5.19 Table Checklist

The following checklist may help ensure that the data in your table are effectively presented and conform to the style rules presented in this chapter.

Table Checklist

- ☐ Is the table necessary?
- ☐ Does it belong in the print version of the article, or can it go in an online supplemental file?
- ☐ Are all comparable tables in the manuscript consistent in presentation?
- ☐ Is the title brief but explanatory?
- ☐ Does every column have a column head?
- ☐ Are all abbreviations explained, as well as special use of italics, parentheses, dashes, boldface, and special symbols?
- ☐ Are the notes in the following order: general note, specific note, probability note?
- ☐ Are all vertical rules eliminated?
- ☐ Are confidence intervals reported for all major point estimates? Is the confidence level—for example, 95%—stated, and is the same level of confidence used for all tables and throughout the paper?
- ☐ If statistical significance testing is used, are all probability level values correctly identified? Are asterisks attached to the appropriate table entries only when needed (as opposed to stating exact probabilities)? When used, is a probability level assigned the same number of asterisks in all tables in the same paper?
- ☐ If all or part of a copyrighted table is reproduced or adapted, do the table notes give full credit to the copyright owner? Have you received written permission for reuse (in print and electronic form) from the copyright holder and sent a copy of that written permission to the journal editor with the final version of your paper?
- ☐ Is the table referred to in text?

Figures

5.20 Principles of Figure Use and Construction

There are many different types of figures; however, certain principles are the same for all figure types. The first consideration is the information value of the figure in the context of the paper in which it is to appear. If the figure does not add substantively to the understanding of the paper or duplicates other elements of the paper, it should not be

included. A second consideration is whether a figure is the best way to communicate the information. In some cases (particularly when quantitative information is being conveyed), a table may offer more precision than, say, a graph. A third consideration is the degree to which the figure can be produced in a way that captures the essential information features desired without visually distracting detail. When considering inclusion of a figure, always remember that the information value of the figure must dominate other decisions. If you focus on the principle of information value, other questions—for example, use of color, use of photographic images, or magnitude of cropping of a picture—should be relatively easy to resolve.

As with other elements of a manuscript, you may wish to consider placing some figures in online supplemental materials archives when those are available. Figures placed in online supplemental materials archives are those that would enrich the understanding of the material presented in the print version of the article but are not essential to the basic understanding of the material. You might want also to include materials that cannot be displayed in print format, such as video clips. As with other online supplemental materials, figures must be able to be understood on their own (see section 2.13). Therefore label them clearly and use detailed legends.

5.21 Types of Figures

Many types of figures can be used to present data to the reader. Sometimes the choice of which type to use will be obvious; at other times it will not. The more common types of figures used are described next.

- *Graphs* typically display the relationship between two quantitative indices or between a continuous quantitative variable (usually displayed as the *y*-axis) and groups of subjects displayed along the *x*-axis.
- *Charts* generally display nonquantitative information such as the flow of subjects through a process, for example, flow charts.
- *Maps* generally display spatial information.
- *Drawings* show information pictorially.
- *Photographs* contain direct visual representations of information.

Although these are general prototypes, there are many variations and versions of each, and the distinctions among many of them are not clear. Computer-generated images can be made to seem as if they are life-reflecting photographs, and photographs can be engineered to look more like drawings. Whenever photographic images are changed in a way that their basic information is modified, you must disclose the manipulation (see section 5.29).

Figures can be effectively used to illustrate complex theoretical formulations (see Figure 5.1) or to represent a theory graphically through a set of path models (see Figure 5.2). They can also show the sampling and flow of subjects through a randomized clinical trial or other experiment (see Figure 5.3) or the flow of participants in a survey study (see Figure 5.4). Figures can be used to illustrate the results of a one-way design with error bars representing precision of the resulting estimates (see Figure 5.5) or empirical results from a complex multivariate model (see Figure 5.6). They can also show details concerning the kinds of responses being gathered and scoring methods (see Figure 5.7) as well as details of an experimental laboratory set-up (see Figure 5.8) and an experimental procedure (see Figure 5.9).

Figure 5.1. Complex Theoretical Formulations

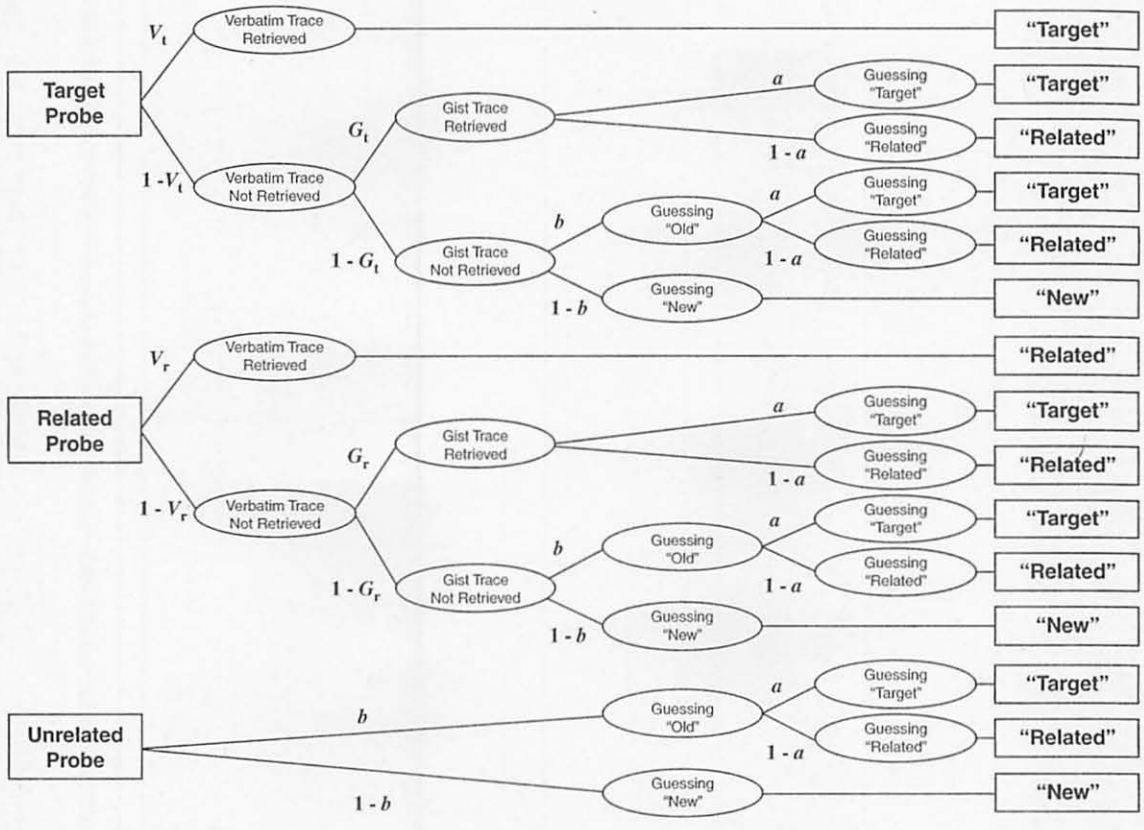

Figure X. Processing tree model for the simplified conjoint recognition paradigm. Rectangles on the left denote probe type, rectangles on the right denote responses. They are connected by branches of the processing tree that represent the combination of cognitive processes postulated by the model. V_t = probability of retrieving a target's verbatim trace given a target probe; V_r = probability of retrieving a target's verbatim trace given a related probe; G_t = probability of retrieving a target's gist trace given a target probe; G_r = probability of retrieving a target's gist trace given a related probe; b = probability of guessing that an item is either a target or a related probe; a = probability of guessing "target." Adapted from "A Simplified Conjoint Recognition Paradigm for the Measurement of Gist and Verbatim Memory," by C. Stahl and K. C. Klauer, 2008, *Journal of Experimental Psychology: Learning, Memory, and Cognition, 34,* p. 573. Copyright 2008 by the American Psychological Association.

