be used to test these hypotheses. You accomplish this step by identifying and familiarizing yourself with research already conducted in your area of interest, an activity called "reviewing the literature." We show you how to review the literature and evaluate research reports in the following section.

QUESTIONS TO PONDER

1. What are the characteristics of an empirical question?
2. Why is it necessary to define your terms operationally?
3. What makes a research question important, and why should you ask important questions?

DEVELOPING RESEARCH IDEAS: REVIEWING THE LITERATURE

One of the most important preliminary steps in the research process is doing a thorough review of the scientific literature on the topic that you have identified for study. This is true whether you begin only with a vague idea of a research project or with a well-developed research plan. In this section, we discuss the tools, techniques, and knowledge that will enable you to identify, read, and evaluate published information on your research topic. In addition, we discuss the process of scientific peer review and describe how this process affects the content and quality of published scientific findings.

Reasons for Reviewing the Scientific Literature

A **literature review** is the process of locating, obtaining, reading, and evaluating the research literature in your area of interest. Perhaps the most important reason for conducting a literature review is to avoid needless duplication of effort. No matter what topic you choose, chances are that someone has already done research on it. By becoming familiar with that area through a literature review, you can avoid "reinventing the wheel."

Another reason for conducting a literature review is that your specific research question may have already been addressed and answered. If so, then conducting your research as originally planned would be a waste of time. This does not mean, however, that you must start over from scratch. To the contrary, your literature review may reveal other questions (perhaps more interesting) that remain to be answered. By familiarizing yourself with existing research and theory in an area, you can revise your research project to explore some of these newly identified questions.

Another reason for reviewing the literature applies to the design phase of your research. Designing a study involves several decisions as to what variables to include and how to measure them, what materials or apparatus to use, what procedures to use, and so on. Published research provides you with a rich resource for addressing these important design questions. You may find, for example, that you can use established procedures and existing materials.

Reviewing the literature also keeps you up to date on current empirical or theoretical controversies in a particular research area. As science progresses, new ideas develop concerning age-old behavioral issues. For example, there is a debate concerning the motives for altruistic behavior. Some argue that empathy (a concern for the victim) motivates altruism and others argue that egoism (self-satisfaction) motivates altruism. Such controversies not only provide a rich source of research ideas but also give direction to specific research hypotheses and designs.

Sources of Research Information

Sources of information about a topic range in quality from the high levels found in the scholarly books and journals of a discipline to the low levels found in the supermarket tabloids of the sensationalist press. Although information presented in the tabloids may arouse your curiosity and suggest a topic for scientific research, you cannot count on that information to be accurate or even true. Popular writing found in magazines such as *Time* may provide more reliable information gleaned from scientific sources, but the information presented generally lacks the detail that would allow you to determine much beyond the major conclusions offered. More substantive writing aimed at a better-educated reader generally provides more details about the methods used to gather the information but still omits important details and may not mention alternative interpretations or other evidence for or against the conclusions presented. You can only count on scholarly sources to provide the level of detail and thoroughness needed for a competent scientific review. Table 3-1, which is based on an analysis provided by the Cornell University Library (2015), identifies four types of periodicals and compares them on a number of important features. You can use this table to help you determine whether a publication is scholarly or not.

QUESTIONS TO PONDER

1. Why should you review the literature on your topic before you begin to design your study?

2. What are the differences between the different types of periodicals, and on which should you rely most heavily (and why)?

Sources of research findings include books, scholarly journals, conventions and professional meetings, and others such as personal communications and certain pages on the Internet. In the following sections we review a few things you should know about these sources.

Primary Versus Secondary Sources

Sources containing research information are classified according to whether a source is primary or secondary. A **primary source** is one containing the full research report, including all details necessary to duplicate the study. A primary source includes descriptions of the rationale of the study, its participants or subjects, materials or apparatus, procedure, results, and references. A **secondary source** is one that summarizes information from primary sources (such as presenting the basic findings). Secondary sources of research include review papers

TABLE 3-1 Comparison of Four Types of Published Periodicals

SCHOLARLY	SUBSTANTIVE NEWS/ GENERAL INTEREST	POPULAR	SENSATIONAL
Sober, serious look with graphs and tables	Attractive appearance, usually with photographs	Often have a slick, attractive appearance with many photographs	Often in newspaper format
Reference citations always provided	Sources are sometimes cited	Sources are rarely, if ever, cited	References to sources are often obscure
Written by a scholar in the field or someone who has done research in the field	Articles written by members of editorial staff, scholar, or free-lance writer	Written by a wide range of authors who may or may not have expertise in an area	Written by a variety of authors
Language of the discipline, assuming a scholarly background of the reader	Language geared to educated audience, but no specialty assumed	Written in simple language with short articles geared to audience with minimal education	Elementary, inflammatory language geared to a gullible audience
Report original research	Do not report original research, report on research in format geared to a general audience	Research may be mentioned, but it may come from an obscure source	Support may come from pseudoscientific sources
Many, but not all, published by professional organizations	Published by commercial publishers or individuals, but some from professional organizations	Published commercially with the intent to entertain the reader, sell products, or promote a viewpoint	Commercially published to arouse curiosity and play to popular superstition. Use flashy, astonishing headlines
Examples: *Journal of Personality and Social Psychology, Child Development, Journal of Experimental Psychology*	Examples: *National Geographic, Scientific American, New York Times, Christian Science Monitor*	Examples: *Time, Parents, Reader's Digest*	Examples: *National Enquirer, Globe, Star, Weekly World News*

and theoretical articles that briefly describe studies and results, as well as descriptions of research found in textbooks, popular magazines, newspaper articles, television programs, films, or lectures. Another type of secondary source is a meta-analysis. In a meta-analysis, a researcher statistically combines or compares the results from research in a particular area to determine which variables are important contributors to behavior. (We discuss meta-analysis in Chapter 8.)

Distinguishing primary from secondary sources is important. Students often rely too heavily on secondary sources, perhaps because it can be a daunting task to read a primary source research report. The language can be technical, and the statistical tests reported can be intimidating. However, with some experience and perseverance, you can get through and understand primary source materials.

Another reason that students may rely heavily on secondary sources is to "save time." After all, someone else has already read and summarized the research, so why not save time and use the summary? This sounds good but can lead to trouble. The author of a secondary source may describe or interpret research results incorrectly or simply view data from a single (and perhaps narrow) theoretical perspective. In addition, secondary sources do not usually present detailed descriptions of methods used in the cited studies. You must know the details of the methods used in a study before you can evaluate its quality and importance. The only way to obtain such detailed information is to read the primary source.

Relying heavily on secondary sources can be dangerous because you cannot be sure that the information in a secondary source is complete and accurate. For example, one of the most widely cited studies in introductory psychology textbooks is John Watson and Rosalie Rayner's (1920) "Little Albert" study. In this study, Watson and Rayner conditioned a child (Albert) to show a fear response to a white rat. They also reported that Albert's fear generalized to other white, furry objects. In a review of how accurately Watson and Rayner's study was portrayed in textbooks, Griggs (2014) found that the study was inaccurately presented in textbooks, especially with respect to the generalization results. Similarly, Treadway and McCloskey (1987) found that many secondary sources misrepresented the methods and results of a classic memory experiment conducted by Allport and Postman (1945). These representations led researchers—and sometimes courts—to draw incorrect inferences concerning the role of racial bias in eyewitness accuracy. To avoid this trap, obtain and read the original report.

Secondary sources do have value, which lies in the summaries, presentations, and integrations of results from related research studies. The secondary source provides an excellent starting point for your literature search. Additionally, an up-to-date review paper or meta-analysis includes a reference section from which you can generate a list of primary sources. However, you should not consider a secondary source as a substitute for the primary source.

You may need to use a secondary source if the primary source it refers to is not available. If you must do so, always stay aware of the possible problems. In addition, cite the secondary source in your research report, not the primary one that you were unable to obtain.

To summarize, use secondary sources as a starting point in your literature search. Avoid overreliance on secondary sources and make every effort to obtain the primary

sources of interest to you. Only by reading the primary source can you critically evaluate a study and determine whether the reported results are reliable and important. Finally, do not rely on a single secondary source. The author of a review article may not have completely reviewed the literature. Always augment the information obtained from a secondary source with a thorough literature search of your own.

Books   You are probably most familiar with general textbooks (such as those covering introductory psychology) or texts covering content areas (such as motivation and emotion, abnormal psychology, social psychology, personality, or cognitive psychology). Other books may contain more detailed information about your research topic. Specialized professional texts present the results of programmatic research conducted by the author over a period of years. These specialized texts may cover research previously published in journals, as well as findings not presented elsewhere. Edited anthologies present a series of articles on related topics, each written by a different set of authors. Some anthologies are collections of articles previously published separately; others present articles written especially for the occasion. Either kind of text may present reviews of the literature, theoretical articles, articles dealing with methodological issues, or original research.

Anthologies are useful because they assemble papers that the editor believes are important in a given area. However, be cautious when reading an anthology. The editor may be biased in judgment on which articles to include. Also, be sure to check the original publication date of articles in an anthology. Even if the publication date of the anthology is recent, it may contain outdated (sometimes classic) articles.

Texts or anthologies are most valuable in the early stages of the literature search. Often you can use the references from these books to track down relevant articles. You may have to treat books (especially textbooks) as secondary sources. Whenever you use a textbook as a source, make an effort to obtain a copy of the primary source cited in the textbook.

The articles in an anthology may be original works and thus can be treated as primary sources—provided that they have been reproduced exactly, not edited for the anthology. Be careful about relying on a chapter reproduced from a book. Isolating a single chapter from the original book can be misleading. In other chapters from the same book, the original author might elaborate on points made in the reproduced chapter. You could miss important points if you do not read the original work.

Whereas some books present original research, others provide only summaries. For example, if you were studying the development of intelligence, you could use Piaget's *The Origins of Intelligence in Children* (1952) as a good original source. However, a book such as *Piaget's Theory of Cognitive Development* by Wadsworth (1971)—a primer on Piaget's theory—should be treated as a secondary source in which you may find references for Piaget's original work.

Whatever route you choose, keep in mind one important factor. Even though you may have used an original work such as Piaget's (1952), problems with using it as a principal source may still exist. Books (especially by noted authors) may not undergo as rigorous a review as works published in scientific journals. You cannot be assured of the quality of any original research reported in the book. In addition, you would be well advised to seek out recent research on the issues covered in a book. Was Piaget

sources of interest to you. Only by reading the primary source can you critically evaluate a study and determine whether the reported results are reliable and important. Finally, do not rely on a single secondary source. The author of a review article may not have completely reviewed the literature. Always augment the information obtained from a secondary source with a thorough literature search of your own.

