

# Psychology of Perception

Psychology 4165, Section 100

Spring 2019  
Tuesday and Thursday  
11:00–12:15  
Muenzinger E113

Lewis O. Harvey, Jr. – Instructor  
Dillon J. McGovern – Teaching Assistant



Thatcher Illusion (Thompson, 1980)

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## Syllabus Topics and Reading Assignments

Week 1	15 Jan	Introduction-----Study Guide 1 -----	(W 1)
Week 1	17 Jan	Psychophysics -----Homework 1-----	(W 1)
Week 2	22 Jan	Vision -----	(W 2)
Week 2	24 Jan	Vision -----Homework 2-----	(W 2)
Week 3	29 Jan	Spatial Vision -----Study Guide 2 -----	(W 3)
Week 3	31 Jan	Spatial Vision -----Homework 3-----	(W 3)
Week 4	5 Feb	Object Perception -----	(W 4)
Week 4	7 Feb	Object Perception -----Homework 4-----	(W 4)
Week 5	12 Feb	Color Vision-----	(W 5)
Week 5	14 Feb	Color Vision-----Homework 5-----	(W 5)
Week 6	19 Feb	Space Perception -----Study Guide 3 -----	(W 6)
Week 6	21 Feb	Space Perception -----Homework 6 -----	(W 6)
Week 7	26 Feb	Attention-----	(W 7)
Week 7	28 Feb	Attention-----	(W 7)
Week 8	5 Mar	<b>Exam 1 -----Mid-Term Exam (200 points) -----</b>	
Week 8	7 Mar	Motion-----	(W 8)
Week 9	12 Mar	Hearing-----Study Guide 4 -----	(W 9)
Week 9	14 Mar	Hearing-----	(W 9)
Week 10	19 Mar	Audition-----	(W 10)
Week 10	21 Mar	Audition-----Homework 7-----	(W 10)

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Week 11	26 Mar	Spring Break – No Class	
Week 11	28 Mar	Spring Break – No Class	

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Week 12	2 Apr	Music & Speech -----	(W 11)
Week 12	4 Apr	Music & Speech ----- Homework 8-----	(W 11)

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Week 13	9 Apr	Vestibular-----	Study Guide 5 -----(W 12)
Week 13	11 Apr	Vestibular-----	(W 12)

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Week 14	16 Apr	Touch -----	(W 13)
Week 14	18 Apr	Touch -----	(W 13)

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Week 15	23 Apr	Taste & Smell -----	(W 14 & 15)
Week 15	25 Apr	Taste & Smell -----	(W 14 & 15)

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Week 16	30 Apr	Dynamic Interactions --	
Week 16	2 May	Review-----	Outside Readings Paper Due (90 points) -----

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6 May 2019 **Final Exam (300 points), Monday, 16:30–19:00, MUEN E113**

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- The “Homework x” notation on the syllabus indicates when homework assignments will be handed out. The homework will be due one week later
- The “Study Guide x” notation on the syllabus indicates when study guides will be handed out. The study guides are meant to focus your reading and notetaking in the lecture portion, as well as focus on the laboratory exercises. They are designed to prepare you for the midterm exam on Tuesday, 5 March 2019 and for the final exam on Monday, 6 May 2019.

## Textbook for the Course

Wolfe, J. M., Kluender, K. R., Levi, D. M., Bartoshuk, L. M., Herz, R. S., Klatzky, R. L., & Merfeld, D. M. (2018). *Sensation & Perception* (Fifth ed.). New York, NY: Oxford University Press.

**Note:** The numbers in parentheses above refer to chapters in the Wolfe (W) text. Please read the indicated chapter before the class meeting.

### Clickers

We will use i>clickers in the class. The clicker code for MUEN E113 is BD. Be sure to bring your clicker to class and register it in your MyCUinfo account so you can receive credit for using it in the class. See <https://oit.colorado.edu/tutorial/cuclickers-iclicker-remote-registration> for instructions on how to register your i>clicker.

### Canvas

The website for the course is available through Canvas using your CU Identikey and password or directly from this URL:

[http://psych.colorado.edu/~lharvey/P4165/P4165\\_2019\\_1\\_Spring/Main\\_Page\\_2019\\_Spring\\_PSYC4165.html](http://psych.colorado.edu/~lharvey/P4165/P4165_2019_1_Spring/Main_Page_2019_Spring_PSYC4165.html)

All handouts, homeworks, study guides, and lab materials are available from this web page. The outside reading, the lectures, and your grades are available through Canvas.

