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Cognition Lab

VSTM task

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Outline

Writing a Report

- Why write a report
- Method section
- Design section
- APA style

Visual Short-Term Memory task

- Theoretical background
- Experimental task

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Why write a report?

One aspect of the lab course is to develop skills in experimental design, data analysis, interpretation etc.

However we need to be able to express these ideas/skills within a written form

- The lab report!

By writing reports you will develop a better writing style and through feedback, will learn how to structure a good report.

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Why write a report?

The aim of a lab report is to indicate to the reader the following:

- Why did you bother?
- How did you do it?
  - You should ask yourself *"Could someone replicate my experiment using the information I have provided them with?"*
- What did you find?
  - *What were the results of your investigation?*
- So what?
  - *How do your results relate to your hypothesis & what theoretical contribution do they make?*

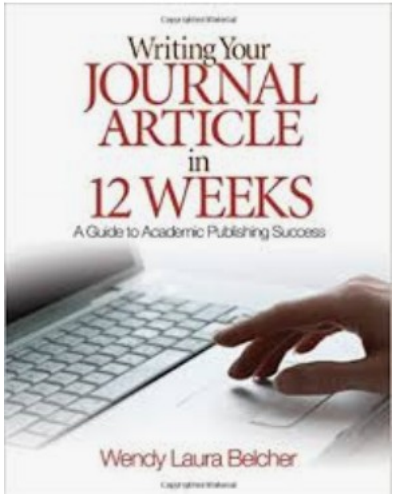
Standard approach

Sometimes reports (certainly some published papers!) can be lengthy…

To reduce the time looking for specific information we rely on a **standard structure** for a report.

Not every published paper contains all of the following sections/sub-sections, but you should include them if they are relevant.





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Sections of a lab report

Title
Abstract
Introduction
Method
- *Design*
- *Participants*
- *Apparatus & Materials (optional)*
- *Procedure*
- *Scoring (optional)*

Results
Discussion
References
Appendix (optional)

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In which order … ?

Title

Abstract 6.

Introduction 4. (outlined in advance)

Method 1.

- *Design*
- *Participants*
- *Apparatus & Materials (optional)*
- *Procedure*
- *Scoring (optional)*

Results 2.

Discussion 5.

References automatic

Appendix (optional) 3.

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Method section

Method

Someone should be able to repeat your experiment by reading this section!

Include **enough information for replication** of the study, but avoid superfluous information



- E.g. 'A pencil and paper were used to record the participant's gender'.

The Method always has clearly labelled sub-sections, but these do vary according to the type of experiment and the Journal type

- E.g. You may not always need an apparatus section (unless, for example, you used a MRI scanner and wanted to report the details about it)

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Method –sub-sections

Design

Participants

Apparatus and/or Materials (optional)

Procedure

Scoring (optional)

Sometimes the order of these sub-sections will be different if you pick up an academic paper. Try to stick with the order above.

Design sub-section

Here you should **formally describe** the type of design being used (using psychological design language)

- This is more often the case for an experimental design where IVs are manipulated and DVs measured. Not all designs (e.g. correlational) have IVs!

Directly **mention and define all IV(s)/DV(s)**.

- Remember to report units of measurement for DVs!

Conditions of the design should be mentioned and how they were manipulated

- E.g. Design type might be a between-subjects design

Design sub-section

You start mentioning the participants in the design sub-section.

You want to explain how the participants "relate" to the design.

That is, how many participants were tested under each condition?

Any design controls should be mentioned here.

- E.g. If the design counterbalanced for the ordering of two conditions, then say so.

How did you assign participants to conditions (or orders of conditions)?

Design sub-section

Example:

‘A repeated measures design was used. There were two independent variables: the lighting used in the nightclub (bright or dim) and the level of alcohol consumed (none or 6 pints). There were two dependent variables that were analysed separately: the participant’s ratings of physical attractiveness (the COAR scale) and their ratings of the attractiveness of personality (the CRAPS scale). Participants took part in all four conditions of the experiment.’

Participants sub-section

So **who** were tested in your experiment?

What age and gender were they?

How did you select them?

- A random sample?
- A snowball sample?
- A convenience sample?

How many of them were there?

Were there specific characteristics (selection criteria) of the people you tested that should be mentioned?

- E.g. All participants were right handed and bilingual.
- Only mention such things **if** they are important to your study

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Participants sub-section

Example:

‘Fifty participants completed all conditions of this study: 25 were male and 25 female. Ages ranged from 18 to 39 years (M = 24.26, SD = 3.52 years). Participants were all undergraduate students at the University of Sussex who took part in return for free admission to the nightclub. All participants were naive to the purpose of the experiment.’

