

CSCI 1377

Tools for Thought

Multimedia II

Communicating in Time

“Before there were presentations, there were conversations, which were a little like presentations but used fewer bullet points, and no one had to dim the lights.”

— Ian Parker, “Absolute PowerPoint” (2001)

Upcoming schedule

- Thu 3/5 → Thu 3/12: Multimedia assignment
- Fri 3/13 → Tue 3/17: Midterm prep
- Thu 3/19 → Thu 4/9: Notation + Programming assignment
- Tue 3/31 → Tue 4/7: Final project proposal
- Wed 4/8 → Tue 5/5: Final project!

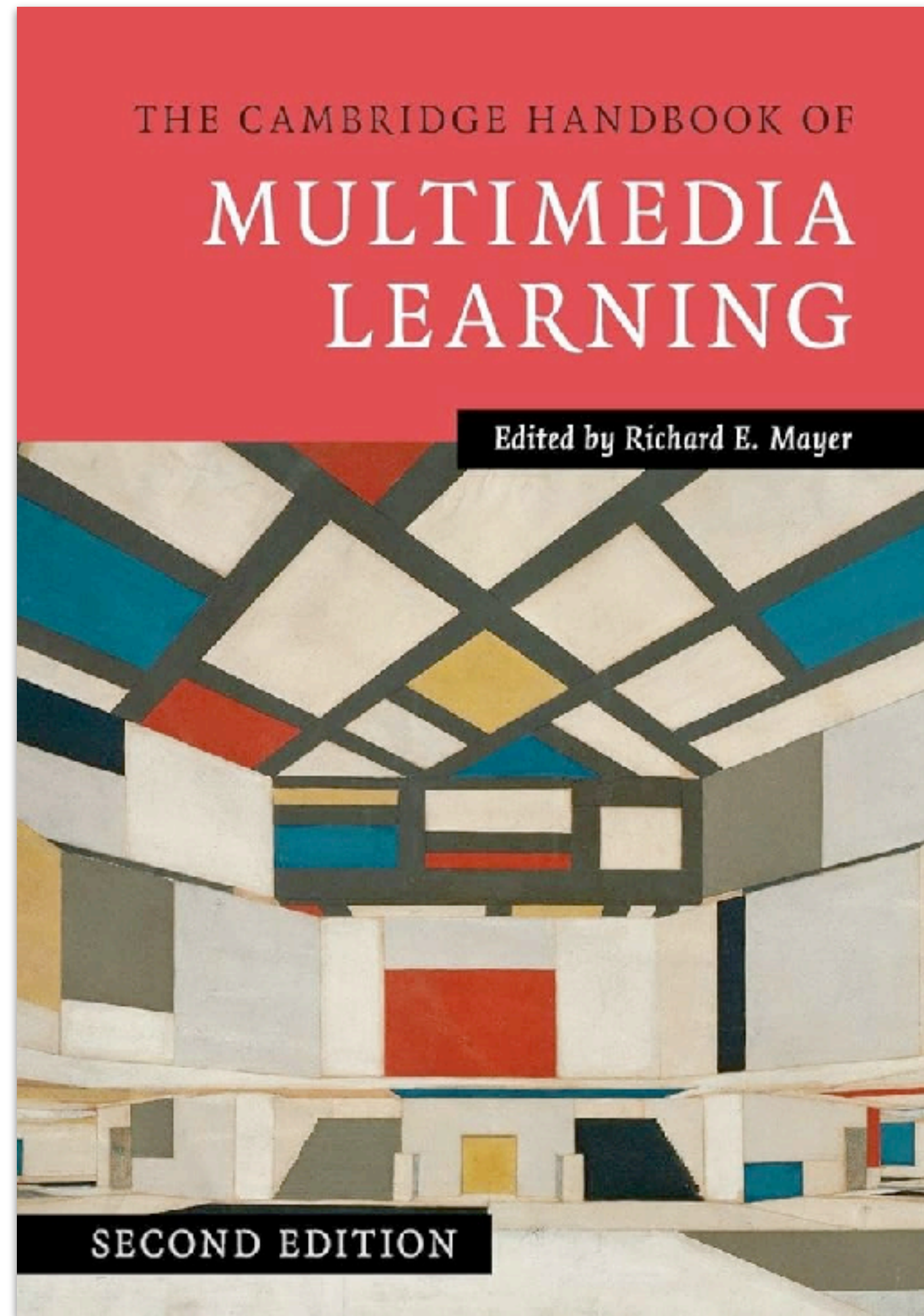
Key aspects of time-based media

animations, talks/podcasts, slideshows, videos

- **Paced:** author dictates when the audience encounters info
- **Ephemeral:** information disappears after a short time
 - Sound disappears instantly, images disappear depending on pace
- **Multisensory:** simultaneously perceive audio and visuals
 - Slideshows and videos, while noiseless animations and talks are monosensory
 - Perceive != understand, of course

Mayer's multimedia principles

Richard Mayer is the leading authority on the cognitive aspects of multimedia explanations



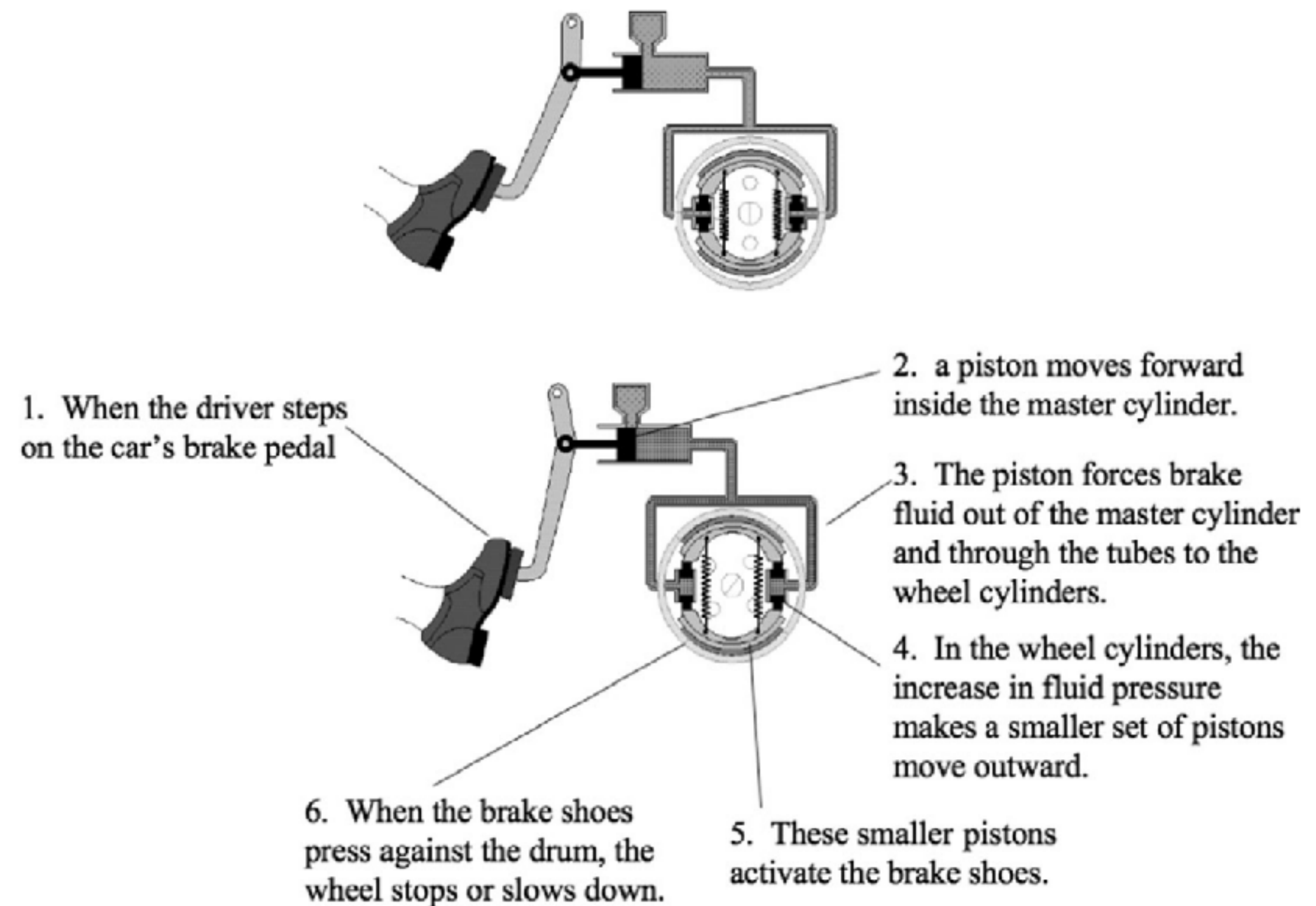
Richard Mayer

Multimedia principle: People learn better from words and pictures than from words alone

Text only

When the driver steps on the car's brake pedal, a piston moves forward in the master cylinder. The piston forces brake fluid out of the master cylinder, and through the tubes, to the wheel cylinders. In the wheel cylinders, the increase in fluid pressure makes a smaller set of pistons move. When the brake shoes press against the drum, both the drum and wheel cylinder stop or slow down.

