

# Outline for Ch. 1

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1. What are statistics?
  - descriptive
  - inferential
2. The research process
3. Populations and samples
- 4. Types of designs, *cont.***
5. Types of variables

What questions do you have from the first two classes?



# How do we conduct studies that use each design?

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## 1. Correlational research involves...

- observing how two or more variables naturally relate to one another, without directly interfering with those variables.
  - you **measure** all of your variables
  - You might find that your variables are completely uncorrelated (unrelated), or that they are positively correlated (moving in the same direction), or negatively correlated (moving in opposite directions)

## 2. Experimental research involves ...

- systematically manipulating one or more variable to see its/their effect on an outcome variable.
  - you **manipulate** at least one variable (you do this 1<sup>st</sup>)
  - you **measure** at least one variable (you do this 2<sup>nd</sup>)

Remember that I will post these slides on Moodle later.

# Types of research designs

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## 2. Experimental research involves ...

- systematically manipulating one or more variable to see its/their effect on an outcome variable.

This variable is called the **independent variable**

- you **manipulate** at least one variable

Researcher directly changes it, directly alters it

- you **measure** at least one variable

Researcher simply records, assesses, observes it *or*  
Participant may be asked to report it

This variable is called the **dependent variable**

**Practice – Below I have put the variables in bold font. Please identify whether each of the three examples contains a **manipulation** or a **measure** of the bolded variable (part 1 of 2)**

As a reminder . . .

**Manipulation:** Researcher directly changes the variable, directly alters it

**Measure:** Researcher simply records, assesses, observes the variable; or Participant may be asked to report it

1. Researchers insult some participants, and compliment other participants, to induce a **negative vs. positive mood**.
2. Researchers record participants' **date of birth** by looking at their college transcript, which contains this info
3. Participants report their **gender** identity on a survey.

**Practice – Again, please identify whether each example contains a **manipulation** or a **measure** of a variable (part 2 of 2)**

4. Researchers record whether participants greet them in a friendly, neutral, or annoyed manner, when arriving for the experiment.
5. Researchers give half their participants a pill to improve sleep, and half their participants a placebo (fake, inactive) pill.
6. Participants wear a special watch that records how much they sleep at night.



For Q1, **mood** is the *variable*.

**negative mood** and **positive mood** are the two *groups, levels, or conditions*.

1. Researchers insult some participants, and compliment other participants, to induce a negative vs. positive mood.  
*manipulation (IV)*
2. Researchers record participants' date of birth by looking at their college transcript, which contains this info.  
*measure (DV)*
3. Participants report their gender identity on a survey.  
*measure (DV)*
4. Researchers record whether participants greet them in a friendly, neutral, or annoyed manner, when arriving for the experiment.  
*measure (DV)*
5. Researchers give half their participants a pill to improve sleep, and half their participants a placebo (fake, inactive) pill.  
*manipulation (IV)*

The *variable* is **type of pill**.

**real** = *group/level/condition 1, aka the experimental condition*  
**placebo** = *group/level/condition 2, aka the control condition*
6. Participants wear a special watch that records how much they sleep at night.  
*measure (DV)*

# Steps a Researcher takes to run a True Experiment

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- To run an experiment . . .
  - Manipulate a variable (IV)
  - Randomly assign conditions/levels of that IV to Ps
  - Measure a variable (DV)
  - *And* try to keep all other details of study method the same across conditions (i.e., do not create other differences between conditions)
    - *this step is also known as standardizing the procedures*

Please note that a *random sample* is *not* required to make a study a true experiment.

# Practice with experimental methods

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- HYPOTHESIS: Engaging in more weekly hours of rigorous exercise causes people to have a higher age at death.

- STUDY METHOD:

- 1) Manipulate **hours of rigorous exercise/wk**

- I. No exercise (0 hours)
- II. 1-2 hours
- III. 3-7 hours
- IV. 8 or more hours

- 2) Measure exact **age at death**

**\*\* and** researchers randomly assign the conditions of the IV to Ps, and do their best to treat the Ps in the various exercise groups identically, except for varying the hours of exercise the Ps are asked to do.

## PRACTICE QUESTIONS

1. How many IVs does our experiment have? Identify the IV(s).
2. How many DVs does our experiment have? Identify the DV(s).
3. How many conditions/levels/groups does our IV have?



