statistics
a virtual lab collection

A DEVELOPMENTAL SCIENCE PUBLICATION

Digital Video Library
with
Time-Linked Transcripts
and
Activities
at
DevSciLabs.com

You may purchase a printed copy of this manual at lulu.com.

Gail M. Gottfried
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Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation.

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Introduction to the Statistics Manual

Too often, statistics classes and their accompanying labs focus almost exclusively on probability, computation, and number-crunching with a computer. In these situations, students lose sight of the behavior in behavioral statistics and often cannot explain the resulting statistical output in terms of the dependent variables of interest, as operationalized in the experiment. Then, if they attempt later classes that require them to compute their own statistics, they appear woefully unprepared. Furthermore, they seem to hate statistics and find them very anxiety-provoking, while they find methods dry and boring. There’s a way out of this dilemma — put the behavior back into stats labs.

The Developmental Science Virtual Labs presented in this text are designed to do exactly that. Each Lab includes a digital library of videos showing experimental or observational sessions; transcripts of the sessions, time-coded to match the videos; references to journal articles relating to the lesson topics; materials for collecting additional data; and interactive tasks that provide a framework for student interaction with the video datasets.

The three Virtual Labs each begin with an introduction to a Target Article, a student-friendly empirical study published in a top peer-reviewed journal within the last 15 years. Activities encourage students to reflect on the research hypotheses and method, code the accompanying video data, compute descriptive and inferential statistics, summarize the results, and design a follow-up study.

Faculty or students who want additional exercises focused more directly on the research methods used in the Target Articles for these Virtual Labs are encouraged to review the Developmental Science “Conduct the Study” Virtual Labs, available at the DevSciLabs.com website.

The Virtual Labs

Chi Square


This lab is based on a cross-sectional study designed to address children’s emerging awareness that feelings can be changed by redirecting one’s thinking. Students are guided through data coding, analysis, and writing results and discussion.

The lab data show seven second-graders and four kindergarteners offering explanations for why several story characters’ feelings had changed. The videos are transcribed and time coded, and the experimental protocol and worksheets to assist with coding and data analysis are included. The Lab Viewer also contains materials for collecting additional data, should you want to increase power or add additional ages or variables (e.g., gender).

An expanded version of this lab is available at the DevSciLabs.com website [see the Virtual Lab Thinking and Feeling].
**Analysis of Variance**


This lab is based on a study of children’s emerging understanding of the origins of gender-typical characteristics, a topic usually addressed in social cognition research. The target study has a complex research design and fairly sophisticated data treatment.

The Virtual Lab dataset includes children from four age groups, allowing for cross-sectional comparisons. Because the experimental task involves a yes/no response, the coding is not complex and inter-rater reliability is easy to achieve, but the lab also includes a table of coded data if class time is limited. Worksheets to guide students through statistical analysis are also included. Pilot testing shows that students can test many new and interesting hypotheses without collecting additional data, but the Lab Viewer also contains the materials to collect additional data from adults or from children in a control condition.

An expanded version of this lab is available at the DevSciLabs.com website [see the Virtual Lab *Gender: Nature or Nurture*].

**Correlation**


This lab showcases research exploring the characteristics of parent–child reminiscence about emotionally salient events. The study is naturalistic, and the data can be used in many different ways.

The videos for this Virtual Lab show 4 children, ages 2;6 to 3;6, reminiscing with their mothers about past emotional events. Although the original study compared European-American and Chinese families, the data set includes only families in the United States, although two of the children (twins) are bilingual Spanish–English speakers. Worksheets and activities guide students through reviewing the target article, coding data, computing descriptive statistics, and computing correlation. A data table is included, if class time for coding is limited.

An expanded version of this lab, with six additional videos, is available at the DevSciLabs.com website [see the Virtual Lab *Parent–Child Reminiscence*].
About the author

Dr. Gail Gottfried received her PhD in psychology with an emphasis in developmental cognition from the University of Michigan in 1994. Since then, she has taught more than three dozen different courses in developmental psychology, cognitive science, and research methods in both large (100+ students) and small (2 students) class settings. In 2001 she began working with Dr. Jim Stigler and the staff at LessonLab (now Pearson Achievement Solutions) to design Interactive Video Assignments, which she then pilot tested in the Research in Developmental Psychology course at UCLA and the Experimental Child Psychology, Cognitive Development, and Research Methods classes at Pitzer College. This manual has resulted from those projects and was supported by the National Science Foundation through the Course, Curriculum, and Laboratory Improvement Program under grants DUE-0231016 and DUE-0441985.

Acknowledgments

This project began as one of those brilliant ideas from Jim Stigler, whose support and guidance have been invaluable at all stages. Jim is a wonderful friend, a true partner, and a formidable ally. Paul Grudnitski is also an invaluable collaborator; he designed the Lab Viewer to accompany the labs and the DevSciLabs.com website.

I could not have completed this project without my videographers, Larry Franzen and Jake Elsas. Not only excellent with the camera, Jake and Larry also have a way with children and the grown-ups that surround them. I am grateful to Sierra Madre Elementary School, St. Rita’s Elementary School, the Children’s Center at Caltech, the Children’s School at Claremont McKenna College, the Broadoaks Children’s School at Whittier College, and the UCLA Center for Autism Research and Treatment, as well as the remarkable children, school staffs, families, and researchers who participated; they are named in the individual labs.