Books   You are probably most familiar with general textbooks (such as those covering introductory psychology) or texts covering content areas (such as motivation and emotion, abnormal psychology, social psychology, personality, or cognitive psychology). Other books may contain more detailed information about your research topic. Specialized professional texts present the results of programmatic research conducted by the author over a period of years. These specialized texts may cover research previously published in journals, as well as findings not presented elsewhere. Edited anthologies present a series of articles on related topics, each written by a different set of authors. Some anthologies are collections of articles previously published separately; others present articles written especially for the occasion. Either kind of text may present reviews of the literature, theoretical articles, articles dealing with methodological issues, or original research.

Anthologies are useful because they assemble papers that the editor believes are important in a given area. However, be cautious when reading an anthology. The editor may be biased in judgment on which articles to include. Also, be sure to check the original publication date of articles in an anthology. Even if the publication date of the anthology is recent, it may contain outdated (sometimes classic) articles.

Texts or anthologies are most valuable in the early stages of the literature search. Often you can use the references from these books to track down relevant articles. You may have to treat books (especially textbooks) as secondary sources. Whenever you use a textbook as a source, make an effort to obtain a copy of the primary source cited in the textbook.

The articles in an anthology may be original works and thus can be treated as primary sources—provided that they have been reproduced exactly, not edited for the anthology. Be careful about relying on a chapter reproduced from a book. Isolating a single chapter from the original book can be misleading. In other chapters from the same book, the original author might elaborate on points made in the reproduced chapter. You could miss important points if you do not read the original work.

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Whatever route you choose, keep in mind one important factor. Even though you may have used an original work such as Piaget's (1952), problems with using it as a principal source may still exist. Books (especially by noted authors) may not undergo as rigorous a review as works published in scientific journals. You cannot be assured of the quality of any original research reported in the book. In addition, you would be well advised to seek out recent research on the issues covered in a book. Was Piaget

sources of interest to you. Only by reading the primary source can you critically evaluate a study and determine whether the reported results are reliable and important. Finally, do not rely on a single secondary source. The author of a review article may not have completely reviewed the literature. Always augment the information obtained from a secondary source with a thorough literature search of your own.

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Anthologies are useful because they assemble papers that the editor believes are important in a given area. However, be cautious when reading an anthology. The editor may be biased in judgment on which articles to include. Also, be sure to check the original publication date of articles in an anthology. Even if the publication date of the anthology is recent, it may contain outdated (sometimes classic) articles.

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Whatever route you choose, keep in mind one important factor. Even though you may have used an original work such as Piaget's (1952), problems with using it as a principal source may still exist. Books (especially by noted authors) may not undergo as rigorous a review as works published in scientific journals. You cannot be assured of the quality of any original research reported in the book. In addition, you would be well advised to seek out recent research on the issues covered in a book. Was Piaget

correct when he speculated in his book about the origins of intelligence? Research published since his book came out may bear on this question. A review of the recent research would help you evaluate Piaget's theory and contributions.

QUESTIONS TO PONDER

1. What is the difference between a primary and a secondary source, and why should you not rely too heavily on secondary sources?

2. What are the advantages and disadvantages to using various types of books as sources?

Scholarly Journals Although textbooks are valuable, the information they contain tends to be somewhat dated. By the time a scientific finding makes its way into a text, it could already have been around for several years. For current research and theories regarding a subject, researchers turn to scholarly journals. Like popular magazines, journals appear periodically over the year in monthly, bimonthly, or quarterly issues. Some journals focus on detailed research reports (although occasionally a theoretical or methodological article may appear). These research reports are the most important primary sources. Other journals deal with reviews of the literature, issues in methodology, or theoretical views.

Keep in mind that not all journals are created equal. You must consider the source. When you submit your work to a **refereed journal,** it is reviewed, usually by two (or more) reviewers, to determine whether the paper merits publication. Other, **nonrefereed journals** do not have such a review process; the articles may be published in the order in which they were received or according to some fee that the author must pay. The review process is intended to ensure that high-quality articles appear in the journal. Although problems do occur with the review procedures, you can have greater confidence in an article from a refereed journal than in one from a nonrefereed journal.

A problem you are more likely to encounter in a nonrefereed journal than in a refereed journal is information that is sketchy and incomplete (Mayo & LaFrance, 1977). If information is incomplete, you may not be able to determine the significance of the article. Rely more heavily on articles published in high-quality, refereed journals than on articles in lower-quality, nonrefereed journals.

How can you determine whether a journal is refereed or nonrefereed? Search the Internet for the journal and check the editorial policy or submission guidelines for authors included on the journal's website. If you have a printed issue of the journal at hand, check the inside front or rear cover for a statement of the journal's review policy.

You can assess the quality of a scholarly journal in several ways. First, you can consult *Journals in Psychology,* published by the APA. This publication lists journals alphabetically and gives their manuscript acceptance rates. Top journals in a field have low acceptance rates (15% or less), whereas lesser journals have higher acceptance rates. Second, you can consult the *Journal Citations Report* available online from Thomson Reuters. Journals are ranked within category by their *impact factor,* which is a measure of "the frequency with which the 'average article' in a journal [was] cited in a particular year . . ." (Institute for Scientific Information [ISI], 1988, p. 10A). Third, you can consult the *Social Science Citations Index (SSCI).* One section of this

publication lists journals by category (e.g., psychology) and subcategory (social psychology, experimental psychology, etc.). Fourth, you can use the online resource, the SCImago Journal & Country Rank (SJR, http://www.scimagojr.com/journalrank.php). The SJR ranks both journals and their countries of origin for quality. You can search by subject area (e.g., psychology) and subarea (e.g., social psychology) or search for a specific journal. Finally, you can use the method of authority discussed in Chapter 1. Ask your professors which journals in their fields of specialty are of highest and lowest quality.

QUESTIONS TO PONDER

1. Why are scholarly journals the preferred sources for research information?

2. What is the difference between a nonrefereed and a refereed journal? Which is more trustworthy (and why)?

3. How do you assess the quality of a scholarly journal?

Conventions and Professional Meetings   Books and journals are not the only sources of research findings, nor are they necessarily the most current. Behavioral scientists who want the most up-to-date information about research in their areas attend psychological conventions. If you attended one of these conventions, you would find a number of **paper sessions** covering different areas of research. Paper sessions are usually simultaneously conducted in different rooms and follow one another throughout the day (much as classes do on campus). At these sessions, researchers present their research, usually within a 15- to 20-minute time period.

Paper sessions are not the best way to convey details of methodology. The written report is far superior for that purpose. At a convention, the author of a paper typically has only 15 minutes to describe his or her research. In that short time, the author must often omit some details of methodology.

Another popular format for convention presentations is the **poster session.** In this format, the presenter prepares a poster that is displayed on a bulletin board. The poster includes an introduction to the topic and method, results, discussion, and reference sections, and the presenter is usually there to discuss the research with you and answer any questions. This forum allows the author to provide more details than would be practical in a paper session and allows you to speak directly to the researcher about the research. Many good research ideas can emerge from such encounters.

Attending a paper or poster session has two distinct advantages over reading a journal article. First, the information is from the very frontiers of research. The findings presented may not appear in print for many months (or even years), if ever. Attending a paper session exposes you to newly conducted research that might otherwise be unavailable to you. Second, it provides an opportunity to meet other researchers in your field and to discuss ideas, clarify methodology, or seek assistance. These contacts could prove valuable in the future.

One drawback to paper and poster sessions at a convention is that a convention can be expensive to attend. In most instances, conventions are located in cities other than where you live. This means you must pay for travel, lodging, and food. Fortunately,

you can gain some of the benefits of going to a conference by obtaining a copy of the program. By reading the abstracts of the papers, you can identify those papers of interest and glean something of the findings. If you want more information, you can then write or call the author. Many professional organizations provide full programs online. Visit one or more of the websites for these organizations (e.g., Eastern Psychological Association, Midwestern Psychological Association, and the Society for Psychological Science) to see if online versions of programs are available.

Other Sources of Research Information   Personal replies to your inquiries fall under the heading of **personal communications** and are yet another source of research information. Projects completed under the auspices of a grant or an agency often result in the production of a *technical report,* which can be obtained through the agency. In addition, dissertations and theses completed by graduate students as part of their degree requirements are placed on file in the libraries of the university at which the work was done. You can find abstracts describing these studies in *Dissertation Abstracts International,* a reference work indexed in many electronic databases. For a fee, the abstracting service will send you a copy of the complete manuscript on paper or as a PDF digital file.

Websites on the Internet are yet another potential source of research information, including limited access to scientific sources discussed earlier such as articles published in scientific journals. In addition, many laboratories doing scientific research maintain websites on which they discuss research currently under way, post lists of references to research papers coming out of the laboratory (and sometimes downloadable copies of those papers), and even may offer videos or computer simulations that you can view. Other websites not providing direct access to scientific material should be treated as secondary sources. Wikipedia, for example, covers a huge number of topics, including those of a scientific nature. Articles summarizing scientific findings or presenting theoretical views can provide a good overview of a given research topic, but keep in mind that these are not peer-reviewed and may reflect strong biases on the part of the writer.

To judge the quality of material found on the Internet, Purdue University's OWL website suggests evaluating Internet sources according to four categories: authorship (e.g., Is an author clearly indicated?), accuracy of the information (e.g., Is the information current and are sources provided?), the goals of the website (e.g., Is it informative, persuasive, or intended to advertise?), and access (e.g., How did you find the site, and are there links to other reputable sites?). Use caution if you cannot determine the quality of a resource found on the Internet.

The Internet also offers services that will allow you to search for and obtain full-text versions of articles from a variety of publications (some scholarly and some not). We discuss these in the next section.

QUESTIONS TO PONDER

1. How can professional conferences provide you with information about research?
2. How can Internet resources be used to track down research information?
3. How do you assess the quality of information found on the Internet?

SEARCHING THE SCIENTIFIC LITERATURE

With so many potential sources of information, how can you quickly and efficiently locate sources that are directly relevant to your research topic? Fortunately, you have available to you a number of powerful tools to help you do just that. In this section, we describe a number of electronic databases and specialized search engines that you can use to turn up relevant sources and, in the case of journal articles, even obtain a copy of the article. Next, we briefly take you through the process, using for our example a search of the PsycINFO database using the EBSCOhost search engine. Finally, we describe a "basic strategy" for identifying virtually all the published articles that are relevant to your research topic.

Research Tools

University libraries subscribe to a number of search engines and associated electronic databases that allow you to search for information sources quickly and easily. Some databases cover a broad range of sources from a variety of disciplines; others specialize in sources pertinent to specific disciplines such as medicine, psychology, or philosophy. In psychology, for example, the American Psychological Association (APA) offers two relevant databases: PsycINFO and PsycARTICLES. We now briefly describe these and a few other databases you may find useful when looking for scientific research in psychology.

PsycINFO and PsycARTICLES   **PsycINFO** indexes journals, books, dissertations, and other sources relevant to psychology. More than 2,500 journals are covered, dating back as far as 1872. Some of the sources turned up in a search include a link to the article itself. By clicking on that link, you can download a copy of the article in HTML or PDF format. Most sources do not include such a link, however. To obtain the source, you may have to locate it in the library or request it through your library's document delivery service.

