

MATERIALS FOR TODAY

Handout, for notes and exercises

- Paper copies available in the room
- Electronic copy at

<http://tinyurl.com/VR2016-training-handout>

Etherpad, for links, sharing and note-taking

<http://pad.software-carpentry.org/2016-08-ACI-REF-VR>

While you're waiting, think of a subject or theme for a workshop you might want to teach in the future, and write it down.

CREATING AND EVALUATING WORKSHOPS

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ACI-REF VIRTUAL RESIDENCY 2016

GOALS FOR TODAY

Focus on learners

Provide tools for creating a workshop

- 4 question process for development
- Examples of specific tools
- Resources for later

Give a taste of educational psychology

- taxonomy of expertise

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If you haven't yet, think of a subject or theme for a workshop you might want to teach in the future, and write it down.

WHO IS YOUR AUDIENCE?

LEARNER PROFILES

Helen Helmet



Helen Helmet, a Ph.D. student in mechanical engineering, is currently doing a six-month internship at an engineering firm that makes carbon-fiber helmets for firefighters and other emergency service personnel. Her undergraduate courses included an introduction to scientific computing using MATLAB and a robotics course that used C. She learned some Python during a co-op placement between her junior and senior years, and used it again in a graduate course on finite elements.

Helen's task is to model the non-combustive thermal degradation (otherwise known as "melting") of candidate materials. Her starting point is a 4,000-line Python program that her supervisor wrote six years ago. She is currently trying to replace the mesh deformation functions with new ones that can handle non-uniform meshes. She sometimes writes, runs, and deletes sections of code three or four times before she is satisfied.

Helen tests her program by writing the total heat content of the mesh at each time step to a file. She then loads this data into a separate Python program to graph the percentage differences between these values and the ones produced by the original program for six sample problems. Right now, the difference is less than 5% for five test cases, but 30% for the sixth. Helen has added hundreds of `print` statements to the program to try to track down the bug, but still doesn't know where it is.

EXERCISE: YOUR AUDIENCE

Who might come to your workshop?

Write a learner profile, describing that person's:

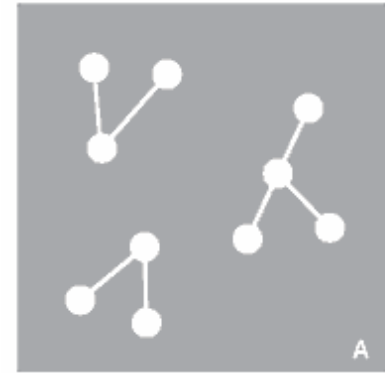
- Experience
- Needs and goals
- How your workshop will help them

Write your own, then compare with your neighbor. If online, paste into etherpad and look at other submissions

LEARNER EXPERIENCE

Novice

- Has no “mental model” of material; possibly isolated bits of knowledge



SIDE NOTE: MENTAL MODELS

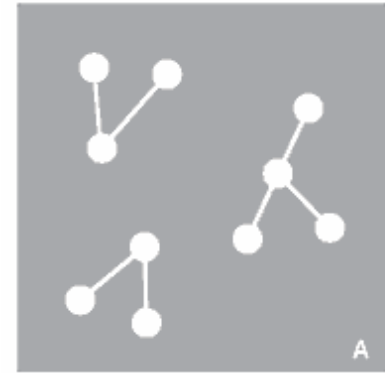
A ‘big picture’ or framework, that can be used to help make sense of or store new information

Examples:

- Molecules as balls and springs
- Shell commands in context of a filesystem
- Mathematical functions as assignment from one value (x) to another (y)

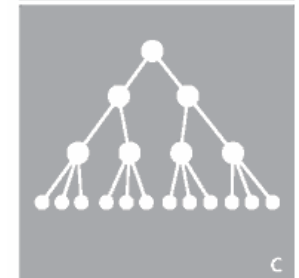
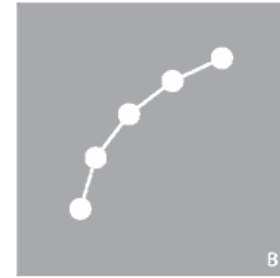
LEARNER EXPERIENCE