# Practice with experimental methods

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- HYPOTHESIS: Engaging in more weekly hours of rigorous exercise causes people to have a higher age at death.
- STUDY METHOD:

## 1) Manipulate **hours of rigorous exercise/wk**

- I. No exercise (0 hours)
- II. 1-2 hours
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- IV. 8 or more hours

## 2) Measure exact **age at death**

**\*\* and** researchers randomly assign the conditions of the IV to Ps, and do their best to treat the Ps in the various exercise groups identically, except for varying the hours of exercise the Ps are asked to do.

### PRACTICE QUESTIONS

1. How many IVs does our experiment have? Identify the IV(s).
2. How many DVs does our experiment have? Identify the DV(s).
3. How many conditions/levels/groups does our IV have?

### Answers:

1. one IV, Hours of rigorous exercise
2. one DV, Age @ death
3. 4 levels (no exercise, 1-2 hrs, 3-7 hrs, 8+ hrs)

# Correlational and Experimental Research – *Additional terms*

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## **Predictor** variable

- The assumed cause
- In *experiments*...
  - it's better to refer to the predictor variable as the **"independent variable" (IV)**

## **Outcome** variable

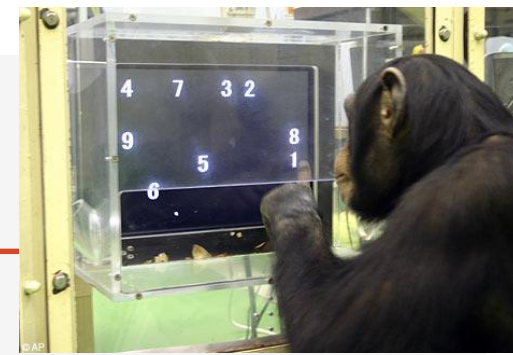
- The assumed effect
- In *experiments*...
  - it's better to refer to the outcome variable as the **"dependent variable" (DV)**

# Outline for Ch. 1

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1. What are statistics?
  - descriptive
  - inferential
2. The research process
3. Populations and samples
- 4. Types of designs, *cont.***
5. Types of variables

Hypothesis: Chimps will learn to run the economy better if they are trained using *bananas* vs. *written* feedback.

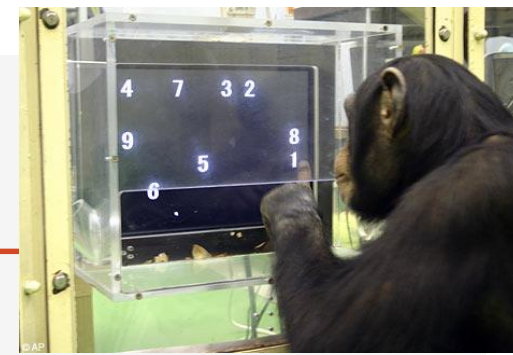


\*\*\* 2 ways to manipulate an IV. Here's the first way...

- First, let chimps play w/features of economy → give chimps **written feedback @ economy's performance** → test chimps.
- Then, let same chimps play with features of economy → give chimps **bananas (or not) based on performance** → test again.
- Compare their test performance across feedback conditions.

What are our **independent and dependent variables** in this example?  
What are the **conditions** of the IV?

Hypothesis: Chimps will learn to run the economy better if they are trained using *bananas* vs. *written* feedback.



\*\*\* 2 ways to manipulate an IV. Here's the first way...

### Study 1

- First, let chimps play w/features of economy → give chimps **written feedback @ economy performance** → test chimps.
- Then, let same chimps play with features of economy → give chimps **bananas (or not) based on performance** → test again.
- Compare their test performance across feedback conditions.

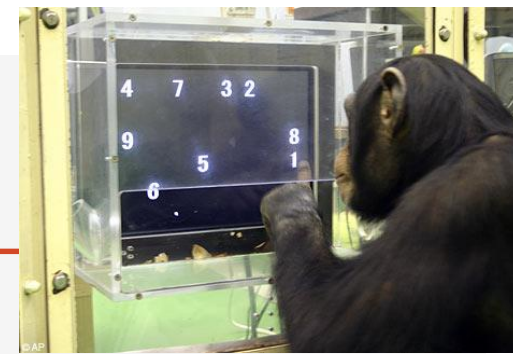
What are our **independent and dependent variables** in this example?  
What are the **conditions** of the IV?

ANSWER:

IV = type of feedback  
DV = performance on economy test  
Conditions of IV = written vs. banana

Hypothesis: Chimps will learn to run the economy better if they are trained using **bananas** vs. **written** feedback.