PsycARTICLES indexes articles appearing in selected journals published by the APA, the Canadian Psychological Association, and a few other publishers. The advantage of using PsycARTICLES rather than PsycINFO is that sources turned up by PsycARTICLES are available for immediate download. However, a search using PsycARTICLES is likely to turn up fewer sources owing to its more limited journal coverage.

The APA's PsycINFO and PsycARTICLES databases are accessible through a number of search engines, including those provided by DIMDI, EBSCO, Ovid Technologies, and ProQuest, as well as through the APA's own search engine, PsycNET. PsycNET offers an advantage over these other search engines in that it is specifically designed for searches of psychological research content and is closely integrated with the APA's *Thesaurus of Psychological Index Terms*. You can use the *Thesaurus* to identify keywords and phrases relevant to your topic as well as identify broader or narrower terms that you can use to expand or restrict your search.

PubMed   If your research topic has a medical or biological component, consider doing a search using the PubMed database. According to the PubMed website,

"PubMed comprises more than 26 million citations for biomedical literature from MEDLINE, life science journals, and online books. Citations may include links to full-text content from PubMed Central and publisher web sites." Some areas of research within psychology also focus on biological or medical questions, so a search using PsycINFO or PsycARTICLES may also turn up relevant sources.

The Web of Science   The Web of Science website provides subscription access to two databases: Science Citations Index (SCI) and Social Science Citations Index (SSCI). Both databases index articles relevant to psychology, although the coverage of sources is different. As you might guess, SCI covers sources with a more biological focus, whereas SSCI covers those with a more social or clinical focus.

If you have identified an older article on your topic, you can use SCI or SSCI to identify more recent sources that cited your older article. This allows you to efficiently bridge the gap between your article and current research on your topic. You can then use the references found in these newer sources to locate yet other relevant sources.

JSTOR   Another tool you may find useful is JSTOR, a search engine and associated database that indexes journals from a wide range of fields (e.g., sociology, philosophy, anthropology, and political science). JSTOR provides access to abstracts and allows you to download a full version of an article (you can limit your search to full-text sources) free of charge in a number of different formats. JSTOR may not be the best choice for searching specific topics in psychology, but used as a supplement to other databases, it may turn up articles that give a different perspective on your topic. From this broader perspective, you may gain some additional ideas about research that needs to be done.

Google Scholar and Microsoft Academic Search   Both Google and Microsoft offer free web searches of academic sources (Google Scholar and Microsoft Academic Search). These employ the familiar Google or Bing search engines, but with databases restricted to academic content. Searches using these products may turn up sources relevant to your topic, including books, journal articles, and websites. In some cases, you even can download a PDF file of an article or view pages from a relevant book. These sources provide a starting point for your literature search, but should not be counted on to turn up all relevant sources as coverage may be quite limited.

Journal or Author-Associated Websites   Many scientific papers are available for download from the journal publisher's website. Usually you can view the table of contents of the current issue and sometimes of past issues. Browsing the most recent issues of journals that publish in your area of interest can reveal some of the most recent publications. Selected articles may be available for download free of charge, but if you are not a subscriber, you may have to pay a hefty fee to obtain others. You may be able to avoid paying the fee, however. Some library database subscriptions allow legitimate users (such as students and faculty) to download articles from certain publishers without charge, as is the case when searching via PsycARTICLES. Alternatively, the author(s) of the paper may have made a free PDF available on their own website. Finally, you may be able to use your library's document delivery service to request a copy. Usually such requests are handled with a day or two, and your

"PubMed comprises more than 26 million citations for biomedical literature from MEDLINE, life science journals, and online books. Citations may include links to full-text content from PubMed Central and publisher web sites." Some areas of research within psychology also focus on biological or medical questions, so a search using PsycINFO or PsycARTICLES may also turn up relevant sources.

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If you have identified an older article on your topic, you can use SCI or SSCI to identify more recent sources that cited your older article. This allows you to efficiently bridge the gap between your article and current research on your topic. You can then use the references found in these newer sources to locate yet other relevant sources.

JSTOR   Another tool you may find useful is JSTOR, a search engine and associated database that indexes journals from a wide range of fields (e.g., sociology, philosophy, anthropology, and political science). JSTOR provides access to abstracts and allows you to download a full version of an article (you can limit your search to full-text sources) free of charge in a number of different formats. JSTOR may not be the best choice for searching specific topics in psychology, but used as a supplement to other databases, it may turn up articles that give a different perspective on your topic. From this broader perspective, you may gain some additional ideas about research that needs to be done.

Google Scholar and Microsoft Academic Search   Both Google and Microsoft offer free web searches of academic sources (Google Scholar and Microsoft Academic Search). These employ the familiar Google or Bing search engines, but with databases restricted to academic content. Searches using these products may turn up sources relevant to your topic, including books, journal articles, and websites. In some cases, you even can download a PDF file of an article or view pages from a relevant book. These sources provide a starting point for your literature search, but should not be counted on to turn up all relevant sources as coverage may be quite limited.

Journal or Author-Associated Websites   Many scientific papers are available for download from the journal publisher's website. Usually you can view the table of contents of the current issue and sometimes of past issues. Browsing the most recent issues of journals that publish in your area of interest can reveal some of the most recent publications. Selected articles may be available for download free of charge, but if you are not a subscriber, you may have to pay a hefty fee to obtain others. You may be able to avoid paying the fee, however. Some library database subscriptions allow legitimate users (such as students and faculty) to download articles from certain publishers without charge, as is the case when searching via PsycARTICLES. Alternatively, the author(s) of the paper may have made a free PDF available on their own website. Finally, you may be able to use your library's document delivery service to request a copy. Usually such requests are handled with a day or two, and your article delivered to you via email.
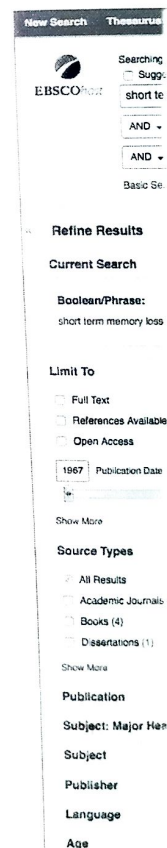
QUESTIONS TO PONDER

1. The American Psychological Association maintains two electronic databases of journal articles and other published sources that cover topics related to Psychology: PsycINFO and PsycARTICLES. How do they differ?

2. What database should you search if your topic has a strong biological or medical component?

3. You have located an older article on your topic. What two databases can you use to identify more recent articles that cited your older one?

4. What sources can you use to locate a downloadable copy of a given research paper?

Conducting an Electronic Database Search

Search engines developed by different providers offer somewhat different user interfaces through which you interact with the engine. We do not have space here to review them all; however, to give you a feel for the search process, we describe a search conducted using EBSCO's EBSCOhost search engine and the PsycINFO database.

Figure 3-3 shows the EBSCOhost screen as it appeared during a search we conducted using the keyword phrase "short term memory loss" that was entered in the first

FIGURE 3-3 Searching PsycINFO using EBSCOhost.

search box. Immediately above this box are the words "Searching PsycINFO," identifying the database currently selected for searching. By clicking on the words "Choose Databases," you bring up a list of databases from which to choose. You can select one or more of these by clicking on the checkbox next to each option. For example, if you were searching for sources on a topic with both psychological and medical or biological aspects, you might want to select both PsycINFO and PubMed.

Immediately to the right of the search box in which we entered the key phrase "short term memory loss" is a button labeled "Select a Field (optional)." Use this button to limit the search to a particular field within the source's citation. For example, if you wanted to search for publications by a certain author, you could select "Author" from the menu that appears when you click the button and enter the author's name in the search box next to it. If you do not choose a field, the engine defaults to a search of the entire citation, including such things as the title and the contents of the abstract.

You can enter additional search terms in the other boxes and choose how the search terms in the different boxes will be combined: AND to locate any source that includes terms from both boxes, OR to locate sources that contain terms from either box, and NOT to find sources that match terms in the top box but do not match the terms in the second.

When entering terms in the search boxes, EBSCOhost may pop up a submenu suggesting additional terms you could use to narrow your search. When searching the PsycINFO or PsycARTICLES databases, you can also access key terms found in the *Thesaurus of Psychological Index Terms*. You can access the *Thesaurus* by clicking the tab that appears along the top of the EBSCOhost screen (see Figure 3-3).

As shown in Figure 3-3, our search turned up 122 sources, the first two of which are shown. By clicking on the title of the source, you bring up another page (not shown) containing the article's abstract and other information. You can read the abstract to determine whether the source is relevant to your topic.

Appearing immediately beneath the first source listed is a button labeled "Find It." Clicking on this button will cause the search engine to look for a location from which you may be able to download a copy of the paper, although you may have to pay a fee for the privilege. Alternatively, you may be able to obtain a free copy by taking advantage of your library's document delivery service. Requested journal articles typically will be e-mailed to you within a day or two; books that the library must obtain through interlibrary loan will take longer to arrive, and you will then have to go to the library to check them out.

The second source listed in Figure 3-3 sports two buttons in addition to the "Find It" button. If these are present (as here), you can obtain a copy of the article in HTML or PDF format simply by clicking on one of these buttons. Because we searched using PsycINFO, many of the sources turned up did not include these buttons as these appeared in publications not affiliated with the APA.

You do not necessarily need to obtain a copy of an article in order to identify the references cited in it. As shown in Figure 3-3, the second source listed includes a link to "56 Cited References" that are indexed in PsycINFO. Likewise, you can obtain the references cited in an article through the Web of Science search engine during a search of the SCI or SSCI databases.

A Note of Caution When Searching an Electronic Database

Electronic search engines can save you considerable time and effort when searching a database. However, a search is only as good as the keywords you enter. The computer is incredibly fast and obedient and, unfortunately, pretty stupid. It will do only what you tell it to do. It cannot think for itself and figure out what you really want when you enter your search terms. It will find *every* reference that includes your keywords. You may find, much to your annoyance, that the terms are used more broadly in the indexed material than you anticipated. If, for example, you entered the keyword "age" (as in age-ed) to find research on a topic concerning the elderly, you might be shocked to find that the search turned up every study that gave the age ranges of the participants (e.g., "participants *aged* 12–14 years"). If this happens, use the online thesaurus (if available) to help you identify more useful keywords.

Another word of caution: With easy access to full-text versions of journal articles, you may be tempted to cut and paste portions of articles verbatim and use them in your course papers. *This is entirely inappropriate and may result in a low or failing grade in the course.* For now, it is sufficient to say that what you present in your writing must be presented in your own words with appropriate citations and references to works you use. Be careful how you use material from electronic versions of articles you find. We discuss the issues of plagiarism and lazy writing in Chapter 16. You may want to read ahead and review that material now so you can avoid problems with plagiarism and lazy writing.