Apparatus / Materials sub-section

This section describes the apparatus and materials used in testing the participants

Apparatus includes specialist equipment e.g. An Apple computer running E-Prime.

Clear **sentences** should be used to describe apparatus/materials and *not bulleted lists*!

Sometimes a Stimuli section is used to describe the stimulus materials that participants responded to

- E.g. Stimuli were four geometric shapes, each containing the letter A-D. Shapes were approximately 2cm wide by 2cm high and were presented in red.
- Sometimes you might find it easier to give some visual examples of stimuli if relevant within a figure, which you can make reference to in your write-up.

An Example Figure

Title (in italics)

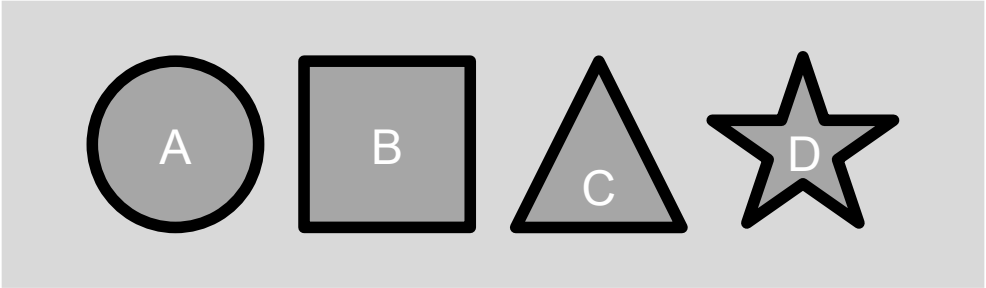


Figure 1: Examples of the four geometric shape stimuli used in the procedure (not to scale).

Caption

Reports can contain *figures* and/or tables and reference to any figure/table should be made in the main text of your report.

A figure can be a graph, charts, drawings, a photograph, a diagram, etc. and these elements are always referred to as a **'figure'** and numbered consecutively. The figure should have a title/caption **below** it (as in the example at the top!)

Just to be awkward, tables have the title and caption **above** the table!!

More on presenting Figures/Tables

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Figures/Tables often help explain things in fewer words

The reader should not have to refer to the text to understand your tables and figures: there should be explanatory figure/table captions

Figures and tables are labeled independently

- E.g. Figure 1 then later Table 1 (not Figure 1 then later Table 2!)

Axes on graphs should be clearly labeled

Units of measurement should be clear



Don't refer to 'graphs', 'diagrams', 'pictures', photographs' etc. in your main report text; use the terms 'Figure' and/or 'Table'

Procedure sub-section

This section should state how the design was implemented with the pre-mentioned participants, using the pre-mentioned design and apparatus/stimuli.

So when participants took part, what happened to them, and in what order, from the moment they began?

Mention important **timings** (especially important in many cognitive tasks).

Need enough detail to be able to replicate the procedure.

- Only include relevant detail!
- TOO DETAILED: E.g. Participants arrived 10 minutes before the start of the experiment. They were permitted, but not required, to sit. The wind was coming from the West…

Procedure sub-section

Very long instructions that were given to participants can be put into an **appendix** (but must be referred to e.g. 'For a full transcript of the instructions, see appendix 1.')

- Shorter instructions can be included in the main procedure section.

Any emphasis within instructions about how to respond should be made clear

- E.g. Participants were asked to respond as quickly as possible but were also reminded to be as accurate as they could be.

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Results section

More on presenting Figures/Tables

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Results

This section provides the reader with a clear, concise summary of the data you collected and the results of any statistical tests

Normally two parts to the results (not sub-sections though!)

1. Describe/Present the descriptive statistics
   - Means, standard deviations etc. for each group/condition
2. Follow with inferential statistical tests you have performed to examine the data
   - t-tests, ANOVA results, correlations etc.
   - E.g. 'An independent samples *t*-test was performed to examine any differences between the male and female groups. Males performed significantly faster than females ($t(29) = 3.65$, $p < .05$)
   - *Note that italics are used for a statistic and for probability*

Descriptive Statistics

When referring to descriptive/summary statistics try to be consistent with APA style

- *M* represents a mean. *Mdn* represents a median
- *SD* represents the standard deviation. *SE* represents standard error.
  - Remember to use UNITS
  - e.g. 'Males were faster than females on the image rotation task (Males: *M* = 20.1, *SD* = 3.6 msecs; Females: *M* = 30.5, *SD* = 7.3 msecs)