Text + images



Multimedia principle: People learn better from words and pictures than from words alone

Retention tests

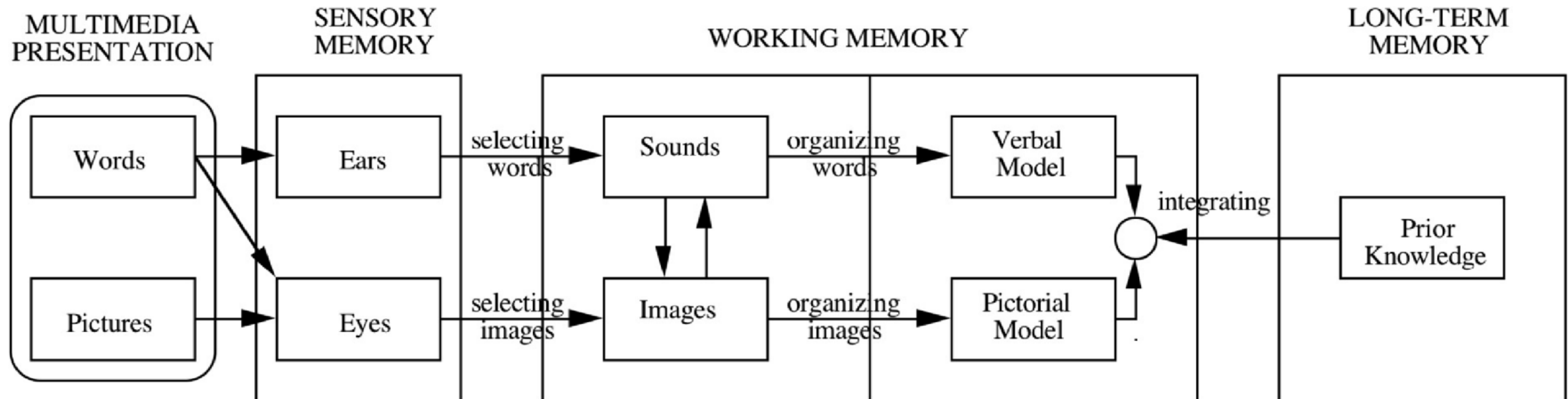
“What happens when the driver steps on the car’s brake pedal?”

“in 13 out of 13 tests, learners who received text and illustrations or narration and animation performed better on transfer tests than did learners who received text alone or narration alone (single representation group), with a median effect size is $d = 1.35$ ”

Transfer tests

“Suppose you press on the brake pedal in your car but the brakes do not work. What could have gone wrong?”

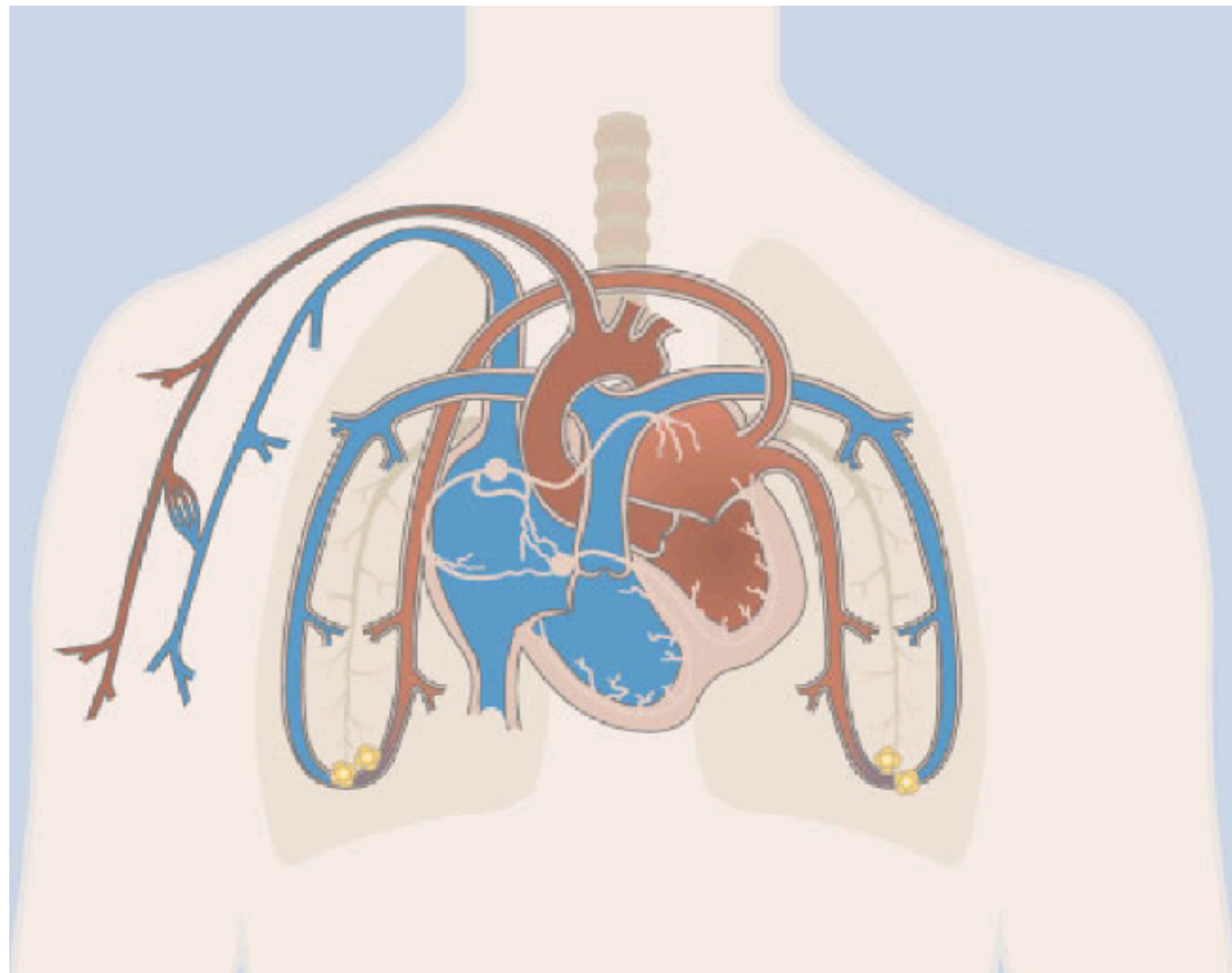
Mayer grounds the multimedia principle in a dual-channel model of working memory



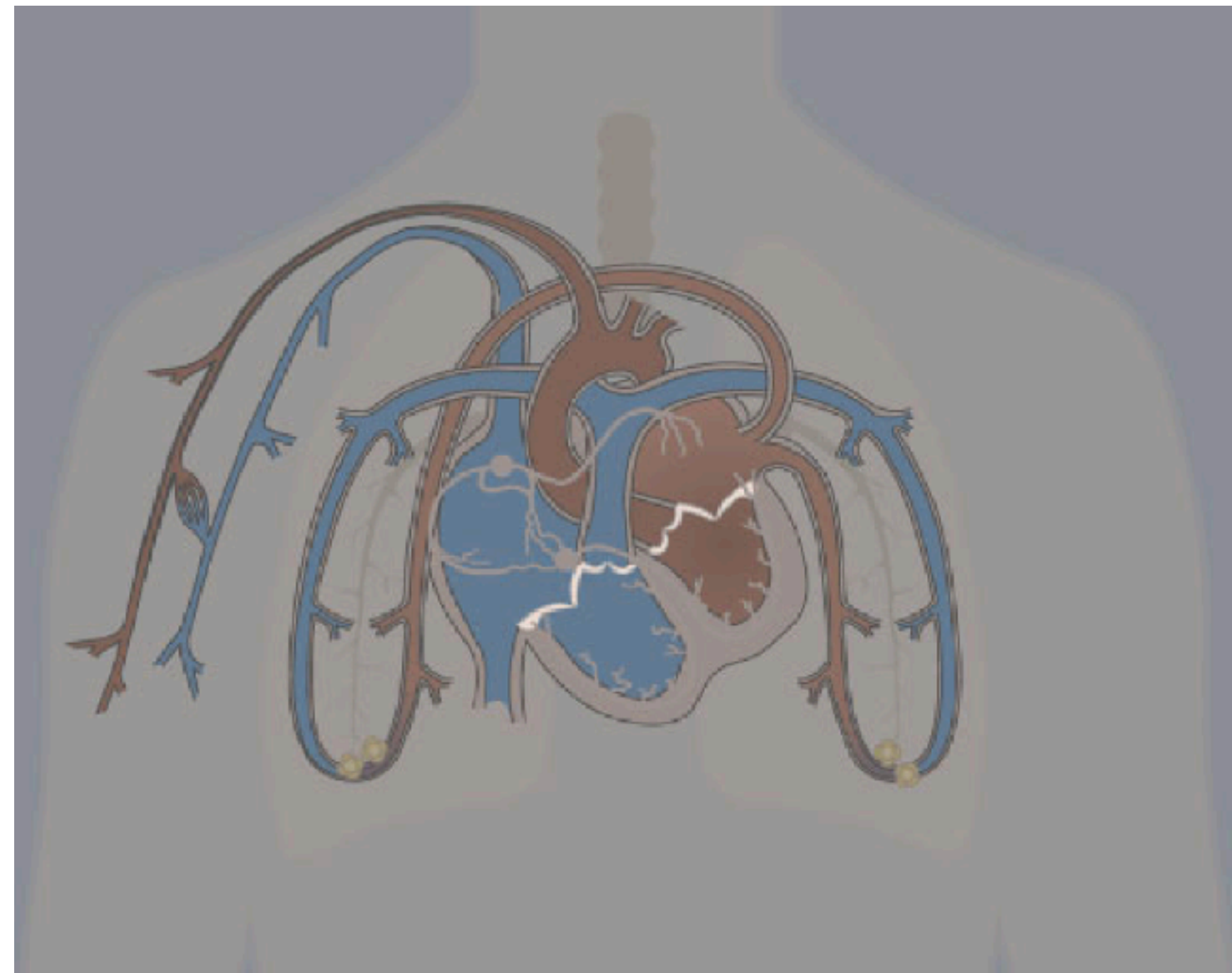
“The multimedia presentation allows learners to hold corresponding verbal and pictorial representations in working memory at the same time, thus increasing the chances that learners will be able to build mental connections between them.”