Novice



- Has no “mental model” of material; possibly isolated bits of knowledge
- Doesn't know what they don't know.
- Computation specific: computers are magical black boxes

LEARNER EXPERIENCE



Competent Practitioner

- Has a “mental model” of the subject
- Can do most things themselves; able to find help and understand it

LEARNER EXPERIENCE

Expert

- Master of the domain
- Knowledge is densely connected with many links between pieces of information



LEARNER EXPERIENCE

Which of these categories best describes the majority of your intended audience?

WHAT DO YOU TEACH?

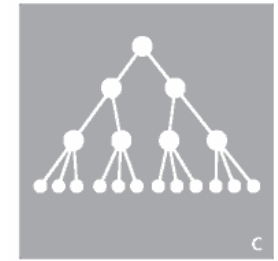
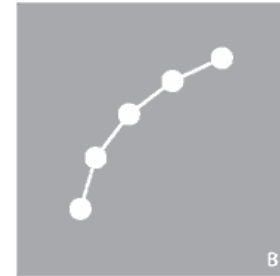
LEARNER EXPERIENCE

Novice



- Has no “mental model” of material; possibly isolated bits of knowledge
- Doesn't know what they don't know.
- Computation specific: computers are magical black boxes
- Don't overwhelm with details!
- Give learners a mental model
- Need a narrative or tutorial

LEARNER EXPERIENCE



Competent Practitioner

- Has a “mental model” of the subject
- Can do most things themselves, able to find help and understand it
- Teach more in-depth skills
- Make connections between already existing ideas

LEARNER EXPERIENCE

Expert

- Master of the domain
- Has a robust “network” of knowledge, with many connections between pieces
- Teach very specific, detailed content
- Learners can teach each other (be instructors)