Thanks also to David McArthur at NSF and my colleagues at LessonLab and Pearson Achievement Solutions — especially Vicki Momary, Phil Makris, Lisle Staley, Maria Alidio, Hilary Hollingsworth, Yuki Miyajima, Juliet Correll, Gina Porterfield, Angel Chui, Travis Dao, Anatoly Valushkin, Nancy Hicks, Jennifer Pastorelli, Kelsey Wyatt, Elaine Roberts, and Mitch Gordon. I’m grateful to the Psychology Department at UCLA, especially Dr. Patricia Greenfield and Dr. Lindsey Richland (now at UCI), and the Psychology Field Group at Pitzer College, especially Dean Alan Jones, Dr. Leah Light, Dr. David Moore, and Dr. Mita Banerjee, for classroom opportunities to refine the materials. The students, too numerous to name here, were incredible helps. Thanks also go to Dean Gary Kates and Sandy Price at Pomona College, and to Lisa Winger for graphic design assistance and creating the cover art.

Additionally, my friends and family supplied the still photos included as stimuli for collecting additional data and illustrating the text. Special thanks to those portrayed in the Virtual Labs, including Ruth, Liz, Robert, Aaron, Eliza, Susan, Sharon, Bob, Marla, Amy, Marcia, Andrew, Marc, Mark, Megan, Sally, CB, Nathan, Spencer, Ian, Pauline, Lewis, Rachel, Benjamin, Alex, Grant, Frankie and Konrad, and the photographers – Josh Laurence, Andrea Burridge, Sarah Traiger, Lesley Levy, Stephen and Mayumi Tonks, Jamie and Andrew Singer, Mark and Judy Singer, Marc and Jessica Gottfried, Marla and Howard Wolf, Carolyn Schult and Maxwell Drain, Stefanie Ribeiro, and my absolutely amazing father, Byron Gottfried, whose photo documentation of my family is invaluable and also beloved.
Finally, the project couldn’t have progressed without our dedicated pilot testers, including Dr. Lorinda Camparo (Whittier College), Dr. Sophie Jacques (Dalhousie University), Dr. Patricia Smiley (Pomona College), Dr. Beth Boerger (University of Mississippi), Dr. Bob Kavanaugh (Williams College), Dr. Carl von Baeyer (University of Saskatchewan), Dr. Julia Heberle (Albright College), Dr. Kathy Johnson (Indiana University-Purdue University Indianapolis), Dr. Kristen Weede Alexander (California State University, Sacramento), Dr. Robin Bartlett (Northern Kentucky University), Dr. Roseanne Flores (Hunter College), Dr. Shayla Holub (The University of Texas at Dallas), Dr. Susan Thompson (Hobart and William Smith Colleges), Dr. Tasha Howe (Humboldt State University), Dr. Tanya Sharon (Mercer University), Dr. Amy Hammond (Centenary College), Dr. Christopher Fennell (University of Ottawa), Dr. Donna Carroll (Wesley College), Dr. Melissa Burch (Hampshire College), Dr. Nicole Guajardo (Christopher Newport University), Dr. Rob Guttentag (University of North Carolina Greensboro), Dr. Sarah Berger (College of Staten Island, City University of New York), Dr. Tanya Martini (Brock University), Dr. Jordan Vosmik (Drew University) and all of their students and my own students, especially Diego Esparza-Duran and Lauren Birnbryer, who found time in their busy schedules to do some extra work on this project.

About the Lab Viewers

The Virtual Lab Viewers to accompany the Virtual Labs in this manual are available at DevSciLabs.com. Each chapter of this manual is also independently available as a .pdf included with the respective Lab Viewer. Please visit DevSciLabs.com for products and pricing information.

Every Lab Viewer has a title page that corresponds to a chapter in this manual, a page with links to the videos and the transcripts, references for the Target Article and other related studies, acknowledgment of participants, a folder of activities and discussion questions, and a folder of worksheets and experimental stimuli.

To achieve a high degree of interactivity, the Lab Viewers rely on Adobe’s AIR technology. To use the Lab Viewers, first download and install Adobe AIR (for Mac or Windows), which is available at http://www.adobe.com/products/air/.

The Virtual Lab Viewers download to your home computer and open in their own windows. Each video opens in an independent window, and the transcripts run along the bottom like subtitles. You must be online to view the videos and must enter a unique password. For best performance, you can cache the video to your computer.

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Students can respond to activities in the Viewer and save or print their responses. More detailed information about the Lab Viewers is available at DevSciLabs.com.

Also at DevSciLabs.com

DevSciLabs.com is the home of Developmental Science, a gathering place for faculty and students interested in research with children. In addition to previewing and purchasing the Lab Viewers, you can find an archive of course syllabi from faculty using the Virtual Labs, as well as suggestions for integrating them into your curriculum. Assessment tools and the results of educational research from classes using the Labs are also available.

Our forums contain technical information related to using the Labs, as well as faculty comments and suggestions. We encourage you to join the community, visit often, and offer your thoughts.
Chi Square

A Virtual Laboratory

Partial support for this Virtual Lab was provided by the National Science Foundation through the Course, Curriculum, and Laboratory Improvement Program under grants DUE-0231016 and DUE-0441985.
Introduction to the Virtual Labs

Welcome to the Developmental Science Virtual Laboratory, *Chi Square*. This laboratory is an edited version of the Developmental Science Virtual Laboratory, *Thinking and Feeling*, which includes additional activities to evaluate the research method and design. It is available at [DevSciLabs.com](http://DevSciLabs.com).

This Lab is one of a series that fills the curricular gap by providing unedited behavioral data for students to analyze in a systematic way. Each Lab includes a digital video library, accompanied by researcher-designed activities that guide students’ interactions with the videos, ultimately allowing virtual experimentation with a diverse group of children.

Activities generally take two forms: Reflections and Interactive Tasks.