Signaling principle: people learn better when cues are added to highlight the organization of the essential information

Without cue



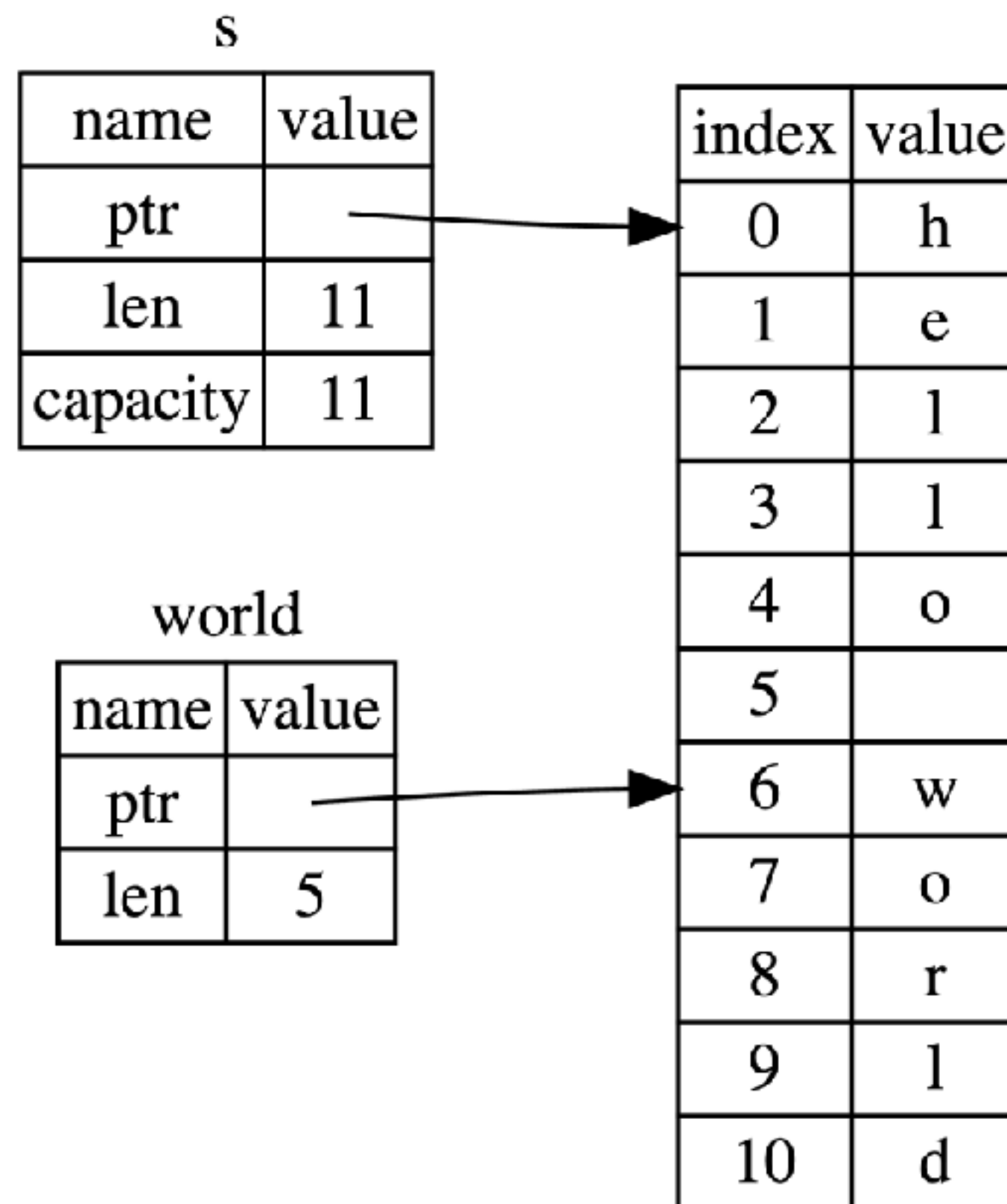
With cue



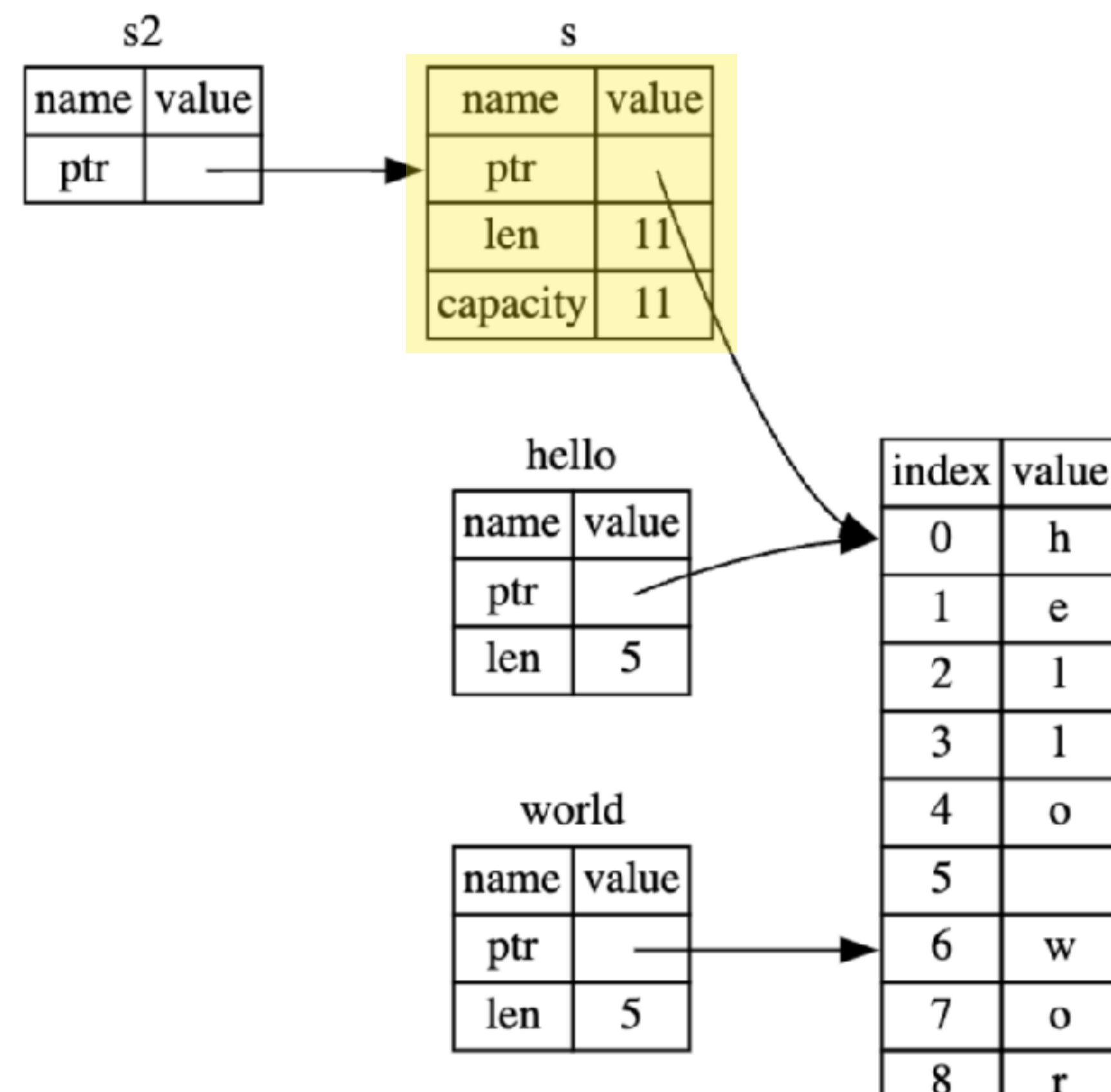
Improved example should avoid misconception

```
let s = String::from("hello world");  
+ let s2: &String = &s;  
let hello = &s[0..5];  
let world = &s[6..11];
```