### Office Hours

Name	Lewis O. Harvey, Jr.	Dillon J. McGovern
Office	MUEN D251b	MUEN D140c
Hours	Tues, Wed, Thurs: 09:00–10:00 and by appointment	Tues, Thurs: 09:30-10:30 in lab and by appointment
Telephone	303-492-8882	
email	lewis.harvey@colorado.edu	Dillon.McGovern@colorado.edu
web	<a href="http://psych.colorado.edu/~lharvey/">http://psych.colorado.edu/~lharvey/</a>	

## Laboratory Schedule

Section L101: 12:30–15:20 Tuesday, Room MUEN D346  
Section L102: 12:30–15:20 Thursday, Room MUEN D346

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1. 15 & 17 Jan 2019      **Lab 1:** Doing Computer-Controlled Experiments  
**Lab 1 Report Due 23:59, Friday, 18 January 2019 (10 points)**
  2. 22 & 24 Jan 2019      **Lab 2:** Using R for Data Analysis  
**Lab 2 Report Due 23:59, Friday, 25 January 2019 (20 points)**
  3. 29 & 31 Jan 2019      **Lab 3:** Data Collection: **Face Recognition**
  4. 5 & 7 Feb 2019      **Lab 3:** Data Analyses: **Face Recognition**
  5. 12 & 14 Feb 2019      **Lab 4:** Create PsychoPy Experiment: **Auditory Scaling**  
**Lab 3: Report Due 23:59, Friday, 15 February 2019 (30 points)**
  6. 19 & 21 Feb 2019      **Lab 4:** Group Data Analyses: **Auditory Scaling**
  7. 26 & 28 Feb 2019      **Lab 5:** Create PsychoPy Experiment: **Stroop Effect**  
**Lab 4: Report Due 23:59, Friday, 1 March 2019 (40 points)**
  8. 5 & 7 Mar 2019      **Lab 5:** Group Data Analysis: **Stroop Effect**  
**Lab 6: Form Research Project Teams**  
**Lab 6 Proposal Version 1 Due at end of lab**
  9. 12 & 14 Mar 2019      **Lab 6:** Work on Group Projects: Design Experiment  
**Lab 5 Report Due 23:59, Friday, 15 March 2019 (50 points)**  
**Lab 6 Proposal Version 2 Due at end of lab**
  10. 19 & 21 Mar 2019      **Lab 6:** Work on Group Projects: Data Collection
  11. 26 & 28 Mar 2019      **Spring Break: No Classes**
  12. 2 & 4 Apr 2019      **Lab 6:** Work on Group Projects: Data Collection
  13. 9 & 11 Apr 2019      **Lab 6:** Work on Group Projects: Data Collection
  14. 16 & 18 Apr 2019      **Lab 6:** Work on Group Projects: Data Analysis  
**Lab 6:** Work on Group Projects: Data Analysis
  15. 23 & 25 Apr 2019      **Lab 6:** Work on Group Projects: Presentations  
**Lab 6:** Work on Group Projects: Presentations  
26 Apr 2019, Friday      **Lab 6: Group Project Posters due (25 points)**
  16. 30 Apr 2019, Tuesday      **Lab 6: All Group Project Presentations (25 points)**  
Room: MUEN E214, 12:30-15:20  
1 May 2019, Wednesday      **Undergraduate Research Day**  
UMC Glenn Miller Ballroom, 15:00-17:00  
2 May 2019, Thursday      **Lab 6: Final Project Reports due (70 + 30 points)**
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## Outside Readings

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1. 15 Jan 2019 (Swets, 1961) —
  2. 22 Jan 2019 (Schiller & Carvey, 2005) —
  3. 29 Jan 2019 (Axelsson et al., 2018) —
  4. 5 Feb 2019 (Owens, Antonoff, & Francis, 1994) —
  5. 12 Feb 2019 (Jacobs & Nathans, 2009) —
  6. 19 Feb 2019 (Kaufman & Rock, 1962) —
  7. 26 Feb 2019 (Most, Scholl, Clifford, & Simons, 2005)  
(Most & Astur, 2007) —
  8. 5 Mar 2019 (Devyatko, Appelbaum, & Mitroff, 2017) —
  9. 12 Mar 2019 (Leek & Summers, 1993) —
  10. 19 Mar 2019 (Plomp & Levelt, 1965) —
  11. 26 Apr 2019 **Spring Break – No Classes** —
  12. 2 Apr 2019 (Arnal, Flinker, Kleinschmidt, Giraud, & Poeppel, 2015) —
  13. 9 Apr 2019 (Held, 1965) —
  14. 16 Apr 2019 (Slater, Spanlang, Sanchez-Vives, & Blanke, 2010)  
(Guterstam, Petkova, & Ehrsson, 2011) —
  15. 23 Apr 2019 (Gelstein et al., 2011)  
(Gračanin, van Assen, Omrčen, Koraj, & Vingerhoets, 2017) —
  16. 30 Apr 2019 **Last Week of Class** —
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Copies of these papers are available to download for reading through Canvas using your CU IdentiKey ID. See the reference section at the end of the syllabus for complete citation information.