A graphical representation of summary statistics is best when there are a few means to compare

If there are lots of means/summary statistics then you may want to present them in table form

Results- Reporting Inferential Statistics /probabilites

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Always report the following information when reporting a statistic analysis

- the value of the test statistic
- degrees of freedom (or number of subjects, sometime n -1)
- one- or two- tailed test
- the observed *p*-value
- whether the test result was significant
  - Exact probability: E.g. 'The mean reaction time for the younger children was significantly slower than for the older children ($t(14) = 12.56$; $p = .03$, two-tailed test)
  - Or: 'The mean reaction time for the younger children was significantly slower than for the older children ($t(14) = 12.56$; $p < .05$, two-tailed test)
- APA suggests rounding to 2 decimal places and many authors do not use a "leading zero" for probabilities
  e.g. *p= .54* rather than *p=0.542*

Results

Remember:



- Descriptive statistics should be reported in sentence form or in a table (not a list)



- Statistical tests should be reported in the standard format for that test.



- Explain what these tests mean in relation to your experiment and the predictions

Results – What *not* to do

- Don't cut and paste tables from excel into your results section
- Don't include statistical calculations (by hand or computer)
- Don't include raw data in the results section (You can put it in the appendix if necessary)
- Don't try to complicate your results- this section is often best to be left as clear and straightforward as possible
- Don't *interpret* your results at this stage – save that for the Discussion. But you *should* state your results in an understandable form. e.g.:
  - 'Males were faster than females' is a statement about your results
  - 'Males were faster than females which supports the findings of Calder (1989), but is in opposition to Broad's (1990) theory which posited that the female brain was more developed for knitting skills' is a discussion & doesn't belong in the results section.

Final Tips

A good book

- Andy Field & Graham Hole (2003). How to design and report experiments. Sage: London.
  - Chapter 9, p. 287 onwards

Write in the past-tense throughout (apart from any predictions made in the intro can be phrased in the future tense)

Avoid personal grammar ('I', 'We' etc.)

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APA style

Section must be formatted in APA* style

- (*American Psychological Association)

"*Communication In Psychology*"

- At the end of PDF, example of **research paper** (like the one we are writing) in APA style, with comments
- excellent guide, maybe a bit outdated regarding APA requirements

"*Purdue guide*"

- This is an example or a **review paper**
- (up to date regarding APA– but be mindful this is a **review paper** – general structure may differ a bit from the model we are using)

"*Useful Phrases*"

- Excellent phrasebook

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VSTM task

Visual Short Term Memory Task

Today we will learn about the nature of visual short term memory by performing a lab exercise based on a well-known article: Luck, SJ & Vogel, EK (1997) The capacity of visual working memory for features and conjunctions. Nature, 390, 279-281

1. Read the original article by Luck & Vogel

2. Develop more skills for collecting and analyzing data; evaluating alternative hypotheses

Look at the images on the next slide.
Can you spot the differences
between the two images?



https://play.google.com/store/apps/details?id=com.wooglie.spotamsterdam. Do not distribute or reproduce

It probably took a few glances back and forth to spot differences between these photos.
Why is it difficult to spot the differences?

The answer lies in the limitations of our Visual Short-Term Memory.
We can only retain a few objects or features of an image in memory during any single glance.

Thus, to notice difference in the two photos we have to look back and forth, piece by piece, until we find patches of the images that do not match.

Each glance captures only a few features or objects of the image.

This lab exercise is modeled after the article by Luck & Vogel (1997) on visual short-term memory. (Visual short-term memory is sometimes referred to as visual working memory.)

In this slide presentation, we'll use the abbreviation VSTM to stand for "visual short-term memory"

Luck & Vogel wanted to find out whether "visual information is stored in working memory as individual features or as integrated objects." (Luck & Vogel, 1997, p. 279).

In other words, we know that VSTM can hold a limited number of “things”.

Luck & Vogel ask: What are these things?

Are these things whole **objects** (a picture of a face, car, table), complete with all their features (color, shape, texture)?

OR are these “things” the component **features** themselves?

Let's clarify these alternatives.

Hypothesis 1: VSTM is defined according to the number of **objects** it can hold. This means that with each glance you can remember only a small number of objects (maybe 3, 4 or 5). It also means that you remember all the features of the objects, such as the shape and color of each one. That can add up to a lot of component features since each object will have its own color, shape and texture!

Let's clarify these alternatives.

Hypothesis 2: VSTM is defined according to the number of **features** it can hold. This means that with each glance you can remember only a small number of features. You might remember an object's color, but not its shape. VSTM is limited by the number of features, not the number of objects.

