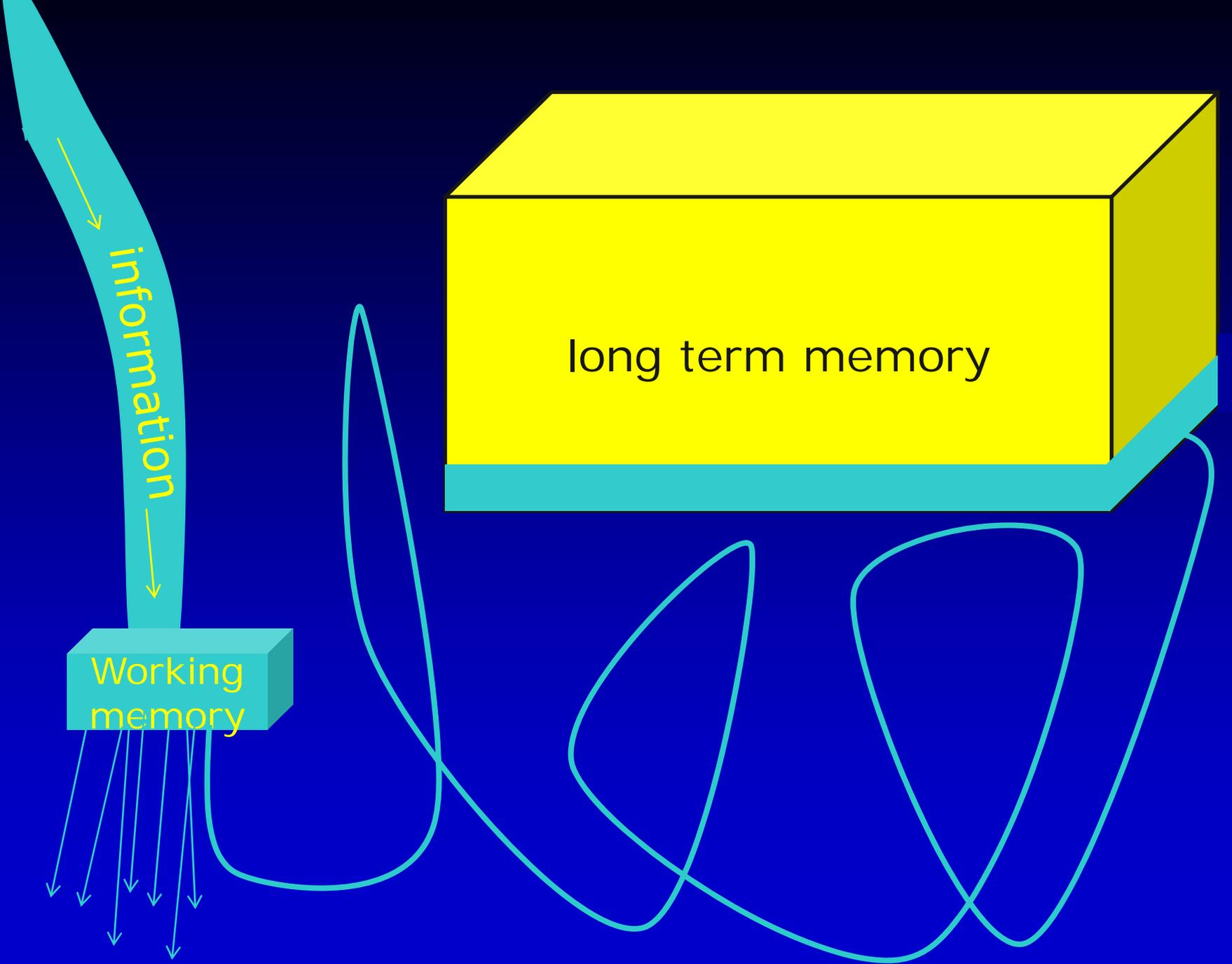


Improving learning by reducing unnecessary demands on working memory

- I. a. Brief intro to basic ideas
 - b. few examples from research
 - c. a few good and bad examples from practice

- II. Discussion-- your specific situation, ideas for how to improve.