Reflections can be completed individually by students as journal entries or short essays that can be collected by or emailed to the instructor. They also work well as class discussion topics, either in the classroom or as moderated online forums.

Interactive Tasks generally involve critical thinking about an article, data coding, or data analysis. These typically can be completed as homework or lab assignments, either individually or with students working in pairs. Students should have speakers or headphones (the latter are particularly useful in a classroom setting) to hear the audio.

The Chi Square Lab Viewer, with activities and worksheets, is available at [DevSciLabs.com](http://DevSciLabs.com). After downloading the viewer, you can watch the videos, read the transcripts, and complete the activities online. You can save your responses to print, email to your professor, or upload into any course management software used in your class.

The videos

The videos for this Virtual Lab show 11 children being interviewed, following a protocol adapted from Flavell et al. (2001). The children were in kindergarten or second grade at the time and were interviewed at a table just outside their school. The interviews were conducted by teachers from the school, both of whom were very familiar with the individual children.

*Please remember that all videos in this Virtual Lab are copyrighted, and assurances were given to the participants as to their use. Remember your professional ethics and do not copy them, post them on the Internet, or distribute them in any way without permission of the author.*
The Virtual Lab

The Target Article

This Virtual Laboratory is based on an article by Flavell, Flavell, and Green (2001). The primary goal of this research was to explore the development of children’s understanding that feelings are accompanied by thoughts, and thus a person’s feelings can be triggered and altered by his or her thoughts. For example, a person who is feeling angry can start to feel happy by thinking of something that provides pleasure. This paper is one of a systematic program of study focused on children’s “theory of mind,” their developing understanding of the mental world.

Flavell et al. (2001) conducted and report the results from two studies. The Virtual Lab replicates Study 2. Read the article, and summarize the study in your own words.

ACTIVITY: Summarize the Study

Read the article by Flavell et al. (2001) and summarize the study. What were the hypotheses of the study? In your own words, state the hypotheses. Be sure to explain the reasons for the direction of each hypothesis.

How were the data obtained? In your own words, explain the methods for collecting and coding data.

Were the hypotheses supported? Focus on the Results section, and consider how well the data support the original hypotheses. Did the children behave as the researchers predicted?

What conclusions did they draw about children’s understanding of thinking and feeling? In your own words, explain the researchers’ conclusions. To answer this question, try NOT to look back at the article.

No study answers all questions — in fact, good studies tend to raise more questions for future research. What additional studies do YOU think would offer insight into young children’s understanding of thoughts and feelings? State your hypotheses, and explain why you predict that the children will behave as you expect.

Collecting the data

In this study, the researcher presented each child with four scenarios about children and, for each scenario, asked a question about the cause of the story child’s feelings. You may review the interview protocol, which is available with the Video Viewer.

If you have reviewed ethical procedures and have IRB approval (if needed for class projects at your school), you may want to collect some data yourself … it’s more challenging than it may look! The full protocol and a set of pictures are available with the video viewer. If you aren’t able to interview children, you may want to interview adults.
Be sure to consult with your instructor about permission/assent, rapport, and other ethical issues before you begin any data collection procedures. If you need additional information on research ethics, you may want to complete the Virtual Lab, *Ethics of Research With Children.*

**Coding the data**

The first step in data analysis is to organize the data. Interviews must be transcribed or coded, and the information relevant to the research question(s) has to be extracted. Describing this process as “turning to words into numbers” is not inaccurate, but it is overly simplistic. When the researcher has clear hypotheses and knows how the data will help to test those hypotheses, data organization is straightforward.

Flavell et al. describe their coding procedure in the Results section of Study 1. They note that responses were judged as correct or incorrect. Correct responses involved “a purely mental, nonenvironmental cause of the story characters’ sudden change of feelings.” All other responses were considered incorrect. Although you may consider other responses, unrelated to thinking, to be valid explanations for changes in the children’s feelings, they would not meet the operational definition of a correct response given by the researchers.

When you feel comfortable that you can distinguish correct responses from incorrect ones, code some or all of the responses from the children in the Virtual Lab dataset.

**ACTIVITY: Coding the Responses**

Watch the videos showing some or all of the second graders. Identify each time the child gives a response and identify it as correct or incorrect, as defined by Flavell et al. You can create a coding worksheet to help you, or you can use the one available with the Lab Viewer.

Watch the videos showing some or all of the kindergartners. Identify each time the child gives a response and identify it as correct or incorrect, as defined by Flavell et al.

“Eyeball” the data. Based on your initial review (without running additional statistics yet), do these data seem to replicate Flavell et al.’s findings? In a few paragraphs, describe any similarities and/or differences that you observe and suggest possible reasons for them.

**Analyzing the data**

When the data are all coded and organized into a table full of numbers, students often panic. When they have a computerized statistics program like SPSS, for example, students sometimes point-and-click their way through any analysis that they can remember. Not surprisingly, this method is not the best way to analyze data! Remember, when the researcher has clear hypotheses and collected data to test those hypotheses, data analysis should be straightforward. Keep in mind what the numbers represent (i.e., responses indicating thought–feeling link) as you proceed through the analyses.
**ACTIVITY: Analyze the Data**

Flavell et al. were interested in children’s performance on each of three types of Intuition tasks. They thus ran separate analyses for each type of task. Moreover, Flavell et al. ran chi-square tests because the data are categorical. Before you begin the analysis, define categorical data.

Analyze the data for each intuition task. If you want to compute chi square by hand, create the appropriate contingency tables for each story. You may use the Contingency Tables worksheet available with the Lab Viewer, or you may design your own. If you want to use a computer program, enter the data as required by the software.

