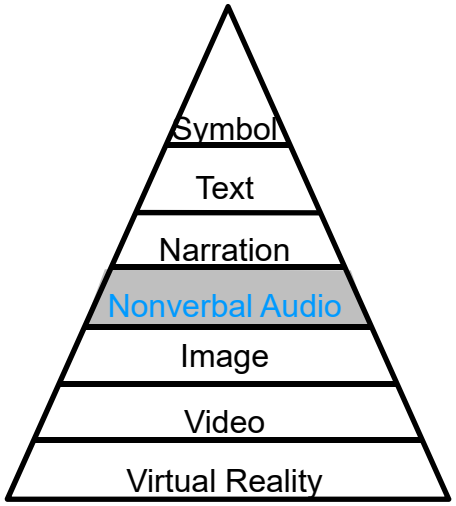
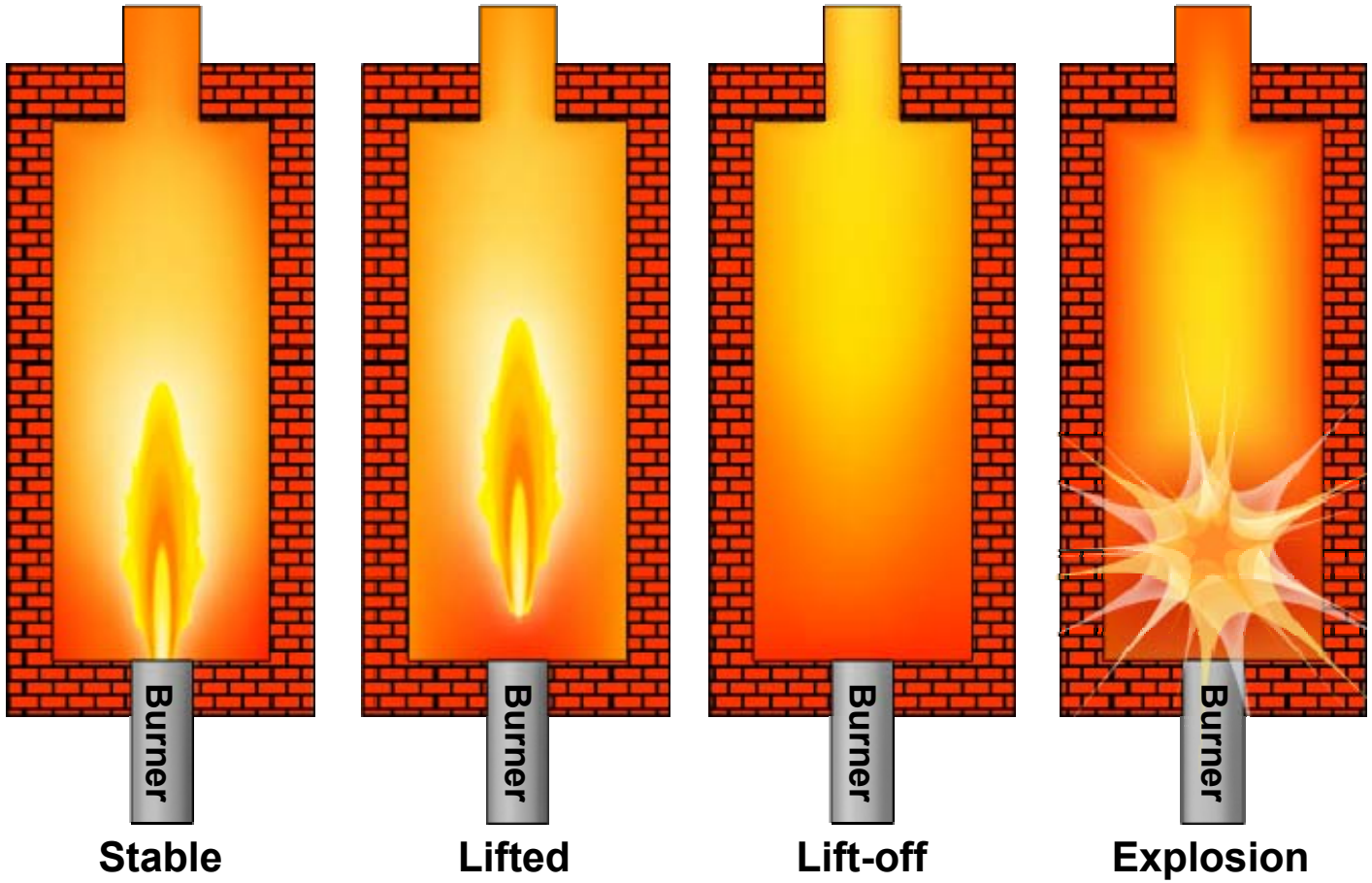
Simulated Image + Non-Verbal Audio





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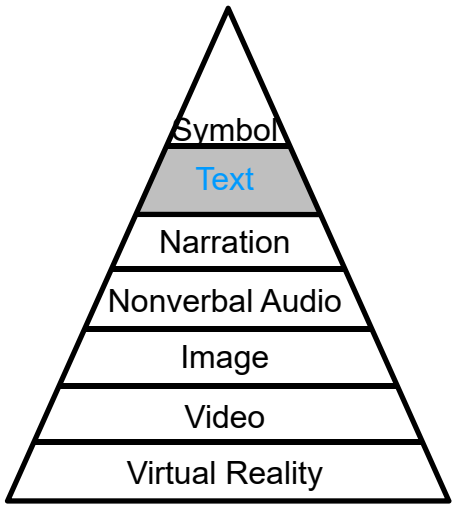
Text (label + description)



