PUBLIC MANAGEMENT PROGRAM

Management Report Series 2023:2

Using Tables, Charts, Maps, and other Visuals: Guidance for Better Management Reports and Papers

A Primer for MPA Students at SUNY Brockport

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The Public Management Program (PMP) conducts applied research and community projects that join faculty expertise and student skills to provide quality professional value for local, regional, and state partners.

Department of Public Administration SUNY BROCKPORT

This guidance primer was developed and adapted from an earlier report:

B.F. Stanton. 1987. MAKING TABLES AND CHARTS**.** A.E. Ext 87-17. Department of Agricultural Economics, New York State College of Agriculture and Life Sciences. Cornell University, Ithaca, New York 14853. Available at: https://dyson.cornell.edu/outreach/extension-bulletins/

Dr. Stanton's guidance from the 1987 publication remains full of valuable insights for a variety of writers. With permission we borrowed generously from the summaries and key points in Stanton's report, adapting it for a public management audience. In our revision most examples of tables, charts etc. have been substituted with examples more germane to our primary audience – master's degree students in Public Administration.

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EXPRESSING IDEAS WITH TABLES AND CHARTS

INTRODUCTION

They say a picture is worth 1000 words. The picture should be in focus and it helps if it is in color. And the eye should be drawn naturally to a central point. After looking at the picture, you should come away with an image that lasts and is meaningful.

Charts and tables can do the same thing. Their eye appeal cannot compete with a color picture from National Geographic, but they can get your attention, make a point, or capture an idea in visual form. Interest rates are falling at an increasing rate. Words cannot say that as well as a one line chart. A mixture of numbers, graphs, words, and illustrations is livelier than any of these by themselves.

PURPOSE

The purpose of this report is to encourage authors to develop and use interesting and understandable tables and charts. If there is a point to be made, a table or chart can help. Some guidelines and examples are offered here to help authors criticize and improve their own efforts.

After a little study, it is easy to see that making a table or chart is not science. There is a lot of ART and EXPERIENCE involved. Most readers can find the central point of a good chart. If a table is poorly organized and cluttered with data, readers will likely pass it by. Clearly, good charts and tables make a difference. There is no standard that everyone accepts as to what is right and wrong, but there are some basic principles to follow. This report will try to illustrate some major points to consider and demonstrate differences between effective efforts and those which fall short. Putting together a table or a chart which makes a point will provide both you and others with satisfaction. It will save the reader time and it can make a difference in your final report.

TYPES OF TABLES AND CHARTS

Tables and charts are familiar concepts to nearly everyone. A table is a formal presentation of numerical information set off from written material. It should be complete enough to stand by itself. Thus, it will have its own title, telling what the table is about, as well as where and over what time span the table provides information. The units of measurement will be clear. Descriptions of the data will be included in the captions and stubs provided in each column and row.

The source of the data, if it is not the author's own work, will be indicated. And the way the data are organized or ordered should help readers understand some basic ideas or find information for their own use.

Tables have different purposes and uses. One type provides original data or compilations of such data for reference and further analysis. These are the general tables one finds in most U.S. Census publications, the Statistical Abstract of the United States, or as an appendix to the Council of Economic Advisers' Economic Report of the President. Often these tables were compiled by special agencies of government, the Federal Reserve Board, or well recognized industry groups. They follow standard procedures for organization and presentation. Most of us take them for

granted because they are easily accessible, straight-forward, and very well organized. Appendix tables presenting original data you have collected should be equally accessible, clearly documented, and detailed. Reference materials by their nature must be complete, orderly, and straight-forward.

Most tables are included in a report or book for a specific purpose. They can be a simple frequency distribution to show variability. They may show a relationship between two variables like size and income. They may document change between two or more time periods. These are the kinds of tables most of us prepare to help explain what we have done and to document our conclusions. Whether they are called analytical, descriptive, or special purpose is unimportant. It is to this kind of table that attention is directed to this report.

Charts include a substantial array of drawings and maps that help readers get perspective on numerical data. Bar charts, pie charts and line graphs are the most familiar and widely used. Pictographs liven up popular stories. Maps help a reader put numbers together by location.

A FEW BASIC RULES

The primary reasons for using tables and charts in a written or oral report is to help the reader or listener understand what you have to communicate. They should aid clarity and create interest. But they should not reduce accuracy or create confusion.

1. Any chart or table should be complete enough to stand by itself.

2. There should be a central idea or impression which the reader can grasp easily.

3. The units of measure should be clearly identified.

4. Sources of information, time period covered, and geographic location should be clearly stated.

5. The amount of detail presented should support the central idea but not overwhelm or obscure it.

6. Be sure the digits presented are significant.

These six simple statements are deceptively easy. They argue for clear, straight-forward tables and charts to help a reader understand what has happened or the reasons for conclusions drawn. In the sections that follow, these generalizations will be illustrated in a variety of ways. Examples of poorly organized tables and charts will be presented and revised. Examples of good charts will be examined. Ideas for developing combinations of tables and charts will be considered. Readers should look at the ideas and approaches rather than specific rules. We can always find ways to improve our illustrations and supporting evidence. This is the basic objective of this report.

TABLES

The most obvious reason for making a table is to present some numerical information in an orderly manner that will help make a point or answer a question. These are the specific purpose tables which most of us use and prepare for research reports, newspaper stories, classroom presentations, or tables to the general public. Usually, the numbers and information come from reference tables prepared by some agency of government or statistical organization. Sometimes they summarize our own work and tabulations of primary data. Regardless, they seek to tell a story or make a point.

RUDIMENTS OF MAKING A SIMPLE TABLE

Let's assume you want to inform a group of people interested in the US public school system and its populations in each state. This kind of information is frequently published by the Pew Research Center and is available for analysis. See Table 1 below:

Table D2. Public School Enrollment by Race and Ethnicity, 2002-03

State	Number of Schools	Total	Hispanic	White	Asian	Black	American Indian
Alabama	1,391	726,545	13,022	437,490	6,264	263,983	5,786
Alaska	497	134,224	4,989	79,796	8,420	6,337	34,682
Arizona	1,800	929,083	338,816	465,255	19,534	44,192	61,286
Arkansas	1,129	450,985	21,422	318,019	4,596	104,593	2,355
California	9,082	6,195,920	2,819,504	2,106,042	700,671	515,805	53,898
Colorado	1,661	750,984	182,590	493,670	22,793	42,994	8,937
Connecticut	1,083	568,739	80,215	392,666	17,122	76,914	1,822
Delaware	201	116,342	8,430	67,992	3,032	36,531	357
District of Columbia	203	76,166	7,893	3,301	1,191	63,739	42
Florida	3,378	2,531,145	537,689	1,315,030	50,196	621,039	7,191
Georgia	2,003	1,496,012	92,837	792,304	36,826	571,721	2,324
Hawaii	283	183,829	8,487	37,481	132,662	4,364	835
Illinois	4,271	2,084,187	352,665	1,214,323	73,920	439,801	3,478
Indiana	1,892	1,000,793	42,659	823,256	10,441	121,746	2,691
Iowa	1,500	482,210	21,375	429,024	8,547	20,629	2,635
Kansas	1,431	468,342	48,837	359,432	10,637	42,779	6,657
Kentucky	1,356	619,511	8,337	540,011	4,986	64,966	1,211
Louisiana	1,522	730,354	12,240	354,537	9,414	349,238	4,925
Maine	671	203,946	1,434	195,941	2,334	3,192	1,045
Maryland	1,358	866,365	50,636	446,363	41,138	325,010	3,218
Massachusetts	1,892	981,972	110,201	737,096	45,516	86,029	3,130
Michigan	3,709	1,705,434	61,808	1,244,696	35,099	338,537	25,294
Minnesota	2,143	843,310	35,186	684,087	44,662	61,964	17,411
Mississippi	885	491,734	4,810	232,349	3,551	250,215	809
Missouri	2,230	917,433	21,157	717,171	11,684	164,442	2,979
Montana	865	149,995	2,955	128,125	1,576	1,015	16,324
Nebraska	1,245	282,547	26,151	227,478	4,541	19,916	4,461
Nevada	526	368,343	105,638	194,276	23,479	38,659	6,291
New Hampshire	473	207,671	4,622	196,133	3,278	3,019	619
New Jersey	2,414	1,367,473	227,154	801,096	93,221	243,764	2,238
New Mexico	801	320,264	165,451	107,690	3,522	7,662	35,939
New York	4,469	2,887,715	547,546	1,566,663	182,388	578,217	12,901
North Carolina	2,245	1,335,954	79,142	790,986	26,129	420,054	19,643
North Dakota	528	104,225	1,405	92,314	920	1,175	8,411
Ohio	3,786	1,787,588	35,710	1,425,256	21,917	302,262	2,443
Oklahoma	1,806	624,548	43,840	391,202	9,358	68,250	111,898
Oregon	1,261	537,437	67,128	419,676	22,626	16,079	11,928
Pennsylvania	3,182	1,814,723	93,603	1,398,571	39,076	280,956	2,517
Rhode Island	326	159,074	24,831	114,899	5,191	13,291	862
South Carolina	1,053	683,514	18,698	372,857	7,228	282,984	1,747
South Dakota	738	128,049	2,033	109,267	1,321	1,881	13,547
Texas	7,757	4,258,009	1,819,063	1,693,989	122,476	609,318	13,163
Utah	801	484,589	50,543	407,539	13,946	5,170	7,391

Table D2. Public School Enrollment by Race and Ethnicity, 2002-03 (cont.)

State	Number of Schools	Total	Hispanic	White	Asian	Black	American Indian
Vermont	349	99,793	745	95,635	1,576	1,262	575
Virginia	1,842	1,166,006	71,770	721,371	52,920	316,551	3,394
Washington	2,179	1,006,749	116,830	730,136	77,080	56,098	26,605
West Virginia	763	282,396	1,310	266,472	1,605	12,723	286
Wisconsin	2,232	881,017	47,377	699,991	29,492	91,289	12,868
Wyoming	387	86,306	6,660	74,873	812	1,137	2,824
Total	89,599	46,579,550	8,447,444	27,513,827	2,050,914	7,993,492	573,873

Source: Pew Hispanic Center analysis of U.S. Department of Education, Common Core of Data (CCD), Public Elementary/Secondary School Universe Survey

*Data is based on Common Core data given from the US Department of Education

Source: Pew Research Center, *The Changing Landscape of American Public Education: New Students, New Schools (2002-03)*

Comment:

A great deal of information is presented in this reference table. States are listed alphabetically. Information for the year can be compared for five key characteristics. The units of measurement are clearly stated. But most general readers would appreciate some assistance in pointing out the key ideas you would like them to observe from these national statistics.