Compare your results to those from Flavell et al. Do these data replicate Flavell et al.’s findings? In a few paragraphs, describe any similarities and/or differences that you observe and suggest possible reasons for them.

**Describing the results**

The Results section of an APA-style empirical report presents the data and the analyses in a standardized format. Usually descriptive and inferential statistics are included; central tendencies in the data are shown in tables or figures. Some authors choose to place information about data coding along with the results (as part of data treatment), whereas others present that information in the Method section (as part of data collection).

If you are unfamiliar with APA style, you should review the current edition of the *Publication Manual of the American Psychological Association* for detailed information. You may be able to find a copy in your school or department library. You can also purchase a copy at a local bookstore or directly from the APA. Visiting the APA website (http://apastyle.apa.org/) is useful for updated information.

**ACTIVITY: The Results Section**

Write a Results section in which you present your data and analyses from the Virtual lab (including any data you collected yourself or with your class). The questions below, when answered systematically in order, will help you to organize the necessary information. Your instructor may ask you to write answers to each question rather than a complete Results section. Prior to beginning, you may want to review the Results sections of the Target Article for a model.

**How did you code the children’s behaviors?** In one paragraph, summarize the coding scheme. Be sure to explain what sorts of answers were considered “correct.” A descriptive example helps clarify the explanation.

**Compute descriptive statistics** — summarize the data from your sample. Design a table or figure to display the data and attach it here.

**Compute inferential statistics:** Do your results support the hypotheses? State your key findings, using the proper inferential statistics as evidence for your claims and referring to the Table/Figure as needed. Use the standardized APA format for reporting the results of statistical tests.
Discussing the findings

In the discussion of a research article, the researcher relates the data to the hypotheses and presents any conclusions or implications of the research. The Discussion section of an empirical paper provides only a brief summary of the results and a more lengthy interpretation of the data in light of the hypotheses presented in the introduction to the study. Although researchers often point out possible flaws that may affect interpretation of the results, you should not provide a laundry list of problems with your study in the discussion. Rather, focus on what you’ve learned, what you’ve not yet learned, and how you could learn what you don’t yet know.

Flavell et al. (2001) do not present a dedicated discussion of Study 1 or of Study 2. Instead, they save their interpretations for a (brief) General Discussion, which presents overall conclusions from both studies. Although less common, this format is appropriate for a short article like the Target Article here. Their choice of format therefore leaves open an opportunity for you to write your own Discussion section. Review the analyses, and consider what the data suggest about the development of children’s understanding of the link between thinking and feelings.

ACTIVITY: Discussing the Results

The Discussion section often begins with a summary of the findings in light of the study goals. In one paragraph, state the goals and hypotheses of the study and then a summary of how the data support or fail to support those hypotheses. Avoid using numbers, which are more appropriate in Results.

What have we learned about children? In several paragraphs, explain what these data tell us about children, focusing in particular on their understanding of the link between thinking and feeling. How are 8-year-olds different than 5-year-olds in other areas that may influence their understanding of thoughts and feelings? What cognitive and social/environmental changes occur during the intervening years? You may choose to look at related research articles or notes from previous classes for additional findings that may support your interpretations.

How do the results advance our understanding of development more generally? Explain the importance of the findings with regard to previous literature. How do these results fit with previous findings in related areas? How do they differ? What have you shown that is new and of interest in the field of developmental psychology?

The Discussion section of an empirical paper often includes new hypotheses that arise from the current findings, as well as suggestions for testing those hypotheses. After considering what you have NOT yet learned about children’s understanding of the link between thinking and feeling, and related issues, suggest some follow-up studies that will add to our understanding of this topic. Be sure to explain the research questions and the hypotheses.

Summary

Reflect on the study. What have you learned about children’s understanding of the relation between thinking and feeling? What have you learned about doing research with children, organizing and coding data, and running analyses?
Reference


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The videos in this chapter were funded by the U.S. National Science Foundation, Grant #DUE-0231016 to Gail M. Gottfried and LessonLab.

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Analysis of Variance

A Virtual Laboratory

Partial support for this Virtual Lab was provided by the National Science Foundation through the Course, Curriculum, and Laboratory Improvement Program under grant DUE-0441985.
Introduction to the Virtual Labs

Welcome to the Virtual Laboratory, *Analysis of Variance*. This laboratory is an edited version of the Developmental Science Virtual Laboratory, *Gender: Nature or Nurture*, which includes additional activities to evaluate the research method and design. It is available at DevSciLabs.com.

This Lab is one of a series that fills the curricular gap by providing unedited behavioral data for students to analyze in a systematic way. Each Lab includes a digital video library, accompanied by researcher-designed activities that guide students’ interactions with the videos, ultimately allowing virtual experimentation with a diverse group of children.

Activities generally take two forms: Reflections and Interactive Tasks.

Reflections can be completed individually by students as journal entries or short essays that can be collected by or emailed to the instructor. They also work well as class discussion topics, either in the classroom or as moderated online forums.

Interactive Tasks generally involve critical thinking about an article, data coding, or data analysis. These typically can be completed as homework or lab assignments, either individually or with students working in pairs. Students should have speakers or headphones (the latter are particularly useful in a classroom setting) to hear the audio.

The Analysis of Variance Lab Viewer, with activities and worksheets, is available at DevSciLabs.com. After downloading the viewer, you can watch the videos, read the transcripts, and complete the activities online. You can save your responses to print, email to your professor, or upload into any course management software used in your class.