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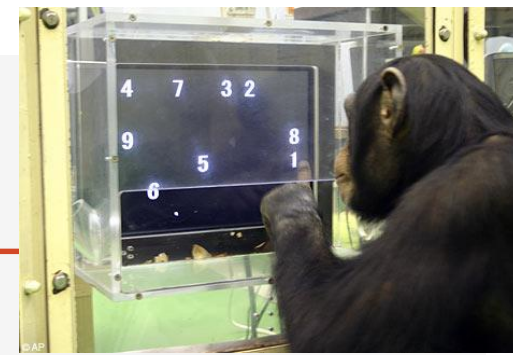


- How many predictor variables do we have?
- How many outcome variables do we have?
- How many conditions of the predictor do we have?

## Study 2

- Let one group of chimps play with features of economy → give chimps **written feedback @ performance** → test chimps.
- Let a *separate group* of chimps play with features of economy → give chimps **bananas (or not) based on performance** → test chimps.
- Compare test performance across feedback conditions.

Hypothesis: Chimps will learn to run the economy better if they are trained using **bananas** vs. **written** feedback.



#### within-subjects design AKA repeated measures design

- First, let chimps play w/features of economy → give chimps **written feedback @ performance** → test chimps.
- Then, let same chimps play with features of economy → give chimps **bananas (or not) based on performance** → test again.
- Compare test performance across feedback conditions.

#### between-subjects design

- Let one group of chimps play with features of economy → give chimps **written feedback @ performance** → test chimps.
- Let a separate group of chimps play with features of economy → give chimps **bananas (or not) based on performance** → test chimps.
- Compare test performance across feedback conditions.

The IV/predictor, its levels, and the DV/outcome is the same across the two studies; what differs is the experimental **design** of the two studies.

# Two Methods of Manipulating IVs

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- **Within-subjects (*aka* repeated measures) design**
  - The *same* entities take part in *all* conditions of your independent variable (IV)

In psychology,  
“entities” are  
often (but not  
always) people.
- **Between-subjects design**
  - *Different* entities take part in each condition of your IV

Why is it important for us to learn about this distinction in this course?



# PRACTICE – label with “within” or “between”

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Pro Tip: Figure out the predictor variable (IV) and its levels, and the outcome variable. Then ask:  
*Does each person get to experience/partake in every level of the predictor variable? → **within!***  
*Or do different people partake in the different levels of the predictor variable? → **between!***

#1. Students are randomly assigned to drink either a bottle of Poland Spring® or smartwater® at the beginning of class. Dr. Valenti counts how many times each person participates during class.

#2. Students take a pre-test on research methods concepts, and then take PY 221 & PY 222. At the end of PY 222, a post-test is given to see if scores have improved.

#3. Freshmen are registered for 1 of 4 different ES courses. At the end of the semester, all freshmen are asked to evaluate their ES course and these evaluations are compared.

#4. A professor keeps the lights on in the classroom vs. off in the classroom on different randomly assigned days across the semester. She measures how many students nod off during class to see if lighting affects sleepiness in class.

1. Btwn
2. Within
3. Btwn
4. Within

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1. What are statistics?
  - descriptive
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3. Populations and samples
4. Types of designs
- 5. Types of variables**

# Two main types of variables (starting on p. 13 of textbook)

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## QUALITATIVE (aka **categorical**) variables

- Express an attribute or quality of something
- Possible responses may not have a sensible order
- Ex: *nominal variables*
- Ex: "religion," "eye color," and "favorite movie" are all *qualitative variables*.

### EXAMPLES of variables

1. Outdoor temperature (°F)
2. Registered to vote vs. not
3. T-shirt size (e.g., S, M, L, XL)
4. Height of a plant (meters)

## QUANTITATIVE variables

- Amounts or counts\*
- Measured in terms of numbers
- Possible values/responses *can* be ordered sensibly
- EX: *ordinal, interval, and ratio scales*

*\*with some exceptions*

EX: "body weight in lbs" is a *quantitative variable*

# Two main types of variables (starting on p. 13 of textbook)

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## **QUALITATIVE** (aka **categorical**) **variables**

- Express an attribute or quality of something
- Possible responses may not have a sensible order
  - EX: religion, eye color, favorite movie

### EXAMPLES – which is which?

1. Outdoor temperature (°F)
2. Registered to vote vs. not
3. T-shirt size (e.g., S, M, L, XL)
4. Height of a plant (meters)

## **QUANTITATIVE** **variables**

- Amounts or counts
  - Measured in terms of numbers
  - Possible values/ responses *can* be ordered sensibly
- EX: body weight in lbs

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## **QUALITATIVE** (aka **categorical**) **variables**

- Express an attribute or quality of something
- Possible responses may not have a sensible order
  - EX: religion, eye color, favorite movie

## Which is which?

1. Outdoor temperature (°F)
2. Registered to vote vs. not
3. T-shirt size
4. Height of a plant (meters)
5. Type of Olympic medal
6. Outcome of a coin toss
7. Time btwn thunder & lightning
8. How old someone is
9. College major
10. Occupation
11. Annual income in dollars & cents
12. Distance btwn 2 students in room
13. How much do you like broccoli on a scale of 1-not at all to 10-an extreme amount?