5.22 Standards for Figures

The standards for good figures are simplicity, clarity, continuity, and (of course) information value.

A good figure

- augments rather than duplicates the text,
- conveys only essential facts,
- omits visually distracting detail,
- is easy to read—its elements (type, lines, labels, symbols, etc.) are large enough to be read with ease,

Figure 5.2. Theory Through a Set of Path Models

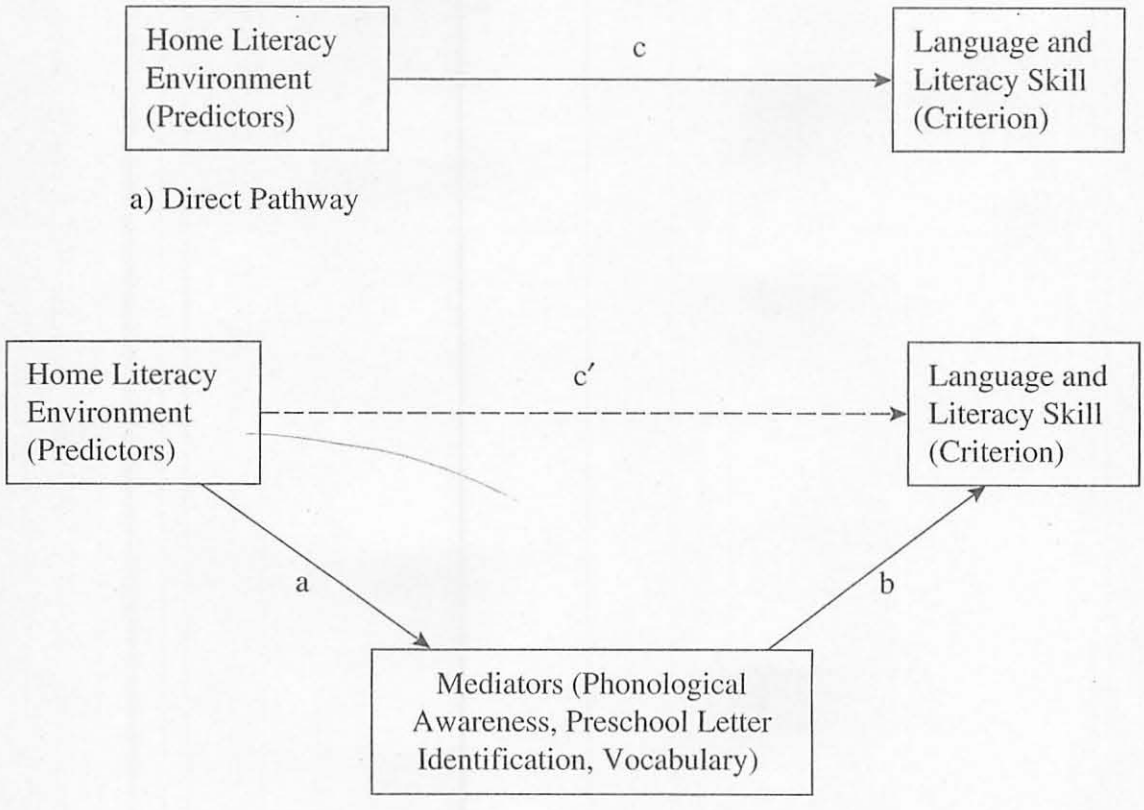

Figure X. Generic mediation model being tested (on the basis of Baron & Kenny, 1986). Adapted from "Preschool Home Literacy Practices and Children's Literacy Development: A Longitudinal Analysis," by M. Hood, E. Conlon, and G. Andrews, 2008, *Journal of Educational Psychology, 100,* p. 259. Copyright 2008 by the American Psychological Association.

- is easy to understand—its purpose is readily apparent,
- is consistent with and in the same style as similar figures in the same article, and
- is carefully planned and prepared.

Be certain in figures of all types that

- lines are smooth and sharp,
- typeface is simple (sans serif) and legible,
- units of measure are provided,
- axes are clearly labeled, and
- elements within the figure are labeled or explained.

Be certain, for instance, to distinguish between error bars and confidence intervals. When using confidence intervals, clearly specify the size of the interval (e.g., 95%);

Figure 5.3. Sampling and Flow of Subjects Through a Randomized Clinical Trial or Other Experiment

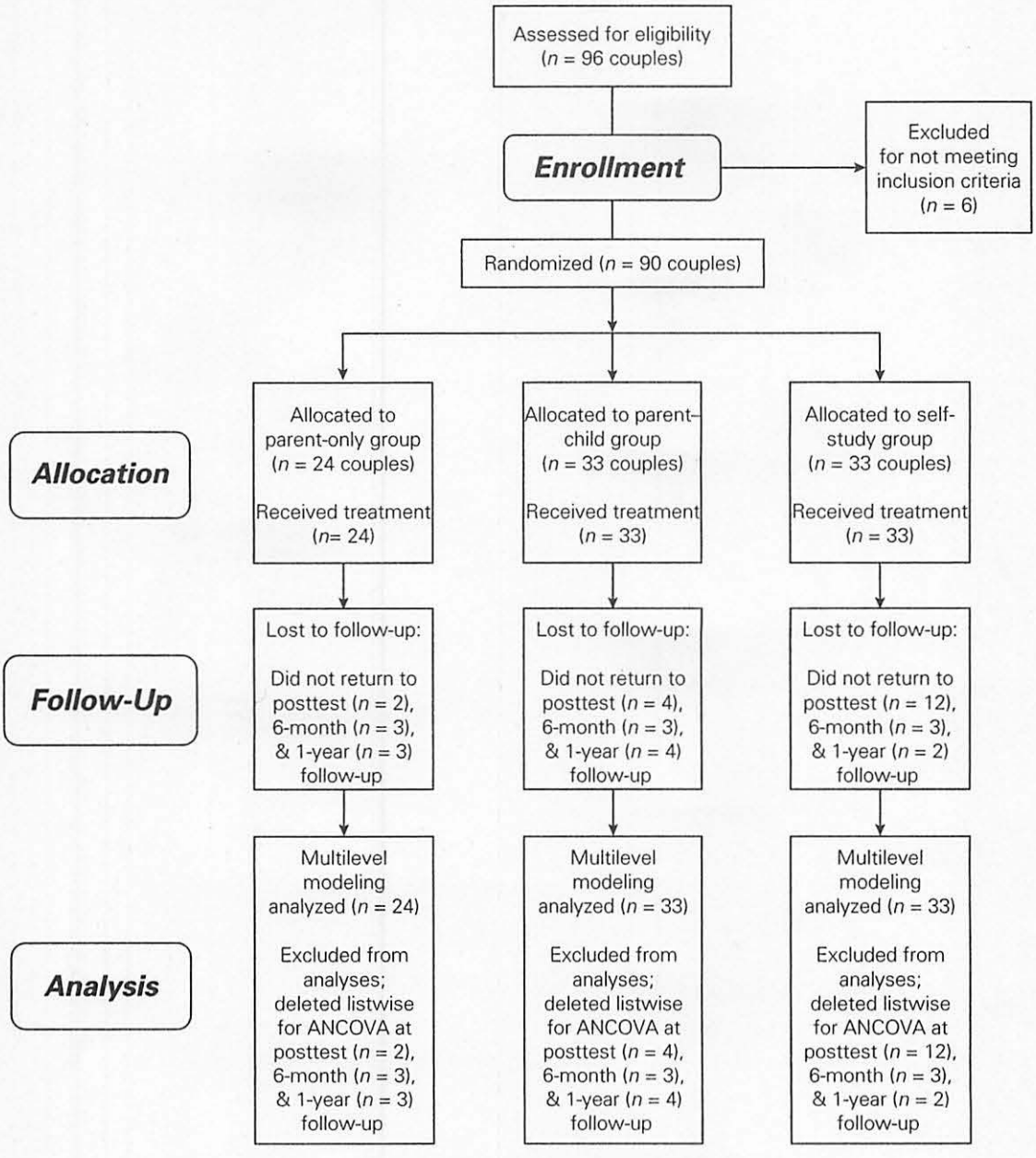

Figure X. Participant flow chart following Consolidated Standards of Reporting Trials guidelines. ANCOVA = analysis of covariance. Adapted from "Evaluating a Brief Prevention Program for Improving Marital Conflict in Community Families," by E. M. Cummings, W. B. Faircloth, P. M. Mitchell, J. S. Cummings, and A. C. Schermerhorn, 2008, *Journal of Family Psychology, 22,* p. 196. Copyright 2008 by the American Psychological Association.