The video cases

The complete set of videos for this Virtual Lab show 35 children being interviewed, following a protocol adapted from Taylor (1996), although we included only the opposite-sex condition. The pictures used in the interviews were the originals, graciously given to us by Marianne Taylor. Our sample includes children from age 4 to age 12.

*Please remember that all videos in this Virtual Lab are copyrighted, and assurances were given to the participants as to their use. Remember your professional ethics and do not copy them, post them on the Internet, or distribute them in any way without permission of the author.*
The Virtual Lab

The Target Article

This Virtual Laboratory exercise is based on an article by Taylor (1996).

The primary goal of this research was to explore the development of children’s beliefs about the origin of gender differences. As adults, we recognize that aspects of gender have biological causes (e.g., genetics, hormones), whereas other aspects may be more influenced by social conventions (e.g., expectations about appropriate hair length or clothing style, etc.). What about children? What are children’s beliefs, and how do they change over time?

This paper is one of a systematic program of study focused on social cognition — children’s developing understanding of the social world. The author also discusses related topics such as biological knowledge, a belief in an underlying category essence, and, of course, gender-role flexibility.

Taylor conducted and reports the results from two studies. The Virtual Lab replicates Study 1. That study addresses two research questions:

1. How do children’s beliefs about the relative contributions of nature and nurture change with age?
2. Do children, like adults, consider some aspects of gender to be biologically based and others to be socially influenced?

ACTIVITY: Think critically about the study

Read the article by Taylor (1996). What were the hypotheses of the study? In your own words, state the hypotheses. Be sure to explain the reasons for the direction of each hypothesis.

How were the data obtained? In your own words, explain the methods for collecting and coding data.

Focus on the Results section, and consider how well the data support the original hypotheses. Did the children behave as the researchers predicted?

In your own words, explain the researchers’ conclusions. To answer this question, try NOT to look back at the article.

No study answers all questions — in fact, good studies tend to raise more questions for future research. What additional studies do YOU think would offer insight into young children’s understanding of gender? State your hypotheses, and explain why you predict that the children will behave as you expect.
Collecting the data

In this study, the researcher presented the children with two stories, one about a girl raised on an island with only boys and men and one about a boy raised on an island with only girls and women. She then asked a series of questions about what the child would be like at age 10, focusing on biological and behavioral properties. The complete set of questions is available with the Lab Viewer.

If you have reviewed ethical procedures and have IRB approval if needed for class projects at your school, you may want to collect some data yourself … it’s more challenging than it may look! The full protocol and a set of pictures are available with the Lab Viewer. If you aren’t able to interview children, you may want to interview adults; Taylor (1996) included an adult sample in her original study.

Be sure to consult with your instructor about permission/assent, rapport, and other ethical issues before you begin any data collection procedures. If you need additional information on research ethics, you may want to complete the Virtual Lab Ethics of Research With Children.

Coding the data

The first step in data analysis is to organize the data. Interviews must be transcribed or coded, and the information relevant to the research question(s) has to be extracted. Describing this process as “turning to words into numbers” is not inaccurate, but it is overly simplistic. When the researcher has clear hypotheses and knows how the data will help to test those hypotheses, data organization is straightforward.

Taylor described her coding procedure in the Method section of Study 1. She noted that for stereotypical and biological properties, participants received one point for each category-based response.

To watch examples of category-based responses, watch the video entitled Responses: Brett, available on the video page of the Lab Viewer. Two of the questions are stereotypical, and two are biological. Note that for the first question, the child does not respond with a clear Yes or No, and thus the coder must make a judgment about whether the answer indicates a category-based response.

With younger children, it’s especially important to be sure they understand the experimental task. In this study, a series of memory check questions are asked to begin the interview. If a child misses one of the questions, the experimenter should retell the story and ask the questions again. What should the experimenter do when a child fails the memory check questions more than once? Watch the video clip entitled Memory Check to see an example.

When you feel comfortable that you can consistently distinguish category-based responses from other responses, and when you have decided how to code ambiguous responses, code the responses from some or all of the 35 children who participated in the Virtual Lab.
ACTIVITY: Code the Data

Watch some or all of the videos showing the interviews with five children in Grade 5. Four are 10 years old, and one is 12. As you watch the videos, code the responses. You can create your own coding sheet, or you can use the one available with the Lab Viewer.

You can use the supplemental videos to view and code responses from preschoolers as well as from the 8- and 9-year-olds in Grade 3. This large sample of children provides a great opportunity to see the variety of responses of children at different ages and to practice analysis skills using cross-sectional data.

Analyze the data

Analysis often requires combining and reorganizing the coded data. The table on the next page shows how one group of students organized some of the data from this Virtual Lab. They began by completing the coding sheets as described in the previous activity, entering all those data into SPSS, and then computing totals, means, and finally proportions. Organizing the data in this way allowed them to test some of Taylor’s hypotheses. Your class may decide on a different organization, using more or less of the data, or you may enter these data into your computer program for practice running analysis of variance. If you choose to use the data in this table, be sure you understand what the labels and the numbers represent.

When confronted with a table full of numbers like this, students often panic. When they have a computerized statistics program like SPSS, for example, students sometimes point-and-click their way through any analysis that they can remember. Not surprisingly, this method is not the best way to analyze data! Remember, when the researcher has clear hypotheses and collected data to test those hypotheses, data analysis should be straightforward. Keep in mind what the numbers represent (i.e., proportion of categorical responses for a given question type) as you proceed through the analyses. The Activity is designed to guide you through.
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ACTIVITY: Data Analysis

These tasks are designed to help you think about the analyses in terms of the original hypotheses and to organize an APA-style Results section.

