You need to know

- Materials in the slides
- Materials in the 5 coglab presented in class
- Textbooks chapters
- Information/explanation given in class

- you can have all these documents with you + your notes during the exam

Types of questions

- (1) Short questions
- (2) Interpretation Questions
- (3) Experiment design and criticism

The number of points will be indicated for each question.

- The exam is worth a total of 20 points

Variables and Scales

Gender

ZIP code

IQ measures

Placement in a beauty contest

Major programs

Response speed

Order in a race

perc

| Nominal | O | Interval | Ratio |
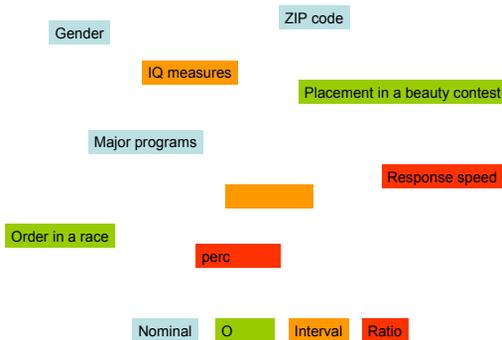
Short question

- " list your 10 favorite CDs – 1-10".
- Which kind of measurements scale is this?

Measurement Scale: Ordinal Scale

- E.g., list your 10 favorite CDs – 1-10.
- It may be that you like #1 and #2 about the same but like these much more than #3 – if so, the distance between 1 and 2 is not the same as the distance between 2 and 3

- A measure that both assigns objects or events a name and <u>arranges them in order of their magnitude</u>

- A list of objects/stimuli arranged in order of preference
- Rule to assign numbers on an ordinal scale: the **rank order** of numbers on the scale must represent the rank order of the psychological attributes of the objects or events.
- On ordinal scale give **the order of preference** not the difference in preference among items

Short question

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- **Interval and ratio scales** allow you to perform most mathematical operations on them and **inferential statistics** (parametric statistics, like pearson correlation, t-test, ANOVA).
- **Nominal and ordinal scale have specific statistics**: non parametric statistics, based on the rank order of the data or on the sign of the differences between subjects.

Short question

- **What does d' (d prime) measure?**

Short question d'

- **d' is a measure of sensitivity.**
- The larger the d' value, the better your performance.
- A d' value of zero means that you cannot distinguish trials with the target from trials without the target.
- A d' of 4.6 indicates a nearly perfect ability to distinguish between trials that included the target and trials that did not include the target.

SDT, Perception and Memory

"Yes-No" paradigms

- A research domain where SDT has been successfully applied is in **the study of memory**. Typically in memory experiments, participants are shown a list of words and later asked to make a "yes" or "no" statement as to whether they remember seeing an item before. Alternatively, participants make "old" or "new" responses. The results of the experiment can be portrayed in what is called a **decision matrix**.
- The hit rate is defined as the proportion of "old" responses given for items that are Old and the false alarm rate is the proportion of "old" responses given to items that are New.
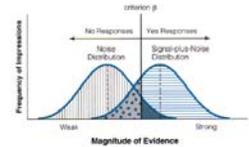
Hypothetical distribution of yes and no response. The decision criterion C determines whether a "yes" or "no" response will be made. Strong evidence to the right of the criterion will lead to "yes" responses and weak evidence to the "left" will lead to weak responses.

	Old	New
Say "Old"	Hit	False Alarm
Say "New"	Miss	Correct Rejection

Short question

- You want to design an experiment with 3 conditions: A, B and C. Being a good scientist, you want to completely counterbalance the order that subjects see these conditions. Show what this factorial counterbalancing looks like.

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  Answer:
  A B C
  A C B
  B A C
  B C A
  C A B
  C B A

Short question

- You want to add two more conditions to this experiment (D and E).

    (i) Name one reason you might not want to do a factorial counterbalance.

    (ii). Show a latin square counterbalancing of the 5 condition design.

    (iii). Why is the latin square design also counterbalanced?