Figure 5.4. Flow of Participants in a Survey Study

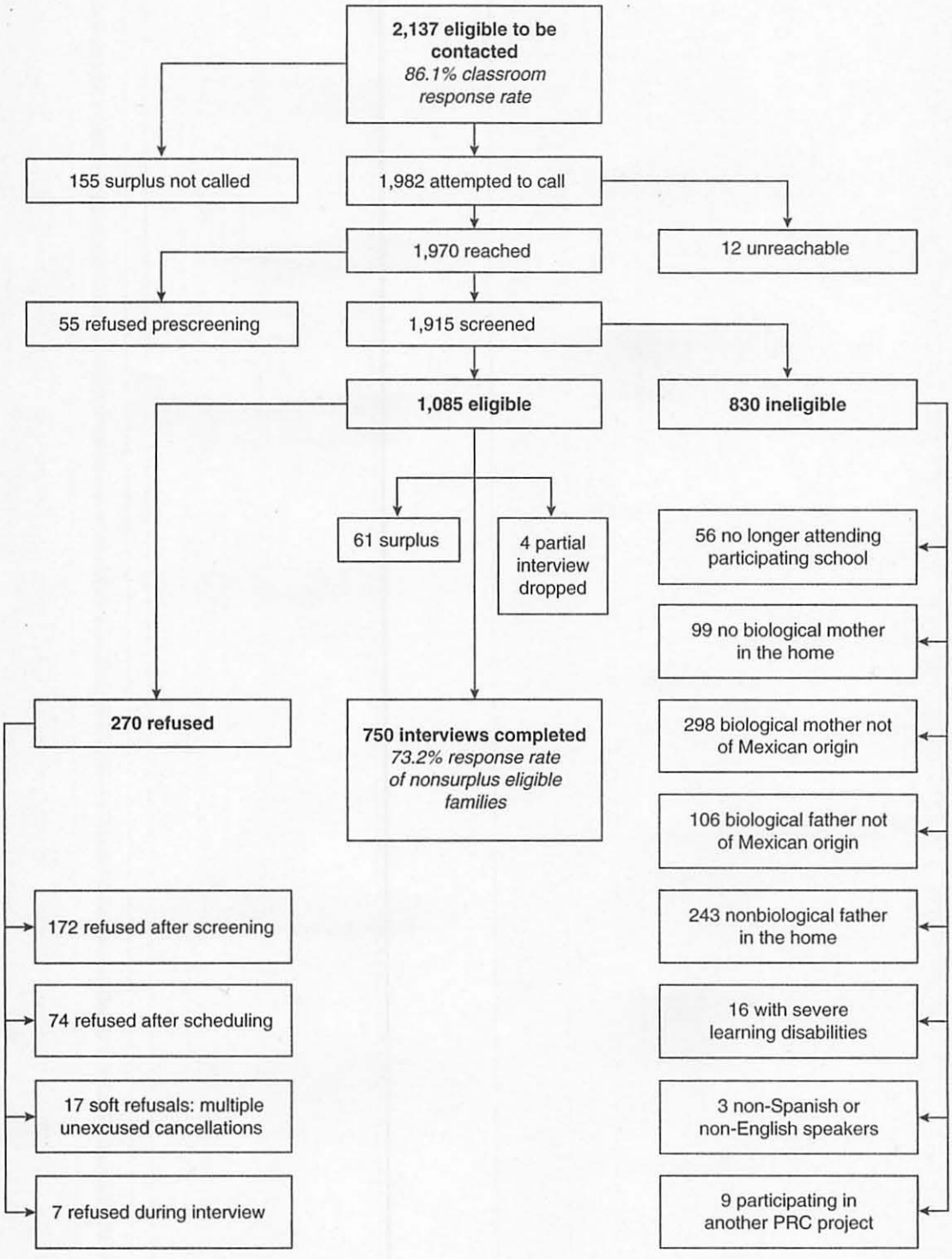

Figure X. Response rate throughout the recruitment and interviewing processes. PRC = Prevention Research Center. Adapted from "Sampling and Recruitment in Studies of Cultural Influences on Adjustment: A Case Study With Mexican Americans," by M. W. Roosa, F. F. Liu, M. Torres, N. A. Gonzales, G. P. Knight, and D. Saenz, 2008, *Journal of Family Psychology, 22,* p. 299. Copyright 2008 by the American Psychological Association.

Figure 5.5. Results of One-Way Design Using Error Bars to Represent Precision of the Resulting Estimates