The Basic Strategy for Conducting a Thorough Search

Articles published in scientific journals or books carefully cite the sources of ideas or research findings that the authors use to support arguments, justify conclusions, and so on. The references for these citations appear in a reference section or bibliography that appears at the end of the article. Typically, these references will include earlier published work on the same topic as the article in hand.

To conduct a thorough search of the scientific literature—one that will turn up nearly every published article relating to your topic—there is a "basic strategy" you can follow:

1. Obtain one or more relevant articles.

2. Examine the reference section or bibliography of each article to identify older sources relating to your topic.

3. Repeat steps 1 and 2 until you are no longer finding any additional relevant articles.

4. Identify more recently published sources that cited the sources you have already identified.

5. Repeat steps 1 and 2 with these sources to "fill in" any gap between these newer sources and the ones previously obtained.

The basic strategy just described has two limitations. First, you must have a relevant article with which to begin your search. Second, you must have a way to identify more recent sources that cited the ones you identified in steps 1 through 3.

Overcoming the first limitation can be as easy as doing a quick web search using appropriate keywords. Such a search generally turns up a large number of sources of varying quality, but as noted earlier, among these results sometimes appear research published in scientific books and journals, as well as secondary sources (such as Wikipedia) that include relevant references. If available to you, you could also use one of the specialized search engines to search databases such as PsycINFO for relevant articles.

Given that you have identified an older source that is directly relevant to your topic, you have a couple of options for locating more recent sources. If you have access to the Web of Science search engine, you can search the Science Citations Index and Social Science Citations Index to identify published sources that have cited your article. Many of these will be directly relevant to your research topic. You can then obtain those articles and use their reference sections to fill in the gaps. Some journal websites and search engines identify sources that cite a given article and may even provide links to those articles where you can read the abstract and, in some cases, obtain a copy of the article itself.

Searching for Books and Other Library Materials

Many libraries have installed electronic databases indexing the books and journals housed in the library. These systems are similar to other databases such as EBSCOhost and allow you to search for materials by author, title, subject, and keywords. Because libraries generally provide access to these databases via the web, you are not limited to searching just your own library. Try searching the web using the search phrase "university libraries databases." This will take you to a list of links to university libraries that you can search. Or, you can type in the name of a specific library (e.g., Purdue University Library) to search that library's holdings.

QUESTIONS TO PONDER

1. When searching the literature using PsycINFO, what should you do if your search returns a huge number of articles? What should you do if it returns too few?

2. When using PsycINFO, what tool is available find search terms to either broaden or narrow your search?

3. Libraries maintain electronic databases of the materials in their collections. How can you access the electronic "card catalogs" of libraries distant from your location?

READING A RESEARCH REPORT

Scientific papers fall into different categories depending on the nature of their content: literature reviews, theoretical articles, papers on research methodology or statistical analysis, and reports of original research. The formats of these papers vary with the category, although they share certain elements in common, such as the formatting of title pages, abstracts, and references. However, most of the papers you will acquire during a search

of the literature on your topic will be journal articles presenting original research. In this section, we describe the sections and subsections of a typical research paper, as specified by the *Style Manual of the American Psychological Association* — hereafter referred to as "APA style" — and offer guidelines for the critical reading of each part.

Reading the Literature Critically

When reading a journal article, think of yourself as a consumer of research. Apply the same skills to deciding whether you are going to "buy" a piece of research as you would when deciding whether to buy any other product. Critically reading and analyzing research literature (or any source of information for that matter) involves two steps: an initial appraisal and a careful analysis of content (Cornell University Library, 2015).

The *initial* appraisal involves evaluating the following (Cornell University Library, 2015):

- Author
- Date of publication
- Edition or revision
- Publisher
- Title of the journal

When evaluating the author, you should look at his or her credentials, including institutional affiliation and past experience in the area. It is important to consider the author and the author's institutional affiliation because not all research findings are reported in scholarly journals. Some research is disseminated through "research centers" and other organizations. By evaluating the author and the institution, you can make an assessment of any potential biases. For example, a study that comes from an organization with a political agenda may not present facts in a correct or unbiased fashion. The main author of a research report from such an organization might not even be academically qualified or trained to conduct research and correctly interpret findings. One way you can check on the author is to see if the author's work has been cited by others in the same area. Important works by respected authors are often cited by other researchers.

Look at the date of the publication to see if the source is current or potentially out of date. In some areas (e.g., neuroscience), new discoveries are made almost daily and may make older research out of date and obsolete. Try to find the most up-to-date sources that you can. It might be worth checking journal websites for the most up-to-date articles. Many journals now publish "Internet first" articles on important topics, which are available before they appear in the journal. When evaluating a book, determine if the copy you have is the most recent edition. If it is not, find the most recent edition because it will have been updated with the most current information available at the date of publication. Also, note the publisher for both books and journals. Some books are published by companies (sometimes called "vanity presses") that require authors to pay for publication of their works. Books published in this way may not undergo a careful scholarly review prior to publication. Generally, books published by university publishers will be scholarly, as will books published by well-recognized publishing houses (e.g., Lawrence Erlbaum Associates). Although this is no guarantee of quality, a book from a reputable

publisher will usually be of high quality. The same goes for journals. As indicated earlier, some journals are peer reviewed and some are not. Try to use peer-reviewed journals whenever possible. Finally, look at the title of the publication that you are thinking of using. This will help you determine if the publication is scholarly or not. There is no hard-and-fast rule of thumb to tell you if a publication is scholarly. Use the guidelines in Table 3-1 to determine the nature of the publication.

The second step is to evaluate the content of the published material. Evaluating the content of an article published in a scholarly psychological journal involves a careful reading and analysis of the different parts of the article (outlined in Table 3-2). In the next sections, we explore how to critically analyze each section of an APA-style journal article.

QUESTIONS TO PONDER

1. Why is it important to read a research report critically?

2. What initial appraisals should you make of an article that you are going to read?

Assume that you have obtained a copy of a research report. Knowing what you will find in it can save you time in locating specific kinds of information. The information contained in the report reflects the purposes for which it was written. These purposes include (1) arguing the need for doing the research, (2) showing how the research addresses that need, (3) clearly describing the methods used so that others can duplicate them, (4) presenting the findings of the research, and (5) integrating the findings with previous knowledge, including previous research findings and theories.

Consider the components of a typical research report and how they fulfill these purposes. Although the format of an article may vary from journal to journal, most research articles include the standard sections shown in Table 3-2. Sometimes sections are combined (e.g., results and discussion) or a section is added (e.g., design). Generally, however, research articles in psychological journals follow the outline shown in Table 3-2. Below we explore how to critically analyze each section of an APA-style journal article.

TABLE 3-2   Parts of an APA-Style Article

Abstract
Introduction
Method
    Participants or subjects
    Apparatus or materials
    Procedure
Results
Discussion
References

Evaluating the Introduction   When reading the introduction to a paper, determine whether or not the author has adequately reviewed the relevant literature. Were any important papers neglected? Does the author support any assertions with reference citations? In addition, ask yourself the following.

1. Has the author correctly represented the results from previous research? Sometimes when authors summarize previous research, they make errors or select only findings consistent with their ideas. Also, as already noted, authors may have a theoretical orientation that may bias their summary of existing research findings. If you are suspicious, look up the original sources and evaluate them for yourself. Also, you should determine if the author has cited the most up-to-date materials. Reliance on older material may not give you an accurate picture of the current research or theory in an area.

2. Does the author clearly state the purposes of the study and the nature of the problem under study?

3. Do the hypotheses logically follow from the discussion in the introduction?

4. Are the hypotheses clearly stated and, more important, are they testable?

Evaluating the Method Section   The method section describes precisely how the study was carried out. You might think of this section as a "cookbook," or a set of directions, for conducting the study. It usually contains subsections including *participants* or *subjects* (describing the nature of the subject sample used), *materials* or *apparatus* (describing any equipment or other materials used), and *procedure* (describing precisely how the study was carried out). You should spend considerable time evaluating the method section because sound methodology is crucial to whether the findings are valid. When reading the method section of an article, evaluate the following:

1. Who served as participants in the study? How were the participants selected (randomly, through a subject pool, etc.)? Were the participants all of one race, gender, or ethnic background? If so, this could limit the generality of the results (the degree to which the results apply beyond the parameters of the study). For example, if only male participants were used, a legitimate question is whether the results would apply as well to females. Also, look at the size of the sample. Were enough participants included to allow an adequate test of any hypotheses stated in the introduction?

2. Does the design of the study allow an adequate test of the hypotheses stated in the introduction? For example, do the levels of the independent variables allow an adequate test of the hypotheses? Is information provided about the reliability and validity of any measures used?

3. Are there any flaws in materials or procedures used that might affect the validity of the study? A good way to assess this is to map out the design (discussed next) of the study and evaluate it against the stated purpose of the study.

To better understand the design of an experiment you may want to "map out" the study. You can do this by drawing a grid or grids representing the design. For example,

FIGURE 3-4   Graphical display of an experimental design.
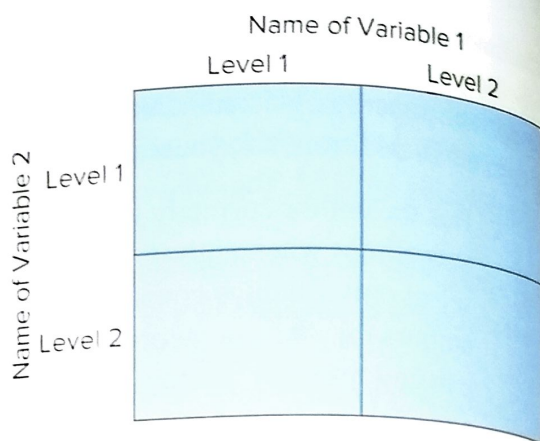
if you were reading about an experiment on stereotype threat which included two independent variables, a map of the experiment would look like the one shown in Figure 3-4. In Figure 3-4, the name of variable 1 (e.g., Stereotype threat condition) would go on top with the names of the two levels (e.g., Threat and No threat) underneath above each row. The name of variable 2 (e.g., Test anxiety assessment) would go on the side next to the names of the two levels to the left of each row (e.g., Before and After). Each box, or cell, on the figure represents a unique combination of variables 1 and 2. Of course, more complex designs would require more complex maps. However, the general strategy of mapping out designs, especially complex ones, can help you better conceptualize what was done in an experiment

QUESTIONS TO PONDER

1. What should you evaluate when reading the [...] an APA-style paper?

2. What should you look for when evaluating th[...] [...]tion of an APA-style paper?

Evaluating the Results Section   The results section [...] the data of the study, usually in summary form (means, standard deviation[...] [...]ons, etc.), along with the results from any inferential statistical tests applied to th[...] [...]a (e.g., a *t* test or analysis of variance). When evaluating the results section, look for the following:

1. Which effects are statistically significant? Note which effects were significant and whether those effects are consistent with the hypotheses stated in the introduction.[1]

2. Are the differences reported large or small? Look at the means (or other measures of center) being compared and note how much difference emerged.