One alternative is to simply organize an ordered list of the top states in number of public schools (keeping in mind this has to do with state population to a certain degree. It would also be beneficial to do bottom five for less populated areas as well) as part of the text you prepare. This is commonly done in news stories if the list is short. For example, one could state that the top five states in 2002-03 in terms of total public schools were:

California	9,082
Texas	7,757
New York	4,469
Illinois	4,271
Ohio	3,786

These states contained 32.7% of all public schools in the US.

In most cases, one or more special purpose tables will serve most effectively to organize the information you want to present. The top ten states in number of public schools are presented in Table 2. The ranking of states and proportion of the national total in each is emphasized.

States With the Greatest Number of Public Schools: 2002-03

State	Number of Public Schools	Percent of Total
California	9,082	10.14%
Texas	7,757	8.66%
New York	4,469	4.99%
Illinois	4,271	4.77%
Ohio	3,786	4.23%
Michigan	3,709	4.14%
Florida	3,378	3.77%
Pennsylvania	3,182	3.55%
New Jersey	2,414	2.69%
North Carolina	2,245	2.51%
40 Other States	45,306	50.57%
United States	89,599	100.00%

*Data is based on Common Core data given from the US Department of Education

Source: Pew Research Center, *The Changing Landscape of American Public Education: New Students, New Schools (2002-03)*

This simple table consists of three columns of information. One can quickly see that California is the leading state by a significant margin.

As soon as one tries to present more information in one table the problems of organization become more complex. Rank order may change. The purpose or central point may be more difficult to grasp. Consider a table which presents both public school amount and the number of students attending for 2002-03. A choice must be made about which series is more important. That will determine the order in which states are listed and where the columns of numbers are placed.

Table 3:

Number of Public Schools and Students: 2002-03

State	Number of Public Schools	Number of Students
California	9,082	6,195,920
Texas	7,757	4,258,009
New York	4,469	2,887,715
Florida	3,378	2,531,145
Illinois	4,271	2,084,187
Pennsylvania	3,182	1,814,723
Ohio	3,786	1,787,588
Michigan	3,709	1,705,434
New Jersey	2,414	1,367,473
North Carolina	2,245	1,335,954
40 Other States	45,306	20,611, 402
United States	89,599	46,579,550

*Data is based on Common Core data given from the US Department of Education

Source: Pew Research Center, *The Changing Landscape of American Public Education: New Students, New Schools (2002-03)*

In this table, the addition and priority of school population has changed the ranking of states. By this addition and side by side comparison, the reader could make inferences regarding the availability of public schools. Florida for example, has moved higher to the third spot in the chart due to its larger public school population, however they are the seventh in for number of schools, showing a lower public school availability.

A few comments on significant digits for whole numbers are appropriate now as well as later. For most situations three significant digits are all that will be important to provide understanding.

Table 4:

Insured workers as a percentage of the corresponding Social Security area population, selected years

	Population aged 20 or older			Population aged 20 to FRA [a]	
Year	Millions	Percentage permanently insured	Percentage fully insured	Millions	Percentage insured for disability
1970	135.1	50	77	113.9	63
1975	147.4	50	80	123.8	66
1980	161.8	53	83	135.2	70
1985	174.9	57	84	145.5	72
1990	186.0	63	86	153.7	75
1995	196.0	66	86	161.6	76
2000	206.9	68	87	171.3	78
2005	219.5	68	87	183.2	78
2010	230.6	69	87	191.8	76
2015	242.6	69	88	197.5	76
2020	251.1	70	89	198.7	77
2021	252.4	70	89	199.4	78
2022	254.3	70	89	200.4	78

SOURCE: SSA, Office of the Chief Actuary.

Source: Social Security Administration, *Fast Facts and Figures About Social Security, 2023*

Comment: For this table, members of the Social Security area are expressed in millions. Instead of writing out the entire number, the author of this graph indicates the first three digits, rounding to the nearest tenth of a decimal. By doing this, the reader can see the importance of the numbers without becoming overwhelmed.

PARTS OF A TABLE

It is easier to discuss repairing a car if we recognize the names of the important parts such as the carburetor and radiator. For the same reason, the parts of a table have been given commonly accepted names.

Every table has a title, and most tables are given a specific number. Captions are used to describe the materials appearing in each of the several columns. There are other names used as well such as "boxheads." Stubs are the descriptive words used in the first column of a table. They identify each row that is used in the body of a table. The body of a table is the central portion where the numerical data are presented. All the other parts of the table are used to explain and identify these numbers or words. At the end of a table are placed footnotes to give further explanations about numbers or definitions. A source note is included to identify from where the basic materials were taken unless they are primary data developed by the authors.

The various parts of a table are designated in Table 5. A standard format is followed. Most of the procedures generally accepted in presenting tables are used. If one seeks to be simple, direct, and clear in terms of purpose and presentation, and then follow a standard format, the results should be acceptable to a wide range of readers.

Table 2 Labeled:

Title

Number of Public Schools and Students: 2002-03

Captions

State	Number of Public Schools	Number of Students
California	9,082	6,195,920
Texas	7,757	4,258,009
New York	4,469	2,887,715
Florida	3,378	2,531,145
Illinois	4,271	2,084,187
Pennsylvania	3,182	1,814,723
Ohio	3,786	1,787,588
Michigan	3,709	1,705,434
New Jersey	2,414	1,367,473
North Carolina	2,245	1,335,954
40 Other States	45,306	20,611, 402
United States	89,599	46,579,550

Stubs

Body

*Data is based on Common Core data given from the US Department of Education

Footnote

Source: Pew Research Center, *The Changing Landscape of American Public Education: New Students, New Schools (2002-03)*

Source Note

FORMAT

The format of a table should help the reader understand what is presented. Authors who prepare excellent tables have differences in style. There is no single form which is always best. But an author should be consistent. All the tables in one publication should follow one basic form.

1. White space -- Avoid the look of crowding information into a small box. Use white space to separate information, to indicate that a change has occurred or to provide balance on a page.
   Too much space between columns of numbers is worse than too little. It should be easy for a reader to follow across a row of numbers. Comparisons should be made easily. Small tables can be incorporated into the text rather than using the whole width of the page for two columns of numbers.
2. Horizontal lines -- Commonly three horizontal lines are used to set off the major parts of a table: the title, the captions, and the body (Table 2 labeled). Some authors use no horizontal lines; others use two under the title and again under the body of the table. The larger or more complex the table, the more these horizontal lines will help the reader.
3. Vertical lines -- The use of vertical lines should be reserved for reference tables or appendices. The statistical Abstract of the United States uses vertical lines in nearly all of its 1600 tables. So does the Census. But for most special purpose tables the need .for a vertical line may mean trying to do too much in too little space. There are always exceptions. If two parts of a table are separated, then a vertical line calls attention to the separation.

Title:

The title of a table is analogous to the title of a book. It should create some interest to look at what follows. It should be short, clear and tell the purpose for which it was constructed.

Most titles are too long. A desire for completeness may override everything else. Short titles can be accurate and complete. The central idea can be emphasized by the title as well as the body of the table. Good titles like good literature are difficult to define. Following a set of rules will not guarantee good titles but it should prevent most bad ones.

Specific Suggestions:

1. Content -- Titles should answer the questions, what, where and when. In some cases, the method of classification within the table may be indicated as well. Usually the question, what, is answered on the first line. The sub-title or second line indicates where and when.
2. Length -- A title, which takes more than two lines, is usually too long. Some of it will not be read. Either use a footnote for part or something can be omitted. Phrases rather than full sentences should be used.
3. Form -- Titles should take the form of inverted triangles. Whenever possible, the first line describing what the table is about, should be longer than the second.

4. Capitalization -- The first line of a title should be set off from the sub-title whenever possible. Full capitals or bold face type achieve this effectively. The words in the sub-title or second line usually are given initial capitals. Since lower case type has been found to be easier to read than full capitals, consistent use of initial capitals throughout a title is also quite acceptable.
5. Abbreviations -- Avoid abbreviations. An exception may be "U.S." when followed by some agency or department. Standard acronyms like USAID or USDA are generally accepted.

A few examples illustrate some of these points. Actual titles for tables as they were published illustrate what was done originally and some suggestions for improving or clarifying these titles are made.

Example 1: Length and Form

Incorrect form:

A brief understanding of the number of schools which have remained closed from March 2020 to February 2021 spanning across world regions. Children affected have also been identified in millions and percentage of population. Source of data is from UNICEF*, COVID-19: Schools for more than 168 million children globally have been completely closed for almost a full year, says UNICEF.*

Revision:

Number of Countries/Children Where Schools Have Remained Closed Since March 2020

Comment:

The original title certainly tries to tell the reader what is included in the table. But it is easy to get lost in the detail. Procedures on calculation can be presented in the text or a footnote. Where the data came from must be separated as a source note. The title simply needs to highlight the central ideas of data analysis. In this case that is the variables (number of countries, number of children, and number of schools closed) and the date of relevance (March 2020). The date's clear implication of the COVID 19 Pandemic can be further explained in written analysis.

Example 2: Central Idea

Incorrect Form:

Examination of Net Tax Exemptions in US Dollars through Project Purpose Category and Total Net Exemptions in the Year 2021

Revision:

Net Tax Exemptions by Project Purpose Category, 2021

Source: Office of the New York State Comptroller, *Performance of Industrial Development Agencies in New York State: 2023 Annual Report*

Comment:

The original title is factual and correct, but long. The reason for developing the table is not highlighted. The revision gives emphasis to the purpose and the essential information as well.

Example 3: Table Number and Form

Incorrect Form:

Table 1:

Percentage changes (Over Previous Census) in the Resident Population for the 50 states, including the District of Columbia, and Puerto Rico: 2010 to 2020

Revision:

Table 1. Percent Change in Resident Population for the 50 States, the District of Columbia, and Puerto Rico: 2010 to 2020

Source: US Census Bureau: 2020 Census: *Percent Change in Resident Population for the 50 States, the District of Columbia, and Puerto Rico: 2010 to 2020*

Comment:

One way to emphasize a table number is to put it on a line separated from the title. The original title takes up more space than necessary. This format will bring white space into a publication if it is heavy with writing. The original also uses extra unnecessary words that make the title much longer. Adding the time period covered as part of the title is encouraged.