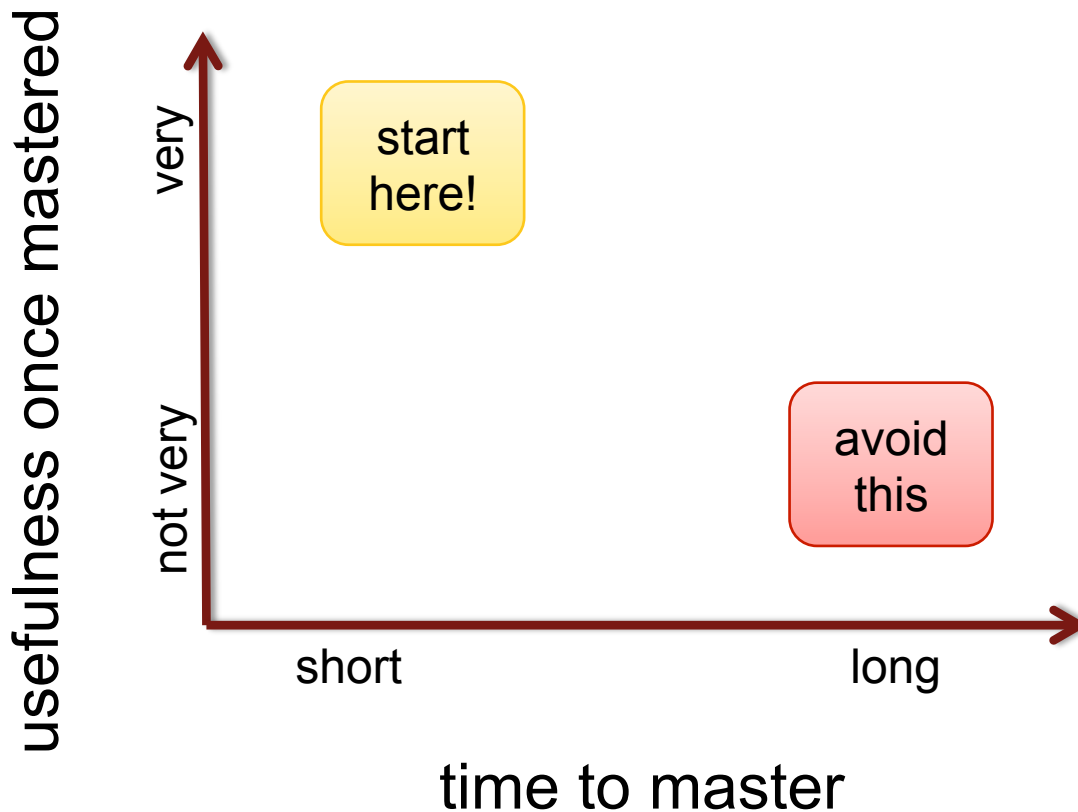


CHOOSING CONTENT

Write down one topic that you might teach at your workshop.

THE AXIS OF USEFULNESS

How useful is your content? And how difficult?



LEARNING OBJECTIVES

One way to codify your workshop content is by writing learning objectives

Example:

- Learners will be able to draw a diagram describing the 3 stages of a batch job.

For more information, see:

<http://teaching.software-carpentry.org/20-lessons>

HOW DO YOU TEACH?

BEWARE OF BLIND SPOTS

**If you are an expert,
chances are you
have some sort of
expert blind spot.**

Examples:

- Knowing how to log in to a remote computer
- Typing quickly or using tab-completion

expert blind spot,
noun: **1.** knowing something so well that it seems easy when it's not **2.** underestimating the time and energy to understand a concept or do a task that seems straightforward and simple

GET FEEDBACK

Use in-class feedback and assessment

Monitor learning space

For quick visual feedback, give each learner two sticky notes that they can put on their computer.

Green indicates:
“I’m with you”
or
“I’m done”

Red indicates:
“Slow Down!”
or
“I need help!”

ACTIVE LEARNING



Live Coding

Hands-on Exercises

Interactive Demonstrations

Think-Pair-Share / Pair Programming

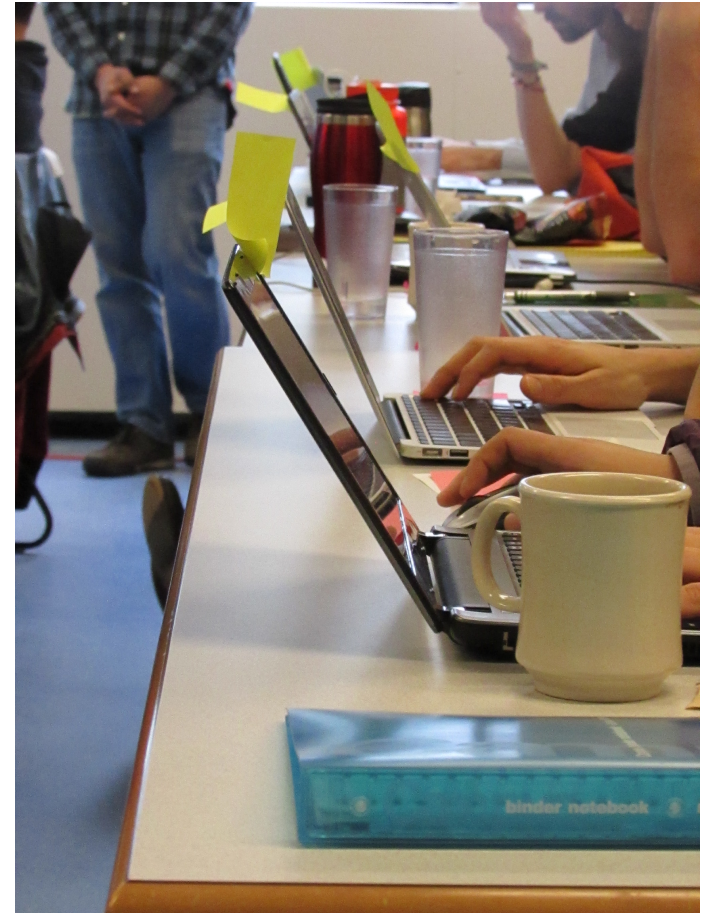


FURTHER READING

There are many resources on different active learning and teaching techniques.

