effective use of **slideware** to help students create **mental models**

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What are some examples of **bad slide design**?

By the end of this workshop, you should be able to:

- **explain** the relationship between working memory, long-term memory & slides that are effective for learning
- summarize Sweller's **Cognitive Load Theory** as it relates to slide design
- apply Mayer's principles from his applied **Cognitive Theory of Multimedia Learning**
- **recognize** the effective use of different forms of graphical representations
- go back to your slides and implement at least a few of these tips to **help your students** learn more effectively

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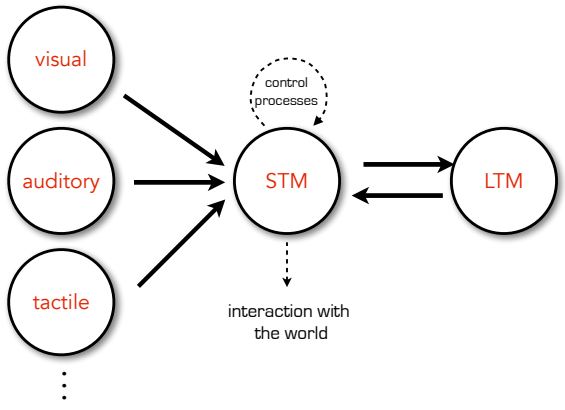

Attkinson & Shiffrin (1968)

can you reproduce the **symbol** I showed a minute ago?

愛

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cognitive theory of multimedia learning

cognitive load theory

cognitive architecture

8

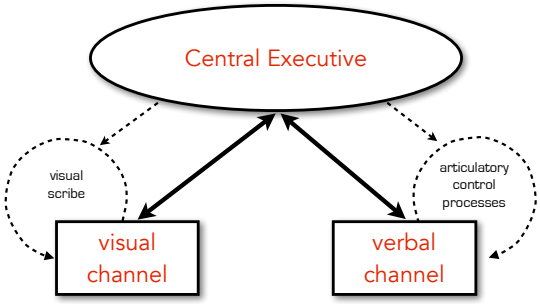
cognitive theory of multimedia learning

cognitive load theory

cognitive architecture

9

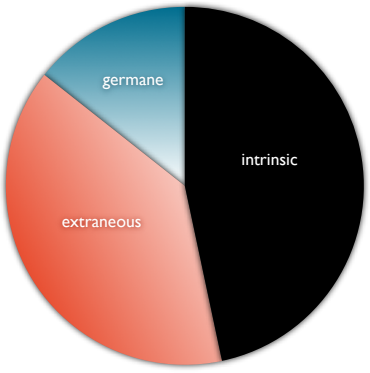
working memory



Baddeley & Hitch (1974)

10

cognitive load theory



Reducing **extraneous** cognitive load provides more capacity for **germane** cognitive load.

Sweller, Merrienboer & Paas (1998); Paas, van Gog & Sweller (2010)

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multimedia principle

People learn more **effectively** with a combination of **words & pictures** than from either one alone.

Mayer & Moreno (2003)

modality principle

images — visual

words — auditory

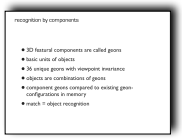
dog

Images are represented by both a **visual** and **verbal** code.

Mayer & Moreno (2003)

The **redundancy principle** refers to the fact that when text on screen is the same as the information being conveyed verbally information is encoded less effectively. People are busy reading the text instead of listening to the information that a person is trying to convey overwhelming both the visual and verbal channels, but people can't stop themselves from reading. Stop reading this. Seriously, stop reading this and pay attention to what I am saying. Fine, if you've gotten this far, please pat your head.