Example 4: Lack of Information

Incorrect Form:

Happiness Inequality

Revision:

Happiness Inequality During Periods of Economic Growth: 1981-2007

Source: Our World in Data, *Happiness and Life Satisfaction*

Comment:

The revised title accounts for the scope of time this data is collected and the independent variable that the researcher is wishing to discuss (economic growth). This data is taken from a survey that has many questions related to individual happiness, however the researcher is looking at the link to the economy in particular. One must read the text carefully along with the tables to get the

necessary information. Even though all of the data presented in a bulletin refer to one survey, each table should stand on its own. More information in this case would help the reader.

Example 5: Handling Complex Comparisons

Incorrect Form:

State Appropriations for Research and for Research and Extension combined, in 14 States Spending Less Than $48,000 Per Annum on Research In 1925-30, As Percent of U.S'. Total of state Appropriations, 1925-30 and 1953-57

Revision:

Relative Growth in 14 Selected State Appropriations for Research and Extension, 1925-30 and 1953-57

Comment:

It is difficult to revise the title of this table unless one studies the accompanying text. Even then one is not completely sure of the author's intent. Some of the details given in the original title are repeated in the text. The method of comparison or technique of analysis, unless simple, should be explained somewhere other than in the title. An effort to explain the purpose of the table is as important here as in any other table.

Example 6: Relationship Statistics

Incorrect Form:

Previous and Estimated Annual Average Global Clean Energy Financing through the Public and Private Sector, Based on Announced Climate Pledges, and Necessary Investment for Net Zero Investment By 2050

Revision:

Previous and Estimated Annual Average Global Clean Energy Financing By Sector

Source: The White House, *The Economics of Public Investment Crowding in Private Investment*

Comment:

Most titles are short and direct because they are revised by a number of people. This one must have escaped such scrutiny. Trying to explain a relationship or the components of a model in a table title is usually a mistake. Help your reader by giving the central idea in the title. Use the text for explanations.

A good title is worth some effort. Potential readers or users of tables deserve to know what was done, where the data came from and why it was assembled as it was. A good practice is to read your title aloud to someone else. Often that will make you more aware if it is too long, too complex, or confusing.

Captions:

The title provides general information about the contents of a table. Captions indicate what will be presented in the columns below. It is here that detail is required in a brief form. The column headings usually tell what is included in the table, how it is measured, the unit of measurement and the time period involved.

1. Abbreviations -- Whenever possible, avoid abbreviations. Write out words like miles/milage, pounds, and percent. An exception is usually made with dollars. The dollar sign, if used at the left of the first item in each column of figures measured in dollars, is more convenient and easier to understand than a column of numbers headed by the word, dollars. In general, the unit of measurement should be placed as close to the numbers as possible.
2. Capitalization -- The first word in each caption should be capitalized, other words in lower case. Whatever form of capitalization used, it should be followed consistently within a table and throughout a report.
3. Method of Measurement -- When both the method of measurement and the unit of measure must be indicated, the method of measurement must appear in the caption. The unit may be placed in the body of the table itself below the caption. For example, a table may be used to compare different measures of output for the United states. Gross national product might well be one caption. The unit of measure, billions of dollars, could appear just above the column of figures in the body of the table, or as an added phrase in the caption (gross national product, billions).
4. Comparisons -- If a comparison is intended between two or more columns with a common characteristic, this should be indicated by the caption.

Body:

The body of a table is its focal point. Here ideas are presented, and evidence arrayed. The skill of an author is finally reflected in the way they assemble their facts and the ease with which another person can follow what he has done. Clarity of presentation and economy of time and space are fundamental things to attain in making decisions on arrangement, content, and detail.

Specific Suggestions:

1. Number of Columns -- Keep the number of columns in a table to a minimum. A table with one or two columns plus stubs is easiest to read. One with three or four columns of numbers is more difficult to follow. If five or more columns are required, an author should consider whether there is not a better way to present the same information. These kinds of tables are usually placed in an appendix or are used for reference.
2. General Shape -- If there are more columns than rows, consider reversing the table. Can the row headings be turned into column headings or captions? In most cases they can. Short tables which stretch across a page are hard to read. Consider typical reading habits. If a total is presented, the numbers which make up the total are expected to be found above it.

3. Width -- The body of a table determines its overall form or shape. Any table that is too wide to fit across a regular 8½ x 11 inch page should be reconsidered. Readers like to look at tables along with the rest of the text. Turning a document sideways to consider a set of numbers requires more effort than most readers are willing to exert.
4. Stubs and Descriptive Material -- The left hand side of a table is used to describe what is placed in each row. Comparisons are usually made across a table; hence the stubs indicate the item for which comparisons are made. Arrangement within the stubs provides emphasis. Minor items which make up totals are usually indented under major headings. The first word in each stub is usually capitalized.
5. Rounding Numbers -- Most tables in a report are not designed to present the details of an original data set. In most cases, two to four significant digits will present as much information as is needed or desired. Relative size is easier to grasp when rounding is done for a reader. Detailed statistics usually belong in an appendix or another volume.

   Some special problems arise in rounding numbers:

   a. Round to a commonly used unit. If some fraction of a dollar is important, use two decimal places (cents) rather than one even though the units are rounded to tenths of a dollar ($7.20, $18.40, $6.80, $0.30). Even if the basic data were correct to the nearest cent, the rounded numbers may tell the story equally well or better.
   b. Adding three zeros after two or three digits to indicate thousands may be more effective than heading a column, thousands. Rounding to millions or billions is more common than rounding to thousands, hundreds, or tens.
   c. Use a zero before the decimal if there is no significant digit on the left hand side of the decimal point. This ensures that the decimal is not overlooked.
   d. Unless reporting cents (see a. above), do not carry decimal places more than one place beyond the original data.

6. Totals and Averages -- Totals and averages are placed below the numbers from which they are computed. Some argue that if the total is of primary concern, it should be presented first and the data from which it is computed, presented later. Most people expect a total or average after they see the numbers from which it is developed. Totals or averages should be set off from other numbers by skipping a line to draw attention to the change.
7. Omissions -- Lack of information for one or more items in a column of figures should be explained using a footnote. (Some authors use "NA" to indicate that the data were not included because they were not applicable.)
   The word "none," “N/A,” or dashes indicate that the author filled the space consciously.
8. Estimates and Sources of Data -- If one or more numbers in a table is (1) obtained from a different source, (2) calculated in a different manner, or (3) estimated, attention should be drawn to this fact by using parentheses or a footnote. Parentheses around a number imply some kind of calculation or forecast. Standard errors or t-ratios are frequently presented using parentheses directly below a coefficient as well.

9. Spacing -- Tables that have more than seven or eight rows of numbers benefit from leaving a blank line after every fourth, fifth or sixth line.
   Space helps to emphasize particular numbers or lines. A row of totals is emphasized by skipping a line after listing the original numbers. In a frequency distribution, a change in the interval used is signaled by skipping a line.
10. Lines -- Vertical lines should be used when an important division is required in a multi-column table. Reserve vertical lines for REFERENCE tables. Horizontal lines should be kept to a minimum. Three are standard: one after the title, another below the captions, and a third to separate the body of the table from footnotes and source notes or the text material which follows.

Source Note:

The source of basic data should always be acknowledged unless the information was collected by the author. This acknowledgment comes at the end of the table below the footnotes if there are any. The title of a general publication or the name of the agency collecting data is sufficient for general sources. Greater detail is needed when the data come from something other than a standard reference.

Designation of the source should stand out. Since every table should stand by itself a source should be repeated even though it was listed on a previous table. Whenever possible, quote the original rather than a secondary source. Abbreviations are acceptable if they are commonly used. For example, the following is an acceptable source note:

Source: U.S Department of Commerce

Or

Source: U.S Bureau of the Census,

Current Population Reports

Specific Suggestions:

1. Location -- The source note should be clearly separated from footnotes. Skip a line and start the statement at the left margin of the table.
2. Form -- The word "source" should be in full capital or underlined and precede the statement. A phrase rather than a sentence is sufficient. The less familiar the source the more detailed should be the citation.
3. Lack of Citation -- Remember that a table without a source note implies that the author collected the basic data.

Footnotes:

Footnotes are used to explain numbers or phrases in a table which are unusual, and which cannot be explained within the framework of the table itself. Avoid footnotes whenever possible. They detract from the general appearance of a table. If the numbers in a table come from a variety of sources, footnotes will be required. When used, they should be concise and limited to one line if possible.

Specific Suggestions:

1. Location -- Footnotes should be placed immediately below the last line of the table. They should be indented a few spaces from the edge of the table and prepared as phrases or short statements.
2. Designation -- Letters or asterisks rather than numbers should be used to designate footnotes. Lower case letters are not likely to be confused with numbers in the body of the table and stand out sharply. Asterisks may be used if one or perhaps two footnotes are required. When three or more footnotes are required, letters should be used instead of asterisks. They should be used in alphabetical order.
3. Order -- Footnotes are listed in order starting with the title, followed by the captions, stubs, and then numbers in the body of the table.

Examples of Table Revisions:

Some tables, presented as they appeared in the original publications, have been selected to illustrate a number of the foregoing suggestions. Both the original table and a revision are presented. Anyone, including this author, is capable of preparing a poor table. Hence, the following tables should be considered as demonstration materials. They were not selected with any intent of discrediting the work of the several authors.

Example 1: Rounding Numbers

Original: (From AJAE 62(1980) :214).

Table 2. Present Values of Public Sector Project Costs at Stated Discount Rates

Source of Cost	Present Values in Year t_0 at Discount Rate 5%	10%
	$	
Interest subsidy[a]	17,016.41	107,672.97
Grant monies[b]	669,849.58	553,305.95
Total public sector cost	686,865.99	660,978.92

[a] The accounting model is $\sum_t (Ap_t - Ar_t)/(1 + p)^t$.

[b] The accounting model is $\sum_t G_t/(1 + p)^t$.

Revision:

Table 2. PRESENT VALUES OF PUBLIC SECTOR PROJECT COSTS
Kentucky Marketing Cooperative, 1969-

Source of cost	Discount rates 5%	10%
	present value in year t_0	
Interest subsidy	$ 17,020	$107,670
Grant monies	669,850	553,310
Total public sector cost	$686,870	$660,980

Comment:

Calculators and computers carry out numerical operations to many decimal places. An analyst must put numbers in perspective both for himself and the reader. Most of the time the numbers will have meaning in relative terms. Three or four significant digits will suffice.

In the revision, the words "present value in year t_0" were moved as close to the numbers as possible. Units of measure are easily lost within the captions.

The two footnotes were dropped in the table revision because the formulas were standard formulations. In a journal article, it is safest to include them, but they could well appear in the text if necessary.