Descriptives. Taylor (1996) presented descriptive data (i.e., mean number of category-based responses) in Table 2 (p. 1563). Using the data from the Virtual Lab and any you may have collected, create a similar table or a graph showing mean proportions of category-based responses. Note, however, that the Virtual Lab data include only children in the opposite-sex environment; if you did not collect additional data, your table should have only one row, or your graph should have only one column, per age group. You can use the Table 1 worksheet, provided with the Lab Viewer, as a template.

The environmental control questions. Taylor (1996) described the responses to the environmental control questions in a section on preliminary analyses (pp. 1560–1561). This analysis addressed the question, “Do children remember the story and understand the task?” Answer this question by running the same analysis she did — a single-mean t test against chance. How do your results compare to Taylor’s?

The acquisition of stereotyped and biological properties. Taylor (1996) made two predictions, both of which can be tested with one analysis. First, for children in the opposite-sex condition, she predicted developmental differences in children’s responses to the stereotyped property questions, with younger children more category-bound than older children (i.e., an interaction between age and property type). Additionally, she predicted “more category-based responses for biological properties than stereotyped properties, for children and adults” (i.e., a main effect; p. 1561). Using the data from the Virtual Lab, test these hypotheses. If required in your class, explain your findings in simple English, using the proper statistical statements and symbols to support your claims. How do your results compare to Taylor’s?

Additional hypotheses and analyses. Ask another question, and use the data from the Virtual Lab to help you answer it. For example, do children hold stronger stereotypes about boys than girls (i.e., respond differently when asked about Pat versus Chris)? Do boys hold stronger stereotypes than girls? Do boys hold stronger stereotypes about boys (i.e., about Pat), or girls hold stronger stereotypes about girls (i.e., about Chris)? Run the appropriate analyses and explain your findings in simple English, using the proper statistical statements and symbols to support your claims.

Discussing the Results

The Discussion of a research article is where the researcher relates the data to the hypotheses and presents any conclusions or implications of the research. The Discussion section provides only a brief summary of the results and a more lengthy interpretation of the data in light of the hypotheses presented in the introduction to the study. Review the analyses, and consider what the data suggest about the development of children’s beliefs about the origins of gender differences.
ACTIVITY: Discussing the Results

The Discussion section of an article often begins with a summary of the findings in light of the study goals. In one paragraph, state the goals and hypotheses of the study and then a summary of how the data support or fail to support those hypotheses. Avoid using numbers, which are more appropriate in Results.

What have we learned about children? In several paragraphs, explain what these data tell us about children, focusing in particular on their understanding of the origins of gender differences. For example, how are the older children different than the younger children in other areas that may influence their beliefs about gender? What cognitive and social/environmental changes occur during the grade-school years? You may choose to look at related research articles or notes from previous classes for additional findings that may support your interpretations.

How do the results advance our understanding of development more generally? Explain the importance of the findings with regard to previous literature. How do these results fit with previous findings in related areas? How do they differ? What has this study shown that is new and of interest in the field of developmental psychology?

What’s the next step? The Discussion section of an empirical paper often includes new hypotheses that arise from the current findings, as well as suggestions for testing those hypotheses. After considering what you have NOT yet learned about children’s beliefs about the social and biological aspects of gender differences, suggest some follow-up studies that will add to our understanding of this topic. Be sure to explain the research questions and the hypotheses.

Summary

Reflect on the study. What have you learned about children’s beliefs about gender? What have you learned about doing research with children, organizing and coding data, and running analyses?
Reference


Acknowledgments

Thanks are due to Principal Gaffney and Ms. Wood and their staffs, Lily, Jake, Larry, and the wonderful children and their families who participated in our project, as well as Vicki Momary and Jim Stigler for assistance.

Special thanks go to Elinor Crescenzi and Paige Pauli for coding and analyzing the data during the development of this lab. We are also especially grateful to Marianne Taylor for sending us the original protocol and materials for the study.
Correlation

A Virtual Laboratory

Partial support for this Virtual Lab was provided by the National Science Foundation through the Course, Curriculum, and Laboratory Improvement Program under grant DUE-0441985.
Introduction to the Virtual Labs

Welcome to the Developmental Science Virtual Laboratory, *Correlation*. This laboratory is an edited version of the Developmental Science Virtual Laboratory, *Parent-Child Reminiscence*, which includes additional activities to evaluate the research method and design. It is available at DevSciLabs.com.

This Lab is one of a series that fills the curricular gap by providing unedited behavioral data for students to analyze in a systematic way. Each Lab includes a digital video library, accompanied by researcher-designed activities that guide students’ interactions with the videos, ultimately allowing virtual experimentation with a diverse group of children.

Activities generally take two forms: Reflections and Interactive Tasks.

Reflections can be completed individually by students as journal entries or short essays that can be collected by or emailed to the instructor. They also work well as class discussion topics, either in the classroom or as moderated online forums.

Interactive Tasks generally involve critical thinking about an article, data coding, or data analysis. These typically can be completed as homework or lab assignments, either individually or with students working in pairs. Students should have speakers or headphones (the latter are particularly useful in a classroom setting) to hear the audio.

The Correlation Virtual Lab Viewer, with activities and worksheets, is available at DevSciLabs.com. After downloading the viewer, you can watch the videos, read the transcripts, and complete the activities online. You can save your responses to print, email to your professor, or upload into any course management software used in your class.

The video cases

The videos for this Virtual Lab show 4 children, ages 2;6 to 3;6, reminiscing with their mothers about past emotional events. Although modeled on the target study by Wang and Fivush (2005), we made several changes for the Virtual Lab.