## Conditions Under Which the Course Operates

### **Lecture:**

There will be two exams given during the semester: one mid-term and one final examination. Both are required. No make-up examinations will be given. You will receive a grade of zero for each exam not taken. There will be eight homework assignments. Each homework will be handed out on a Friday (indicated on the syllabus) and will be due the following Friday. Home works should be prepared using R Markdown with RStudio. The pdf rendering (knitting) of the markdown file for each homework must be uploaded to the appropriate Canvas Assignment Dropbox. Participation counts for 3% of your grade. It will be assessed by using clickers during each lecture meetings.

### **Outside Articles Reading:**

There are 17 journal articles that are assigned as part of the course. These papers will form the basis of a six to nine-page paper about experimental design and drawing conclusions from data that you will write. This paper will be due on Wednesday, 12 December 2018, the last day of class, and is worth 90 points. Your paper will be returned to you at the final exam.

### **Laboratory:**

The laboratory is not optional in PSYC 4165. There are eight graded assignments in the laboratory. The sum of the eight grades will be your laboratory grade. All lab reports will be prepared using RStudio and R-markdown so that your writing can be integrated with data analysis and graphic presentations and presented as a pdf document.

### **Grading:**

Your final grade is computed from your exam scores, your laboratory grade, your homework grades, and the outside readings paper grade. The total possible points in the course is 1000:

200	First Examination (Tuesday, 5 Mar 2019, 11:00-12:15)
300	Final Examination (Monday, 6 May 2019, 16:30–19:00)
300	Laboratory Grade
80	Homework Grade
90	Outside Readings Paper Grade (Thursday, 2 May 2019)
30	Participation
<hr/>	
1000	Total Possible Points

Your final letter grade in the course will be assigned in the following manner. The mean score of the top three students computed as a reference score. Your letter grade is determined by comparison to this reference score:

	A > 94%,	A- 90% of reference score
B+ > 87%,	B > 83%,	B- 80% of reference score
C+ > 77%,	C > 73%,	C- 70% of reference score
D+ > 67%,	D > 63%,	D- 60% of reference score
	F < 60%	

It is therefore possible for the entire class to receive the grade of A. By the same token, it is also possible that very few people would receive an A, depending on the spread of grades across the class.



## **Comments About the Psychology of Perception**

### ***Why Take This Course?***

There are three reasons to take this course:

1. To gain an understanding of the capabilities and limitations of our perceptual experiences;
2. To sharpen your ability to critically evaluate theories of perception in light of the results of experiments;
3. To gain practical skills in the use of computers for designing experiments, for analyzing and graphing data, and for preparing written research reports.

The study of perception is the oldest part of modern psychology. It developed from trying to answer two questions posed by philosophers: “How do we know what we know?” and “Why do things appear the way they appear?” Since most of what we know about the outside world comes to us through our sensory systems, our sensory capabilities were the first to be studied extensively. Perceptions are derived from neural and psychological mechanisms that operate on sensory information. We will study the limits of our sensory and perceptual abilities and learn how to characterize the unreliability that results from these limits.

### ***Prerequisites:***

A broad understanding of the basic concepts from a general psychology course is assumed. You will be using methods of inferential statistics, such as those taught in PSYC 2111 and PSYC 3111, to evaluate the results of your experiments. A facile ability with these methods in particular and with mathematical concepts through algebra and trigonometry are required. A familiarity with calculus is helpful but is not necessary. Please work through the eight questions on the next two pages. If you find these questions very difficult and you don't even know how to find out how to answer them, you probably are not ready to take this course.

You will be expected to write in a clear and grammatically correct style in this class. If you believe you will require extra help with your writing, please visit The Writing Center located in Norlin E111. More information can be found at:

<http://www.colorado.edu/pwr/writingcenter.html>.

You can also reach The Writing Center help desk by phone at (303) 735-6906.

You need to make a considerable commitment of time to do well in this class. For each credit hour of the course you should expect to spend 3 hours on class-related activities (studying, research, writing) per week. Since the class is a four-credit course, expect to spend 12 additional hours per week outside the class and laboratory.

### Skills Needed for Psychology of Perception

**Question 1:**

Rearrange the following linear equation to solve for  $b$ :  $y = a + bx$

$$b =$$

**Question 2:**

Solve the following equation for  $X$ :  $y = \log(x)$

$$x =$$

**Question 3:**

Using R, compute the arithmetic mean and the standard deviation of this sample of numbers:  
10.0, 9.0, 12.0, 11.0, 8.5, 13.0, 8.0, 10.0, 7.0, and 11.5:

$$\mu =$$

$$\sigma =$$

**Question 4:**

In an experiment, you observe the number of times six different kinds of events occur. A theoretical model makes predictions about how often these events *should* occur. These data are presented in the table below. Using R compute the chi-square ( $\chi^2$ ) statistic to test if the observed data are significantly different from the predicted data. You may assume  $n-1=5$  degrees of freedom for the significance test.