Example 2: Format and Position on Page

	Number of US Cities with an Installed Traffic Light Camera by Number of Installations, Selected Census Years, 1990-2020*				
	1990	2000	2010	2020
Number of Cities with Traffic Light Cameras				
Number of Traffic light cameras per city	4,663,431	3,648,253	1,791,729	568,052
1-19 Cameras	4,538,117	3,498,564	1,572,035	362,467
Percent of all cities with TL cameras	97.30%	95.00%	85.30%	63.80%
20-49 Cameras	115,226	166,248	230,187	157,309
Percent of all cities with TL cameras	2.50%	4.50%	12.50%	27.70%
50 Cameras and more	10,088	16,815	41,157	48,276
Percent of all cities with TL cameras	0.20%	0.50%	2.20%	8.50%

Revision:

Number of US Cities with an Installed Traffic Light Camera by Number of Installations, Selected Census Years, 1990-2020*

	Census Year			
	1990	2000	2010	2020
Number of TL Cameras				
1--19	4,538,000.00	3,465,000	1,572,000	363,000
20--49	115,000	166,000	230,000	157,000
50 or more	10,000	17,000	35,000	48,000
Total	4,663,000	3,648,000	1,837,000	568,000
Percent of Total				
1--19	97.30%	95%	85.30%	63.80%
20--49	2.50%	4.50%	12.50%	27.70%
50 or more	0.20%	0.50%	2.20%	8.50%
Total	100%	100%	100%	100%

Comment:

The original table is hard to read for a number of reasons. Its location on the page requires a reader to turn the report in order to study the title and table contents. Adding some horizontal lines helps the reader separate captions from the numerical data. Mixing percentages with the original data makes comparison difficult. One could argue that the percentages are unnecessary. If they are included, it is easier to see the changes through time as suggested in the revision.

Some of the other proposed changes are more a matter of style or preference than requirements. Because the data came from the Census, some would feel that the numbers should not be rounded; But if one is trying to show the nature of changes in these distributions over time, the rounding helps. Moreover, the original data are always available, and the author has already aggregated the herd size categories.

In 2000 and 2010, the data presented in the original table do not add to the total number of farms for those years. Returning to the census, the discrepancies were found and the numbers for those years revised accordingly. A general rule for any author is to make sure one's numbers add up or are internally consistent. If there is a ·problem, it should be corrected or identified as such.

Example 3: Reversing Captions and Stubs

Original:

			Private Sector Organizations and Number of Employees, 940 New York State Businesses, 1976					
Business Organization Type reported by CEO		1--74	74--149	150--299	300--499	≥500	no response	total
			Size of organization: number of employees					
Single Operator		91	180	308	175	64	14	832
		(9.7)	(19.2)	(32.8)	(18.6)	(6.8)	(1.5)	(88.5)
		[94.8]	[98.9]	[90.1]	[85.4]	[64.0]	[93.3]	
Partnership		5	2	32	26	24	1	90
		(0.5)	(0.2)	(3.4)	(2.8)	(2.6)	(0.1)	(9.6)
		[5.2]	[1.1]	[9.4]	[12.7]	[24.0]	[6.7]	
Family Corporation				1	4	11		16
				(0.1)	(0.4)	(1.2)		(1.7)
				[0.3]	[2.0]	[11.0]		
Manager (only)				1		1		2
				(0.1)		(0.1)		(0.2)
				[0.3]		[1.0]		
Total		96	182	342	205	100	15	940
		(10.2)	(19.4)	(36.4)	(21.8)	(10.6)	(1.6)	(100.0)
		[100.0]	[100.0]	[100.0]	[100.0]	[100.0]	[100.0]	

Revision:

Private Sector Organizations and Number of Employees, 940 New York State Businesses, 1976

	Business Type				
	Single Operator	Partnership	Family Corporation	Manager	Total
Number of Employees					
1--74	91	5	0	0	96
75--149	180	2	0	0	182
150--299	308	32	1	1	342
300-499	175	26	4	0	205
500 and over	64	24	11	1	100
No Response	14	1	0	0	15
Total	832	90	16	2	940

Comment:

It is usually easier to look at a frequency distribution when numbers are presented in a column next to the individual classes. In this case, there are four different business organizations to consider. Partnerships and family corporations occur on farms with larger crop acreages. All the necessary information is included in the revision.

The original table can help the reader throughout their bulletin by including percentages both for row totals and for column totals. This practice may be helpful depending on what the author would like to convey. Be sure to understand what information is the most relevant for the audience.

Example 4: Space and Organization

Function	Percentage of Total Expenditures			Percentage of GDP		
	1952	1975	1996	1952	1975	1996
Central Executive, Legislative, and Judicial Activities	5.78%	4.98%	6.03%	0.44%	0.74%	0.86%
Civilian Safety	7.31	7.24	9.88	0.56	1.07	1.42
Education	31.77	38.64	35.27	2.43	5.71	5.05
Health and Hospitals	7.52	5.29	3.17	0.57	0.78	0.45
Housing and Community Services	6.43	3.74	2.46	0.49	0.55	0.35
Income Support, Social Security, and Welfare	12.37	15.39	22.77	0.95	2.28	3.26
Medical care	0.42	5.90	14.96	0.03	0.87	2.14
Welfare and social services	9.94	7.92	6.88	0.76	1.17	0.99
Other income support	2.01	1.56	0.93	0.15	0.23	0.13
Transportation	20.59	13.78	11.87	1.57	2.04	1.70
Other*	8.22	10.94	8.56	0.63	1.62	1.23
Total	100.00	100.00	100.00	7.64	14.79	14.32

* *"Other"* consists of agriculture; commercial activities; economic development, regulation, and services; energy; labor training and services; natural resources; net interest paid; recreational and cultural activities; veterans' benefits and services; and other and unallocatable expenditures.

Source: NIPA, table 3.17 in *Survey of Current Business*; October 1997, 77(10), supplemented by unpublished data from the same table.

Source: Research Gate, *State and Local Expenditures by Function*

Comment:

This table is executed well in terms of labels and presenting numerical data. One revision that could be made, however, is better spacing, and possibly the addition of gridlines would make it easier to read. In some cases, excessive spacing can make it difficult to line up numbers and see data trends. A revision of this table would remove large spacing and possibly add gridlines or shading to add clarity.

CHARTS

A good chart helps one see a basic relationship or make a comparison. Charts make statistics come to life. They put ideas into perspective. They are the pictures the mind retains long after the numbers on which they were based are forgotten. Very often a few well designed charts will make central points in ways that words or tables could never do.

There are many different kinds of charts used to present numerical statements. We see them in newspapers and magazines and on television nearly every day. They are a kind of standardized art form. Most of us, with thought and care, can help people understand what we have to say by using them. The most important types are:

1. Graphs.
2. Bar charts.
3. Pie charts.
4. Maps.
5. Flow charts and diagrams.

Good charts are sometimes made more exciting by the use of cartoons and pictures. These add to the fun and create reader interest. But they are not required. Emphasis here is placed on developing ideas supported with numerical data in the form of charts. If someone with graphic skills is available to liven up the chart, so much the better. But concept and control of what is presented should remain with the author.

Some General Suggestions

Charts like tables need to be labeled. They should stand on their own and provide enough information so a reader can find the basic data from which they were constructed. If a data source is not provided, you imply that you collected the original data. Different kinds of charts require different procedures, but all charts need numbers, titles, units of measurement, source notes and data references.

1. For most publications, with the exception of newspapers and news magazines, charts should be numbered. The numbers help in making references and discussing central points in the text. Whether they are called charts, figures, or diagrams, stick with one such designation and number them consecutively.

2. A short descriptive title that tells what you want the reader to see is preferred. If the chart itself does not tell the data source and the time span covered, it should be a part of the title. In most cases, the title should appear above the chart along with the number. That provides space below for data and data sources as well as room for the label on a horizontal axis when there is one.

3. Units of measurement must be clearly indicated. Abbreviations are acceptable if they are widely known. Write out descriptions in full for lines, bars or axes of a graph or sections of a pie chart. If there isn't room to write out the description, think about what you are doing.

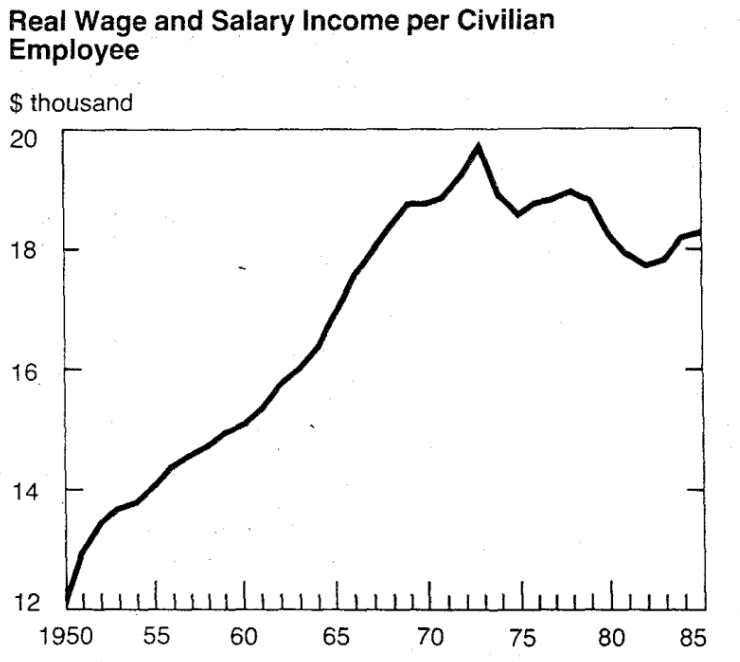
4. Make sure the reader can find the source of the data from which the chart is made. If no source is listed, it implies that the author collected the original data. Most charts are constructed from someone else's numbers. Give that source appropriate credit. Source notes like those suggested in the section on tables are appropriate.

GRAPHS

Graphs are the most commonly used charts and help readers visualize trends, changes through time and simple relationships. Examples of some well-designed graphs have been chosen to illustrate some important points. Brief comments accompany each.