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## **QUANTITATIVE** **variables**

- Amounts or counts
  - Measured in terms of numbers
  - Possible values/responses can be ordered sensibly
- EX: body weight in lbs

## Which is which?

### **QUALITATIVE (categorical) variables**

- Express an attribute or quality of something
- Possible responses may not have a sensible order
  - EX: religion, eye color, favorite movie

1. Outdoor temperature (°F)
2. Registered to vote vs. not
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11. Annual income in dollars & cents
12. Distance btwn 2 students in room
13. How much do you like broccoli  
on a scale of 1-not at all to  
5-an extreme amount?



*Psychologists typically treat  
scale questions like this as  
**quantitative.***

### **QUANTITATIVE variables**

- Amounts or counts
  - Measured in terms of numbers
    - Possible values/responses can be ordered sensibly
- EX: body weight in lbs



An example of a *binary* or *dichotomous* qualitative variable (binary = only 2 categories)



Which is which?

Outdoor temperature (°F)

2. Registered to vote vs. not

3. T-shirt size

4. Height of a plant

5. Type of Olympic medal

6. Outcome of a coin toss ★

7. Time btwn thunder & lightning

8. How old someone is

9. College major

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## QUALITATIVE (categorical) variables

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## QUANTITATIVE variables

- Amounts or counts
  - Measured in terms of numbers
    - Possible values/responses can be ordered sensibly
- EX: body weight in lbs

There is a self-graded HW assignment on Moodle related to these important concepts.

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- The next few slides are connected to the exercise given out in class, which is also on Moodle in the “Class Handouts” section.



# PRACTICE Ch. 1 concepts -- #1

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- Jade hypothesizes that watching football makes people more aggressive. She has all Ps in her study watch 10 minutes of a football game in which there is a good deal of aggressive tackling, and then she has her Ps punch a punching bag for 15 seconds – it's a special, high-tech punching bag that records amount of force. She also has the Ps watch 10 minutes of baseball in which no aggression is displayed, and then has them punch the punching bag for another 15 seconds. The order of the two tasks (baseball vs. football) is randomly determined for each participant. She compares the average force of each set of 15s punches.
  1. Is this a correlational study or an experiment? Why do you think so?
  2. Identify the predictors/outcome variables/IVs/DVs.
  3. Classify your predictor/IV as *qualitative* or *quantitative*.
  4. Does "between-subjects" or "within-subjects" better fit how the IV is manipulated, and why do you think so?

# PRACTICE Ch. 1 concepts -- #1

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1. Is this a correlational study or an experiment? Why do you think so?

**ANSWER: An experiment. She *manipulates* sport, making all Ps watch 10 min. of both sports, and randomly assigning participants to watch the sports in one of two different orders. She also measures a dependent variable (aggression). Finally, she standardizes the procedures. For example, baseball and football are each watched for 10 minutes, the punching is held constant at 15 seconds for each sport and for all participants.**

2. Identify any predictor variables, outcome variables, IVs, and DVs.

**ANSWER: IV (aka, predictor variable) is “sport watched”**

**DV (aka outcome variable) is “aggression,” measured as force of punches**

# PRACTICE Ch. 1 concepts -- #1

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3. Classify your predictor/IV as *qualitative* or *quantitative*.

**ANSWER: IV is qualitative – “baseball” and “football” are the categories (in this case, also known as the *levels* (or *conditions*, or *groups*) of the IV)**


4. Does “between-subjects” or “within-subjects” better fit how IV is manipulated? Why?

**ANSWER: within-subjects. The independent variable is “sport watched,” with the levels “baseball” and “football.” Because each level of the IV (baseball & football) is administered to each entity (i.e., both sports are watched by every single participant), we have a within-subjects design.**

You may have noticed that Jade also manipulated *order* in which the sports were watched. The manipulation of order is **between-subjects**, because each of the two levels of orders (baseball 1<sup>st</sup> vs. football 1<sup>st</sup>) is assigned to different participants.