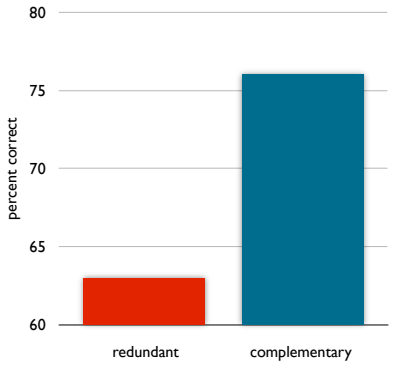
Mayer & Moreno (2003)



redundant

complementary

performance: **comprehension**



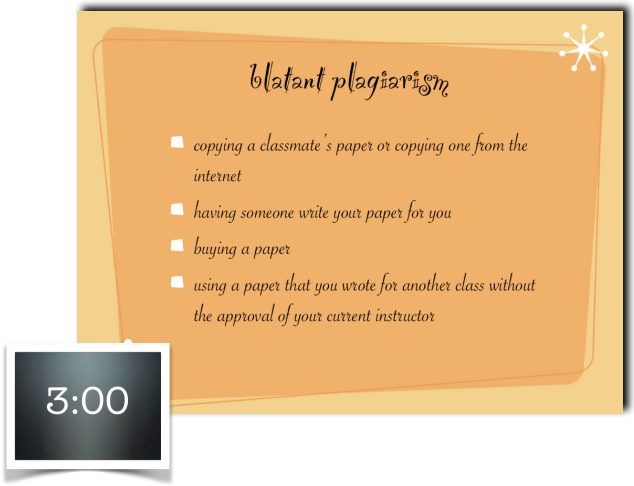
Fenesi & Kim (2014)

how do you use bullet points?

People remember **grammatical** sentences better than **lists of words**.

Dukewich & Nicolas (in prep)

let's **translate**



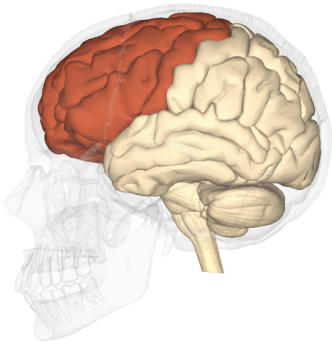
let's **translate**

decorative graphics*

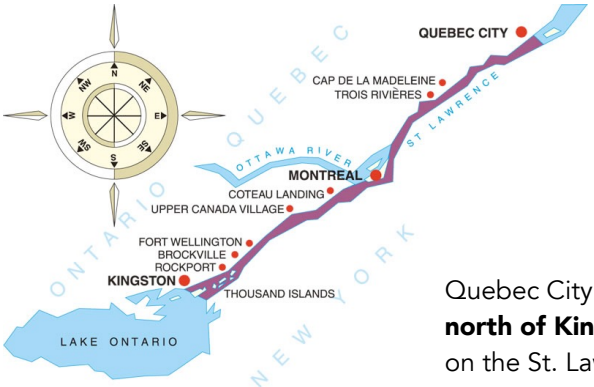
… can be **distracting**.

representational graphics

The **frontal lobe** is involved in **higher-order** cognitive processes.

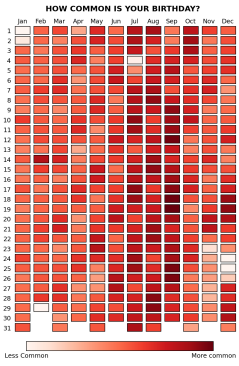


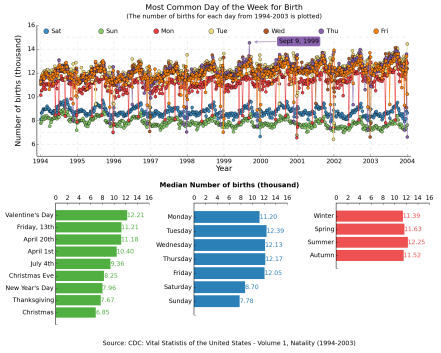
representational graphics



Quebec City is **north of Kingston** on the St. Lawrence River.

relational graphics



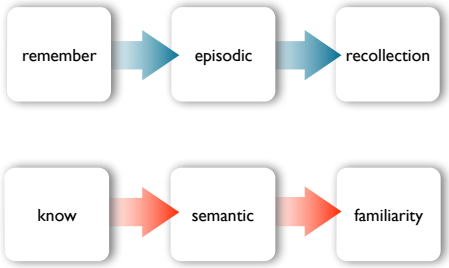


remember/know procedure

- remembering
  - associated with episodic memory
  - experience of recollection
- knowing
  - associated with semantic memory
  - experience of familiarity