The experiment we will run is based on the main experiment of Luck & Vogel used to "compare memory for simple features with memory for objects defined by a conjunction of features". (their results are in **Fig. 1 c**).

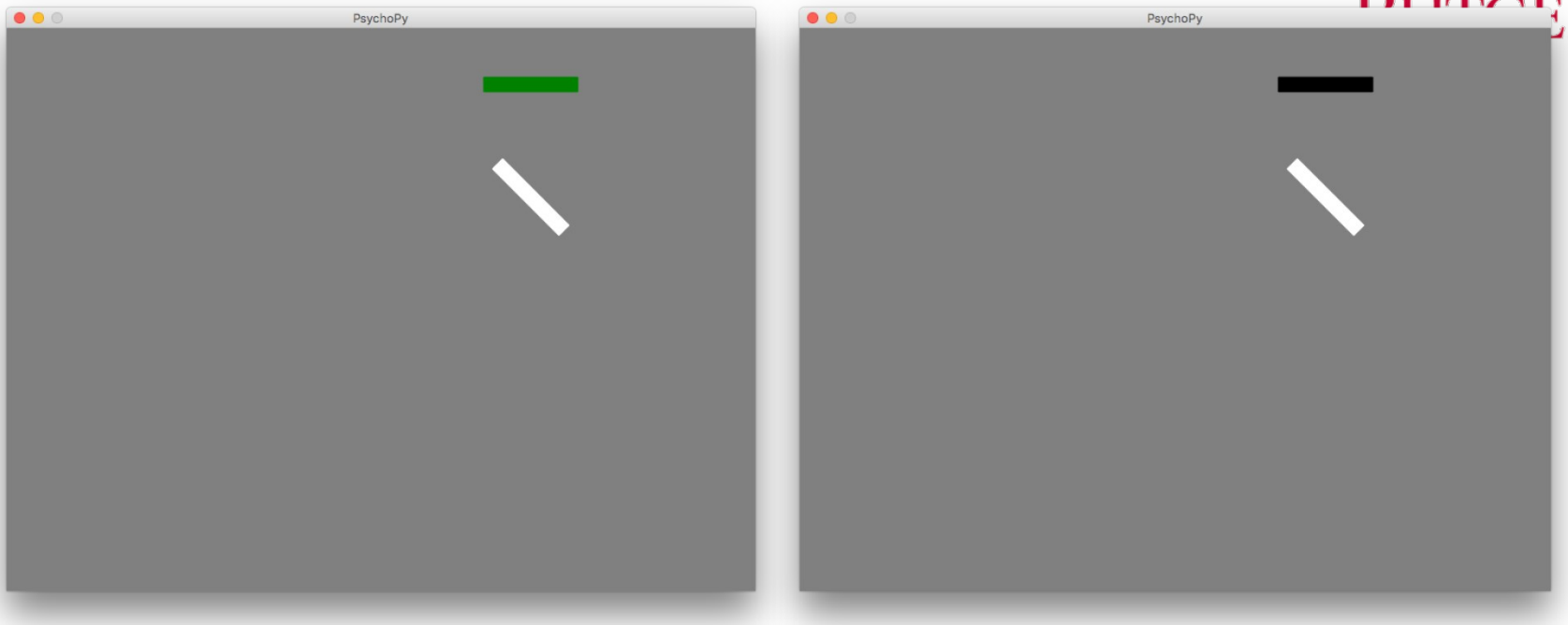
On each trial you'll see **two displays** in succession. Each display contains 2, 4, 6, or 8 tilted bars of different colors.

The second display is either the SAME as the first, or it's DIFFERENT from the first in that one of the items has changed.

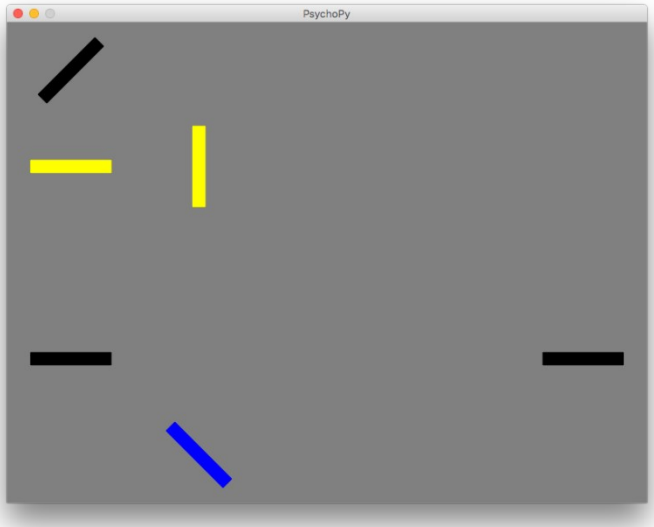
After each trial, type S if you think the displays were the same, and type D if you think they were different.

