Appendix: How to Read a Journal Article in Cognitive Psychology

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Research in cognitive psychology and cognitive neuroscience is aimed at understanding the workings of the mind/brain. Cognitive processes are those involved in knowing the world, and cognitive scientists are interested in all facets—from sensing and perceiving, to attending and remembering, and on to thinking, reasoning, and solving problems. Language processes are often a central part of the study of cognition, as language is regarded as "the light of the mind." Therefore, processes involved in listening to speech and in reading are frequently studied. The study of cognition can proceed through use of purely behavioral methods or by methods from cognitive neuroscience. In the first approach, researchers control and manipulate stimulation to the senses and measure behavioral responses, often focusing on the speed of responses or the patterns of errors generated on a task. From these data, they make inferences about the mental processes involved in a task. The cognitive neuroscience approach involves the study of cognitive processes through use of neuroimaging techniques or from studying patients who have suffered various types of brain damage. The patients and people whose brains are scanned are usually given tests much like those in purely behavioral experiments, but interest centers on specifying neural correlates of performance.

As in all sciences, the journal article is the dominant form of communication among researchers in cognitive psychology. Many journals exist to report findings in the field of cognitive psychology and cognitive neuroscience, and most subscribe to a similar format. The form of scientific journal articles is unlike that of forms of literature you have already experienced as students; journal articles are not like magazine articles, expository essays, short stories, or novels. The one feature in common is that the journal article, like these other forms, is intended to communicate information and tell a story about the research that was conducted.

The purpose of this appendix is to give you advice on how to approach the journal article. We assume that most readers will have had little more than a first course in psychology. Entering the world of scientific literature is, in one experience, rather like embarking on a journey in a foreign country where the language and customs are strange. To be sure, the words in these journal articles may be English, but often the terms (even ones that seem
Introduction

The introduction specifies the problem to be studied and tells why it is important. A good introduction will have you involved in a fascinating scientific journey, so that by the end addition, the author also reviews the relevant research literature on the topic in the intro- the work right in the text (e.g., Jacoby, 1991), rather than in a footnote. 1 The reference text can how extensively the authors report it, the introduction may vary in length. By the end of the by and conclusions that will be delivered in the remaining sections.

Method

The method section describes exactly how the experimenter conducted the study, and it should contain enough information so that another researcher could replicate the work. Although it is sometimes printed in smaller type to conserve space, it is still a critical part of the article, because it tells how the researchers approached the issue and what they experiment and form your own interpretation of them.

The method section is usually divided into subsections that cover the participants (or the participants’ experiences). The participant or subject section tells how many people (or specified criteria), and who were they were (college undergraduates taking introductory psych- cal procedure, etc.). Depending on the nature of the study, more or less detail may be provided. For example, in studies of aging it is typical to give a bit of detail about the design section provides a crisp description of the conditions that will be involved. For example, in an experiment on remembering, it might be that old, middle-aged, and both types of material simultaneously. Thus, the design would be described as a 3 (age: young, middle, or old) x 3 (materials: pictures, words, or pictures + words) design. The design section is to present the logic of the experiment concisely. The design just levels of each factor. Recall that independent variables manipulate the experiments are those that are the design sections typically describe the measures of behavior that are taken. The design sections are used to the experiments. This section is referred to as the materials and methods section. If they are long, lists of special materials may be placed in an appendix section.

1 Footnotes are used for aside, like this one, or to qualify the point under discussion with new information. Footnotes are generally discouraged, but some authors cannot live without them.
usually set in smaller type, or placed on the Internet with an address provided. (The difficulty with this last practice is that the website may become unavailable as technologies change.)

The procedure section explains what happened to subjects in relatively great detail, so that the experimental techniques could be replicated. Therefore, the critical features must be clearly enumerated. Many "failures to replicate" past work often hinge on factors that were not well specified in the original procedure but that are discovered, after much later work, to have been critical. The procedure section should include instructions subjects received, the timing of events, the responses participants were required to make, the number of trials or events experienced, and so on. When you read the procedure, it is often helpful to imagine being a subject in the experiment to form an intuitive understanding of the task and the demands that were placed upon the participant.

**Results**

The results section tells the outcome obtained in the research. It is unusual to find raw data or individual subjects' scores reported in a journal article; instead, descriptive statistics are presented that summarize the data. Typical descriptive statistics are the mean of a distribution of scores, reflecting a central tendency or "average" score, and some measure of variance (the standard deviation or standard error of the mean) about the mean value. Inferential statistics provide the probability that the observed differences between the various experimental conditions could have been produced by random, or chance, factors. Statistically significant results are those that are judged unlikely to have occurred by chance; they are said to be reliable, which means that they can probably be replicated. This information helps both the researcher and the reader determine how confident to be that the independent variable(s) produced a change in the dependent variable. Both kinds of statistics are important to help psychologists understand the outcome of an experiment.