organizational graphics

remember/know procedure



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organizational graphics

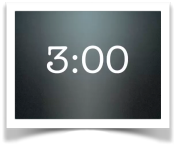
causes of **suburbanization**

Push Factors

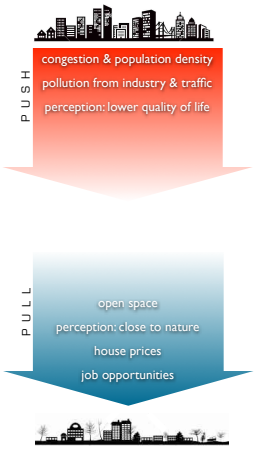
- congestion & population density
- pollution from industry & traffic
- perception: lower quality of life

Pull Factors

- open space
- perception: close to nature
- house prices
- job opportunities

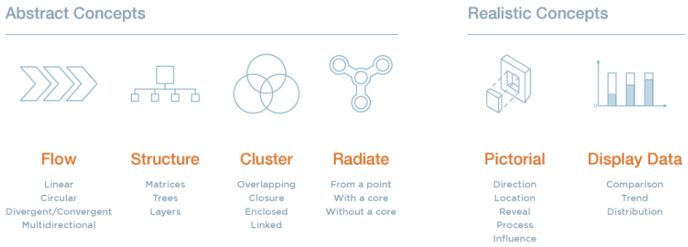


organizational graphics



The causes for **suburbanization** included both **push** and **pull** factors.

organizational graphics



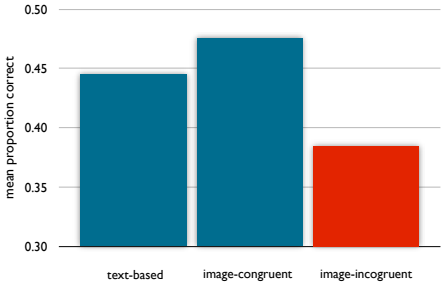
Duarte (2012)

coherence principle

REMOVE EXTRANEOUS MATERIAL, IN ALL FORMS.

Mayer & Moreno (2003)

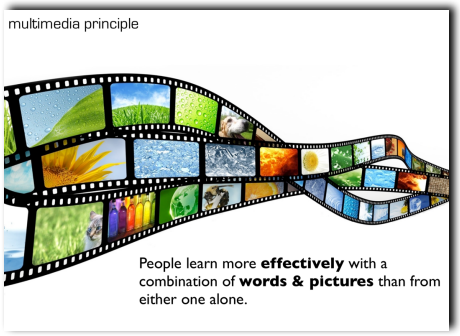
coherence principle



Images that are "**decorative**" can be helpful for learning as long as they're **related**.

Tangen, Constable, et al (2011)

coherence principle



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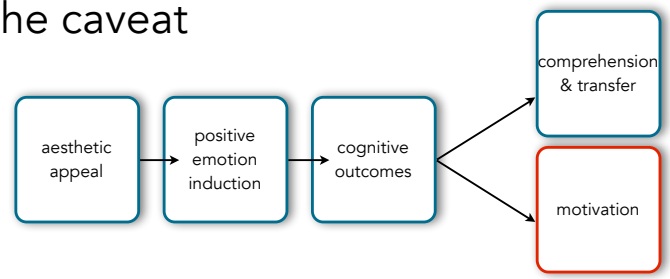
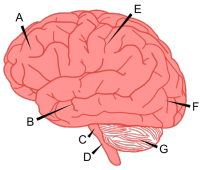
coherence principle: the caveat



Plass, Heidig, Hayward, Homer & Um (2013)

contiguity principle



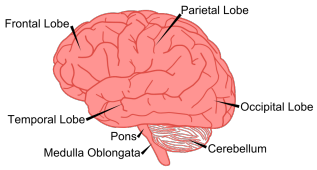
A - Frontal Lobe
B - Temporal Lobe
C - Pons
D - Medulla Oblongata

E - Parietal Lobe
F - Occipital Lobe
G - Cerebellum

Words & corresponding text should be **spatially** & **temporally** aligned.