Example 1: Single Line Graph

Real Wage and Salary Income per Civilian Employee

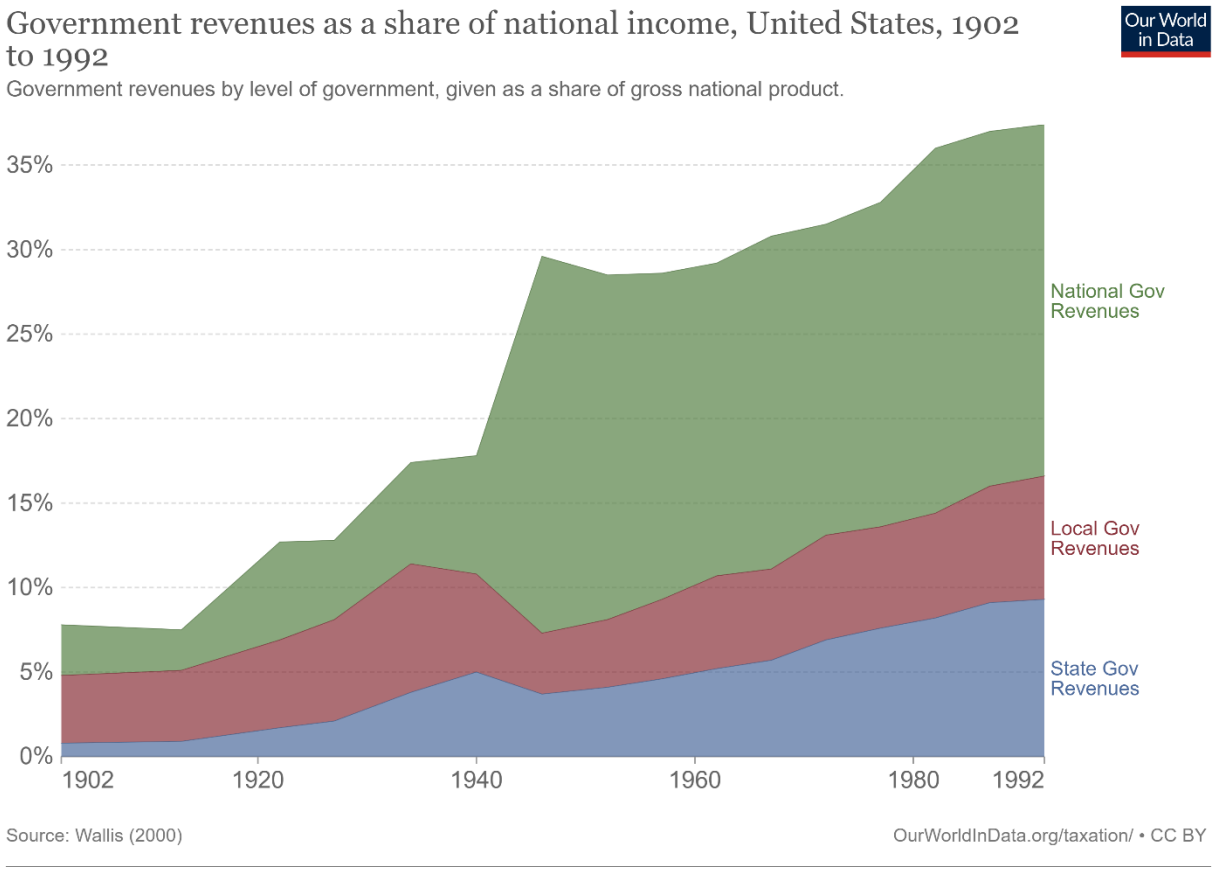


Source: Bureau of Economic Analysis and Bureau of Labor Statistics.

Comment:

One line on charts can have many advantages. There is no question about what is of central importance. The horizontal and vertical axes of the diagram are clearly labeled. The title is short and to the point. It is clear that annual data were used and obtained from two U.S. government agencies. The central point is clear. Real wage and salary income per employee in the U.S. increased steadily from 1950 to 1973. Since that time, it has declined in more years than it has increased. The vertical scale is clearly identified. The line uses much of the available space drawing attention to the annual changes from the earlier trend.

Example 2: Two or More Lines



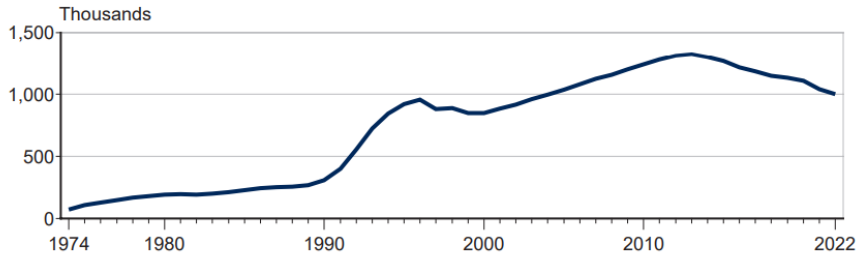
Source: In Our World Data, *History of Taxation* https://ourworldindata.org/taxation

Comment:

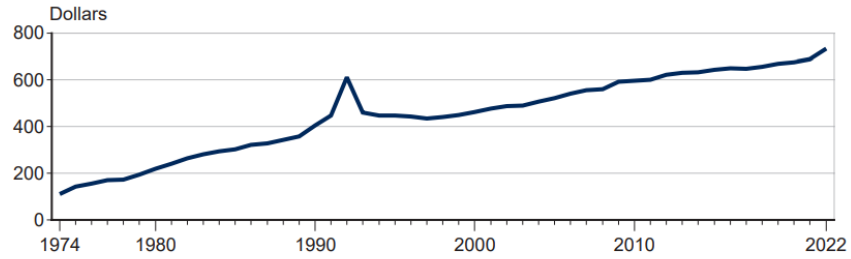
Multiple lines on a graph are easy to read if they are related in a logical manner and use the same scales. The lines must be labeled clearly. This excellent chart describes the increase of government revenues as a part of national income in the US. This chart has three components: state, local, and national government revenues. The three different areas of shading help to make the relationships clear.

Example 3: A Set of Related Single Line Charts

Number of children under age 18 receiving SSI



Average monthly SSI payment to children under age 18 [a]

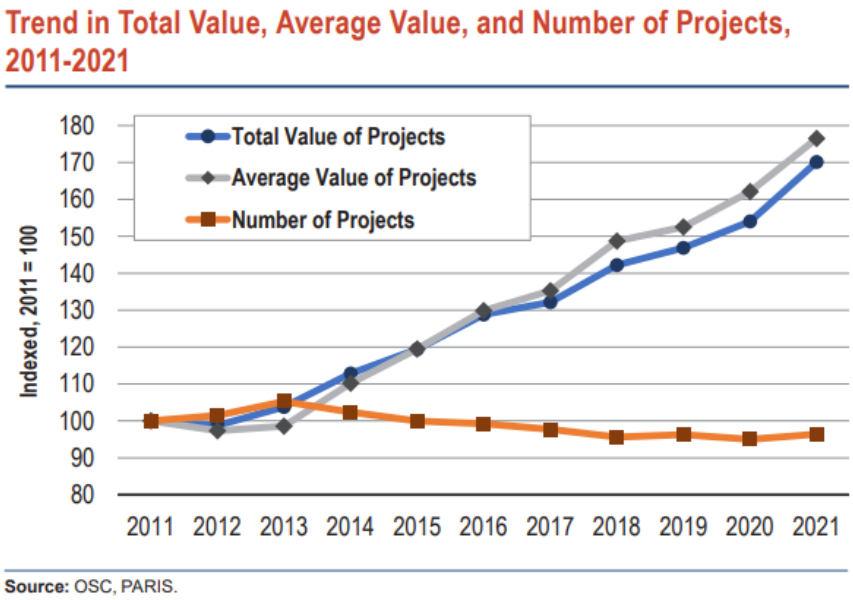


Source: Social Security Administration (.gov), *Fast Facts & Figures About Social Security* (2023)

Comment:

A series of individual, single line graphs which have common characteristics is more effective than trying to put all of the same lines on one or two larger charts. The trends are different. The individual diagrams show the variability of SSI payments from year to year for the number served and the average payment . Comparisons can be made more easily than if the lines are closer together.

Example 4: Three Lines, Different Units

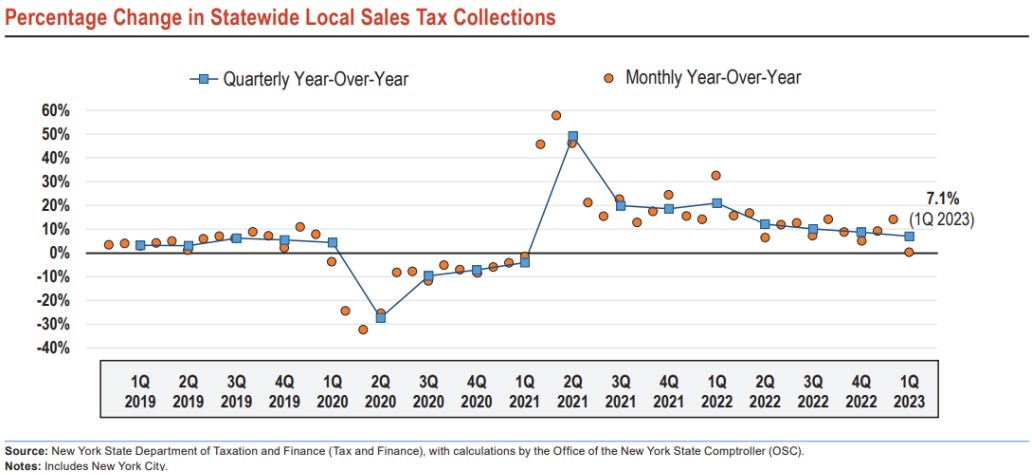


Source: Office of the New York State Comptroller, *Performance of the Industrial Development Agencies in New York State*

Comment:

If one wants to show how contrasting trends bring about a specific result, this chart is quite effective. The authors wisely put all of the information in numerical terms. The number of projects and value of projects require different quantity scales. It is a rare situation indeed when you can justify more than one scale on a chart! With time series data, this is an ideal way to make a point. The number of projects has remained remarkably stable while the average value of projects and total value of projects have increased together.

Example 5: Scatter Diagram



Source: Office of the New York State Comptroller, *Local Sales Tax Collections Increase by Over 7 Percent in the First Quarter of 2023*

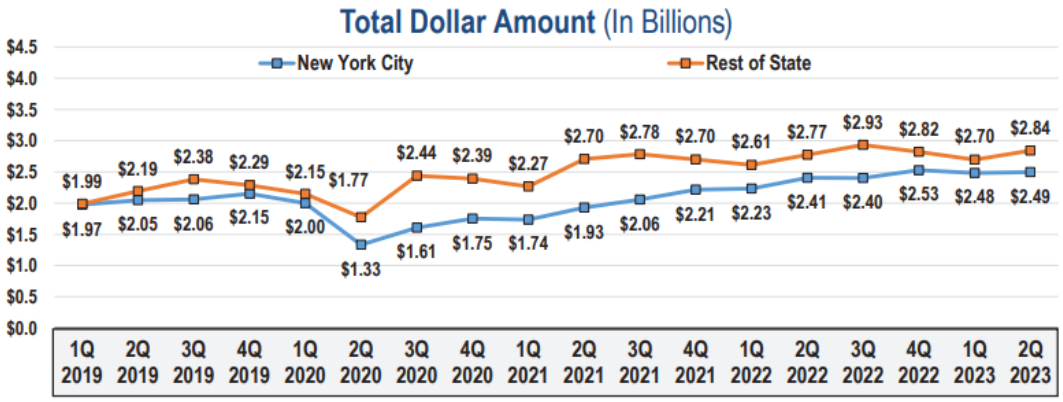
Comment:

One of the most effective ways to analyze cross section or time series data for relationships is with the aid of a scatter diagram. A chart like this one allows each reader to get an impression of the nature and extent of the variability over the range of observations made.