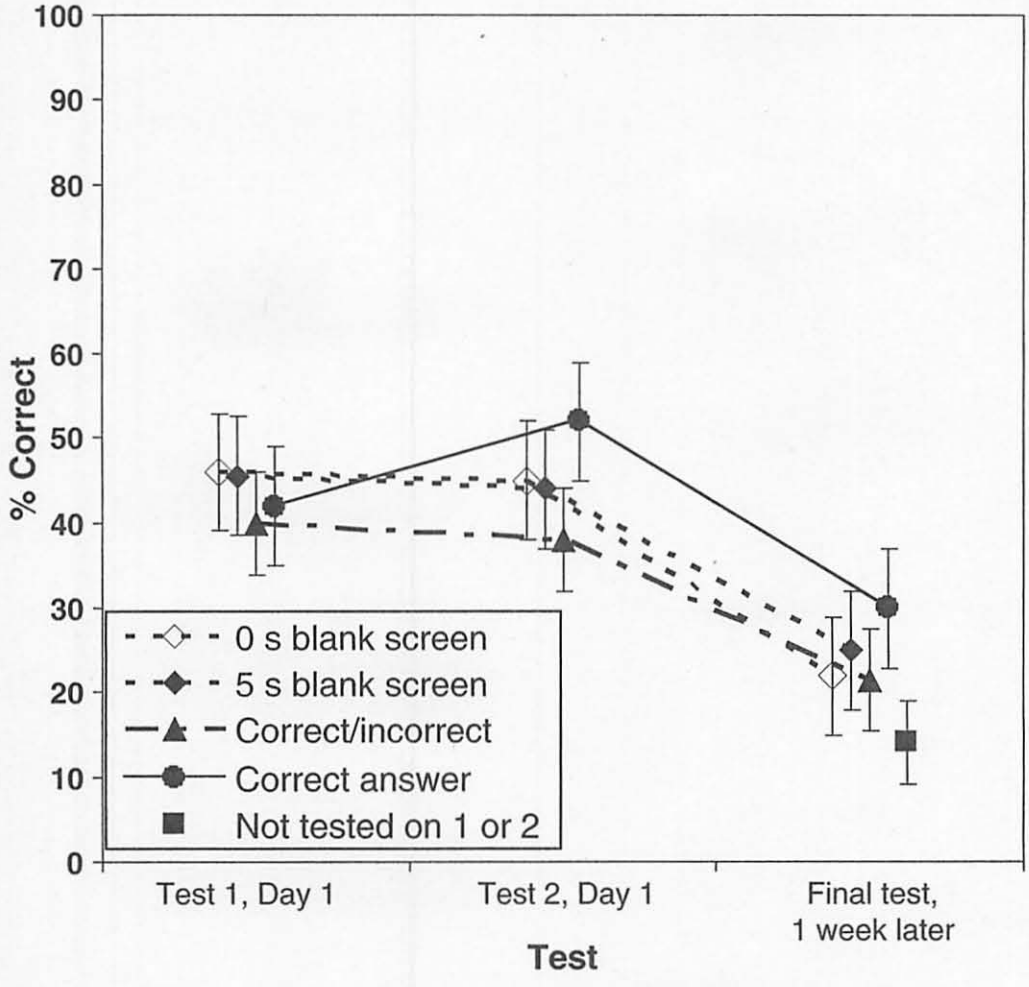

Figure X. Accuracy in Experiment 1 for each type of feedback and for each test. Error bars represent standard errors. Points are offset horizontally so that error bars are visible. Adapted from "When Does Feedback Facilitate Learning of Words?" by H. Pashler, N. J. Cepeda, J. T. Wixted, and D. Rohrer, 2005, *Journal of Experimental Psychology: Learning, Memory, and Cognition, 31,* p. 5. Copyright 2005 by the American Psychological Association.

when using error bars, provide the label for the error (e.g., standard error of the mean). In addition, be sure in all figures that

- sufficient information is given in the legend to make the figure understandable on its own,
- symbols are easy to differentiate, and
- the graphic is large enough for its elements to be discernible.

In general, high-quality graphics software handles the technical aspects of constructing figures. However, do examine the resulting images to ensure that figure guidelines have been followed and make any adjustments that might be needed.

Figure 5.6. Empirical Results From a Complex Multivariate Model

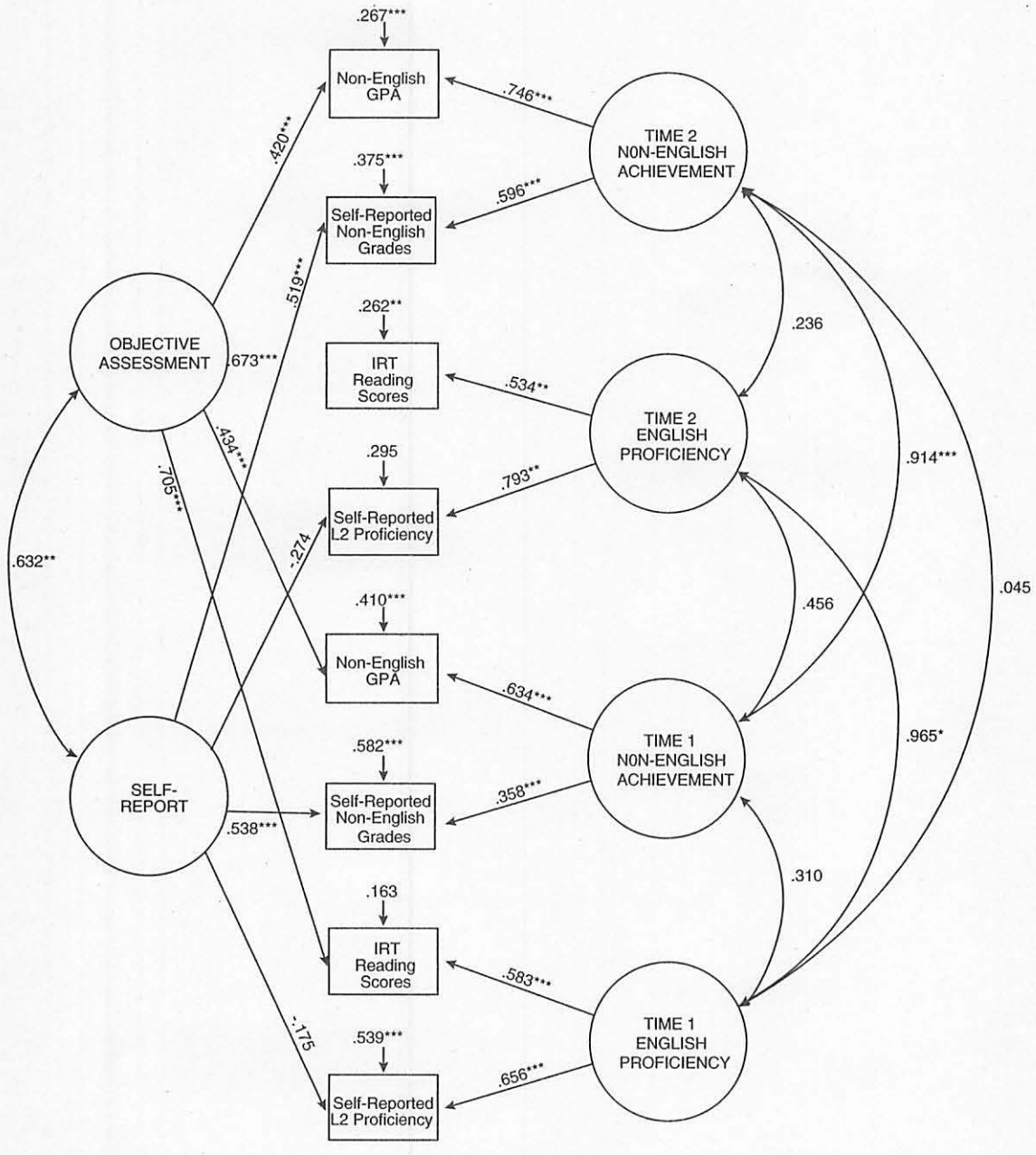

Figure X. Multitrait–multimethod confirmatory factor analysis model of two correlated traits and two correlated methods across two measurement waves. Completely standardized robust maximum likelihood parameter estimates. The residual variance components (error variances) indicate the amount of unexplained variance. Thus, for each observed variable, R^2 = (1 – error variance). GPA = grade point average; IRT = item response theory; L2 = English. Adapted from "Native Language Proficiency, English Literacy, Academic Achievement, and Occupational Attainment in Limited-English-Proficient Students: A Latent Growth Modeling Perspective," by R. S. Guglielmi, 2008, *Journal of Educational Psychology, 100,* p. 329. Copyright 2008 by the American Psychological Association.
*p < .05. **p < .01. ***p < .001.