Don't be afraid to try something new!

For the cautious, try one new thing at a time.



HOW DID IT GO?

DESIGNING AN EVALUATION

Think back to your goals and objectives when designing the workshop

Different areas to measure

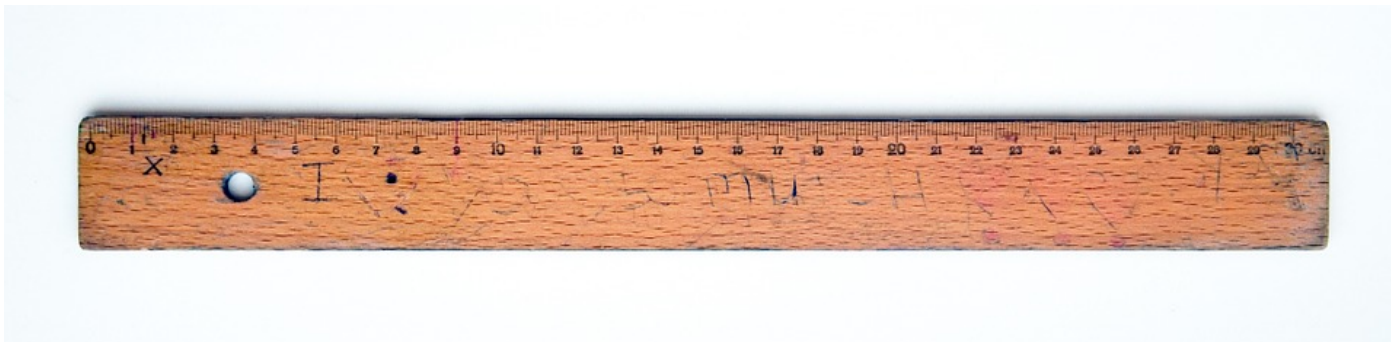
- Learning (did we learn something?)
- Content (was it useful?)
- Presentation (was the presentation effective?)
- Logistics (was there coffee?)

GENERAL THOUGHTS

Less is more

Ask for specifics

Use quantitative and qualitative measures



If you have any ideas to add, write them down in the etherpad.

EXERCISE: EVALUATION

Please fill out a survey evaluating this training session (link is also in the etherpad):

<http://tinyurl.com/VR2016-training-eval>

ACKNOWLEDGEMENTS

Software/Data Carpentry Instructor Training

<http://teaching.software-carpentry.org/>

How Learning Works: Seven Research-Based Principles for Smart Teaching,
Ambrose et al.

FURTHER RESOURCES

Software and Data Carpentry lessons

- <http://software-carpentry.org/lessons/>
- <http://www.datacarpentry.org/lessons/>

Instructor training materials

- <http://teaching.software-carpentry.org/>

Books

- How Learning Works
- Teaching What You Don't Know
- Teach Like a Champion
- Small Teaching

Blogs

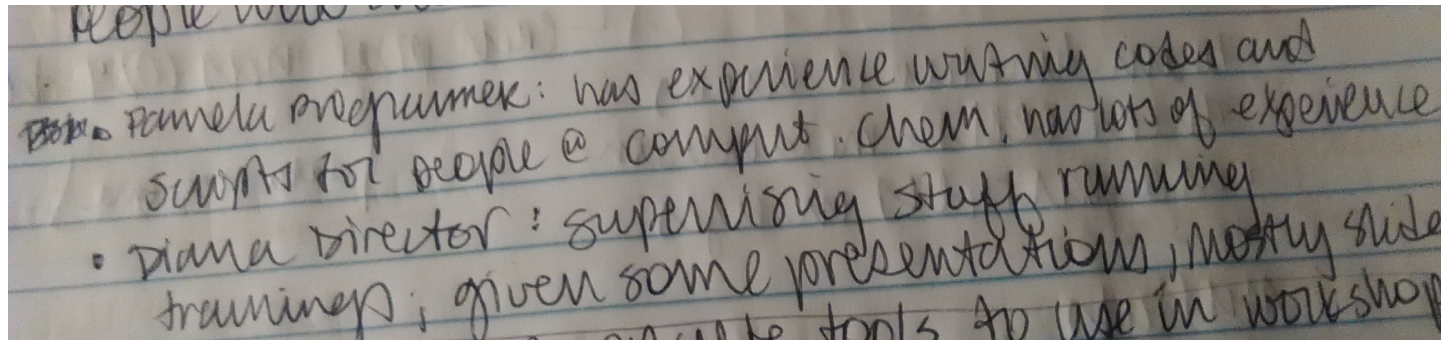
- Mark Guzdial - <https://computinged.wordpress.com/>