Scales on both the right and left hand side of the diagram are helpful. The units of measurement should be clearly indicated as was the case here. The title explains the relationship studied as well.

Example 6: Relationship Comparisons

Quarterly Local Sales Tax Collections for New York City and Rest of State

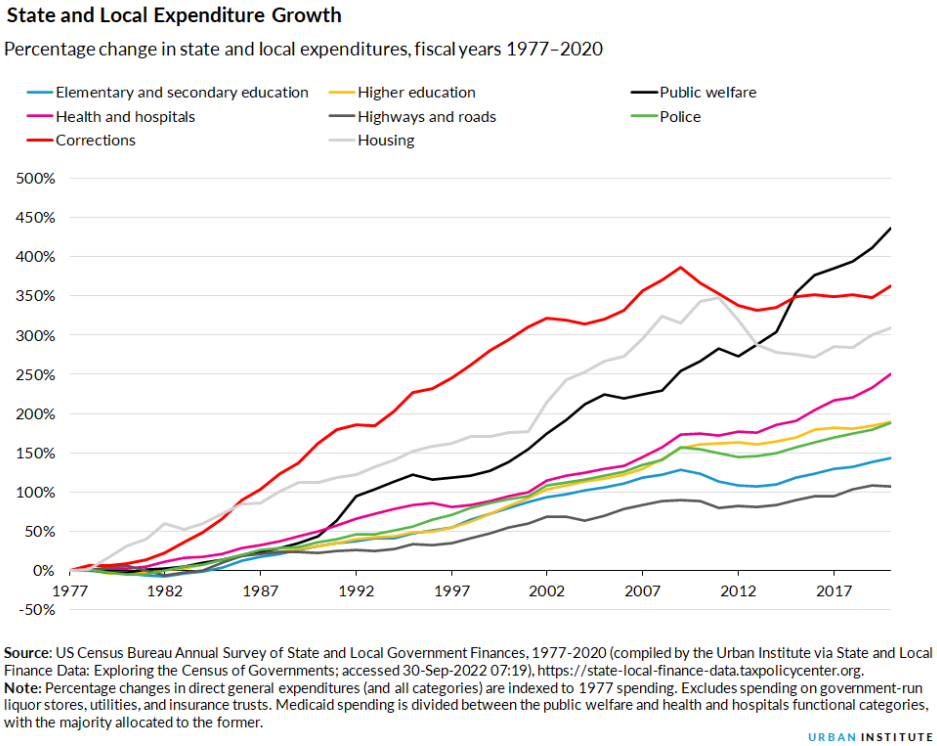


Source: Office of the New York State Comptroller, *Local Sales Tax Collections Up 3 Percent in the Second Quarter of 2023*

Comment:

A graph can often provide perspective on a set of relationships that is impossible in a standard table. In this example, the scales are clearly identified and the data on the curves are calculated values.

Example 7: Too Many Lines



Source: Urban Institute, *State and Local Backgrounds*

Comment:

In most cases, having three lines on a chart is the maximum. One begins to have trouble telling which line is which if they intersect or move closely together. If one must put as many as five lines on one chart, care should be taken to make the lines different enough so they can be identified.

In this chart, there is the added problem of using percentages which are mostly 100 or greater. If percentages are to be presented for time series data, try to get the index of 100 somewhere in the middle of the numbers. Whenever possible, it is helpful to chart percentages within a range between 50 and 200.

BAR CHARTS

Bar charts are the most widely used means of presenting relative rankings of numerical data other than tables. They are surprisingly flexible. In most cases, they help one grasp the size of relative differences.

In most cases, bar charts are used to supplement more detailed numerical data in one or more tables. An author can use a bar chart to emphasize one or more key points. The decision as to whether to use horizontal or vertical bars is a matter of personal preference. Vertical bars are somewhat more commonly used. A few general comments on making bar charts follow:

1. Be sure there is a properly labeled scale to provide reference, either vertical or horizontal.

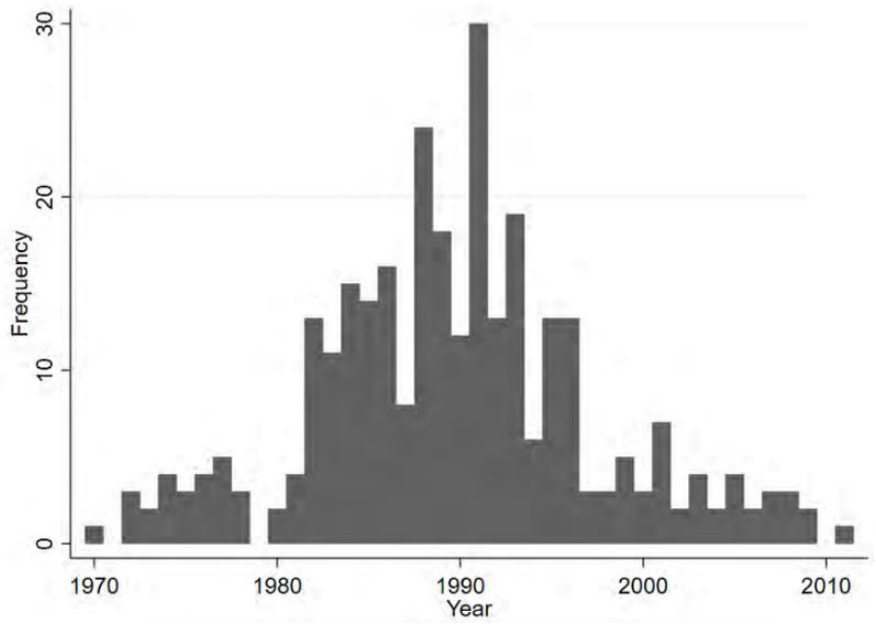
2. Dividing a bar into components is acceptable; 3 or 4 parts is about all most people can comprehend if a series is presented.

3. Use consistent spaces or intervals between bars except where an important change in time periods or categories occurs.

4. A clear title and chart number is just as important for a bar chart as for a table.

5. Provide the actual numbers or values either at the end of each bar or inside the bar itself.

Example 1: Frequency Distributions



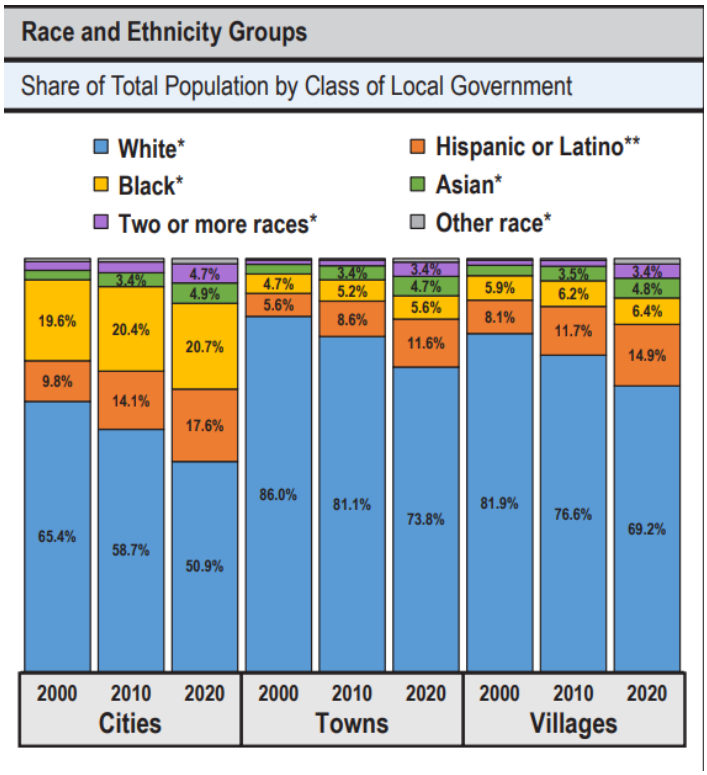
Years of Changes from At-Large to Ward Voting

Source: The Center for Growth and Opportunity (Utah State University)

Comment:

In this bar chart, a frequency distribution is presented. A scale is clearly identified. The diagram is self-contained, and comparisons facilitated. The title would be easier to identify if it were in larger or bold face type and placed above the diagram.

Example 2: Components of a Total

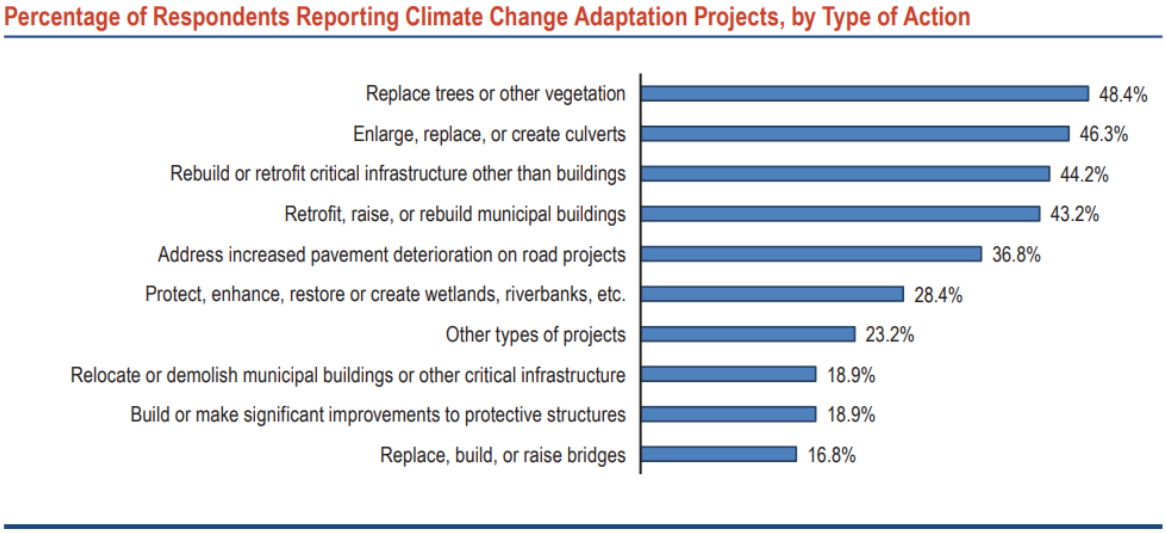


Source: Office of the New York State Comptroller, *2020 Census: Municipal Population Shifts in New York State*

Comment:

Race and ethnicity categories are divided into six categories in this chart. It is traditional to place the largest item on the bottom and the smallest percentage on the top of the most recent bar on the chart. This order should prevail on each bar even though the importance (percentage) of items may vary for individual bars. The proportions or the actual values are indicated for each of the sections within the individual bars. It presents important information in an attractive and easy to read manner.