Figure 5.7. Kinds of Responses Being Gathered and Scoring Methods

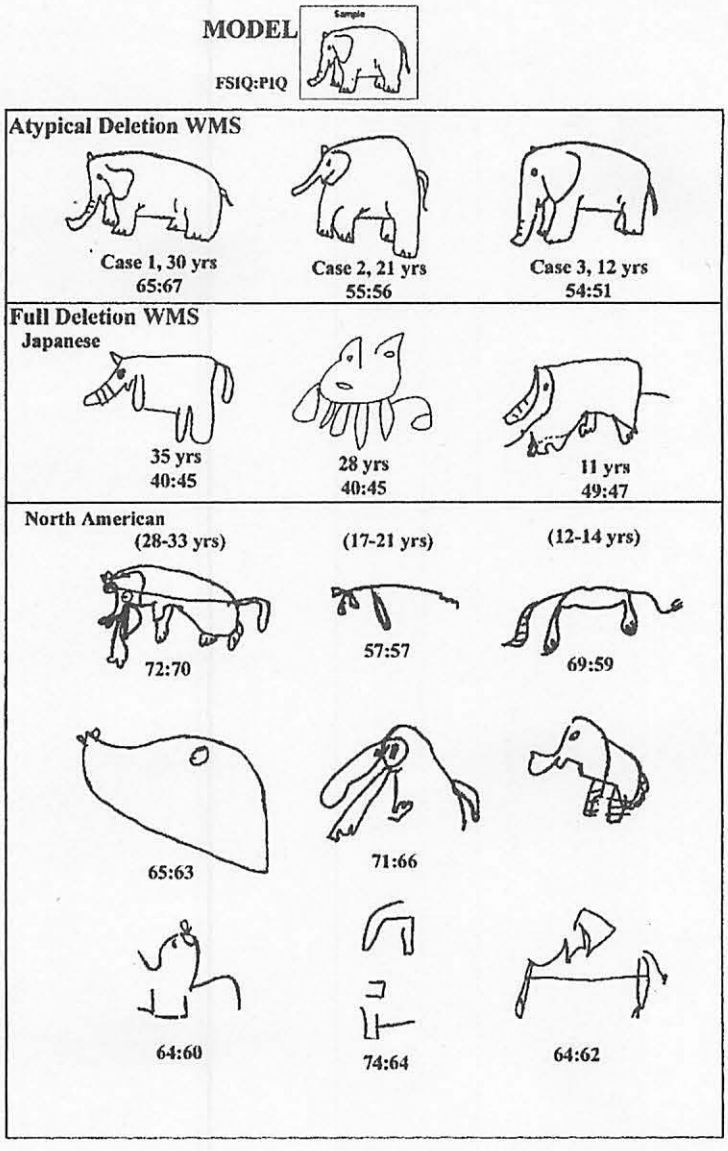

Figure X. Drawing copy task with elephant by smaller deletion cases (Cases 1, 2, and 3) and age and IQ-matched full deletion William syndrome cases. Adapted from "Williams Syndrome Deficits in Visual Spatial Processing Linked to GTF2IRD1 and GTF2I on Chromosome 7q11.23," by H. Hirota, R. Matsuoka, X.-N. Chen, L. S. Salandanan, A. Lincoln, F. E. Rose, . . . J. R. Korenberg, 2003, *Genetics in Medicine, 5,* p. 318. Copyright 2003 by American College of Medical Genetics. Reprinted with permission.

5.23 Figure Legends and Captions

A *legend* explains the symbols used in the figure; it is placed within the figure. A *caption* is a concise explanation of the figure that is placed directly below the figure and serves as the title of the figure.

Figure 5.8. Details of an Experimental Laboratory Set-Up

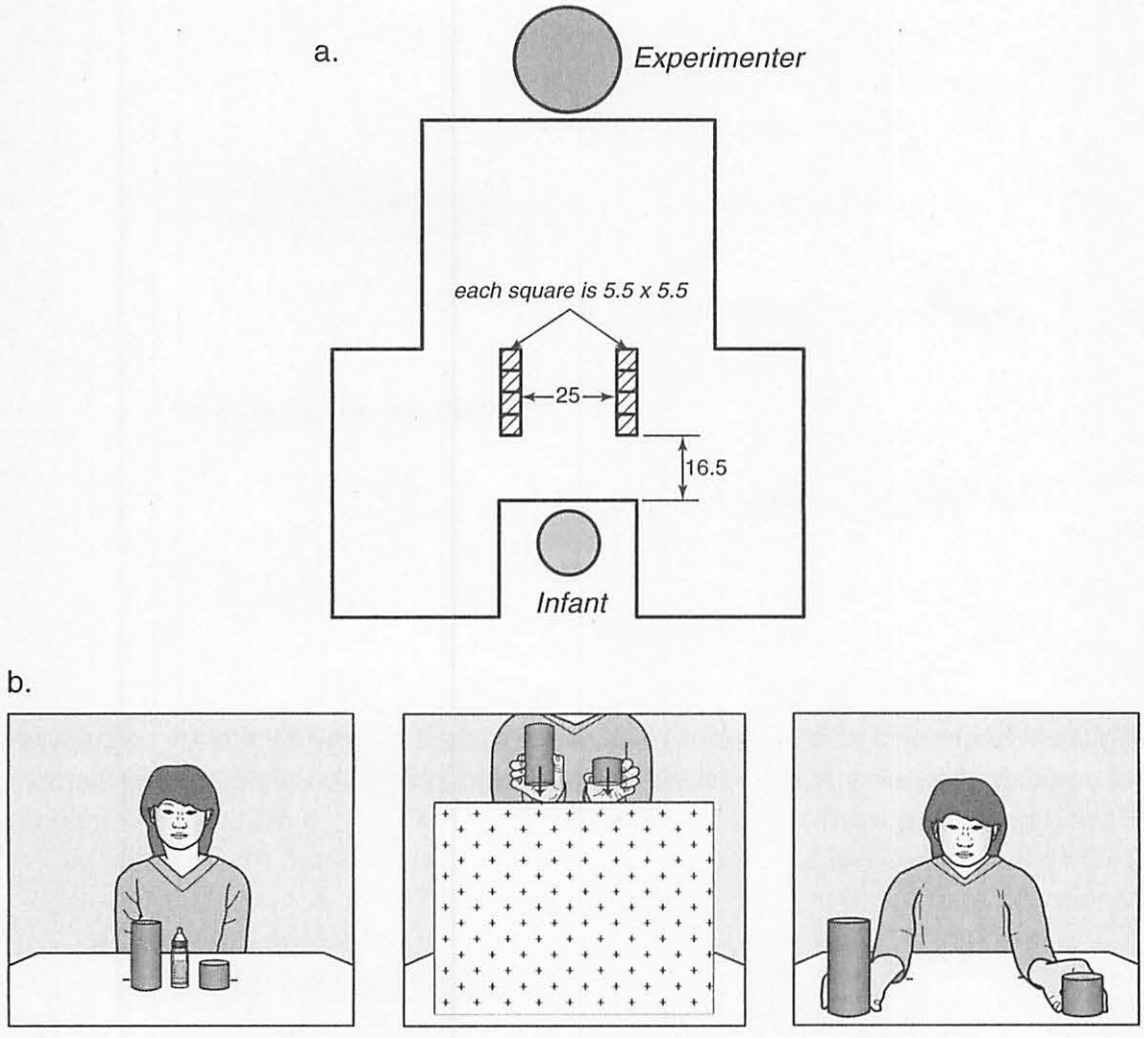

Figure X. Schematic drawings of a bird's eye view of the table (a) and the test phase of the choice task (b). Numbers represent the dimensions in centimeters. Adapted from "Visual Experience Enhances Infants' Use of Task-Relevant Information in an Action Task," by S.-h. Wang and L. Kohne, 2007, *Developmental Psychology, 43,* p. 1515. Copyright 2003 by the American Psychological Association.

Legends. The legend is an integral part of the figure; therefore, it should have the same kind and proportion of lettering that appear in the rest of the figure. Capitalize major words in the legend.

Captions. The caption serves both as an explanation of the figure and as a figure title; therefore, the figure itself should not include a title. The caption should be a brief but descriptive phrase. Compare the following captions.

Too brief:

Figure 3. Fixation duration.