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[1] Some journals now actively discourage the publication of *p-values* in favor of confidence intervals, which are more informative. Confidence intervals indicate not only average differences between conditions, but also the degree of overlap in the scores.

Note the effect size if given. Effect size tells you how big a difference is relative to the overall variability in the scores. You may find that, although an effect is statistically significant, it is small. A small effect may be meaningful from a theoretical perspective but of little practical value.

3. Were the appropriate statistics used?

4. Do the text, tables, and figures match? Sometimes errors occur in the preparation of tables and figures, so be sure to check for accuracy. Also check to see if the author's description of the relationships depicted in any tables or figures matches what is shown.

5. If data are presented numerically in tables or in the text of the article, you should graph those results. This is especially important when complex relationships are reported among variables.

If statistics are not reported, determine whether the author has correctly described the relationships among the variables and has indicated how reliability was assessed.

Evaluating the Discussion Section In the discussion section, you will find the author's interpretations of the results. The discussion section usually begins with a summary of the major findings of the study, followed by the author's interpretations of the data and a synthesis of the findings with previous research and theory. You also may find a discussion of any limitations of the study. When evaluating the discussion section, here are a few things to look for:

1. Do the author's conclusions follow from the results reported? Sometimes authors overstep the bounds of the results and draw unwarranted conclusions.

2. Does the author offer speculations concerning the results? In the discussion section, the author is free to speculate on the meaning of the results and on any applications. Carefully evaluate the discussion section and separate author speculations from conclusions supported directly by the results. Evaluate whether the author strays too far from the data when speculating about the implications of the results.

3. How well do the findings of the study mesh with previous research and existing theory? Are the results consistent with previous research, or are they unique? If the study is the only one that has found a certain effect (if other research has failed to find the effect or found just the opposite effect), be skeptical about the results.

4. Does the author suggest directions for future research in the area? That is, does the author indicate other variables that might affect the behavior studied and suggest new studies to test the effects of these variables?

References The final section of an article is usually the reference section (a few articles include appendixes as well) in which the author lists all the references cited in the body of the paper. Complete references are provided. You can use these to find other research on your topic.

QUESTIONS TO PONDER

1. What information should you evaluate in the results section of an APA-style paper?
2. What information should you evaluate in the discussion section of an APA-style paper?

FACTORS AFFECTING THE QUALITY OF A SOURCE OF RESEARCH INFORMATION

One thing to keep in mind when selecting a source of information about a particular area of research is that not all books, journals, or convention presentations are created equal. Some sources of information publish original research whereas others may only summarize the findings of a study. The criteria that journals use for accepting a manuscript determine which manuscripts will be accepted or rejected for publication, leading potentially to a bias in the content of the journal. Additionally, although most publications use a peer-review process to ensure the quality of the works published, some do not. In this section, we explore these issues and show how they relate to your literature review.
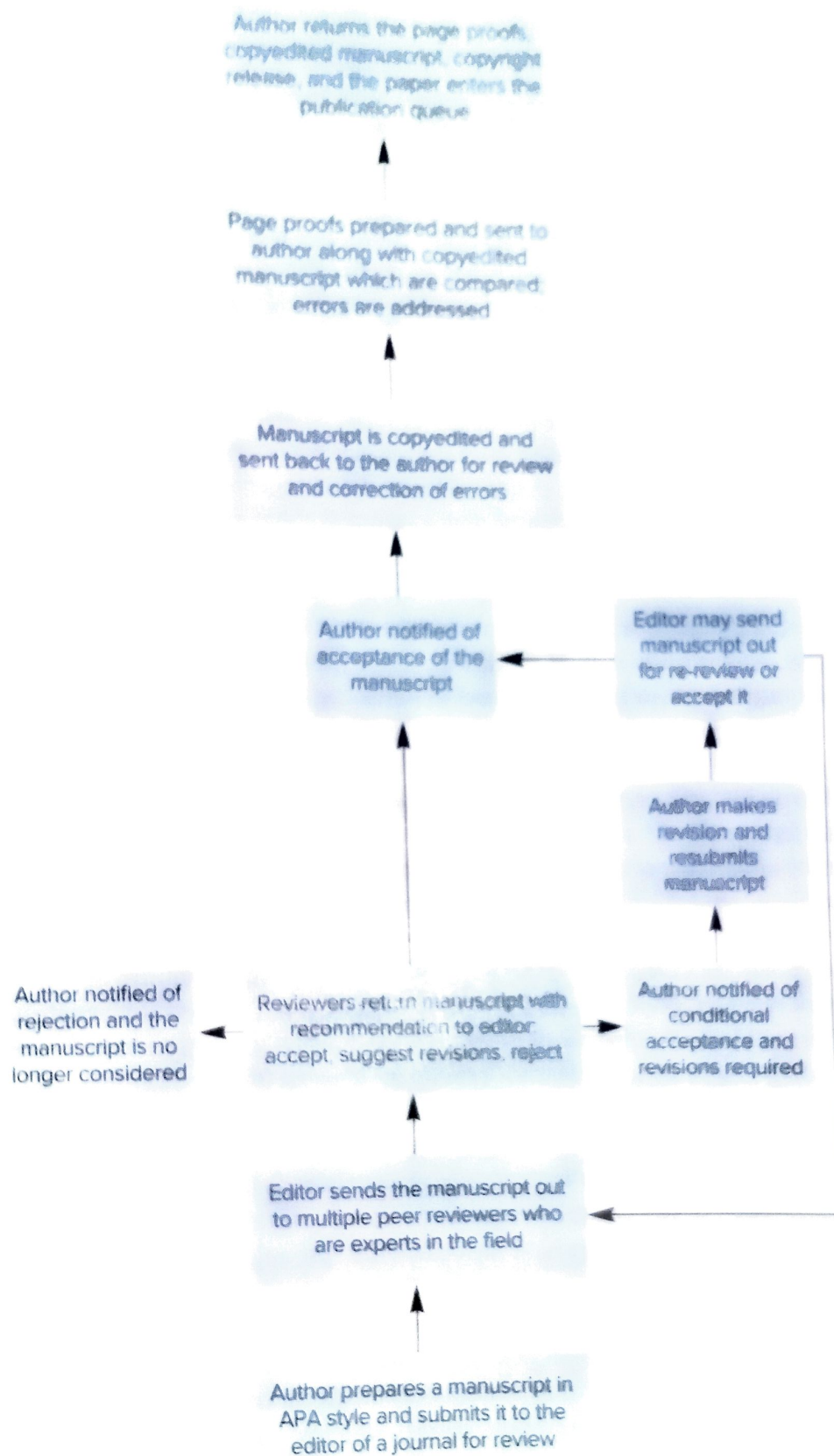
Publication Practices

When you conduct a literature review, one question should come to mind in considering a research area as a whole: Do the articles that you are reading provide a fair and accurate picture of the state of the research in the field? Figure 3-5 shows the general process that a manuscript undergoes when it is submitted for publication. Although it is true that journals generally provide a good comprehensive view of the research within their scope, there may be research that never makes it into the hallowed pages of scientific journals because of the publication practices adopted by scholarly journals.

When a manuscript is submitted for consideration to a scholarly journal, editors and reviewers guide their evaluations of the manuscript by a set of largely unwritten rules. These include whether the results reported meet conventionally accepted levels of statistical significance, whether the findings are consistent with other findings in the area, and whether the contribution of the research to the area is significant. The policies adopted by the current editor also could affect the chances of a manuscript being accepted for publication. We examine these publication practices and their possible effects on the published literature next.

Statistical Significance

Data collected in psychological research are usually subjected to a statistical analysis in order to determine the probability that chance and chance alone would have resulted in effects as large as or larger than those actually observed. If this probability is sufficiently low (e.g., less than .05, or 1 chance in 20), it is deemed unlikely that chance alone was

Author returns the page proofs, copyedited manuscript, copyright release, and the paper enters the publication queue

↑

Page proofs prepared and sent to author along with copyedited manuscript which are compared; errors are addressed

↑

Manuscript is copyedited and sent back to the author for review and correction of errors

↑

Author notified of acceptance of the manuscript ← Editor may send manuscript out for re-review or accept it

↑ ↑

Author makes revision and resubmits manuscript

↑

Author notified of rejection and the manuscript is no longer considered ← Reviewers return manuscript with recommendation to editor: accept, suggest revisions, reject → Author notified of conditional acceptance and revisions required

↑

Editor sends the manuscript out to multiple peer reviewers who are experts in the field

↑

Author prepares a manuscript in APA style and submits it to the editor of a journal for review

FIGURE 3-5 Diagram of the editorial review process.

responsible for the observed effect, and the effect is said to be *statistically significant*. (See Chapter 14 for a more detailed discussion of statistical significance testing.) The criterion probability used to determine statistical significance, called *alpha*, determines how often effects that are just chance differences end up being declared statistically significant. Thus, if alpha is .05, a chance effect will be declared statistically significant, on average, 5 times in 100 tests. In most journals, editors are reluctant to accept papers in which results fail to achieve the accepted minimum alpha level of .05. The reason, of course, is that such results stand a relatively high chance of being due to random factors rather than to the variable whose possible effect was being assessed in the study. Researchers are aware of the requirement for statistical significance and therefore usually do not report the results of studies that fail to meet it. It is worth noting here that there is a nascent movement to abandon statistical significance as a criterion for publication (Siegfried, 2015). For example, in 2015 the journal *Basic and Applied Social Psychology* changed its editorial policy so that *p*-values will no longer be published.

If the investigator is convinced that an effect is there, despite the lack of statistical significance, he or she may elect to repeat the study while using better controls or different parameters. Nothing is inherently wrong with such a strategy. If the effect is there, better control over extraneous variables and selection of more favorable parameters are likely to reveal it. If the effect is *not* there, however, **repeated** attempts to demonstrate the effect eventually lead to obtaining statistically significant results by chance. Through probability pyramiding (see Chapter 14), the likelihood that this will happen is much greater than the stated alpha level would suggest.

The failures to obtain significant results generally wind up in someone's file drawer, forgotten and buried. In most cases, only those attempts that were successful in obtaining significant results are submitted for publication. Yet, because of probability pyramiding, the published results are more likely to have been significant because of chance than the stated alpha would lead us to believe. This effect is known as the **file drawer phenomenon** (Rosenthal, 1979, 1984). To the extent that the file drawer phenomenon operates, published findings as a group may be less reliable than they seem.

The problem of negative findings is serious. The failure to obtain an expected relationship can be as important for understanding and for advancement of theory as confirmation. Yet this information is difficult to disseminate to the scientific community. Laboratories may independently and needlessly duplicate each other's negative findings simply because they are unaware of each other's negative results.