- tile — ceramic part which shapes flame
- pilot — small premix burner to ignite main flame
- riser — tube connecting manifold to tip
- manifold — distributes incoming fuel to tips
- plenum — delivers uniform air flow to outlet
- muffler — reduces noise
- damper — adjusts incoming air flow
- mounting plate — used to attach burner to heater
- tip — injects fuel into flame zones
- flame holder — anchors and stabilizes flame

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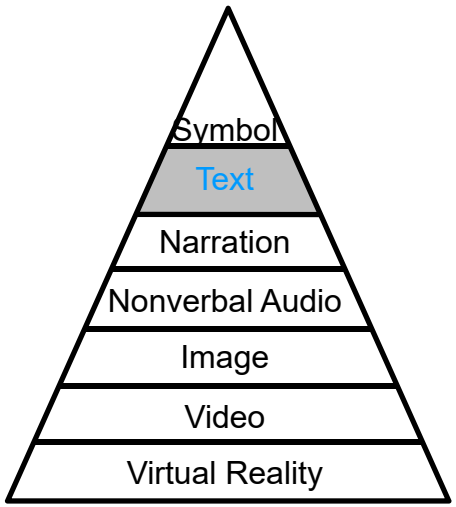
Text (labels)



- tile
- pilot
- riser
- manifold
- plenum
- muffler
- damper
- mounting plate
- tip
- flame holder

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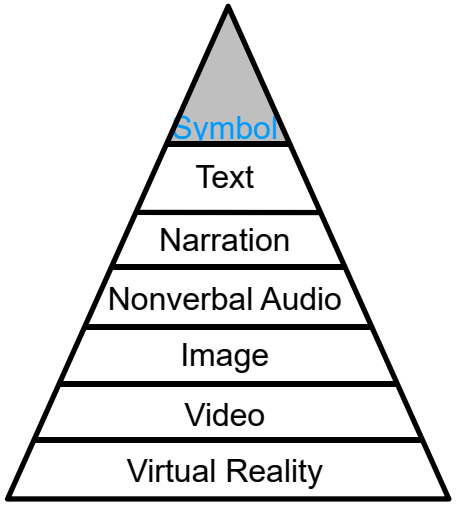
Symbol (Nonverbal)



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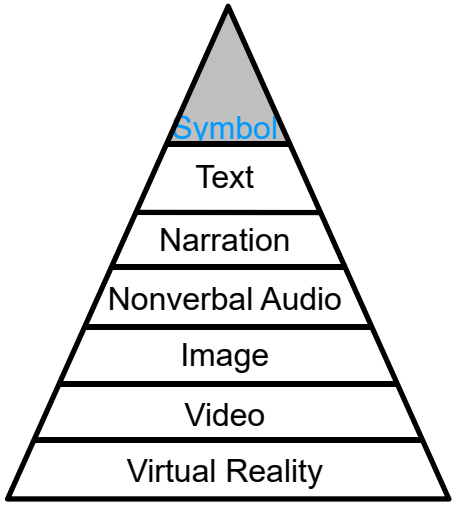
Symbol (Verbal)



FGR = furnace gas recirculation

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Practice Example

Scenario: training on 3D metal printing

	Senior engineering students	Experienced practicing engineers
Company's products	Low knowledge	High knowledge
Metal fabrication	Low knowledge	High knowledge
3D plastic printing	High knowledge	Low knowledge
CAD software	High knowledge	Low knowledge

What multimedia should be used for this training?

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Conclusions

- Multimedia may or may not enhance learning
- No consensus on static vs. dynamic multimedia
- Different levels of abstraction
- No superior type of multimedia
- Many types of multimedia can be inexpensively & made fairly quickly

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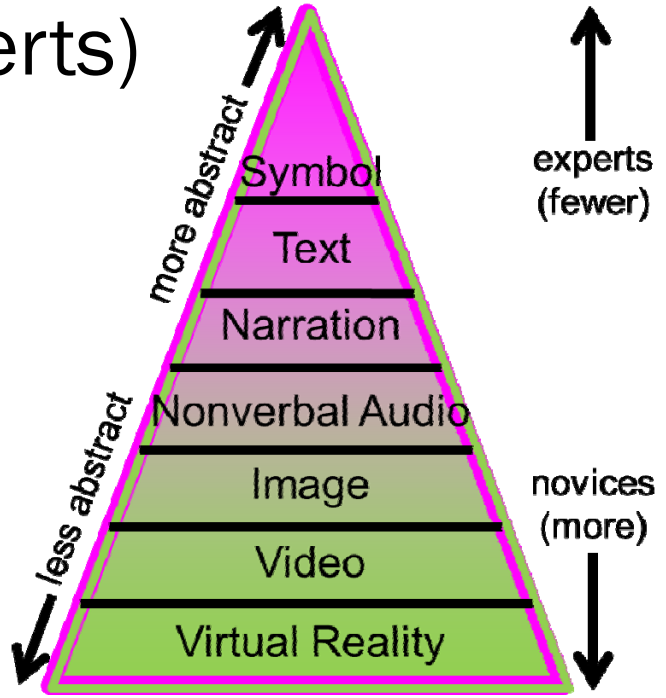
Recommendations

- Use more concrete multimedia for low prior knowledge learners (novices)
- Use more abstract multimedia for high prior knowledge learners (experts)



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Recommendations

- Time and cost to develop various types of multimedia need to be considered
- Use variety as some learners are more verbal and others are more visual
- Choose the level of abstraction based on content & learners' experience levels
- Use multiple representations to help learners better understand a topic

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Summary

- Introduction
- Prior Knowledge
- Multimedia Theories
- Examples
- Conclusions & Recommendations

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Learning Objectives

At the conclusion of this session, the participant should be able to:

- Discuss the importance of prior knowledge
- Discuss multimedia theories
- Select appropriate multimedia for a presentation

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Thank You