Figure 5.9. Details of Experimental Procedure

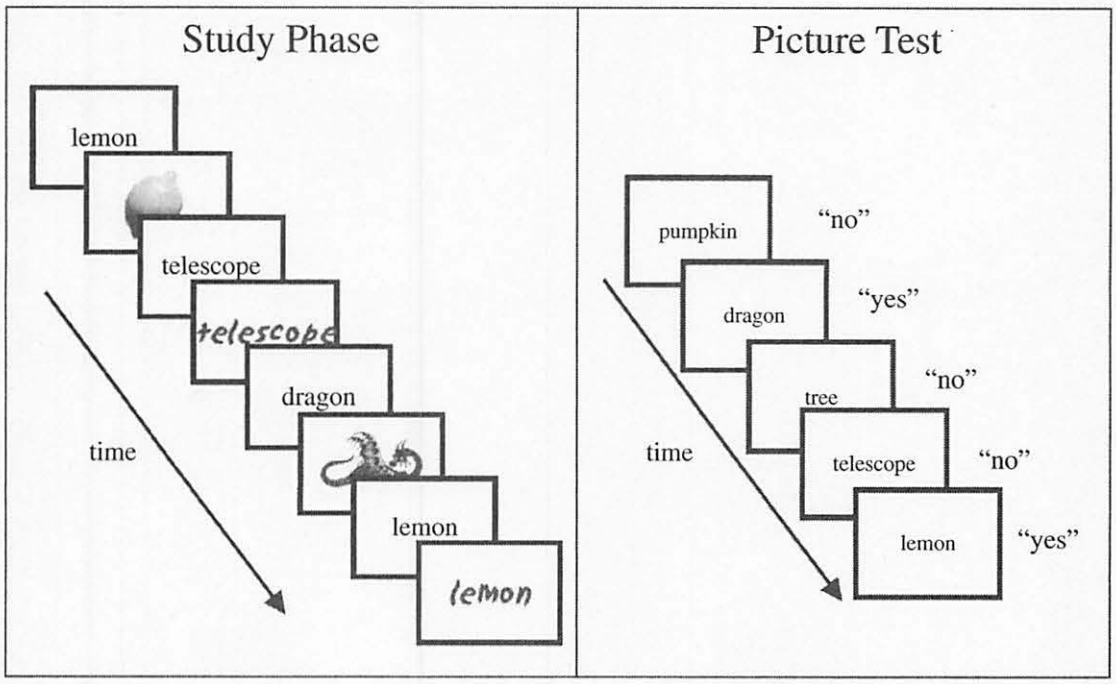

Figure X. Schematic of the criterial recollection task. At study, each black word was followed by the same word in red letters (depicted in italics) or by a colored picture. Black words were used at test as retrieval cues, under various retrieval instructions (picture test shown, with correct responses in quotes). Adapted from "Retrieval Monitoring and Anosognosia in Alzheimer's Disease," by D. A. Gallo, J. M. Chen, A. L. Wiseman, D. L. Schacter, and A. E. Budson, 2007, *Neuropsychology, 21,* p. 560. Copyright 2007 by the American Psychological Association.

Sufficiently descriptive:

> *Figure 3.* Fixation duration as a function of the delay between the beginning of eye fixation and the onset of the stimulus in Experiment 1.

After the descriptive phrase, add any information needed to clarify the figure: A reader should not have to refer to the text to decipher the figure's message. Always explain units of measurement, symbols, and abbreviations that are not included in the legend. If your graph includes error bars, explain whether they represent standard deviations, standard errors, confidence limits, or ranges; it is also helpful to display sample sizes. If statistically significant values are marked in the figure, explain the probability in the caption (follow the same system used for table notes; see section 5.16). Include within the caption any acknowledgment that a figure is reproduced from another source (see section 2.12).

Make certain that the symbols, abbreviations, and terminology in the caption and legend agree with the symbols, abbreviations, and terminology in the figure, in other figures in the article, and in the text.

5.24 Planning Figures

When planning a figure, consider the following guidelines:

- Parallel figures or figures of equal importance should be of equal size and scale.
- Like figures should be combined to facilitate comparisons between them. For example, two figures can be placed one above the other and treated as one figure. Two line graphs with identical axes might be combined horizontally and treated as one figure.
- A figure legend should be positioned within the borders of the figure (see Figure 5.5). Place labels for parts of a figure as close as possible to the components being identified.

5.25 Preparation of Figures

Figures intended for publication in scholarly journals should be computer generated using professional-level graphic software. Always check the file type requirements of the publisher to which you intend to submit your paper. Figures should be prepared at a resolution sufficient to produce high-quality images; appropriate resolution depends on figure type. Photographs (see section 5.29), for example, can be reproduced clearly at lower resolution than that needed for line art.

Image dimensions should be such that files can be easily transferred electronically. Avoid the use of three-dimensional and other effects (including color), except in rare instances in which they demonstrably enhance the presentation of your data. Individual publishers have stated policies with regard to color printing.

Size and proportion of elements. Each element must be large enough and sharp enough to be legible. Use a simple typeface (such as Arial, Futura, or Helvetica) with enough space between letters to avoid crowding. Letters should be clear, sharp, and uniformly dark and should be sized consistently throughout the figure. Type style affects legibility. For example, boldface type tends to thicken and become less readable. The size of lettering should be no smaller than 8 points and no larger than 14 points. As a general guideline, plot symbols should be about the size of a lowercase letter of an average label within the figure. Also consider the *weight* (i.e., size, density) of each element in a figure in relation to that of every other element, making the most important elements the most prominent. For example, curves on line graphs and outlines of bars on bar graphs should be bolder than axis labels, which should be bolder than the axes and tick marks.

Shading. Limit the number of different shadings used in a single graphic. If different shadings are used to distinguish bars or segments of a graph, choose shadings that are distinct (e.g., the best option to distinguish two sets of bars is no shading [open] and black [solid]). If more than three shadings are required, a table may be a better presentation of the data. Use computer-generated art in such a way as to maximize the clarity of the resulting graphic. And as always, keep it simple and clean looking.

Presenting Electrophysiological, Radiological, and Other Biological Data

The presentation of electrophysiological and radiological data presents special challenges because of both the complexity of the data and the lack of existence of a

single convention for presentation of these types of data. The lack of a single, well-established standard for presentation requires that labeling of all aspects of the presentation be done clearly and completely (readers are referred to Devlin & Poldrack, 2007; Mildenberger, Eichenberg, & Martin, 2002; Picton et al., 2000; see also http://www.fmrimethods.org). Do not assume that readers will know the convention that you are following. In addition, most graphical and image-based representations of the basic data are highly processed, edited, and enhanced. The high level of processing of these forms of data makes it essential that the processing methods are clearly identified and that enhanced data (and the ensuing representation of such enhanced data) are clearly and openly identified.

In selecting data elements to present in the print version of the document, focus first on principles of clarity of representation, necessity for understanding, and coherence among representations. With the availability of online supplemental archives, carefully consider the readability of the text when deciding whether to include complex graphs and images in the text proper. When materials are better viewed in nonprint media or when images and graphics contain more information than can easily be comprehended in the usual print formats—for example, those that are greatly enhanced through the use of color or instances in which numerous images are needed to communicate the essential features of the study—consider the use of online supplemental archives for the presentation of the bulk of this information.

Many procedures used for the display of biologically related data use color, motion, or other display features not best rendered in black-and-white printing. In particular, fMRI images are typically coded in color, where color differences indicate activation differences. In the genetics area, gene staining results are often presented in color. Dynamical spread of brain activation can be displayed through color video clips. In the material that follows, we present print examples that are appropriate for black-and-white printing but also point to a number of examples (particularly those using color) that are included on the APA Style website (www.apastyle.org).

5.26 Electrophysiological Data

When presenting electrophysiological data, clear labeling is essential; for example, in the presentation of event-related brain potential data, it is essential that the direction of negativity (i.e., negative up or down) be indicated as well as the scale of the response. Information that is necessary for proper interpretation of the graphic, such as number or placement of electrodes, should accompany the graphic display. The graphic image and the points made in the text should be closely allied. Eliminate extraneous materials from graphic presentation (see Figure 5.10).

5.27 Radiological (Imaging) Data

When presenting brain images, clearly label each image. When axial or coronal sections are being displayed, clearly label which hemisphere is the left and which the right. When saggital slices are displayed, clearly indicate whether each slice is of the right or the left hemisphere. When slices are shown, show also an image that indicates where the slices were taken to help orient the reader. Specify the coordinate space in which the images have been normalized (e.g., Talairach, MNI).