- We did not include a sample of children from China. Two children were European-American boys whose families spoke English. Additionally, one bilingual (Spanish–English) mother of twin girls discussed the same events with each child individually in English.
- The presence of the video camera affected children more than the tape recorder used in the target study. To alleviate discomfort, we invited some parents to play naturally with their children and begin the conversation spontaneously during the play session. As a result, some of the conversations include discussion of topics beyond the selected emotional events, and in some cases other people were present in the room or nearby.

*Please remember that all videos in this Virtual Lab are copyrighted, and assurances were given to the participants as to their use. Remember your professional ethics and do not copy them, post them on the Internet, or distribute them in any way without permission of the author.*
This Virtual Laboratory is based on an article by Wang and Fivush (2005). The primary goal of this research was to explore the characteristics of parent–child reminiscence about emotionally salient events. Comparing American and Chinese mother–child dyads, the researchers looked for differences in conversational style and content that may reflect culturally specific beliefs about what is appropriate to remember and to talk about. For example, adults and children from Euro-American cultures frequently talk about the self, whereas Chinese culture emphasizes social harmony and group interdependence. This article reflects research that is part of a systematic program of research in cultural differences in social cognition, addressing the ways in which family socialization processes encourage emotional understanding and shape autobiographical memory.

Read the article by Wang and Fivush (2005) carefully. When you are finished, you should be able to summarize the study without looking back at the article.

**ACTIVITY: Think critically about the study**

Why did Wang and Fivush choose to study talk about past emotional events? Why is this topic important and/or interesting to developmental scientists?

Wang and Fivush predicted cultural and gender differences, which you can review in the Target Article. To test for differences with these variables, researchers usually use analysis of variance or t tests. Were these predictions supported by the data and analyses?

Because this Virtual Lab addresses correlation, focus on the authors’ prediction regarding individual differences. In particular, Wang and Fivush expected “high consistency in conversational style and content between individual mothers and their children” (p. 477). In your own words, first explain the predicted relation between mother talk and child talk. Then, explain the predicted relation between reminiscing about positive events and reminiscing about negative events.

**Collecting and coding the data**

In this study, the researchers asked each mother to select emotionally positive and negative events that had occurred in her child’s life during the past year and to discuss those events with the child. The researchers were not present during the conversations, which were tape recorded and later transcribed.

After transcribing the data, the first step in coding is to identify the parts of the conversation that involve discussion of the positive and the negative events. The remainder of the conversation is not relevant to the research hypotheses.
For each event, Wang and Fivush computed the number of turns and the number of propositions from the mother and from the child (see Table 1 in the Target Article, p. 482). When coding conversational data, a *turn* is typically defined as the sequence of utterances during which a speaker holds the floor without yielding to another speaker. For example, consider the following exchange, from the video Matthew and Dianna. In this example, the mother has four turns; the child has three.

M  Wow.
C  Mm.
M  Were the dolphins good jumpers?
C  Mm.
M  How did they do it?
C  Jumped for me, and you, and Daddy, and Erin.
M  They were jumping by all of us, weren’t they?
M  Like this?
M  Let’s do jumping with our hand, like we’re dolphins.
M  Ready?
M  Swim, swim, swim, jump!
M  Is that what they were doing?
C  Hm.
M  Yeah.
M  Here, you do it like your hand’s a dolphin.
M  Ready?
M  Swim, swim, swim, jump!
M  That’s what they were doing, huh?

A *proposition* is defined as a single unit of meaning and is operationalized in this study based primarily on independent clauses (i.e., subject–verb constructions that can stand alone and make sense). In the example shown previously, most lines show one proposition; the utterance, “They were jumping by all of us, weren’t they?” has two propositions.

An important question for researchers to address, prior to counting the total number of turns and propositions, is whether to include all utterances between the start and end of the discussion of each event or to omit from the count any that are unrelated to the event. For example, shortly after one mother initiated the discussion of a negative event, her child stated, “I’m hungry.” His mother replied, “Okay, well, we'll have a snack in a couple minutes…” and continued with the conversation about the event. Because these two turns in the conversation are not focused on the topic, the researcher must decide whether to include them in the count of turns related to the negative event. In this particular example, Dr. Wang would not have counted them.

You may practice coding by using the data from the Virtual Lab to compute the number of turns and the number of propositions produced by each mother and child for the discussions of the positive and the negative events.
ACTIVITY: Identifying turns and propositions

Using some or all of the videos from this Virtual Lab, compute the number of turns and the number of propositions produced by each mother and each child for one positive and one negative event. If you made the decision to omit any utterances unrelated to the event, identify them first so that you don’t accidentally count them. You may use the worksheet Coding Conversational Interaction, available with the Lab Viewer, to guide you, or you may design your own coding sheet.

Analyzing the data

Descriptive statistics

The first step in data analysis is to compute descriptive statistics. Wang and Fivush, for example, present descriptive statistics for all continuous variables in Table 1 (p. 482). Using the data from the Virtual Lab, compute the same measures of central tendency (i.e., means and standard deviations) for the number of turns and the number of propositions in the emotional conversations. You may use a hand calculator, or you can enter the data from the worksheet Coding Conversational Interaction into statistical analysis software like SPSS.

If you did not code the videos yourself, you may use the data table presented on the worksheet, Conversational Data. This worksheet shows how one novice coder computed turns and propositions, as well as two markers of narrative style, repetitions and evaluations. If you use this table, be sure you understand the variable labels. Note that, if you code the data yourself, your numbers are likely to differ from this coder’s — coding propositions accurately can be difficult, and researchers generally undergo rigorous training to establish reliability. You can review this coder’s identification of repetitions and evaluations on the worksheet Coding Narrative Style.