Before



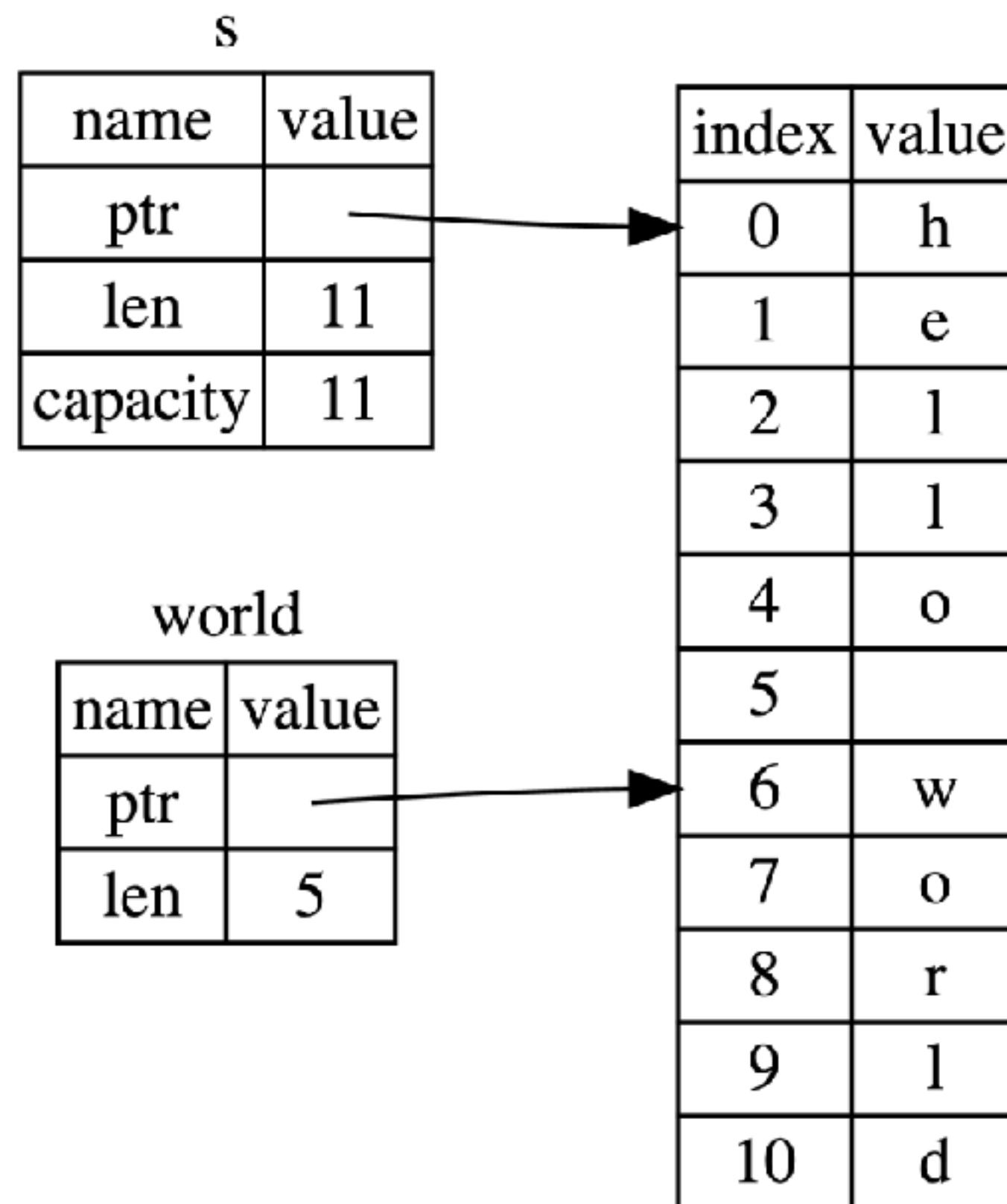
After



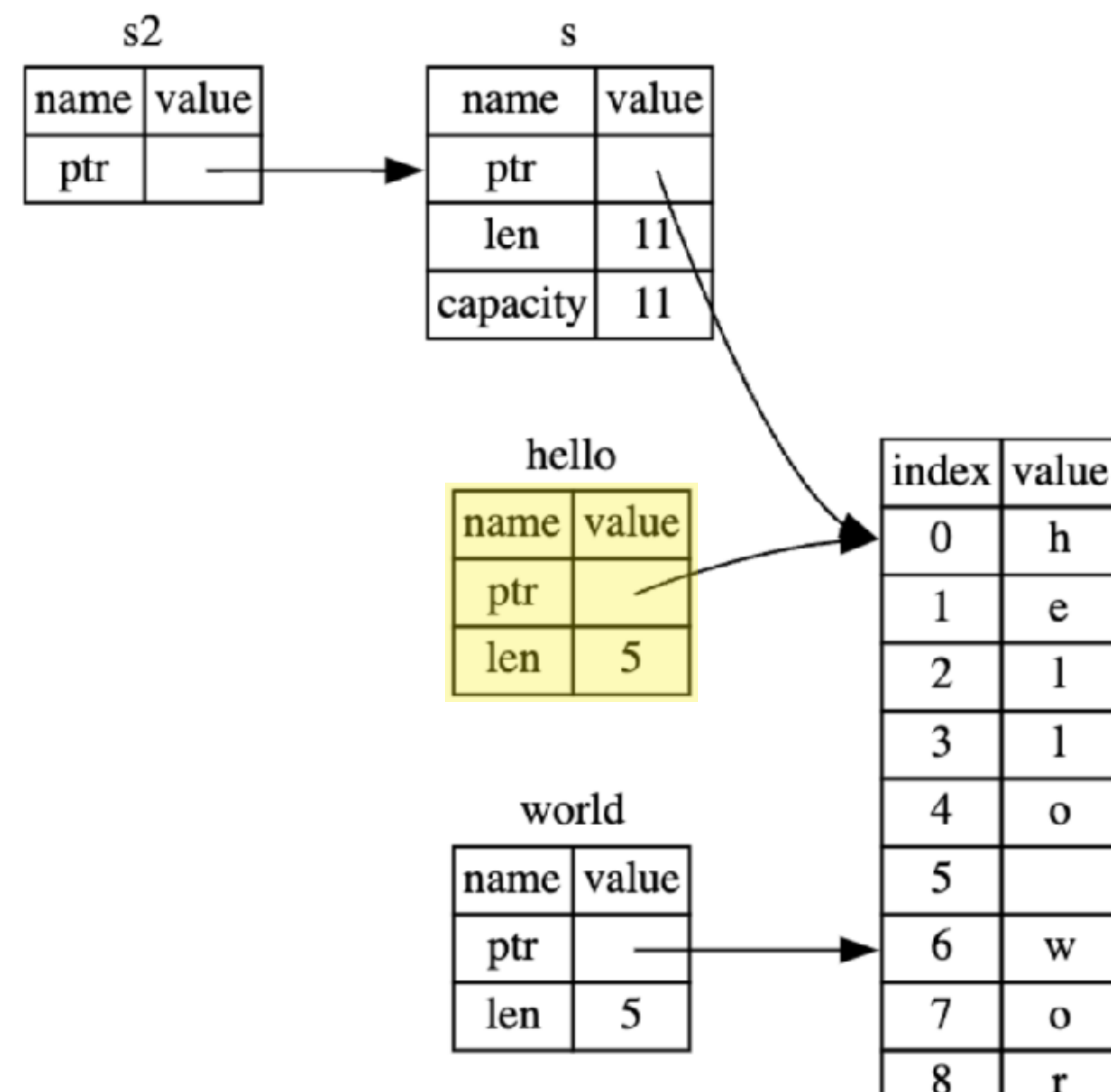
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Before