To combat the file drawer phenomenon and certain other sources of bias, some researchers and journal editors have advocated the "pre-registration" of scientific studies (see, e.g., Gonzales & Cunningham, 2015). Pre-registration involves submitting the design and methodology of a proposed study to an appropriate journal prior to actually conducting the study. Reviewers determine whether the study is properly designed to answer the questions it poses; if approved, then the results of the study will be accepted for publication (barring other complications) whether they are positive or negative. According to Gonzales and Cunningham (2015), several journals of the American Psychological Association were in the process of developing a pre-registration option for submitters. However, not everyone is convinced that pre-registration is a good idea (e.g., Scott, 2013), and it remains to be seen whether the potential advantages of the practice will outweigh its significant disadvantages.

QUESTIONS TO PONDER

1. How do publication practices affect the articles that ultimately get published in journals?

2. What role does statistical significance play in determining what gets published in a journal?

3. What is the file drawer phenomenon and how does it relate to published research?

Consistency with Previous Knowledge

Another criterion used to assess a research paper's acceptability is the consistency of its findings with previous knowledge. Most findings are expected to build on the existing structure of knowledge in the field, that is, to add new information, to demonstrate the applicability of known principles in new areas, and to show the limits of conditions within which a phenomenon holds. Findings that do not make sense within the currently accepted framework are suspect.

When the currently accepted framework has deep support, then such anomalous findings call into question the study that generated them rather than the framework itself. Reviewers and editors are likely to give the paper an especially critical appraisal in an attempt to identify faults in the logic and implementation of the design that may have led to the anomalous results. Ultimately, some reason may be found for rejecting the paper.

An excellent example in which this process operated was the initial work by Garcia and Koelling (1966) on learned taste aversions. Garcia and Koelling exposed thirsty rats to a solution of water that had been given a flavor unfamiliar to the rats. Some of the rats were then injected with lithium chloride, and the rest of the group was given a placebo injection of saline solution. The rats injected with lithium chloride became ill from the injection about 6 hours later. The rats were allowed to recover and then were given a choice between drinking plain water or the flavored water. Rats injected with the saline solution showed no preference between the two, but rats injected with lithium chloride avoided the novel flavor.

From this evidence, Garcia and Koelling (1966) concluded that the rats injected with lithium chloride had formed, in a single "trial," an association between the novel flavor and the illness. In other words, classical conditioning had occurred between a conditioned stimulus (the flavor) and an unconditioned stimulus (the illness) across a 6-hour interstimulus interval.

This was a striking finding. Classical conditioning had been extensively researched by Pavlov and others. It was well known that interstimulus intervals beyond a few *minutes* were completely ineffective in establishing a conditioned response, even when hundreds of trials were conducted. To reviewers and editors looking at Garcia and Koelling's (1966) manuscript, something was fishy. Garcia and Koelling's finding was a fluke, or some unreported aspect of methodology was introducing a confounding factor. The results simply couldn't be correct. The paper was repeatedly rejected by reviewers.

It was not until others heard of Garcia and Koelling's (1966) findings "through the grapevine" and successfully replicated their results that the phenomenon of learned taste aversions gained credibility among reviewers. Only then did papers on the topic

reports to be accepted in the established refereed journals. Once accepted, Garcia and Koelling's discoveries and other similarly anomalous findings became the basis for new theories concerning the nature and limits of laws of learning (see, e.g., Seligman & Hager, 1972). Hence, in refusing to publish Garcia and Koelling's findings, reviewers and editors delayed progress, but ultimately the new findings surfaced to challenge established thinking.

Editors and reviewers are thus in a tough position. To function effectively, they must be conservative in accepting papers that report anomalous findings. Yet they must be open-minded enough to avoid simply assuming that such findings must result from methodological flaws. Later in this chapter, we examine just how successful editors and reviewers have been at maintaining this balance.

Significance of the Contribution

When determining whether to accept or reject a paper for publication, editors and reviewers must assess the degree to which the findings described in the paper contribute to the advancement of knowledge. At one time, papers were considered acceptable even if they reported only a single experiment involving simply an experimental and a control group. A researcher could publish a number of papers in a relatively short time, but each contributed little new information.

Today, journals usually insist that a paper report a series of experiments or at least a parametric study involving several levels of two or more variables. For example, a paper might report a first experiment that demonstrates a relationship between two variables. Several follow-up experiments might then appear that trace the effective range of the independent variable and test various alternative explanations for the relationship. Such a paper provides a fair amount of information about the phenomenon under investigation and, in pursuing the phenomenon through several experiments, also demonstrates the phenomenon's reliability through immediate systematic replication.

Although these are important advantages, insisting on multiple experiments or studies within a paper also can have a negative side. Although the study provides more information, the information contained in the study cannot see the light of day until the entire series of experiments or observations has been completed. The resulting paper is more time-consuming to review and evaluate. Reviewers have more opportunities to find defects that may require modification of the manuscript. The result is delay in getting out what may be an important finding to the scientific community.

Editorial Policy

Editorial policy is yet another factor that can influence what appears in journals. Frequently, an area of research becomes "hot," resulting in a flood of articles in the area. Researchers latch on to a particular research area (e.g., eyewitness identification, day care in early infancy) and investigate it, sometimes to the exclusion of other important research areas. When this happens, a journal editor may take steps to ensure that more variety appears in a journal. For example, research on eyewitness identification became a hot topic in the area of psychology and law. Interest reached its peak in the 1980s, and the premier journal in the area, *Law and Human Behavior*, published a large

number of articles on this topic—perhaps too large a number. In 1986 Michael Saks took over as editor of the journal. He made it clear that he was going to give preference to manuscripts dealing with issues other than eyewitness identification.

Editorial policy also can show itself if the editor enters an unintended bias into the review system. The editor is the one who decides whether a paper will be sent out for review and, ultimately, if it will be published. If the editor has a bias—say, toward a particular theory—that editor may be unwilling to publish articles that do not support that theory. We discuss this issue in the next section.

QUESTIONS TO PONDER

1. How can consistency with previous knowledge affect whether a paper gets published in a journal?

2. How does the significance of a contribution influence an editor's decision to publish a paper in a journal?

3. How can editorial policy affect whether a paper gets published in a journal?
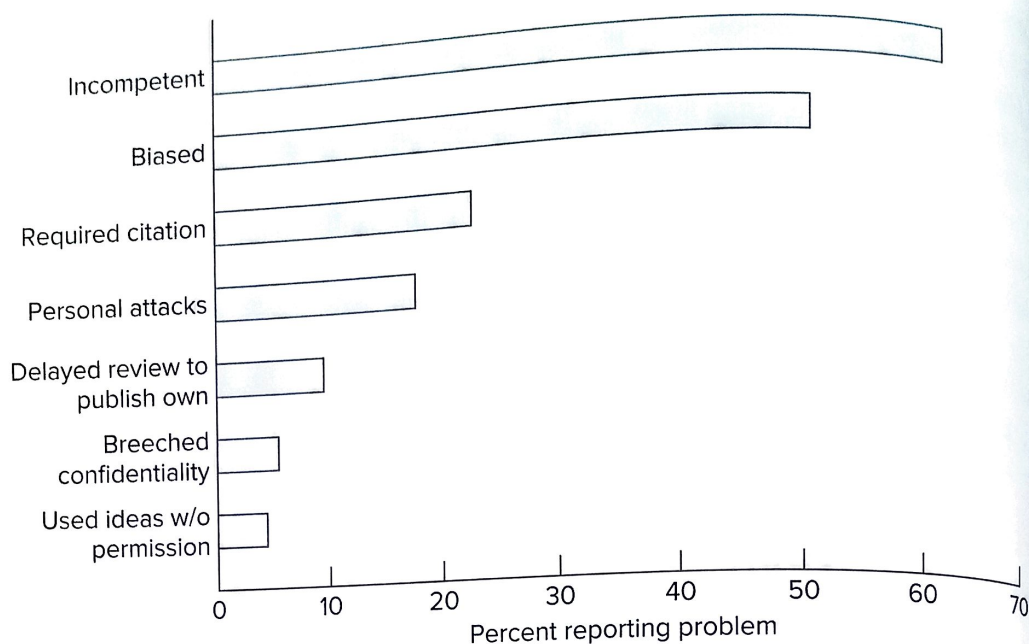
Peer Review

Some sources of information (including books, journal articles, and convention proceedings) use a **peer-review** process. This means that the materials to be published or presented are reviewed by experts in the area that the material covers. These experts receive a copy of the materials and do a thorough review of the content.

There are three functions of the peer-review process (Resnik & Elmore, 2016). First is to provide advice to an editor whether to accept or reject a paper for publication. The editor of the journal can either accept (outright or with revisions) or reject the manuscript. Second, through the peer-review process, authors receive feedback, which allows them to make changes and improvements to a paper. Third, through interaction with reviewers and editors, authors can learn to do better science and better writing.

Peer review is a time-honored tradition in science as a way to ensure quality and provide feedback to authors. Most authors receiving feedback from the process (73.8%) believe that they received useful feedback, and a large majority (75.6%) believe that reviews provided a firm basis for an editor's decision (Shattell, Chinn, Thomas, & Cowling III., 2010). However, peer review is far from perfect. In one study, for example, authors reported several "ethical" problems with the peer-review process. As shown in Figure 3-6, 61.8% of authors reported incompetent reviews, 50.5% reported a biased review, and 22.7% reported that reviewers required them to cite the reviewer's research. Remember, although peer review helps to ensure quality, it does not guarantee it. Conversely, you may find some gems in nonrefereed journals. The reason for this seeming lack of consistency has to do with problems in the peer-review process.