Figure 5.10. Event-Related Brain Potential Data

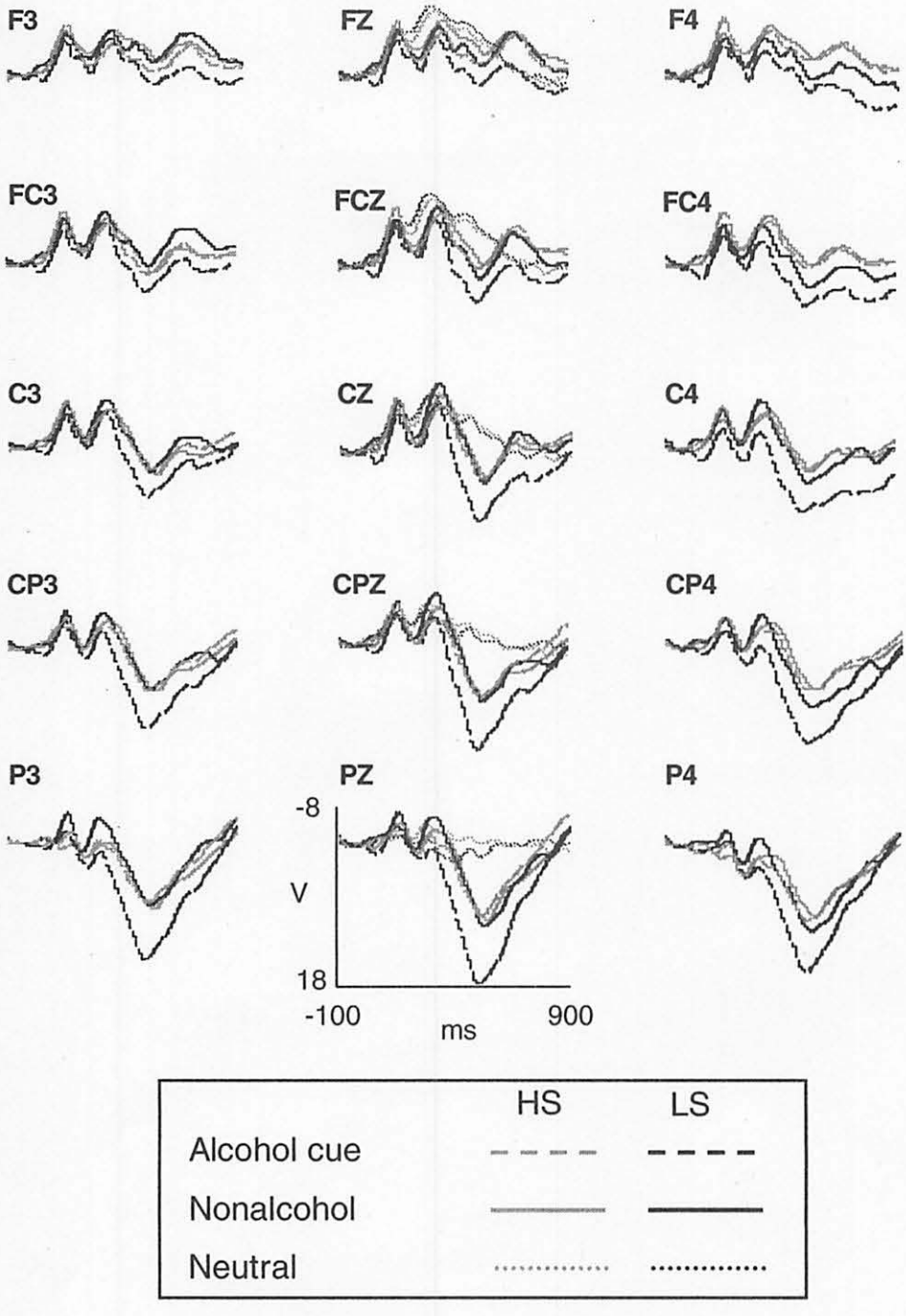

Figure X. Event-related brain potential waveforms elicited by alcoholic and nonalcoholic beverage cues as a function of sensitivity group. Waveforms elicited by frequent neutral (nontarget) images are presented for midline locations to illustrate the oddball effect in these data. Stimulus onset occurred at 0 ms. Electrodes are arrayed from most anterior (top) to most posterior (bottom) and from left to right as they were positioned on the scalp. HS = high alcohol sensitivity group; LS = low alcohol sensitivity group. Adapted from "Effects of Alcohol Sensitivity on P3 Event-Related Potential Reactivity to Alcohol Cues," by B. D. Bartholow, E. A. Henry, and S. A. Lust, 2007, *Psychology of Addictive Behaviors, 21,* p. 560. Copyright 2007 by the American Psychological Association.

Figure 5.11. Neuroimaging Data With Details of Processing Information

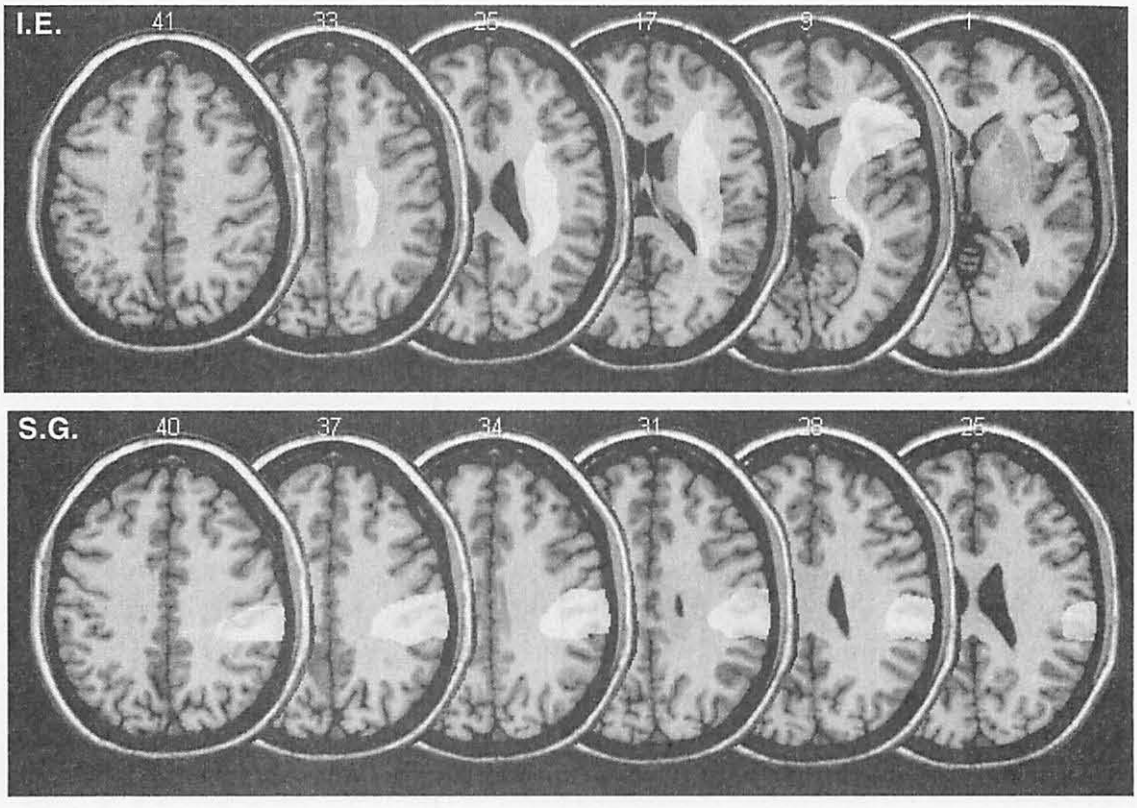

Figure X. Lesion maps for the two right hemisphere patients plotted onto a normal template brain using MRIcro software (Rorden & Brett, 2000). Affected regions (translucent white) are plotted onto axial slices, with numbers above each slice indicating *Z* coordinates in Talairach space. Adapted from "Central Perceptual Load Does Not Reduce Ipsilesional Flanker Interference in Parietal Extinction," by J. C. Snow and J. B. Mattingley, 2008, *Neuropsychology, 22,* p. 375. Copyright 2008 by the American Psychological Association.