# PRACTICE #1 – same scenario, following up question

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- Jade hypothesizes that watching football makes people more aggressive. She has all Ps in her study watch 10 minutes of a football game in which there is a good deal of aggressive tackling, and then she has her Ps punch a punching bag for 15 seconds – it's a special, high-tech punching bag that records amount of force. She also has the Ps watch 10 minutes of baseball in which no aggression is displayed, and then has them punch the punching bag for another 15 seconds. The order of the two tasks (baseball vs. football) is randomly determined for each participant. She compares the average force of each set of 15s punches.
- **How would we make this study a correlational study?**
  - A correlational study would involve *measuring* "watching football" & *measuring* "aggression"  
 i.e., record, assess, have Ps report
  - Jade might hypothesize that the more hours per week a person spends watching football, the more aggression they tend to display.
    - Note that the language here does not explicitly refer to cause and effect.

## PRACTICE #2

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Suppose we *measured* “watching TikTok videos” in the following ways. Identify whether each measure is **qualitative** or **quantitative**

1. put Ps in front of a screen with an open TikTok account, and ask them to watch for as long as they’d like, and time them.
2. give people a questionnaire asking how many minutes of TikTok videos they tend to watch per day.
3. ask people what they watch the most of in a given week – YouTube videos or TikTok videos.

1. Quantitative
2. Quantitative
3. Qualitative *and in particular, it's a binary qualitative variable*

## Practice #3 - answer

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Suppose a school administrator wanted to examine whether greater program attendance **caused** higher reading scores.

Could they learn this information from the study that the teacher conducted? **No.**

Why or why not?

**The study that was run used a correlational design. To conclude that attendance causes better scores, we'd need to run a study with an experimental design.**

...if not, design a study that could test the hypothesis that greater program attendance caused higher reading scores. How would you change the study method described above? Be specific.

**We would have to manipulate program attendance. We might create three levels of program attendance: No attendance, Attend 10-12 sessions, Attend 20-25 sessions.**

**We would then randomly assign students to one of these three groups, requiring them to not attend, attend between 10 and 12 times, or attend between 20 and 25 times.**

**In April, all students would take the same standardized test so that we could measure their reading scores.**

## Practice #4

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Generate three different variables and, for each, describe a way to measure it. Then, given the way you are choosing to measure each variable, state, for each, whether the variable is being measured in a **qualitative** or **quantitative** way.

Other rules:

- You cannot use any of the examples that I have provided today (e.g., the variables *age* and *college major* are off limits) and you cannot use any examples you remember from your textbook.
- Among your three examples must be at least one quantitative variable and at least one qualitative variable. The third example is up to you.

# More practice with experimental methods

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- HYPOTHESIS: Being in a sad mood makes you engage in more critical thinking than being in a happy mood.

- STUDY METHOD:

1) Manipulate **mood**

- I. Sad
- II. Happy
- III. Neutral (control group)

2) Measure **amount of critical thinking**

**\*\* and** researchers use random assignment to conditions, and do their best to treat the Ps in the various mood groups identically, except for whatever is done to vary their mood.

Fill in the blank:

1. The predictor variable in this study is: \_\_\_\_\_.
2. The outcome variable in this study is: \_\_\_\_\_.
3. The independent variable in this study is: \_\_\_\_\_.
4. The dependent variable in this study is: \_\_\_\_\_.
5. Our independent variable has [insert #] levels.  
They are: \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.



# More practice with experimental methods - KEY

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- HYPOTHESIS: Being in a sad mood makes you engage in more critical thinking than being in a happy mood.

- STUDY METHOD:

1) Manipulate **mood**

- I. Sad
- II. Happy
- III. Neutral (control group)

2) Measure **amount of critical thinking**

**\*\* and** researchers use random assignment to conditions, and do their best to treat the Ps in the various mood groups identically, except for varying their mood.

Fill in the blank:

1. The predictor variable in this study is: **mood**.
2. The outcome variable in this study is: **amount of critical thinking**.
3. The independent variable in this study is: **mood**.
4. The dependent variable in this study is: **amount of critical thinking**.
5. Our independent variable has **3** levels. They are: **sad, happy, and neutral**.

*Tuesday we'll be back in this classroom.*

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- You'll work in groups on Practice Lab #1. *If possible*, bring your laptop with your lecture slides downloaded, and your textbook.
- To work on the practice lab, you must first...
  - finish Ch. 1 reading (if you haven't already)
  - study all of the PPT slides for Chapter 1
  - complete the self-graded homeworks for Ch. 1 (on Moodle)
  - finish today's handout
- And of course, complete LSR #2 between 8:00 pm and 12:30 pm

Also, please complete your first P3R survey of the semester,  
to account for the work you did this week!