Example 3: Comparisons Without Scales



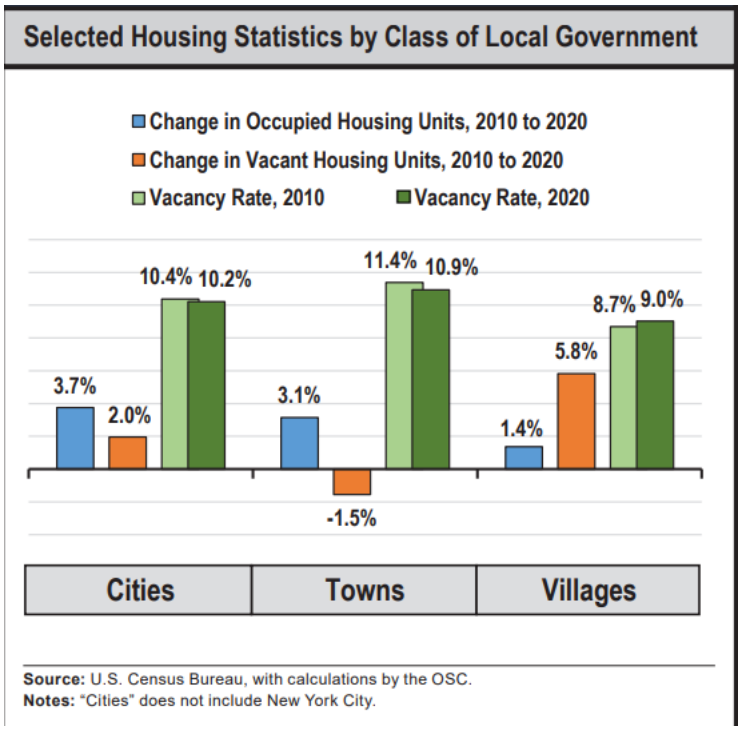
Source: Office of the New York State Comptroller, *New York's Local Governments Adapting to Climate Change: Challenges, Solutions, and Costs*

Comment:

All of the basic data can sometimes be presented in a bar chart if the classifications used are relatively simple. This chart tells the relative importance of different climate change adaptations used by local governments. The year involved could have been included in the title. It is very much like a simple table.

It is useful to put actual numbers inside a bar or close to it as has been done in this case. This kind of chart can be surrounded by text or explanation and be a natural part of a page, providing a change of pace for interested readers.

Example 4: Positive and Negative Changes



Source: Office of the New York State Comptroller, *2020 Census: Municipal Population Shifts in New York State*

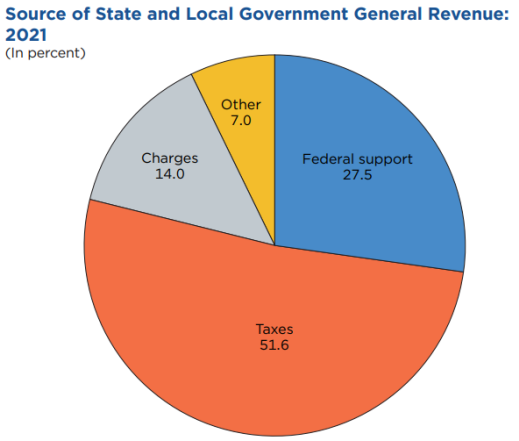
Comment:

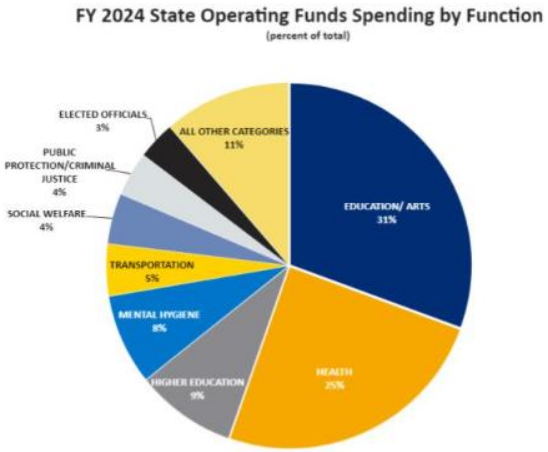
A bar chart is effective in contrasting positive and negative changes. Either horizontal or vertical bars can be used for this kind of presentation. The lack of a scale in this case is compensated for by listing the individual percentage changes next to each bar. A chart like this draws attention both to the major changes and the products which have had stable consumption patterns. A table presenting the original numerical data can be combined with this kind of chart to provide quantitative information on per capita use in both time periods.

PIE CHARTS

Splitting a circle into parts is a good way to show proportions as long as the pieces are large enough so the reader can see them. Pie charts add variety to a publication and are particularly effective in showing how changes in proportion have occurred over time. The circles or pies should be large enough, so the reader has no difficulty in getting perspective on the proportions.

Example 1: Form and the Number of





Pieces

Sources: U.S Census Bureau, *Annual State and Local Government Finances Summary: 2021*

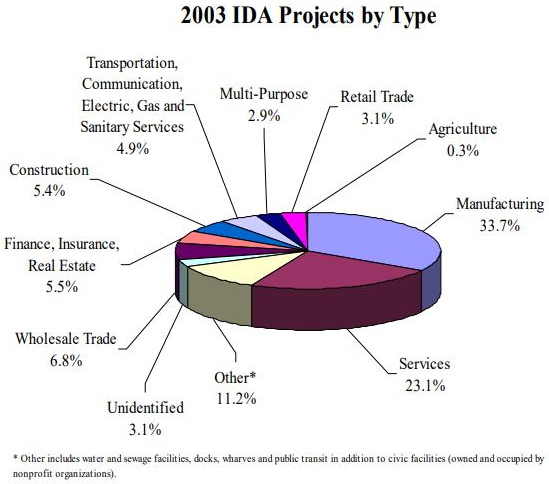
Town of Irondequoit, *2023 Adopted Budget*

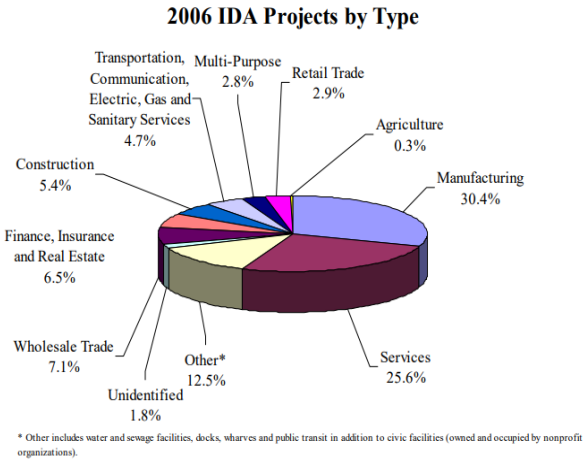
FY 2024 Enacted Budget Mid-Year Update. See: https://openbudget.ny.gov/overview.htm

Comment:

Both of these charts are quite easy to read and understand. The proportions are clearly indicated and related to the appropriate description. The chart on the left with four divisions is the easier one to read and construct. The one on the right has 9 pieces and has almost become a table because some of the pieces are so small. Slicing up a dollar bill would be another approach to presenting the same material.

Example 2: Comparisons Over Time



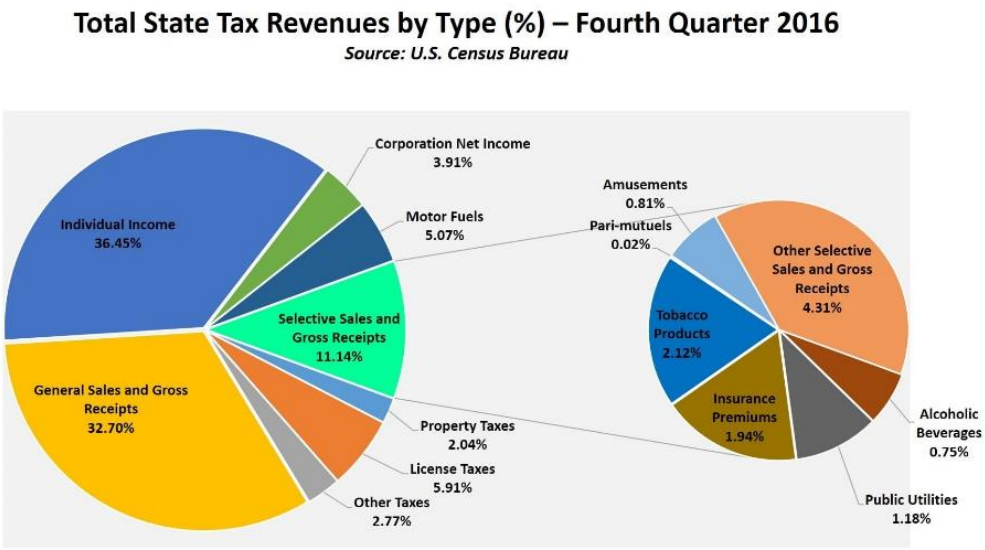


Source: Office of the New York State Comptroller, *Performance of Industrial Development Agencies*

Comment:

Two circles of the same size divided into several pieces show change over a three year span effectively. This chart is easy to understand and easy to remember. The categories are clearly identified with percentages in the more recent year. Commonly, the most recent year is placed on the right, not the left.