Either tables or graphs may be used to describe and summarize data. In the typical table, such as Table A.1, data appear under various headings. The experiment required students to answer one of three types of questions about words they saw one at a time. Questions given before each word directed attention to simple perceptual features (Is the word in uppercase letters?), to what it sounded like (Does the word rhyme with chair?), or to its meaning (Does the word refer to a type of animal?). If the word to be judged were yes, then the answer to any of the questions would have been yes. In actuality, half the time the presented word required a yes response and half the time it required a noreponse. After subjects had answered a question for each of the words, they were given a recognition memory test.

Before you look at the data, you should first read the title of the table. The title should be explicit enough to tell you what type of data appears in the table. The title of Table A.1 tells you that it contains information about recognition of the words as a function of the question that people were asked about the words. Sometimes you will also find a note at the bottom of the table, which is usually used to provide more specific information about how subjects were tested.

<table>
<thead>
<tr>
<th>Question Type</th>
<th>Case</th>
<th>Rhyme</th>
<th>Semantic</th>
<th>Yes or No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>42</td>
<td>.65</td>
<td>.90</td>
<td>.50</td>
</tr>
<tr>
<td>No</td>
<td>32</td>
<td></td>
<td></td>
<td>.50</td>
</tr>
</tbody>
</table>

Note. Adapted from Craik and Tulving (1975, Experiment 9).
FIGURE A.1 Mean proportion of items recognized for each of the three question types in Craik and Tulving (1975, Experiment 9). The dependent variable (mean proportion of recognized items) is on the ordinate, or vertical axis, and one independent variable (question type) is on the abscissa, or horizontal axis. The other independent variable (response type) is represented by the different colored bars, as specified in the upper-left hand key. Note how the main effect of each independent variable, and their interaction, can be seen from the figure.

When you are trying to understand the data in a figure, be sure that you pay close attention to the scale of the dependent variable on the ordinate. Sometimes the scale can be misleading: An exaggerated scale with widely spaced numbers will tend to make differences appear more impressive, and a scale with numbers jammed close together will tend to make differences appear smaller. To see how this works, look back to Figure A.2. Here we put breaks along the ordinate so that the scale could be widely spaced from 0 to 1, thereby exaggerating the differences in the data to highlight the effect of study time on recall. However, if we had simply allowed the scale to range from 0 to 1, as in Figure A.3, one gets a much different impression from the data. Here the differences among the conditions are not emphasized as much, and a casual glance might lead to the conclusion that the manipulation was not nearly as effective as it appeared in Figure A.2. However, exactly the same data are accurately plotted in both figures.

Both of these graphing techniques are common, and you should always look carefully to see what the scale is in a graph. But which way of graphing the results is right? In a sense, both are, because both can be argued to portray matters accurately. However, if statistical tests have shown a difference to exist between the three conditions, then Figure A.2 would more accurately capture the relation between measures and show up the differences obtained. With experimental data, it is more important to determine whether a difference is obtained. With statistical data, it is more important to determine whether the difference appears large when graphed.

FIGURE A.2 Mean proportion of items recalled at each of the three presentation rates in Gally and Roediger (2000, Experiment 2). Sloping presentation rate appears to result in a dramatic increase in recall because whether a result appears large or small depends on the scale of the dependent variable on the ordinate.

Inferential statistics permit the assessment of whether differences that appear between conditions are the result of the experimental manipulations as opposed to unknown or chance factors. Inferential statistics about the data appear in such statements as "F(4, 60) = 2.03, MSe = 3.40, p < .05." This means that the odds for obtaining by chance an F-statistic at least as large as 2.03 would be less than 5% if the experiments were repeated and conducted 100 times, the direction of difference in the statistical test. That is, if the experiment at least 95 out of the 100 repetitions. You do not necessarily need to know a lot about the results that meet the .05 level of confidence are deemed statistically significant; if you see a statistically significant result, a good indicator that they are reliable.

Discussion

The discussion section is often the most creative part of an article. At the beginning of the section, the author will typically provide a concise statement of the outcome of the experimental manipulations from the results and to relate them to the rest of the literature on the topic. How do these results change what we know about the topic at hand? How do these results fit in with past results? Besides answering these sorts of questions, the author may go on to
describe future research that might be useful in answering questions that are left unresolved by the current research.

References

References are found at the end of the article, and include only those articles that are cited in the text. This is different from a bibliography, which includes as many relevant citations as feasible. In contrast to journals in other disciplines, psychology journals list full titles of referenced articles. This practice helps to tell the reader what the article is about, making this section a valuable guide for related information. Furthermore, the references in an article can also be used as a good starting place to find out more about the topic. The cited articles usually refer to the most recently published works in the area before the current one you are reading, as well as including the most important previous publications.