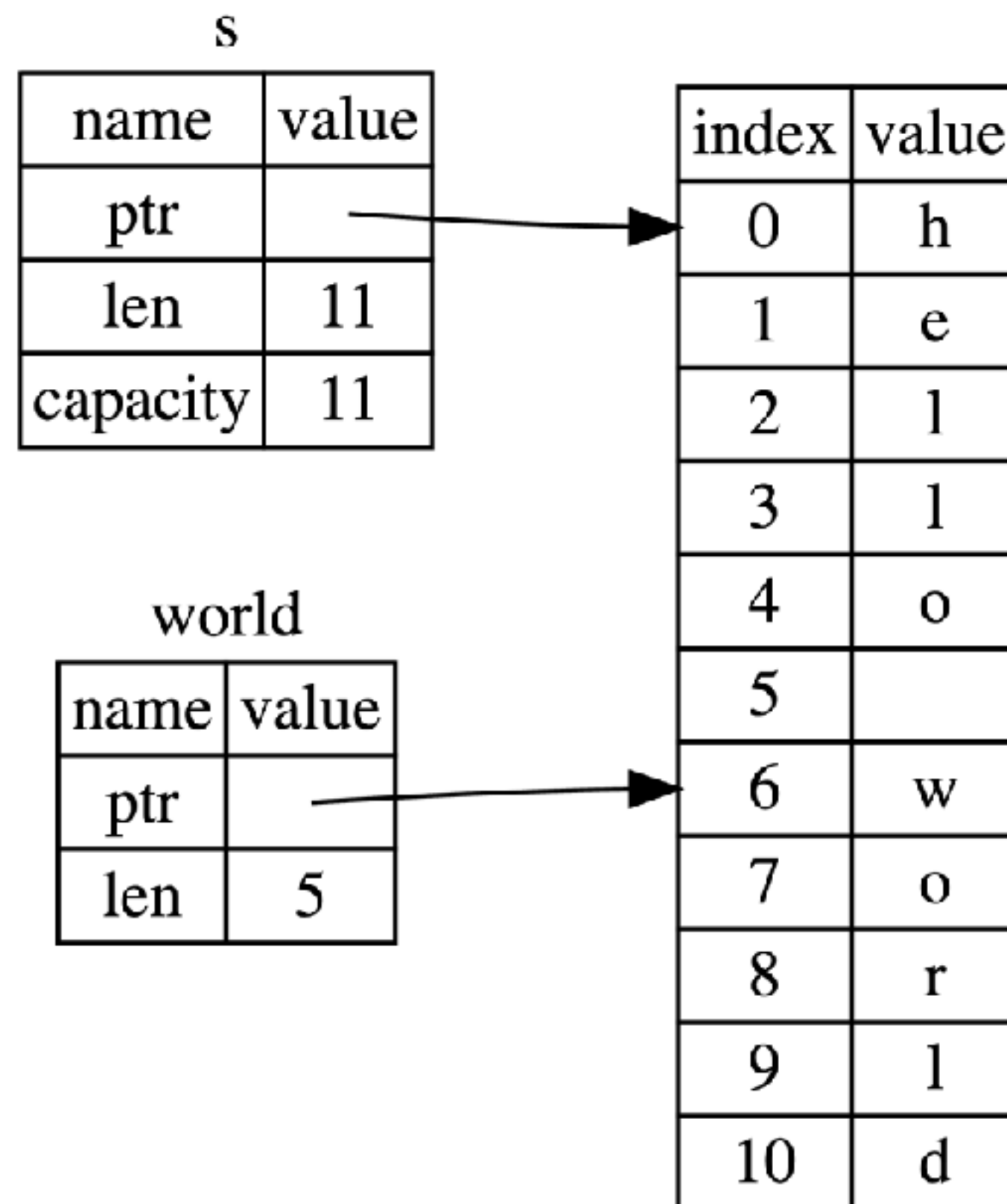
After



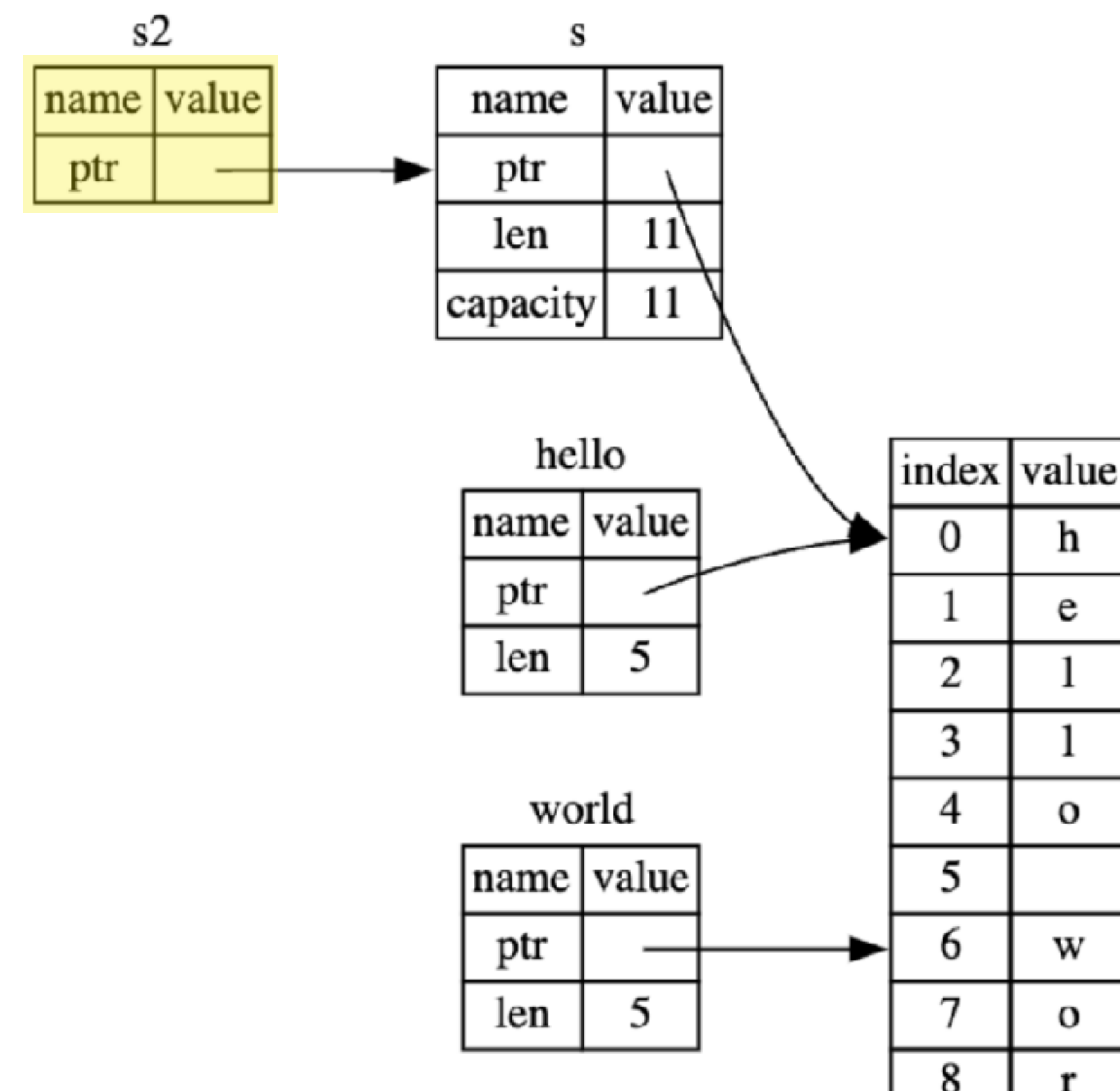
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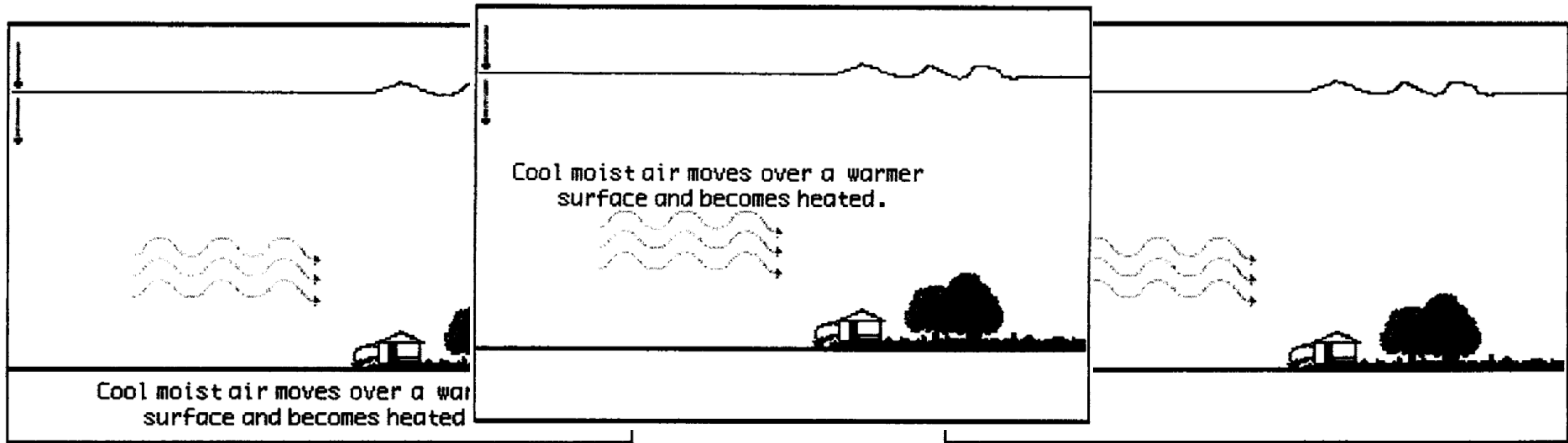


After



Spatial contiguity principle: people learn better when words and corresponding graphics are physically integrated rather than separated

Separated < Integrated < Narrated



New explanation improved scores

Question 1

Consider the variables `s2` and `s3` in the following program. These two variables will be located in memory within the stack frame for `main`. Each variable has a size in memory on the stack, *not* including the size of pointed data. Which statement is true about the sizes of `s2` and `s3`?

```
1 fn main() {  
2     let s = String::from("hello");  
3     let s2: &String = &s;  
4     let s3: &str = &s[..];  
5 }
```


Response	<u>Before</u>	<u>After</u>
<input type="radio"/> <code>s3</code> has fewer bytes than <code>s2</code>	26%	→ 17% (-9pp)
<input type="radio"/> <code>s3</code> has the same number of bytes as <code>s2</code>	51%	→ 40% (-11pp)
<input checked="" type="checkbox"/> <code>s3</code> has more bytes than <code>s2</code>	23%	→ 43% (+20pp)

Multimedia challenges

Which explanation produces the best learning outcomes?

Rich multimedia

relative **size**



When 2 objects are of equal physical size, the one that is farther away will take up less of the visual field.

youtu.be/z4DCQfLqvBI

Sparse multimedia

Relative Size

- When 2 objects are of equal physical size, the one that is farther away will take up less of the visual field.