Problems with Peer Review   As we noted, when you send a manuscript to a refereed journal, the editor will send your manuscript to expert reviewers (usually two) who will carefully evaluate your paper. In some cases, peer review is anonymous, and in
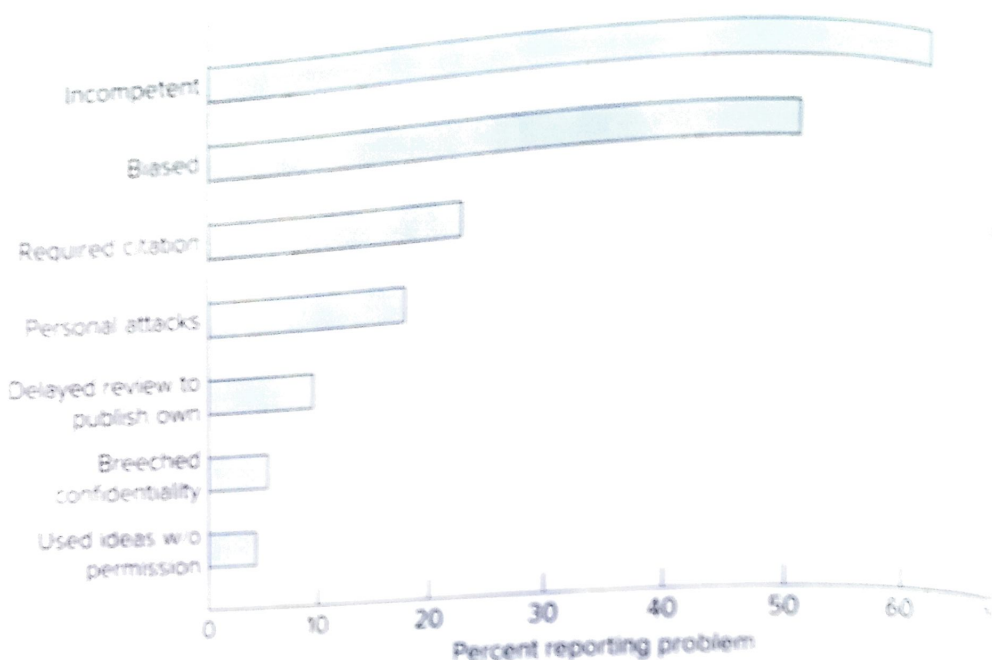
FIGURE 3-6 Problems with peer review reported by authors.
SOURCE: Resnik, Gutierrez-Ford, and Peddada, 2008.

others it is not. Individual journals determine their peer-review policies, and some choose to use anonymous peer review. Anonymous peer review might be necessary, but it does have its problems. Although you hope that your colleagues in research are honest and fair in their appraisals of your work, someone with a personal dislike for you or your ideas could sabotage your efforts. Even in the absence of malice, the reviewer may judge your manuscript unfairly because of a lack of knowledge, a bias against your general approach to research, or misreading.

Suls and Martin (2009) suggest that there are several problems with traditional peer review in the social sciences that may make the process unfair or biased. Suls and Martin point out that even though reviewers are supposed to be "experts," reviewers may lack expertise relating to the methods and issues within a field. Even if a reviewer is a true expert, he or she may be a direct competitor of the author of an article, coloring that reviewer's evaluation. Suls and Martin also suggest that using anonymous reviewers might encourage reviewers to be overly critical of a paper due to lack of accountability. Reviewers may also see their role as "gatekeeper" and be overly harsh and critical especially for articles with controversial content. Suls and Martin also note that a frequent criticism of peer review is that papers from well-established authors are treated more leniently than papers from lesser-known authors. The result is that papers from well-known authors have a better chance of being published, even if the work is of lower quality. Yet another problem with peer review is low levels of agreement between reviewers of the same paper (Suls & Martin, 2009).

The extent to which such factors operate within the peer-review system has been the subject of research and debate. For example, Mahoney (1977) investigated the influence of several properties of a research manuscript on its acceptance for publication by reviewers. With the approval of the editor, Mahoney sent manuscripts describing a fictitious experiment to 75 reviewers working for the *Journal of Applied Behavior Analysis.*

FIGURE 3-6 Problems with peer review reported by authors.
SOURCE Resnik, Gutierrez-Ford, and Peddada, 2008

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Five randomly constituted groups of reviewers received different versions of the manuscript that varied according to their results and interpretations of those results. Mahoney found that the paper was consistently rated higher if its results supported the reviewer's theoretical bias and lower if they did not. How the results were interpreted had little impact. Similarly, the recommendation to accept or reject the paper for publication was strongly influenced by the direction of the data. If the data supported the reviewer's theoretical leanings, the reviewer usually recommended acceptance. If the data argued against those leanings, the reviewer usually recommended rejection or major revision.

Mahoney's (1977) findings showed that results favorable or unfavorable to the reviewer's point of view affect how the reviewer receives the manuscript. If the results are favorable, the reviewer is likely to believe that the results are valid and that the methodology was adequate. If the results are unfavorable, however, the reviewer is likely to believe that the study must be defective. The reviewer will search diligently for flaws in the design or execution of the study and use even minor problems as reasons for rejection.

Partly because of such sources of bias, estimates of inter-reviewer reliability in the social sciences have tended to be low. Fiske and Fogg (1990) examined 402 reviews of 153 papers and found almost no agreement among reviewers, not because the reviewers overtly disagreed but because the reviewers found different aspects of the papers to criticize. It was as if they had read different papers! Lindsey (1978), in his book *The Scientific Publication System in Social Science,* notes that empirical studies have consistently found reliabilities of around .25 (the correlation between reviewer judgments). Whether both reviewers will agree that your paper is publishable is thus very nearly a chance affair.

Other research shows there may be an own-country bias in the review process. Lutz Bornmann and Hans-Dieter Daniel (2009) examined a number of factors that related to a reviewer's decision to accept or reject a manuscript in a German-language international chemistry journal. The journal required its reviewers to provide a host of information about themselves, which Bornmann and Daniel related to a number of manuscript characteristics. Among their findings was that a manuscript was more likely to be accepted by a reviewer if the authors and/or the reviewers had a German institutional affiliation and that ratings were most favorable if both the reviewer and author were German. Bornmann and Daniel also found that although scientific impact was an important factor in determining ultimate acceptance of rejection of a manuscript, a manuscript had a greater chance of being accepted if it had scientific impact and if all of the authors were at German institutions.

Gender also appears to relate to the review process. With respect to the gender of the reviewer, the evidence is mixed. Two studies using different methods (Mutz, Bornmann, & Daniel, 2012; Borsuk et al., 2009) found that female reviewers tend to be more critical than male reviewers. Mutz, Bornmann, and Daniels found that grant applications were more likely to be recommended for funding by an all-male panel of reviewers than by an all-female panel or one with gender parity. However, another study (Grod et al., 2008) found that males recommended rejection of manuscripts more frequently than females. The difference in the findings of these studies may relate to the samples used, the task required, and the type of material to be reviewed. What we can conclude at this point is that gender does relate to the outcome of peer review in some way.

How about the gender of the author? Is there any systematic bias against male or female authors? Commentators have been concerned that there may be a systematic bias against female authors in the peer-review process. However, evidence suggests that there is no systematic bias against female authors (Marsh, Bornmann, Mutz, Daniel, & O'Mara, 2009). For example, Herbert Marsh and his colleagues conducted a meta-analysis (a study that statistically compares results of a number of studies on a given topic) of the literature on the relationship between author gender and the peer review process for grant applications. They found no evidence for a bias against women in the peer review process. In fact, they found a slight pro-woman author bias. Robyn Borsuk and her colleagues (2009) also found no evidence for a bias against women authors in review of a manuscript.

The unreliability of the peer-review system was highlighted by a study conducted by Peters and Ceci (1982). Peters and Ceci identified 12 *published* articles that had appeared in different major psychology journals. Each article was authored by at least one individual from a "prestige" institution and had appeared between 18 and 32 months earlier. The names of the original authors and their institutional affiliations were removed and replaced by fictitious names and affiliations. In addition, the titles, abstracts, and introductions were cosmetically altered (without changing the content) to reduce the chances that the articles would be recognized. Retyped as manuscripts, the articles were then resubmitted *to the same journals that had originally published them* (and in most cases, to the same editor).

The results were dramatic. Only 3 of the 12 articles were identified as resubmissions and rejected for this reason. The remaining 9 were undetected. Of those 9, *8 were rejected for publication*. Even more amazing, in every case both reviewers agreed and the editor concurred.

Because the articles had appeared before, the reviewers might have rejected the papers because they remembered the earlier data (although not the articles themselves) and thus viewed the information they contained as contributing nothing new. If this were the case, however, no hint of this was given in the reasons cited by the reviewers. According to Peters and Ceci (1982), the reasons given for rejecting the papers usually concerned major flaws in the methodology. Thus, papers that had already been accepted into the archival literature only months earlier were subsequently seen as too methodologically flawed to merit publication.

Peters and Ceci (1982) offer two possible reasons for the new attitude toward the papers. The change in authorship and affiliation from prestigious to unknown may have had a negative influence on the evaluation. Or, because of the approximately 80% rejection rate, peer review may have been so unreliable that the chances of getting positive evaluations were just too low to expect acceptance the second time. This latter view assumes that getting a positive evaluation is essentially a matter of chance for manuscripts that cannot be rejected out of hand for obvious fatal flaws. Whether either or both possibilities are true, the implication is that acceptance of your paper (given that it is reasonably good) depends to a large extent on factors that are not under your control.

Can anything be done to improve the peer-review process? A number of commentators have offered suggestions to improve the process. Cooper (2009), for example, suggests a training program for reviewers. She points out that at the present time, reviewers receive little, if any, formal training. One way to do this is to include graduate students as co-reviewers during their graduate training (Cooper, 2009). Cooper

also suggests that increasing accountability can help improve the process. According to Cooper, this could be accomplished by allowing authors to provide feedback on the review process and/or allowing an appeal process for authors. Another thing that could improve the review process is to relieve the burden on reviewers by reducing the number of manuscripts they review (Cooper, 2009). According to Cooper, editors could reject more obviously poor papers before sending them out for review or solicit fewer reviews for each paper submitted.

Despite the problems associated with the peer-review process, it does work pretty well. Although peer review is no guarantee that all things published are of impeccable quality, it does provide a measure of confidence that what you read is valid and reliable.

QUESTIONS TO PONDER

1. What is peer review, and what are the major problems associated with the practice?

2. How can the peer-review process affect the likelihood that a paper will be published in a journal?

3. What evidence is there that the peer-review process affects publication practices?

Values Reflected in Research

Another thing you need to take into account when evaluating research is whether values have influenced the research hypotheses tested and how results are interpreted. Values may flow from an entire field of science or from individual authors. For example, currently there is discussion about the ideological bias in social psychology. The majority of social psychologists identify themselves as politically liberal on a number of issues. In one study (Inbar & Lammers, 2012), only 5.5% of social psychologists described themselves as "moderate" and even fewer (3.9%) as "conservative" on social issues. The percentage identifying in various ideological categories varied according to the issue evaluated. For example more social psychologists describe themselves as moderate or conservative (compared to social issues) on economic (18.9% and 17.9%, respectively) and foreign policy (21% and 10.3%, respectively). Inbar and Lammers also found that moderates and conservatives were more likely to have experienced a hostile climate in the science than liberals. Ominously, the more liberal social psychologists were, the more willing they indicated they would be to discriminate against a conservative social psychologist (e.g., in hiring, publication and grant decisions).

The bottom line is that scientists are human beings and have their own attitudes, values, and biases that may be reflected in science. These values sometimes show up in published research, potentially reducing the its validity. When general cultural values, political agendas, and personal values of the researcher are introduced into the research process, it can affect the validity and generality of science. For example, Duarte and colleagues (2014) indicate that ideological values in social psychology can result in three negative consequences for the science. First, the values becoming embedded in the theory and methods of the science, resulting in research questions being approached from only one point of view. Second,

researchers might focus only on issues that validate the dominant ideology, while ignoring those that do not. Third, the behaviors and motives of members of the nondominant ideology might be mischaracterized. So, although we would like to think of research as "value free" and objective, some philosophers of science suggest that research cannot easily be separated from a set of values dominating a culture or a person (Longino, 1990).