Cutaway views of the brain that show activations interior to it can be useful if the cutaways clearly depict the tissue that has been excised. When activations are superimposed on a surface-rendered image of a brain, include a clear explanation of what activations are being shown, particularly with regard to the depth of the activation that has been brought to the surface; the use of flattened surface images may help make the data clearer. When using color, use it consistently in all representations within the document and clearly specify the color–scale mapping (see example at www.apastyle.org).

Neuroimaging data almost always require extensive postacquisition processing. Details of the processing methods should accompany their display (see Figure 5.11).

Photomicrographs are often used in cell-staining and other types of imaging studies. When preparing photomicrographs, include a scale bar and staining materials information in the figure caption.

5.28 Genetic Data

As with other displays of biological material, clear labeling enhances the display of genetic information such as deletion patterns—be they of the physical map variety (see Figure 5.12) or the photographic stain variety (see example at www.apastyle.org). Present information concerning locations, distances, markers, and identification methods with the figure. Genetic data displays often contain much information; careful editing of the image, and of its legend, can improve the communicative value of the figure.

5.29 Photographs

Photographic images are almost always submitted as digital files embedded in or attached to the electronic version of the manuscript. It is essential that these images be submitted at appropriate levels of resolution.

Because reproduction softens contrast and detail in photographs, starting with rich contrast and sharp prints will improve the final print version of the image. The camera view and the lighting should highlight the subject and provide high contrast; a light or dark background can provide even more contrast.

Photographs must be of professional quality and should be presented as black-and-white images, unless they include color-specific information relevant to the study (e.g., differently colored stimuli). Submit the image as a file type appropriate to the needs of the publication to which you are submitting. Do not submit color image files for figures intended for black-and-white printing; the transition from color to black and white for reproduction is unpredictable and can result in misleading images. It is the author's responsibility to ensure that the final representation is accurate. If color photos are necessary, consult your publication's instructions to authors for guidelines regarding color images.

Photographs usually benefit from cropping (i.e., eliminating what is not to be reproduced), just as careful editing of words can produce a more comprehensible text. Cropping recomposes the photo, eliminates extraneous detail, and centers the image. Before cropping, ensure that the image is straight (e.g., that vertical lines are truly vertical); use your software application to align the image if necessary. When used appropriately, these alterations can enhance and clarify the image and make it more useful

Figure 5.12. Display of Genetic Material—Physical Map

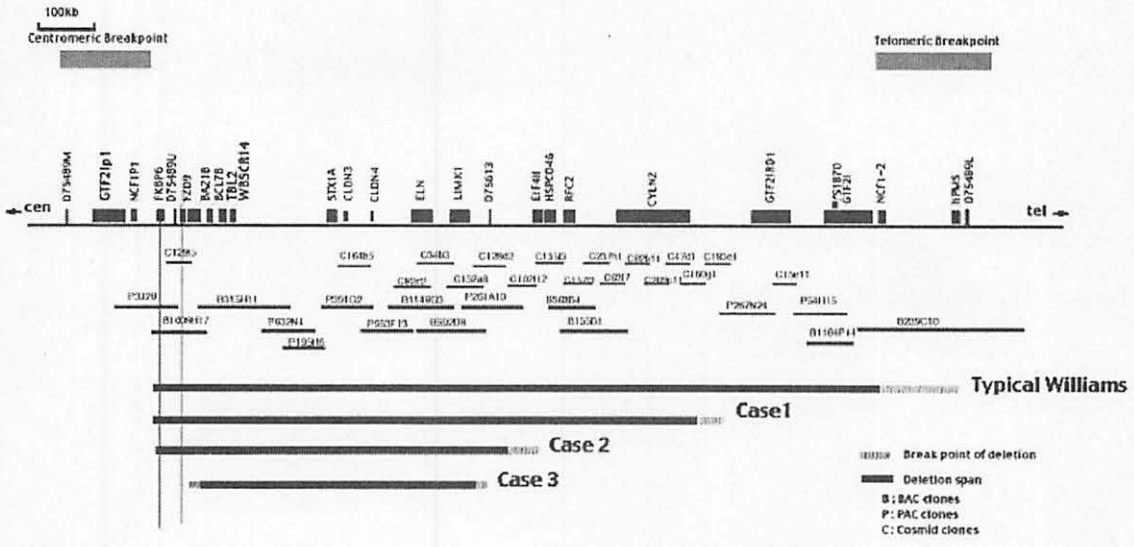

Figure X. Physical map of the common Williams syndrome deletion. Genes mapping in this region are represented by black boxes (names reading vertically). Bacterial artificial chromosomes, P1-derived artificial chromosomes, and cosmid clones spanning this region are indicated below the genes and are described in the Method section. The black horizontal lines depict the approximate size and extent of deletions in the three cases with atypical deletions and in typical subjects with Williams syndrome. Adapted from "Williams Syndrome Deficits in Visual Spatial Processing Linked to GTF2IRD1 and GTF2I on Chromosome 7q11.23," by H. Hirota, R. Matsuoka, X.-N. Chen, L. S. Salandanan, A. Lincoln, F. E. Rose, . . . J. R. Korenberg, 2003, *Genetics in Medicine, 5,* p. 315. Copyright 2003 by American College of Medical Genetics. Reprinted with permission.

as a means of scientific communication; they also help to protect the identity of individuals. However, the same technology can be used to deceive. Ethical principles of publication forbid any intentional misrepresentation of images in exactly the same way that fraudulent data manipulation is forbidden. When an image that might reasonably be thought to be a photographic image (as opposed to an image that is clearly a constructed image—a table, chart, cartoon, etc.) has been altered in a manner beyond simple cropping, clearly indicate in a note that accompanies the image that it has been altered.

If you photograph a person, obtain a signed release from that person to use the photograph. If you use a photograph from another source, try to obtain the original photograph because photographs of photographs do not print clearly. Obtain written permission for reuse (in both print and electronic form) from the copyright holder, and acknowledge the author and the copyright holder in the figure caption (see section 5.06; see also section 2.12). You may need to obtain permission from the photographer as well because professional photographs do not meet all the criteria of work for hire and are usually the property of the photographer.

5.30 Figure Checklist

The following checklist may be helpful in ensuring that your figure communicates most effectively and conforms to APA Style and formatting conventions.

Figure Checklist

- ☐ Is the figure necessary?
- ☐ Is the figure simple, clear, and free of extraneous detail?
- ☐ Is the figure title descriptive of the content of the figure?
- ☐ Are all elements of the figure clearly labeled?
- ☐ Are the magnitude, scale, and direction of grid elements clearly labeled?
- ☐ Are figures of equally important concepts prepared according to the same scale?
- ☐ Are all figures numbered consecutively with Arabic numerals?
- ☐ Are all figures mentioned in the text?
- ☐ Has written permission for print and electronic reuse been obtained? Is proper credit given in the figure caption?
- ☐ Have all substantive modifications to photographic images been disclosed?
- ☐ Are the figures being submitted in a file format acceptable to the publisher?
- ☐ Have the files been produced at a sufficiently high resolution to allow for accurate reproduction?