youtu.be/sq7kr2TOCDo

No multimedia

Depth Perception

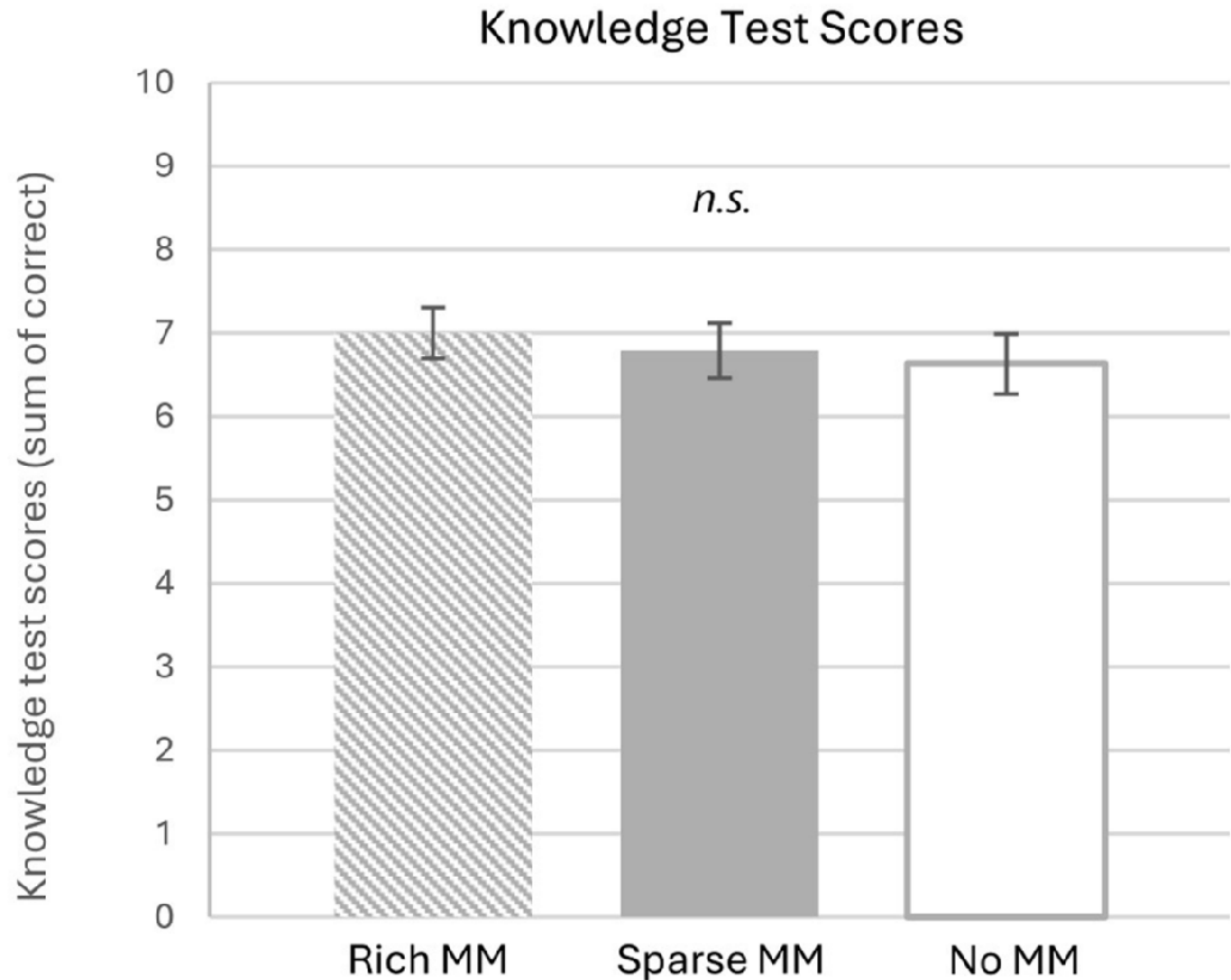
youtu.be/UzOkP9KT3Bc

No stat. sig. difference between explanations

Example question

What is the difference between relative size and familiar size as depth cues?

- A. Relative size assumes objects are the same size, while familiar size uses knowledge of an object's typical size
- B. Relative size is used for common objects, while familiar size is used for novel objects
- C. Relative size is based on shape, while familiar size is based on location
- D. Relative size is used in artificial environments, while familiar size is used in natural environments

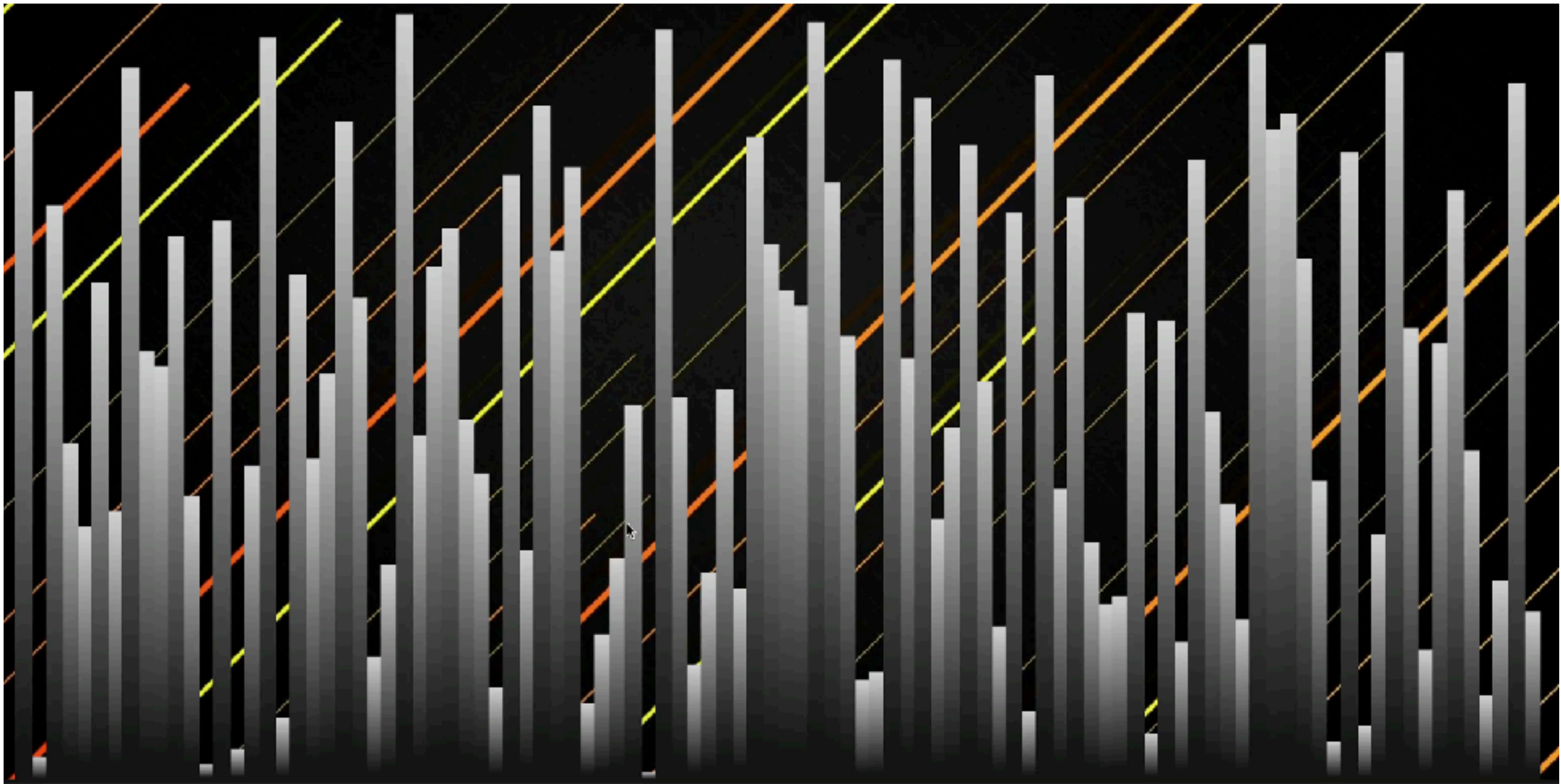


When are animations effective?

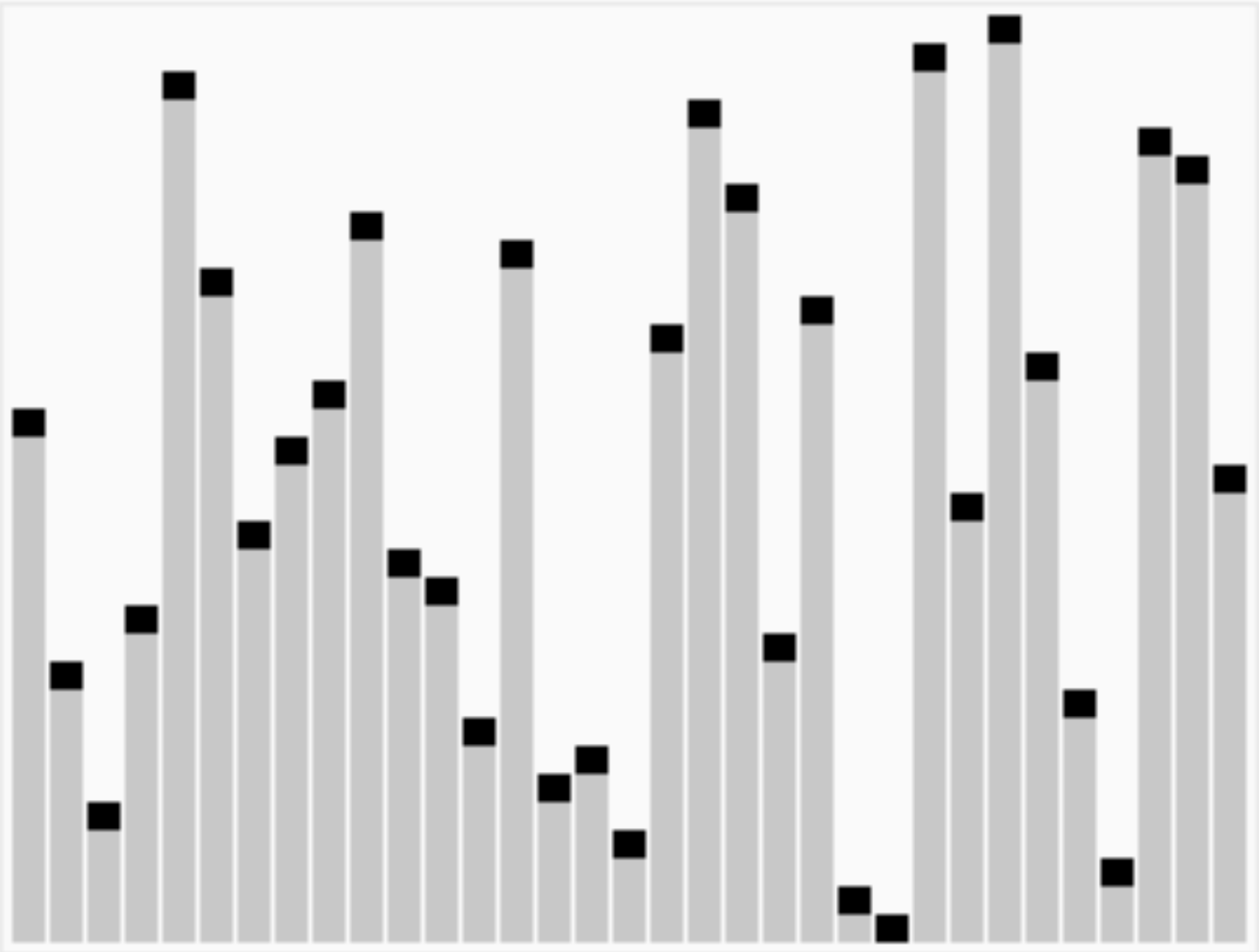
“In cases where animated graphics seem superior to static ones, scrutiny reveals lack of equivalence between animated and static graphics in content or procedures; the animated graphics convey more information or involve interactivity. Animations of events may be ineffective because animations violate the second principle of good graphics, the Apprehension Principle, according to which graphics should be accurately perceived and appropriately conceived. Animations are often too complex or too fast to be accurately perceived.”