Short question

- You want to add two more conditions to this experiment (D and E).
    1b (i) Name one reason you might not want to do a factorial counterbalance.
    Answer: eek, that's a lot of conditions, and latin square accomplishes the same thing.

    1b(ii). Show a latin square counterbalancing of the 5 condition design.
    Answer:
    A B C D E
    B C D E A
    C D E A B
    D E A B C
    E A B C D

    1b (iii). Why is the latin square design also counterbalanced?
    Answer: because each condition appears in each position the same number of times.

Short question

- You run an experiment with 8 subjects. You analyze the data and find that they have the following d' values:

1.0
1.7
0.9
2.4
2.1
1.2
-2.4
1.1

Would you exclude any subject(s) data? For what reason?

Short question

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- ANOVA means Analysis of Variance
- Goal: to compare variances estimates between conditions and groups

Short question

- When one conducts an ANOVA, a large F-ratio implies a significant result. Explain what the F-ratio is and why bigger values are better.

ANOVA

- The greater the variance (differences) between the groups of the experiment, the more likely the independent variable is to have had an effect, especially if the within group variance is low

- The *F* is a ratio of the between groups variance estimate to the within-groups variance estimate

$$F = \frac{\text{Between-groups variance}}{\text{Within-groups variance}}$$

•Under the null hypothesis, the F ratio should be 1

Visual Search

- Most of researchers separate the analyses of target present and target absent in visual search task. Why?

More on d'

- In the signal detection coglab, the mean d' centered around 0. Two subjects had d' values of ~-1. What does a large negative d' value mean?

Paradigms

- Briefly describe two paradigms for testing the change blindness phenomena.

Interaction graphs

- Sketch graphs of the following hypothetical results:
  a.) A main effect of variable 1, with no main effect of variable 2 and no interaction.

  b.) A main effect of variable 1 and variable 2 with interaction.

  c.) Interaction, but no main effects of either variable.

Interpretation

- Imagine a 2 factors experiment, with a factor C with two levels (C1, C2) and a factor X with two levels (X1, X2). The dependent variable is a score from -10 to + 10. The graph bellow show hypothetical results. Interpret the results by looking at the graph:

- is their a main effect of factor C ?
- is their a main effect of factor X ?
- is their an interaction?
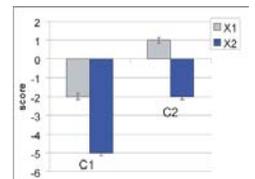
Interpretation question

- Greg is interested in whether or not children improve at knowing the past tense of a word between the ages of 3 and 4.
- He decides to follow a population of 20 children who have just turned 3 and measure their performance on a past tense test. He gets a score for each child that indicates the percent the child got correct on the test. Then he waits until they have just turned 4 and he tests the same children again on the same test. Greg now wants to find out if there is significant improvement between the children at age 3 and age 4. What kind of statistical analysis should he do? Be specific.

Interpretation

- A group of students in 9.63 run an RSVP (Rapid Sequential Visual Presentation) memory experiment with 2 factors:
- 1- presentation time of each image in the sequence (0.1 second or 1 second) and
- 2- the type of images (faces or natural landscapes pictures).

  Each RSVP stream had 12 different pictures. The experiment was a between design with 10 observers per group. At testing, they present 50% of the same images and add 50% of novel images. The dependent variable is d' (d prime). In the talk, they present the following group results (see graph).
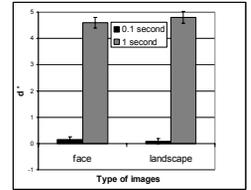
- a) Based on the graph, interpret the d' performances.
- b) Is there an interaction?
- c) If this was your pilot data, what would you change for the main experiment? why?

Interpretation

- **Human and Model**

- You want to compare a computational model of object detection to human performances. First, you have human observers performing a car detection task (say if a picture of an urban environment has a car or not). In your design, 50% of the images contained one car and 50% of the images have no car. You present the picture for only 50 msec, and masked them, to avoid ceiling effect in performances.