Checklist for the Critical Reader

In this section, we offer some hints that have helped us to become better consumers of the information presented in psychological journals. Keep this checklist handy as you read through the journal articles included in this book. Although many of the points should seem redundant to you by now, going through them will help you identify which sections you may not be reading as effectively as possible, and will sharpen your skills in extracting the critical pieces of information from these sections.

Introduction

1. What is the author’s goal? The introduction explains the reasons behind the research and reviews the earlier literature on the phenomena of interest. If one or more theories exist, the introduction gives the predictions the theories make. As with scientists in other areas, psychologists do not necessarily agree as to the underlying mechanisms and theoretical interpretations of behavior. The author may present a particular theory that he or she thinks provides a useful prediction, he or she may proceed later on to demonstrate that they do not all agree with the several theories the author believes and which are stated for subsequent rejection.

2. What hypothesis will be tested in the experiment? The answer to this should be obvious and stated directly within the introduction section.

3. If I had to design an experiment to test this hypothesis, what would I do? This is the key question for the introduction. You must try to answer this before continuing on a systematic investigation of behavior to test and support a particular theoretical framework developed by the author. If the author has any skill as a wordsmith, once the author has advocated in the article, a clever author will plant the seeds to this method independently. Write down your ideas for testing the hypothesis.

Method

Compare your answer to question 3 with the method used by the author. They probably differ, if you have not peeked. Now answer questions 4a-c.

4a. Is my proposed method better than the author’s? Regardless of who has the better method, you or the author, this forced comparison will make you think about the method section critically, instead of passively accepting it.

4b. Does the author’s method actually test the hypothesis? The hypothesis is sometimes an early casualty, disappearing between the introduction and the methods section. Always check what the method used is adequate and relevant to the hypothesis.

4c. What are the independent, dependent, and control variables? This is an obvious reading of the methods section. After you have resolved differences between your proposed method and the author’s, answer the next question: what would results I predict for this experiment? You must answer this on your own before reading the results section. Think about the procedure of the exper- experimental procedure that you have been a participant. State your prediction in terms of the hypothesis and the independent and dependent variables. You may find it impossible to predict a single outcome. This is not really a problem, because the author has had more than one prediction originally. He or she may have done he or she may have been surprised by the results and had to rethink the introduction.
TABLE A.2. Questions for Critical Readers

**Introduction**
1. What is the author's goal?
2. What hypothesis will be tested in the experiment?
3. If I had to design an experiment to test this hypothesis, what would I do?

**Method**
4a. Is my proposed method better than the author's?
4b. Does the author's method actually test the hypothesis?
4c. What are the independent, dependent, and control variables?
5. Using the participants, apparatus, materials, and procedures described by the author, what results would I predict for this experiment?

**Results**
6. How did the author analyze the data?
7. Did I expect the obtained results?
8a. How would I interpret these results?
8b. What applications and implications would I draw from my interpretation of the results?

**Discussion**
9a. Does my interpretation, or the author's, best represent the data?
9b. Do I or does the author offer the most cogent discussion of the applications and implications of the results?
10. Am I being too critical?

The results were in. Draw a rough sketch illustrating the most likely outcomes you have predicted.

**Results**
6. How did the author analyze the data? Although you may not be totally comfortable with statistics yet, a good exercise is to note how the author presented and analyzed the data. Note which conditions are being compared and why. Data from experiments not come out exactly as anticipated, and authors will often focus on presenting data that they feel are important to convey their main point, while downplaying other data. Do try to understand the author’s point of view, but also try to form your own impression about the data as a whole. Are there some unexplained puzzles in the results that the author overlooks?

7. Did I expect the obtained results? If not, then you will reach one of two conclusions: either your prediction was wrong, or the results are hard to believe. Perhaps the method the author selected was inappropriate and did not adequately test the stated hypotheses or introduced sources of uncontrollable variance. Or perhaps these results would not be obtained again if the experiment were repeated. Still, even if you did not expect the results, the author obtained them and clearly believes them. Also, if the editors selected the paper for this book of readings, the results are probably considered important to the field.

8a. How would I interpret these results?
8b. What applications and implications would I draw from my interpretation of the results? Try to answer these questions on your own, before reading the discussion.

**Discussion**
9a. Does my interpretation or the author’s represent the data? Because authors are that an author has drawn conclusions that may not be warranted by the data. In other cases, authors draw conclusions that are largely appropriate but may proceed to extend curs when a researcher fails to recognize the limitations of the dependent variable. Them. Think critically about nuances, but don’t become nihilistic and believe nothing of the results even? This question is secondary to the question posed in 9a. Note-controlled experiment. He or she must also consider the rationale and theory that underlie the results contributes to the overall integrity of the research process.

10. Am I being too critical? Although critical evaluation of a particular set of findings is ideas and discoveries. Keep in mind that, with practice, anyone should be able to find capable of acknowledging these limitations while, at the same time, recognizing the shouldn’t necessarily see it as partly empty.

**Authors’ Note**
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**REFERENCES**