Mayer & Moreno (2003)

contiguity principle



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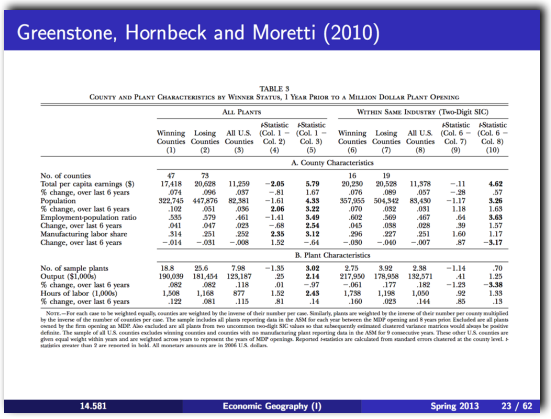
Mayer & Moreno (2003)

how would you improve this?



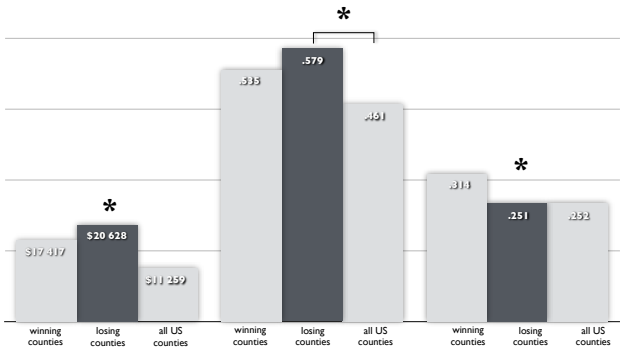
Greenstone, Hornbeck and Moretti (2010)

TABLE 3
COUNTY AND PLANT CHARACTERISTICS BY WINNER STATUS, 1 YEAR PRIOR TO A MILLION DOLLAR PLANT OPENING

	All Plants					Within Same Industry (Two-Digit SIC)				
	Winning Counties (1)	Losing Counties (2)	All U.S. Counties (3)	tStatistic (Col. 1 − Col. 2) (4)	tStatistic (Col. 1 − Col. 3) (5)	Winning Counties (6)	Losing Counties (7)	All U.S. Counties (8)	tStatistic (Col. 6 − Col. 7) (9)	tStatistic (Col. 6 − Col. 8) (10)
A. County Characteristics										
No. of counties	47	73				16	19			
Total per capita earnings ($)	17,418	20,628	11,259	−2.05	5.79	20,250	20,528	11,378	−.11	4.62
% change, over last 6 years	.074	.096	.037	−.81	1.67	.076	.089	.057	−.28	.57
Population	322,745	447,876	82,581	−1.61	4.33	357,955	504,342	83,430	−1.17	3.26
% change, over last 6 years	.102	.051	.036	2.06	5.22	.070	.032	.031	1.18	1.63
Employment-population ratio	.535	.579	.461	−1.41	3.49	.602	.569	.467	.64	3.63
Change, over last 6 years	.041	.047	.023	−.68	2.54	.045	.038	.028	.39	1.57
Manufacturing labor share	.314	.251	.252	2.35	5.12	.296	.227	.251	1.60	1.17
Change, over last 6 years	−.014	−.031	−.008	1.52	−.64	−.030	−.040	−.007	.87	−3.17
B. Plant Characteristics										
No. of sample plants	18.8	25.6	7.98	−1.35	3.02	2.75	3.92	2.38	−1.14	.70
Output ($1,000s)	190,039	181,454	123,187	.25	2.14	217,950	178,958	132,571	.41	1.25
% change, over last 6 years	.082	.082	.118	.01	−.97	−.061	.177	.182	−1.25	−3.38
Hours of labor (1,000s)	1,508	1,168	877	1.32	2.43	1,738	1,198	1,050	.92	1.33
% change, over last 6 years	.122	.081	.115	.81	.14	.160	.023	.144	.85	.13

NOTE.—For each case to be weighted equally, counties are weighted by the inverse of their number per case. Similarly, plants are weighted by the inverse of their number per county multiplied by the inverse of the number of counties per case. The sample includes all plants reporting data in the ASM for each year between the MDP opening and 9 years prior. Excluded are all plants owned by the firm opening an MDP. Also excluded are all plants from two uncommon two-digit SIC values so that subsequently estimated clustered variance matrices would always be positive definite. The sample of all U.S. counties excludes winning counties and counties with no manufacturing plant reporting data in the ASM for 9 consecutive years. These other U.S. counties are given equal weight within years and are weighted across years to represent the years of MDP openings. Reported *t*statistics are calculated from standard errors clustered at the county level. *t* statistics greater than 2 are removed in bold. All monetary amounts are in 2000 U.S. dollars.