	E1	E2	E3	E4	E5	E6
Observed Data	174.0	172.0	104.0	92.0	41.0	8.0
Predicted Data	175.5	167.8	106.5	90.4	44.3	6.5

$$\chi^2 =$$

**Question 5:**

In an experiment with two levels of an independent categorical variable you observe the following values of the dependent variable for 10 subjects (five were tested under level 1 and five under level 2). Compute the mean of each group and then fit a linear model to the data using R. Is there a meaningful difference between the means of the two groups? Explain your conclusion.

Level 1		Level 2	
Subject	Dependent	Subject	Dependent
1	8.0	6	10.0
2	9.0	7	9.5
3	7.5	8	11.0
4	7.0	9	9.0
5	8.5	10	10.5
Mean		Mean	

**Question 6:**

Convert the probability 0.8413447 to a quantile score based on the cumulative distribution function (CDF) of the unit normal Gaussian distribution (a quantile is a z-score). Such a transformation is achieved by the quantile function ( $q \leftarrow \text{qnorm}(p)$  in R, where  $p$  is the probability). What is the probability that a single sample drawn from a population having a Gaussian distribution with a mean of 0.0 and a standard deviation of 1.0 will have a value of 1.959964 or greater (use  $\text{pnorm}(q)$  in R)?

$q =$

$p =$

**Question 7:**

Using least-squares linear regression,  $\text{lm}()$ , in R, find the y-intercept ( $b_0$ ) and the slope ( $b_1$ ) of the straight line,  $y = b_0 + b_1x$ , that best fits this set of data:

$x$	1.0	3.0	5.0	7.0	9.0
$y$	0.98	8.73	17.0	20.9	27.4

$b_0 =$

$b_1 =$

**Question 8:**

Plot the data in Question 7 on a graph using linear axes. The x-axis should have a range of 0.0 to 10.0 and the y-axis should range from 0.0 to 30. Use either  $\text{plot}()$  or  $\text{ggplot}()$  in R.

## **AGREEMENTS FOR PARTICIPATING IN THE COURSE**

The purpose of these agreements is to create a condition that allows all people in the class to get maximum value from the course.

### **AGREEMENTS**

- 1 You agree to be responsible for these agreements.
- 2 You agree to be on time to class and to your laboratory meetings.
- 3 You agree to complete the assigned reading and homework on time.
- 4 You agree to complete your laboratory assignments on time.
- 5 You agree to attend all class and laboratory meetings unless an emergency comes up.
- 6 You agree to understand the material.
- 7 You agree to ask questions when you don't understand the material.
- 8 You agree to communicate any complaints and criticisms you may have only to someone who can do something about the situation and you agree not to complain or to criticize to someone who cannot do something about the situation.
- 9 You agree to get value out of your participation in the course.

If you attend the next class meeting, you are accepting responsibility for the above agreements.

**Statements Required by  
Associate Vice Chancellor for Undergraduate Education**

## **Accommodation for Disabilities**

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the [Disability Services website](#). Contact Disability Services at 303-492-8671 or [dsinfo@colorado.edu](mailto:dsinfo@colorado.edu) for further assistance. If you have a temporary medical condition or injury, see [Temporary Medical Conditions](#) under the Students tab on the Disability Services website.

## **Classroom Behavior**

Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. For more information, see the policies on [classroom behavior](#) and the [Student Code of Conduct](#).

## **Honor Code**

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the policy may include: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code ([honor@colorado.edu](mailto:honor@colorado.edu)); 303-492-5550. Students who are found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code as well as academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found at the [Honor Code Office website](#).

## **Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation**

The University of Colorado Boulder (CU Boulder) is committed to fostering a positive and welcoming learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct (including sexual assault, exploitation, harassment, dating or domestic violence, and stalking), discrimination, and harassment by members of our community. Individuals who believe they have been subject to misconduct or retaliatory actions for reporting a concern should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127 or [cureport@colorado.edu](mailto:cureport@colorado.edu). Information about the OIEC, university policies, [anonymous reporting](#), and the campus resources can be found on the [OIEC website](#). Please know that faculty and instructors have a responsibility to inform OIEC when made aware of incidents of sexual misconduct, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about options for reporting and support resources.

## **Religious Holidays**

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, please let me know when you have conflicts so we can accommodate you. See the [campus policy regarding religious observances](#) for full details.

## References

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