ACTIVITY: Descriptive Statistics

Compute the mean number of turns and the mean number of propositions for mothers and children and present them in a table like Table 1 of the Target Article (p. 482). If you did not code the videos yourself, you may use the data table presented on the worksheet Conversational Data. The worksheet Table 1 presents a template, or you may design your own table.

Correlational analysis

Wang and Fivush conducted two sets of correlational analyses. First, they looked at the consistency between individual mothers and children (see Table 2, p. 486). Then, they looked at the consistency
between conversations about the positive events and the negative events (see Table 3, p. 487). Using the data from the Virtual Lab, compute the same correlational analyses.

If you did not code the videos yourself, use the data table presented on the worksheet, *Conversational Data*. When confronted with a table full of numbers like the one in that worksheet, students often panic. When they have a computerized statistics program like SPSS, for example, students sometimes point-and-click their way through any analysis that they can remember. Not surprisingly, this method is not the best way to analyze data! Remember, when the researcher has clear hypotheses and collected data to test those hypotheses, data analysis should be straightforward. Keep in mind what the numbers represent (i.e., frequency of each conversation code) as you proceed through the analyses.

**ACTIVITY: Correlational Analysis**

Wang and Fivush found statistically significant, high correlations between the number of turns and propositions produced by the mothers and the number of turns/propositions produced by their children. Identify the correlation coefficients showing these relations (see Table 2 in the Target Article).

Next, use the Virtual Lab data to test the same relations in this sample: Compute correlations between mothers and children. How do your results compare to Wang and Fivush’s results? If required in your class, explain your findings in simple English, using the proper statistical statements and symbols to support your claims.

Wang and Fivush also found a significant relation between mothers’ and children’s use of repetitions in both the positive and negative conversations. Using the data you coded or the data table presented on the worksheet *Conversational Data*, compute the correlation coefficients for this sample and note whether they are statistically significant or not. How do your results compare to those presented in the target study?

Finally, review Table 3 (p. 487), which shows the correlations between conversation codes for the positive and negative events. Using the data from this Virtual Lab, compute the correlation coefficients for this sample and note whether they are statistically significant or not. How do your results compare to those presented in the target study?

**Discussing the findings**

The discussion of a research article is where the researcher relates the data to the hypotheses and presents any conclusions or implications of the research. The Discussion section of an empirical paper provides only a brief summary of the results and a more lengthy *interpretation* of the data in light of the hypotheses presented in the introduction to the study. Review the analyses, and consider what the data suggest about mother–child reminiscing in the United States.
ACTIVITY: Discussing the results

The Discussion section of an empirical paper often begins with a summary of the findings in light of the study goals. In one paragraph, state the goals and hypotheses of the study (focus on those relevant to this Virtual Lab) and then a summary of how the data support or fail to support those hypotheses. Avoid using numbers, which are more appropriate in Results.

What have we learned about parent–child reminiscing about emotional events? Be sure that you discuss the correlational findings and do not inappropriately attribute causality (i.e., we cannot conclude that a child’s narrative style is caused by his or her parent’s narrative style). You may choose to look at related research articles or notes from previous classes for additional findings that may support your interpretations.

How do the results advance our understanding of development more generally? Explain the importance of the findings with regard to previous literature. How do these results fit with previous findings in related areas? How do they differ? What has this study shown that is new and of interest in the field of developmental psychology?

What’s the next step? The Discussion often includes new hypotheses that arise from the current findings, as well as suggestions for testing those hypotheses. After considering what you have NOT yet learned about emotional reminiscing, suggest some follow-up studies that will add to our understanding of this topic. Be sure to explain the research questions and the hypotheses.

Summary

Reflect on the study. What have you learned about parent–child reminiscing about emotionally salient events? What have you learned about doing research with children, organizing and coding data, and running analyses?
Reference


Acknowledgments

Thanks are due to our cameramen Jake and Larry, and the wonderful children and parents who allowed us into their homes and to hear their stories, including Nathan and Lesley; Matthew and Dianna; and Carolina, Mia, and Julie. Thanks also to Vicki Momary, Jennie Pastorelli, Travis Dao, Sandy Price, and Jim Stigler for assistance with the research.

We are especially grateful to Qi Wang for her generous assistance in helping us replicate her study, coding examples of the data, and for sending us the original protocol used for the study.
Too often, statistics classes and their accompanying labs focus almost exclusively on probability, computation, and number-crunching with a computer. When students lose sight of the behavior in behavioral statistics, they cannot explain statistical output in terms of the dependent variables operationalized in the experiment. When they attempt later classes that require them to compute their own statistics, they appear woefully unprepared. Furthermore, they seem to hate statistics and find them very anxiety-provoking, while they find methods dry and boring. There’s a way out of this dilemma — put the behavior back into stats labs. The Developmental Science Virtual Labs in Statistics are designed to do exactly that.

The three Virtual Labs in this manual each begin with an introduction to a Target Article, a student-friendly empirical study published in a top peer-reviewed journal within the last 15 years. Each Lab includes a digital library of videos showing experimental or observational sessions; transcripts of the sessions, time-coded to match the videos; materials for collecting additional data; and interactive tasks that provide a framework for student interaction with the video datasets. Activities encourage students to reflect on the research hypotheses and method, code the accompanying video data, compute descriptive and inferential statistics, summarize the results, and design a follow-up study.

Faculty or students who want additional exercises focused more directly on the research methods used in the Target Articles for these Virtual Labs are encouraged to review the Developmental Science “Conduct the Study” Virtual Labs. For additional information, please visit DevSciLabs.com.