Values can influence science in other ways as well. Helen Longino (1990), for example, lists five nonmutually exclusive categories of these influences (p. 86):

1. *Practices.* Values can influence the practice of science, which affects the integrity of the knowledge gained by the scientific method.

2. *Questions.* Values can determine which questions are addressed and which are ignored about a given phenomenon.

3. *Data.* Values can affect how data are interpreted. Value-laden terms can affect how research data are described. Values also can determine which data are selected for analysis and the decision concerning which phenomena are to be studied in the first place.

4. *Specific assumptions.* Values influence the basic assumptions that scientists make concerning the phenomena that they study. This may cause a scientist to make inferences in specific areas of study.

5. *Global assumptions.* Values can affect the nature of the global assumptions that scientists make that can affect the nature and character of the research conducted in an entire area.

Similarly, David Myers (2008) indicates a number of ways that values can affect science. First, scientists often come from a common culture and share a set of beliefs about the world, which may go unchallenged. These unchallenged beliefs become resistant to change, and anyone from outside who challenges them is viewed with suspicion and their ideas given little weight. Because of this, new ideas and research issues may not be accepted. Second, values may be expressed as value judgments concerning the best way to live one's life (Myers, 2008). Myers gives the example of Abraham Maslow's concept of self-actualization as a person who is autonomous and mystical. That concept was based on Maslow's personal values and may have been different had Maslow had different personal values. Third, values can influence how we conceptualize behavior or scientific phenomena. For example, if a study finds that authoritarian people are more likely to endorse "unethical" positions, values can influence what a researcher considers "unethical" (Duarte et al., 2015). Or, if unethical is defined in terms of not taking a liberal or conservative view of what is unethical, then values are directly reflected in how that construct is defined and measured (Duarte et al., 2015). Third, Myers (2008) states that values can affect how we label behavior or psychological phenomena. The classic example is that one person's "terrorist" is another person's "freedom fighter" (Myers, 2008).

How Values Influence What and How Scientists Study   Cultural values can be seen operating on science. For example, in the United States, researchers interested in conformity effects have focused on the role of the majority in influencing the minority.

This probably filters down from the American political system in which the "majority rules." In Europe where there are parliamentary democracies, minority viewpoints are often taken into account when political coalitions are formed. As a consequence, much of the research on how a minority can influence a majority came out of European psychological laboratories.

Feminist scholars point out that assumptions about gender can influence how research questions are formulated (Unger & Crawford, 1992). For example, research on the effects of early infant day care on children is usually couched in negative terms concerning how maternal employment may adversely affect a child's development. Rarely are such questions phrased in terms of the potential positive outcomes (Unger & Crawford, 1992).

Unger and Crawford (1992) also point out that gender may play a role in the manner in which research hypotheses are tested. They suggest, for example, that focusing on quantitative data (representing behavior with numerical values) may be biased against female research participants. They suggest that research also should be done that focuses on qualitative data. Such a focus would lead to a richer understanding of the motives underlying behavior. They also point out that research designs are not value neutral. Overreliance on rigid, laboratory experimentation, according to Unger and Crawford, divorces social behavior from its normal social context. They suggest using more field-oriented techniques. They do not advocate, however, abandoning experimental techniques.

What you read in scientific journals and in the media is filtered through a system in which reviewers and editors—and their values—determine what gets published or widely disseminated. We have already seen how agreement with a reviewer's point of view increases the likelihood that a manuscript will be accepted. Journal and media editors serve as *gatekeepers*, determining what research will be published (Crane, 1967). On another level, what may be *allowed* to be disseminated may depend on biases of editors and those within the scientific community as a whole. In this way, editors affect those who read journals, society as a whole, and authors by limiting what is disseminated (Hojat, Gonnella, & Caelleigh, 2003). This problem becomes most serious when scientific, political, or personal agendas systematically suppress research on one side of an issue. Let's look at a couple of examples of how this works.

Between 2004 and 2006, NASA scientist James E. Hanson alleged that his research and conclusions on the causes of climate change were systematically suppressed by political appointees with NASA. As a result, the public was allegedly exposed to a biased view of global climate change. In response to the allegations, the Inspector General of NASA initiated an investigation. Based on this investigation, the Inspector General concluded, "the NASA Headquarters Office of Public Affairs managed the topic of climate change in a manner that reduced, marginalized, or mischaracterized climate change science made available to the general public through those particular media over which the Office of Public Affairs had control" (Winters, 2008, p. 1). The Inspector General's report indicated that NASA officials used a number of tactics to minimize the impact of certain research findings. These included denying access to media, adding statements concerning uncertainty, timing release of research so that it had minimal impact, and releasing unfavorable information to lesser news outlets. Practices like this may lead to a one-sided presentation of scientific findings, where those who subscribe to the accepted

view are more likely to have their results published or disseminated in the media. In fact, a survey by Naiomi Oreskes (2004) of 928 published papers on the causes of climate change provides evidence for this. Oreskes found that 75% of the published papers agreed with the prevailing views of the causes of climate change, and the other 25% took no mention (e.g., dealt with methodological or other issues).

The gatekeepers of science sometimes send clear messages to scientists about what is appropriate subject matter for study. In addition, negative personal and professional consequences may befall scientists who try to publish research that is perceived to fly in the face of what is conventionally acceptable. Consider the case of Mark Regenerus. Regenerus published a study questioning the equivalence of "gay parenting" and traditional parenting (by heterosexual parents), which is the widely accepted "truth" in this research area. After his article was published, Regenerus was the target of much vitriol by the scientific community and by the public at large. He was accused by colleagues of damaging the image of the University of Texas, was the target of an investigation into his research integrity, and was the target of a complaint to the Texas Attorney General (Ferguson, 2012). The very public excoriation of Regenerus sends a clear message to other researchers who might dare to challenge the prevailing view in science: don't do it (Ferguson, 2012).

Interpreting Behavior   Scientists do not merely "read" what is out there in nature. Rather, scientists interpret what they observe (Myers, 2008). One's personal biases and cultural values may exert a strong influence over how a particular behavior is interpreted. For example, a conservative scientist may favor a biological explanation for aggression whereas a more liberal one may favor a societal explanation. In such cases, the values of the researcher provide an overarching view of the world that biases his or her interpretations of a behavioral event.

Moving from What Is to What Ought to Be   Values also can creep into science when scientists go beyond describing and explaining relationships and begin to speculate on what ought to be (Myers, 1999). That is, scientists allow values to creep into the research process when they endeavor to define what is "right" or "normal" based on research findings. On another level, this influence of values also is seen when researchers conduct research to influence the course of political and social events. Some feminist scholars, for example, suggest that we should not only acknowledge that values enter into science but also use them to evaluate all aspects of the research process (Unger, 1983). According to this view, science should be used to foster social change and challenge existing power structures (Peplau & Conrad, 1989).

Making sense of research requires that you be aware of the biases and other sources of error that afflict research. Given the ubiquitous nature of these sources, it is not surprising that research findings within a given area often appear contradictory.

Combating Values and Ideological Homogeneity in Science.   Is there anything we can do to address the problems of values and ideological bias in science? Fortunately, there is. Although we may never be able to eliminate these influences, we may be able to reduce them. In the context of ideological homogeneity, Roy Baumeister (2015)

TABLE 3-3 Areas in Which Ideological Bias in Science Can Be Addressed

ORGANIZATIONAL RESPONSES	PROFESSIONAL RESPONSES	RESEARCH PRACTICES
Formulate anti-discrimination policies relating to ideological diversity.	Raise awareness by acknowledging the presence of ideological bias.	Be aware of double standards that result in harsher criticism of conservative than liberal ideas and findings.
Implement a "climate study" to evaluate experiences of members of nondominant ideology groups.	Solicit and welcome feedback from nonliberal students.	Support "adversarial" collaborations by encouraging researchers with differing views to collaborate on research.
Conduct studies of the barriers to nonliberal students.	Expand diversity statements and policies to include ideology and diversity of thought.	Place more emphasis on getting science right and establish norms for handling when scientific claims are shown to be incorrect.
Expand the number of nonliberal reviewers.		
Develop strategies to recruit, hire and retain nonliberal students and professionals.		

SOURCE: Duarte et al., 2015.

suggests that we can attenuate the influence of a particular ideological bias by becoming aware of our own biases and how they might be affecting the course of research. One strategy he suggests is to try to think about an issue from a perspective different from your own. So, if you believe that differences between racial groups are due to environmental factors, you should address the issue from a biological perspective. Duarte et al. (2015) suggest that there are three areas in which ideological bias can be addressed. These, along with their examples, are shown in Table 3-3. Although these suggestions were proposed in the context of ideological homogeneity, they may also apply to reducing other forms of value-related bias in science.

DEVELOPING HYPOTHESES

Your library research and critical reading have now put you on the threshold of the next major step in the research process: developing your idea into a testable hypothesis. This hypothesis, as we pointed out in Chapter 1, will be a tentative statement relating two (or more) variables that you are interested in studying. Your hypothesis should flow logically from the sources of information used to develop your research question. That is, given what you already know from previous research (either

your own or what you read in the journals), you should be able to make a tentative statement about how your variables of interest relate to one another.

Hypothesis development is an important step in the research process because it will drive your later decisions concerning the variables to be manipulated and measured in your study. Because a poorly conceived research hypothesis may lead to invalid results, take considerable care when stating your hypothesis.

As an example, imagine that your general research question centers on the relationship between aging and memory. You have spent several hours in the library using PsycINFO to find relevant research articles. You have found several articles showing that older adults show poorer memory performance on tasks such as learning nonsense syllables, learning lists of words, and recognizing pictures. However, you find very little on age differences in the ability to recall details of a complex event such as a crime. Based on what you found about age differences in memory from your literature review, you strongly suspect that older adults will not recall the details of a complex event as well as younger adults.

Thus far, you have a general research question that centers on age differences in the ability to recall details of a complex event. You have identified two variables to study: participant age and memory for a complex event. Your next step is to translate your suspicion about the relationship between these two variables into a testable research hypothesis. You might, for example, develop the following hypothesis:

> Older adults are expected to recall fewer details of a complex event correctly than younger adults.

Notice that you have taken the two variables from your general research question and have linked them with a specific statement concerning the expected relationship between them. This is the essence of distilling a general research question into a testable hypothesis.

Once you have developed your hypothesis, your next task is to decide how to test it. You must make a variety of important decisions concerning how to conduct your study. The next chapter explores the major issues you will face during the preliminary stages of planning your study.

QUESTIONS TO PONDER

1. How do values affect the research process?
2. How do you develop hypotheses for research?

SUMMARY

Sources of research ideas include experience (unsystematic observation and systematic observation), theory, and the need to solve a practical problem. Unsystematic observation includes casual observation of both human and animal behavior. Systematic observation includes carefully planned personal observations, published research reports, and your own previous or ongoing research. Theory is a set of assumptions about the causes of a phenomenon and the rules that specify how causes