- You observe that the mean HIT rate (correct positive responses) of human observers is 82 % and the mean HIT performance of your model is also 82%. You conclude that your model performs as well as human observers.

- Is this conclusion valid? Do you need to take into account other measurement(s) of performances? which one(s) and why?

Interpretation question

- Remember the mental rotation coglab. Extend Shepard and Metzler's findings to another imagery task. What would they predict about how long it would take to say how many windows were in a familiar room in which the windows were far apart from each other vs. how many windows were in a familiar room in which the windows were close together.

Interpretation

You and your two project partners are analyzing some data for Project 3. You are looking at the effects of word length and word color on word memory. You chart your data and get the following bar graph:

One of your partners, Dan, claims there is no interaction here, just a main effect. Your other partner, Eva, claims that there is an interaction. Who do you side with? How do you explain your decision to them?
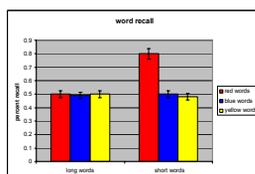
Interpretation question

- A group of 9.63 students wanted to study memory for pictures used to advertise vacations on the web.

- They ran a two factor study. Their first factor was the type of vacation (sea vs. snow). The second factor was the source of the pictures (from agencies vs. from people).

- To collect the images, they visited several advertising sites and found 10 colorful pictures of beach vacations and 10 colorful pictures of ski vacations. They also had 20 pictures from the vacation snapshots of one of the team members (10 pictures of sea and 10 pictures of snow vacations).

- During the learning phase, each of 12 subjects saw all 40 pictures for 0.5 second each (pictures were presented in random order). During the test phase, the 40 old pictures were randomly interleaved with 40 new pictures (more pictures of the vacation snapshots of one of the group members). Participants had to say if the picture was an old or a new picture.

- From the HITs and the False Alarms, the group computed a *d prime* for each subject

Interpretation question

• From the HITs and the False Alarms, the group computed a *d prime* for each subject, and the results are shown on the graph.

• Interpret and criticize the results and the experiment

• is there an interaction? Are there any problems with the data and/or the method?
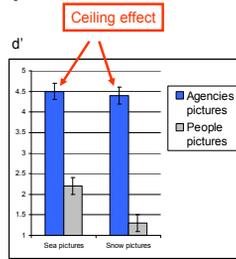
Provide a critic

• **Provide a critic**

Dr. Tandoori was asked to conduct a quick survey in three large cities to find out what political issues or problems were of primary importance to the voters. The results of the survey were to be used by a political candidate in developing her campaign. Dr. Tandoori randomly selected names from the phone books and called as many of these people as could be reached between 9 a.m. and 5 p.m. on Monday and Tuesday. The results were collated and presented to the candidate on Wednesday with the statement that this was a valid representation of the attitudes of the voters in the three cities.

Experimental design

• You are running a change blindness experiment. One factor is the type of change (location change or color change). The second factor is the importance of the object (central vs. marginal interest).

• What are the other factors you should control in this experiment?

Experiment design

• Video Games You work for a video game company. The company is working on a novel flight simulator game where the goal of the player is to detect and shoot enemy aircraft. Your boss asks you to propose an experiment which will test something interesting about the game. Your boss does not know much about experimental methods, human vision, attention, or marketing, so you can choose a question and a design that involve:
•   -- a perceptual aspect of visual processing (e.g. the color of the aircraft),
•   -- an attentional aspect (e.g. false cues),
•   -- subjective aspects (e.g. how to make the game more interesting), or
•   -- a marketing aspect (e.g. how to sell the game to a particular population).
• Choose a question related to the video game, and design one simple experiment (true or quasi-experimental design) which will test your question. Choose 1 or 2 independent variables, 1 dependent variable and 1 design (between or within). Formulate 1 or 2 hypotheses (interaction hypotheses are welcome but not a requirement). Tell us about the population of subjects. Make sure we can understand your design, and tell us what statistics you will run on the data you collect. Make some predictions about the data you'll see, and draw a graph that illustrates the significant effects you expect to find. Explain briefly why you think your question is interesting.

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