1 year prior to the opening of a million dollar plant



total per capital earnings

employment population ratio

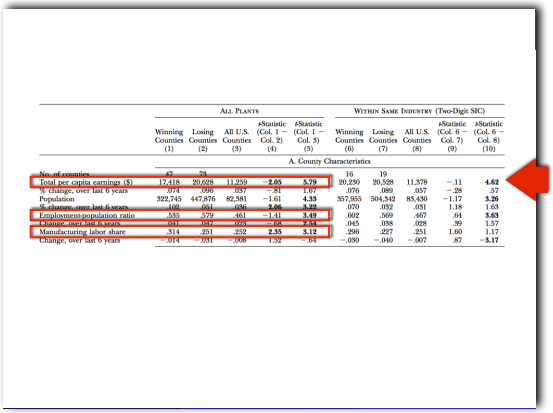
manufacturing labor share

Greenstone, Hornbeck & Moretti (2010)

Signalling is a way to point at things you want people to **pay attention** to.

Mayer & Moreno (2003)

signalling



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pay attention to this

now this

look over here!

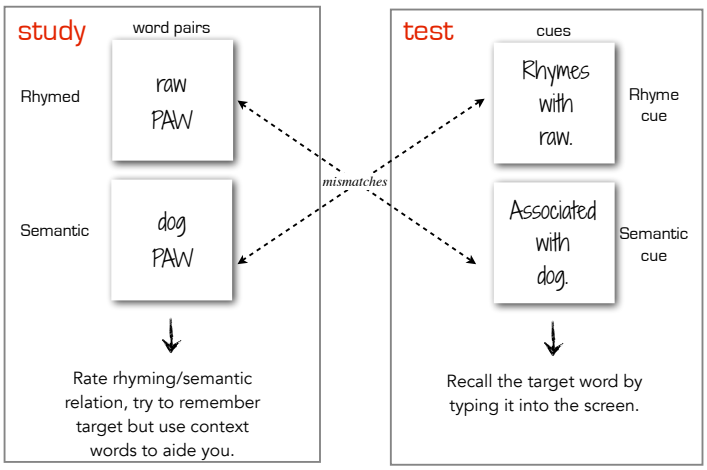
builds can also serve as **reminders** of what you want to say

Thomson, Smilek & Besner (2012) - Expt 1

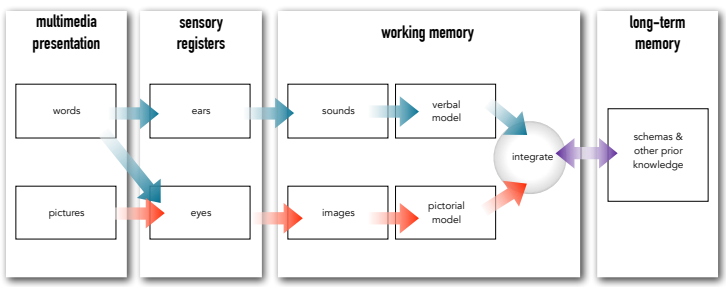
- **study phase:**
  - participants presented with word pairs
  - capitalized = recall target
  - two conditions:
    - rhymed ex. *raw-PAW*
    - semantic ex. *dog-PAW*
  - rate rhyming/semantic relation strength
  - "*try to remember target, use context word*"
- **test phase:**
  - participants give cue, asked to recall target
  - two conditions:
    - rhyme cue: "*rhymes with raw*"
    - semantic cue: "*associated with dog*"
  - recall target word

- **study x test fully crossed to produce match/mismatch**
  - ex. match: study (rhyme) + test (rhyme)
  - ex. mismatch: study (rhyme) + test (semantic)

signalling: builds & animations



summary



Mayer & Moreno (2003)

These principles are **guidelines**, not rules

It's the end of this workshop! You should be able to:

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