THANK YOU!

**META SLIDES:
HOW I DEVELOPED THIS PLENARY**

META SLIDES: WHO IS MY AUDIENCE?

Created learner profiles



Assume audience has familiarity with content, but not with lesson design or pedagogy; needs mental model for design as well as some specific tools.

META SLIDES: WHAT DO I TEACH?

Focus on learners

Provide tools for creating a workshop:

- Mental model (4 question process)
- Examples (profiles, axis, exercises, etc.)
- Resources for later

Give a taste of educational psychology

- taxonomy of expertise
- limits of human memory

Turned these into learning objectives

META SLIDE: LEARNING OBJECTIVES

Use a 4-question roadmap for designing workshops

Compare learners who are novices, competent practitioners, and experts and give an example of appropriate teaching for each

Describe the significance of 7 ± 2 in human memory

Define and identify expert blind spot

Find teaching resources.

META SLIDES: HOW DO I TEACH?

Use handout

- Help clear short-term memory by giving notes and structure
- Facilitates hands-on exercises

Hands-on/interactive exercises

- Write Learner Profile (think-pair-share)
- Plot usefulness of topics
- Memory exercise (if time)

META SLIDES: HOW DO I TEACH?

Removed slides on memory management, because it was too much information for short-term memory. #irony

(see the omitted slides, starting at 40)

Wasn't able to use sticky notes. ☹️

META SLIDES: HOW DID IT GO?

**Created survey and administered as part of
talk**

THE OMITTED MEMORY SLIDES

EXERCISE: MEMORY

Read the following list and try to memorize the items in it:

EXERCISE: MEMORY

Read the following list and try to memorize the items in it:

**cat, apple, ball, tree, square, head,
house, door, box, car, king, hammer,
milk, fish, book, tape, arrow, flower,
key, shoe**

EXERCISE: MEMORY

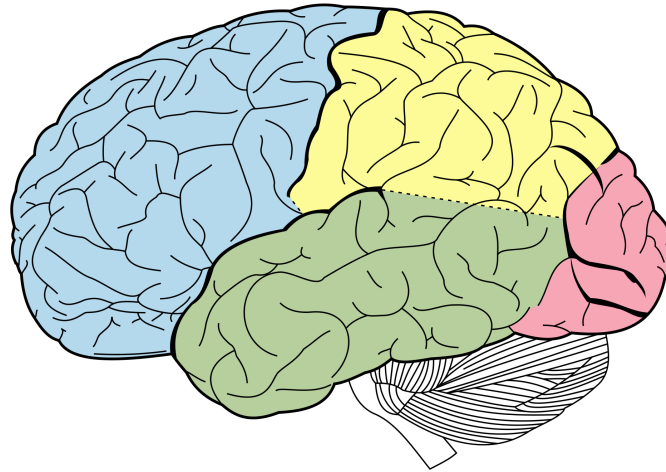
Without looking at the list again, write down as many words from the list as you can.

Compare to people around you. Remote participants can share their list in the etherpad.

What words are remembered the most?

HUMAN MEMORY

Humans have limited short-term (also called working) memory.



We can hold about 7 ± 2 items of knowledge in our short-term memory

MANAGING MEMORY

- Teach in small chunks, limiting the number of ideas introduced at once
- Pause (or have exercises) for learners to consolidate the ideas in working memory
- Reduce “cognitive load”; any extra ideas that distract from main goal