Limits on working memory--best established, most ignored result from cognitive science



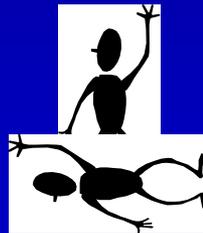
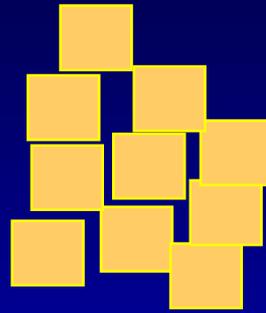
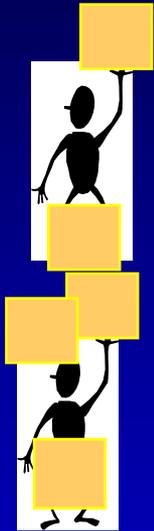
Working memory capacity
VERY LIMITED!
Every additional demand
reduces effectiveness.

*Remember & process
 7 ± 2 distinct new items.
Maybe as little as 4.*

time dependence complex

Mr Anderson, May I be excused?
My brain is full.

mental analogue to carrying packages



What is a “new item”?

Everything not in long term memory and organized as single item.

remember this set of letters:

how about: C o l u m b i a

Why so much easier?

o
i
u
a
m
c
b
l

Long term memory (LTM) glue “chunks” into one item--
order of letters, spatial arrangement.

Depends on LTM. If only write Chinese, no difference.

A few Working memory studies:

1) Person looks briefly at chessboard, see how many pieces and their locations they can remember.

me & chess
Van.

a. chess novices ~ 7

b. chess experts-- if game situation, all
-- if randomly scattered pieces, ~7

Explanation. LTM of expert has stored patterns of common piece arrangements. Allows chunking.

2. Study 2-- worked examples (Sweller).

Learning to solve algebra problems from well explained worked out examples	215 seconds
Learning by just solving problems	495 sec

Explanation. Cognitive load (demand on working memory) much larger in solving problems.

Worked example provides organizational structure, focuses attention.

3. Study 3-- seductive details (Mayer). Adding some interesting but basically irrelevant detail to explanation. Reduces amount learned.

Explanation. Interesting detail used up working memory, less left to process primary material.

Examples from practice.

What things done in this talk

a. reduced cognitive load?

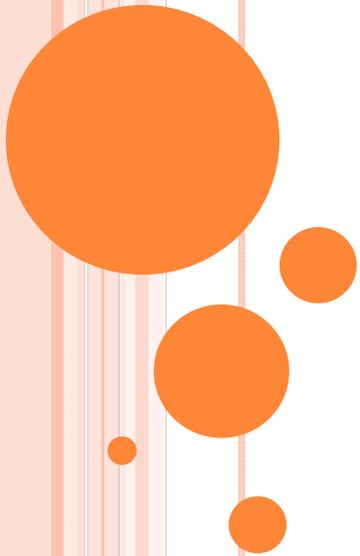
b. added unnecessary cognitive load?

list items on board

Reduced demands on working memory

1. use of analogies-- water containers and pipes, pc with limited RAM, student carrying package
2. Pictures to illustrate, rather than verbal description of tanks and pipes.
3. explicitly giving organization of presentation
4. color and font coding and labeling separate portions-- description of experiment vs explanation
5. Bringing in information on slide as needed
6. little technical terminology

7. Avoided distracting Powerpoint backgrounds and effects



How increased demands unnecessarily

Increased demands unnecessarily

1. Use of LTM for “long term memory”
2. use of jargon “cognitive load” for “demand on working memory”
3. “time dependence complex” in middle of discussion of capacity, without setting it off or showing how related.
4. digression about my chess playing days

II. Discussion.

Your situation.

What increases demand on working memory in class you teach?

How can demands be minimized to increase learning?