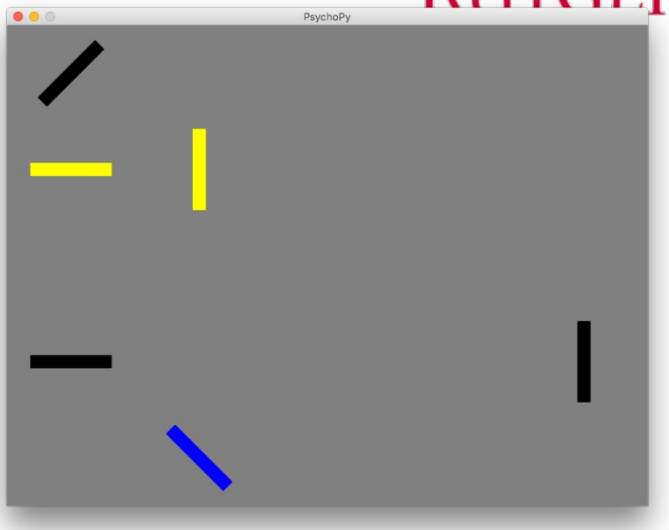
Read Luck & Vogel (1997), posted on the Sakai site. In your reading, pay attention to the following points because these are most relevant to this week's lab:

a. The specific task used to study VSTM. They called this the "sequential comparison task." We'll be using it too.
b. The main result obtained when they "compare memory for simple features with memory for objects defined by a conjunction of features". You can find the main result described in the text of the article (p 280, left column, near the top) and also in **Fig. 1c**.
c. The "important implications" mentioned by Luck & Vogel for their results. (see paragraph beginning on page 280 and extending to page 281).



Here is an example of two displays that are DIFFERENT. Each contains two tilted bars. One of the objects in the display on the left and has a different color than the corresponding object in the display on the right.





Here is another example of two displays that are DIFFERENT. Each contains 6 tilted bars. One of the objects in the display on the left has a different orientation (tilt) than the corresponding object in the display on the right.

Now, we're ready to run the exercise.

1. Before you start the exercise, create a new subfolder within the folder you're using for this class.
2. Download visualSTM.py into this folder
3. Open PsychoPy and enter *Coder View* (under *View -> Coder View*)
4. Go to *File -> Open* and select *visualSTM.py* from the folder you just made
5. Follow the instructions on the powerpoint

First, lets run a demo version of the exercise first so you can get used to the task.
Use the following menu options:

Initials:	(your initials)
SessionNumber:	0
Number of trials:	10
Time between display 1 and 2	1000
Bar length	100
Bar width	15
Task (C, O or E):	E

*In this demo version we picked task E. This means displays might differ in **either** the color or the orientation of one of the objects.*

After you finish the demo, let's run the exercise for real.

We'll run it three times. Each run will contain 40 trials.

FIRST RUN: Task C: One object in display 1 may differ from the corresponding object in display 2 in COLOR only.

SECOND RUN: Task O: One object in display 1 may differ from the corresponding object in display 2 in ORIENTATION only.

THIRD RUN: Task E: One object in display 1 may differ from the corresponding object in display 1 in EITHER COLOR or ORIENTATION.

Here are the details about the menu options for the first run.

First run: make you judgments on the basis of a color difference
Initials: (your initials)
SessionNumber: 1
Number of trials: 40
Time between display 1 and 2 1000
Bar length 75
Bar width 10
Task (C, O or E): C

Here are the details about the menu options for the second run.

Second run: make you judgments on the basis of a difference in orientation:

Initials:	(your initials)
SessionNumber:	2
Number of trials:	40
Time between display 1 and 2	1000
Bar length	75
Bar width	10
Task (C, O or E):	O

Here are the details about the menu options for the third run.

Third run: make you judgments on the basis of EITHER a color difference or a difference in orientation

Initials:	(your initials)
SessionNumber:	3
Number of trials:	40
Time between display 1 and 2	1000
Bar length	75
Bar width	10
Task (C, O or E):	E

Figure

Because of the nature of the data, there will be no statistical analysis this week

Instead you will graph a figure with the results from the three trials and you'll compare your results with the ones originally found by Luck and Vogel