— Tversky et al. “Animation: can it facilitate?” (2002)

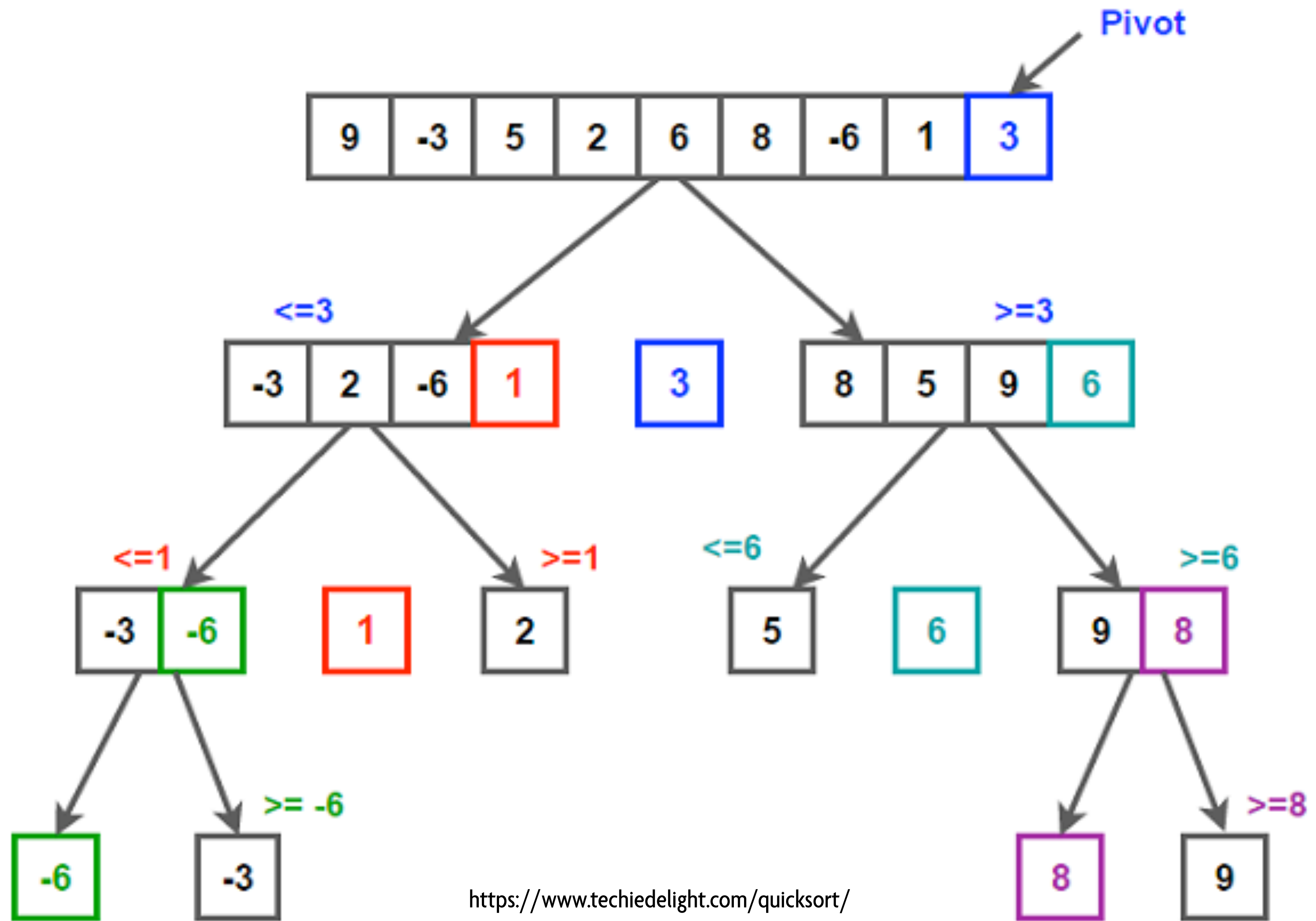
Are sorting animations more effective than diagrams?

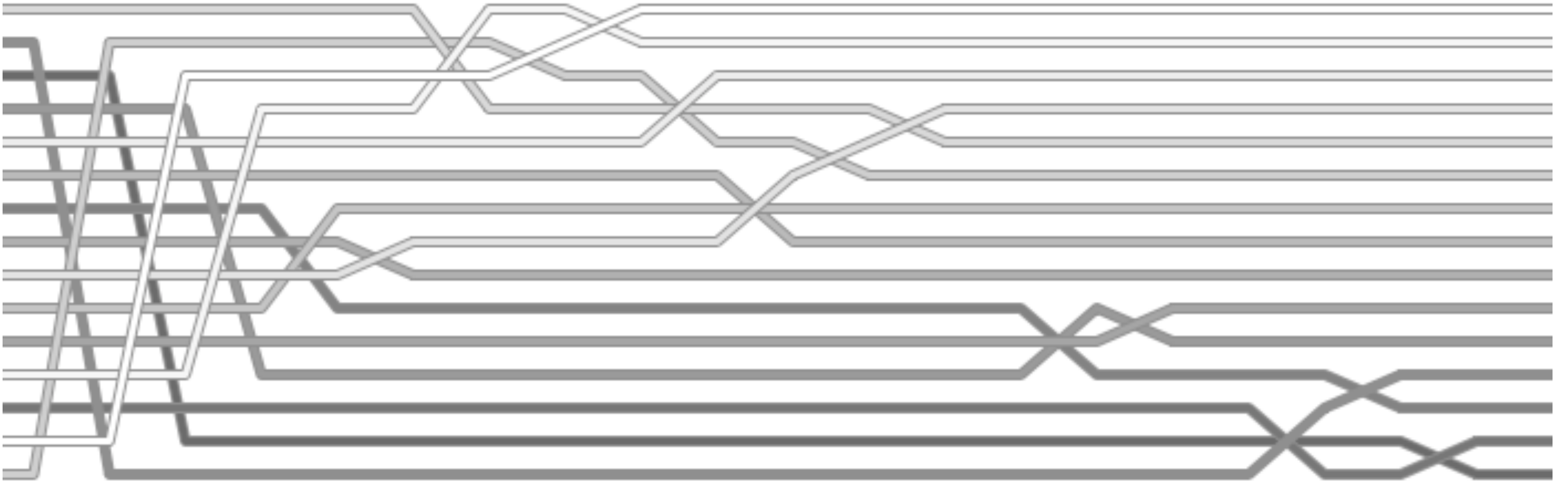


<https://sortvisualizer.com/quicksort/>



via Wikimedia Commons





<https://corte.si/posts/code/visualisingsorting/>

Slide design

The one multimedia tool used by everyone!



The early history of slides

The before times:

<https://www.youtube.com/watch?v=Nqf1DKSXJro>

The ramp-up:

“By 1993, PowerPoint had a majority share of the presentation market. In 1995, the average user created four and a half presentations a month. Three years later, the monthly average was nine.”

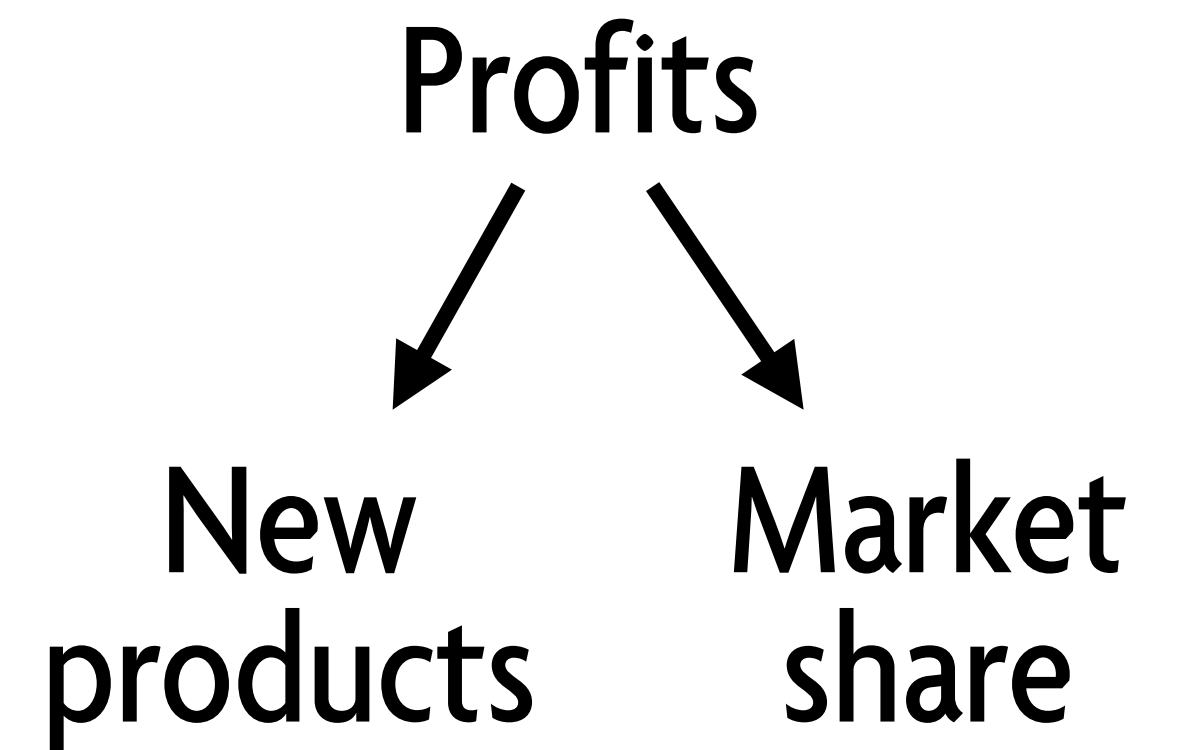
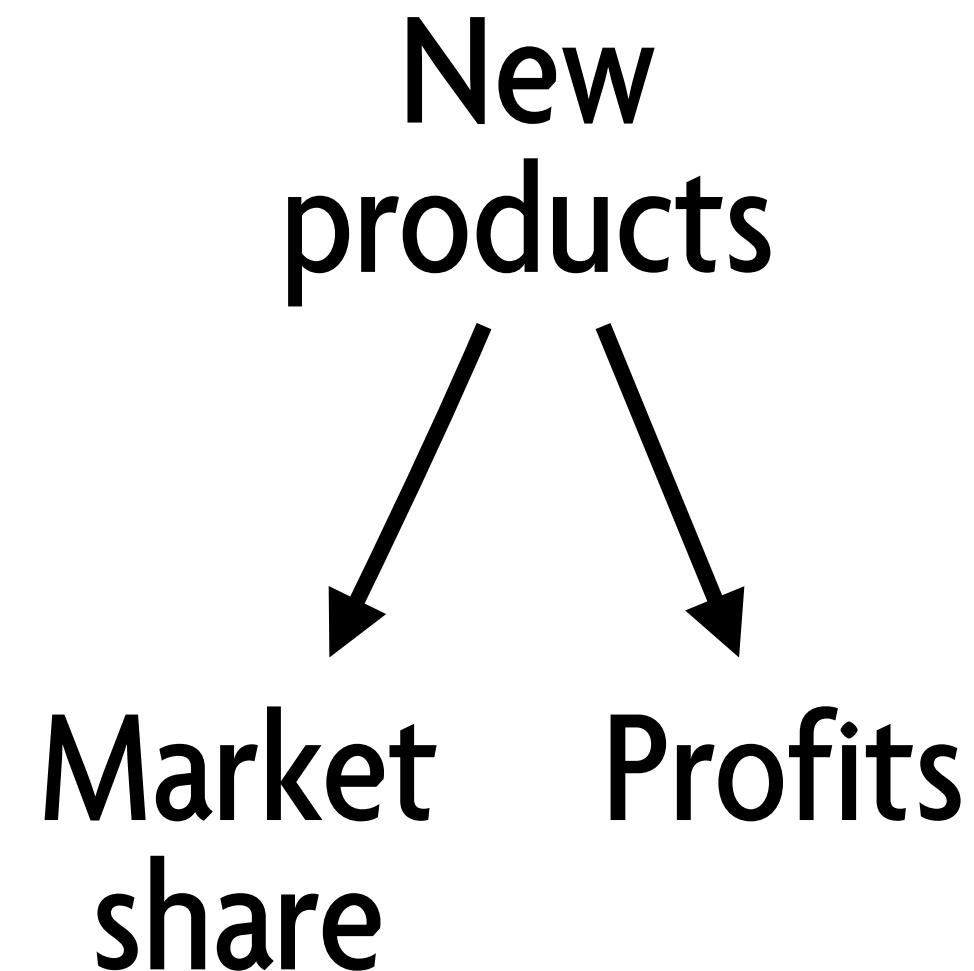
Gettysburg Cemetery Dedication

Abraham Lincoln

11/19/1863

“Bullet outlines dilute thought”

- Increase market share by 25%.
- Increase profits by 30%.
- Increase new-product introductions to ten a year.



20% of the slide is used for content!!

Why Brown Engineering?

Slide deck sample

Brown Engineering is a unique place, which emphasizes the power of interdisciplinary thought and recognizes that engineering is intertwined with every aspect of our lives.

Slides as a tool for emotional communication vs. technical communication

Today: Prezi + AI?


<https://prezi.com/view/xxdyCCE3KsHEKHveJKHq>

**Everyone has their own rules for
good slide design...**

Assertion-evidence format puts claim in the title and evidence in the slide

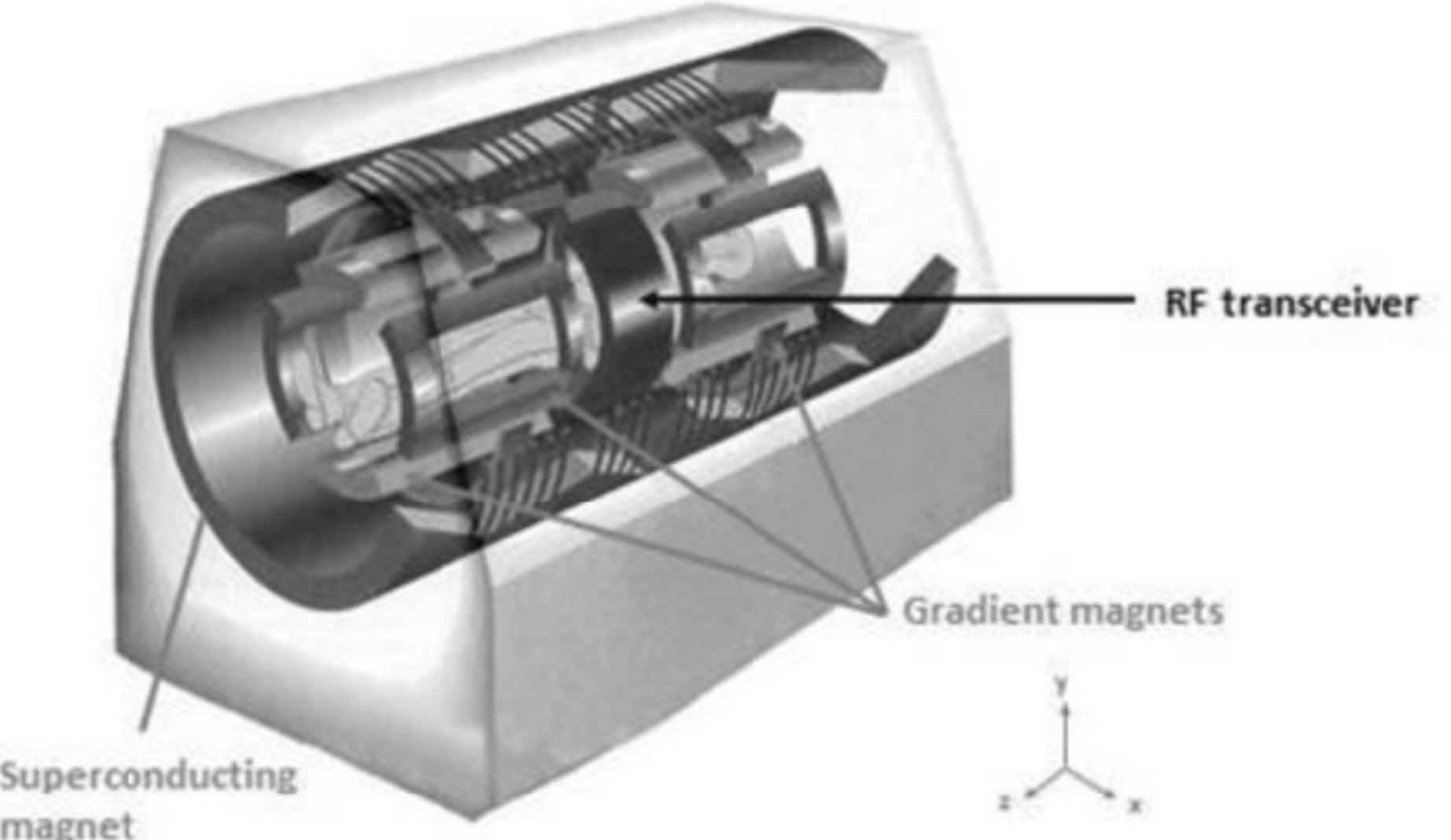
Main Components of MRI

- Superconducting magnet
 - Large field: on order of 1.5 tesla
 - Strong enough to move a car
- Array of gradient magnets
 - Allows for field in set x, y, z plane
 - Counteracts main magnet's field
- Radio frequency (RF) transceiver
 - Transmits and receives RF waves



The diagram shows a cutaway view of the MRI components. Labels include: Superconducting magnet, RF transceiver, and Gradient magnets. The ENGR HEALTH logo is in the bottom left corner.

An MRI machine contains a large superconducting magnet, gradient magnets, and a radio frequency (RF) transceiver



The diagram shows a cutaway view of the MRI machine. Labels include: Superconducting magnet, RF transceiver, and Gradient magnets. A 3D coordinate system (x, y, z) is shown in the bottom right corner.

Study: students had higher retention and fewer misconceptions using assertion-evidence compared to common-practice

Tip 8

In the results section:

One point per slide!

One point per slide!

One point per slide!

(and the point is the title of the slide!!!)

Make the point of the graph the slide's title:

- It provides audience context for interpreting the graph
 - Audience reaction: "Let me see if I can verify that point in the graph to check my understanding"
- This is another example of the "audience prefers not to think" principle