Example 3: Pie Charts of Different Sizes



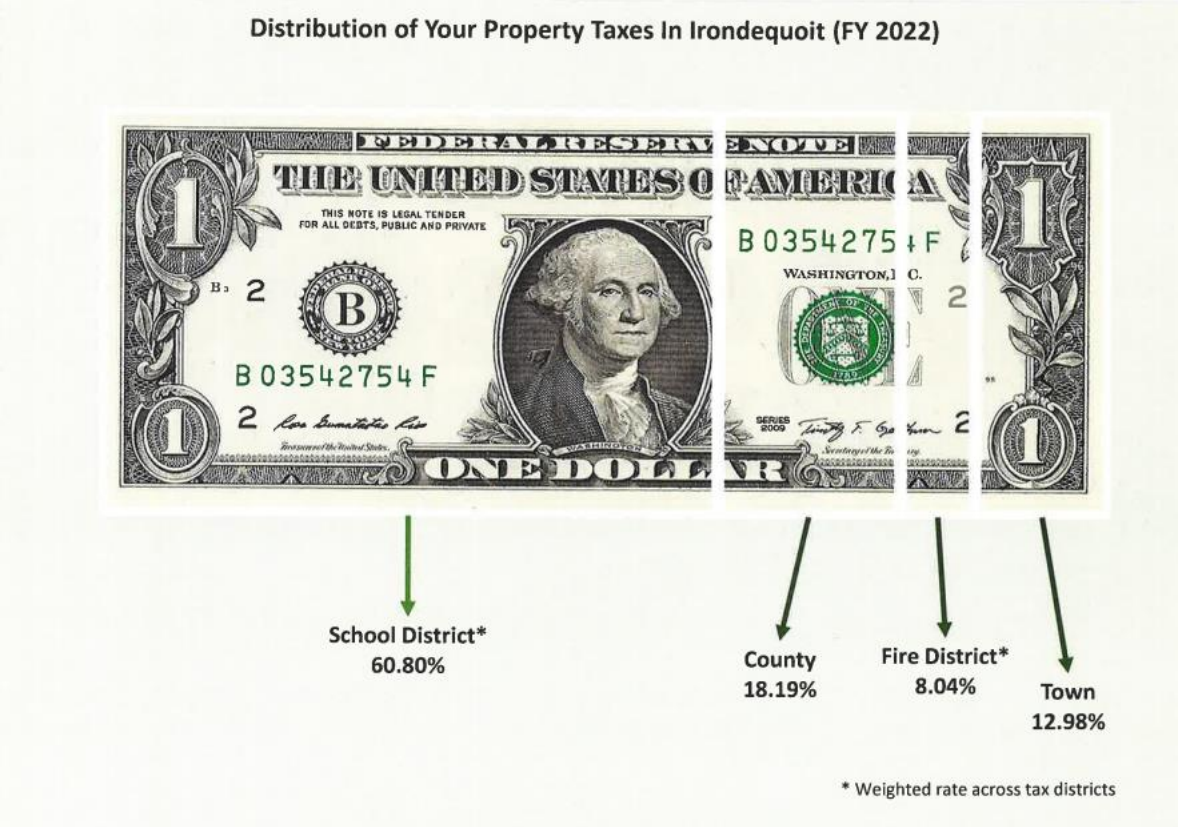
Source: University of Chicago, State and Local Governments See Healthy Tax Revenue Growth, 2017

Comment:

Two or more pies of different sizes can draw attention to relative differences. The general effect is helpful in getting perspective as shown in this example. Two comparisons are possible.

It is important to note the lines that connect the two charts. This small detail tells the reader that the chart on the right breaks down a specific portion of the chart on the left. Without including such lines, it may be difficult to understand the significance of including the second smaller chart.

Example 4: Dividing up the Dollar



Source: Town of Irondequoit, NY, *2023 Adopted Budget*

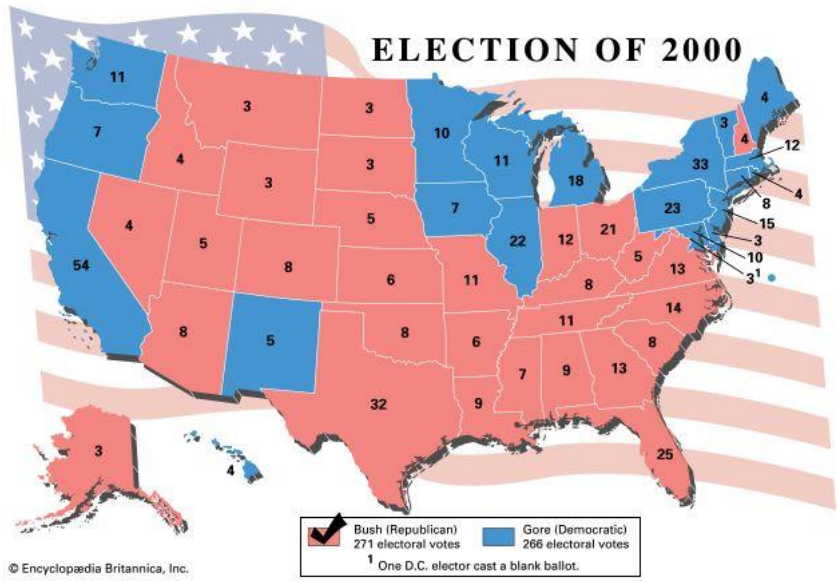
Comment:

A variation in the pie chart is to divide some other familiar item. The annual report of a corporation often provides some excellent charts. Cutting up an American dollar has the same effect as splitting a pie and helped to keep reader interest in a potentially dull report.

MAPS

One of the most effective ways of showing information on a geographical basis is to use an outline map. Geographic Information Systems (GIS) software can ease this process. A map can convey many things at a glance, which is almost impossible in a table.

Example 1: Numerical Data

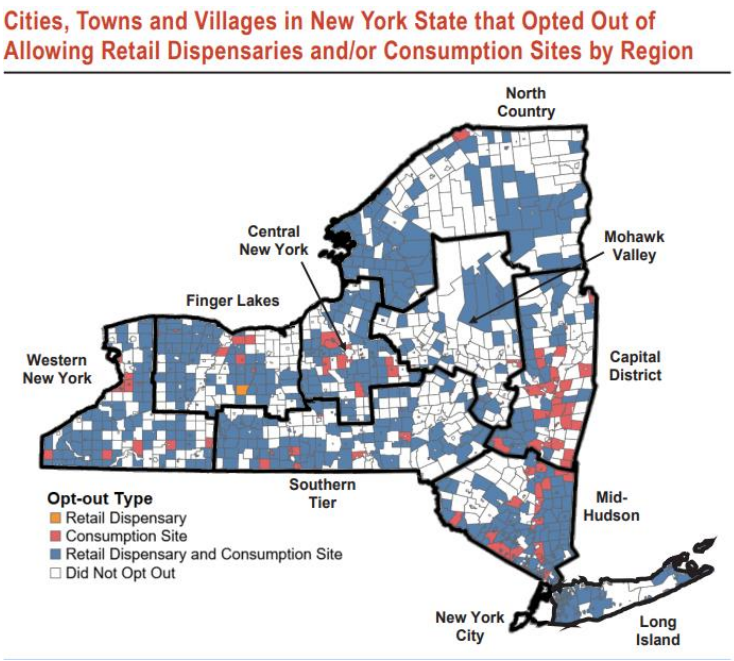


Source: Brittanica, *Electoral College*

Comment:

A common example used to show numerical data is the electoral map. A table presenting this information cannot allow one to see all the regional comparisons as easily or effectively. One can see the substantial differences from state to state and by region. Reasons for the observed differences and any other comments can be discussed in written materials provided with the map. This is an excellent example of how to use a map to convey a large amount of information in a relatively small space.

Example 2: Shaded Maps



Source: Office of the New York State Comptroller, *Local Governments and Recreational Adult-Use Cannabis in New York State*

Most readers expect the shading on a map to indicate that light or no color means small or very little and dark means large or more. Dot maps are white where there are no observations and dark where there is heavy concentration. Don't confuse a reader by making up a different system.

This map conforms to the general rule. There are four categories indicating the use of cannabis sales in New York. The areas with no opt out status have no color, while the areas opting out of the two categories (retail dispensary and consumption site) are the darkest color. This follows the idea that more of a variable indicates a darker map portion.

Trying to shade with more than four different categories becomes difficult. In most cases, four is the maximum number one can see easily.

FLOW CHARTS AND DIAGRAMS

Just as an outline helps a writer organize their thoughts, a flow diagram can help a reader see how ideas or variables relate to each other. Economists have learned that flow charts help them organize their own thinking. In turn, this is a good way to present some ideas. Even though some relationships are very complex, it is most helpful to see the central ideas before one is overwhelmed with the details. A flow chart should ensure that the central variables and directions of flow are easily identified. A very busy chart is not likely to help the reader or the analyst themself.

Example 1: A Simple Flow Diagram

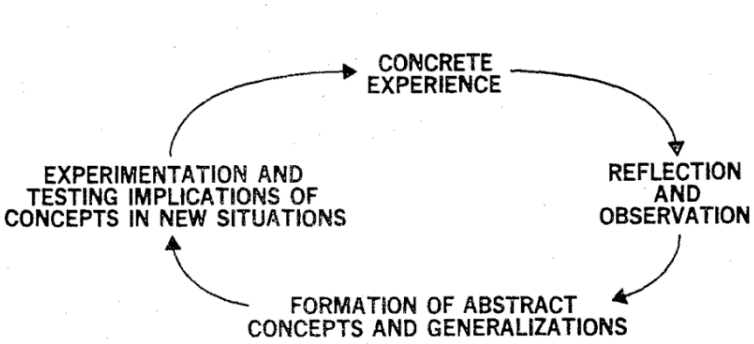


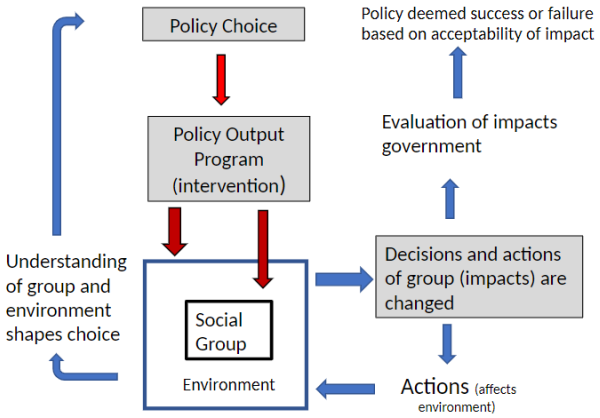
Figure 1. The experiential learning model

Source: Boehlje, M.D. and Vernon R. Eidman. AJAE, December 1978, p. 988

Comment:

This simple diagram with its circular flow helps draw attention in an article to a central idea. It is easy to grasp and easy to read. More flow diagrams should emulate this style and clarity of presentation.

Example 2: A Complex Flow Diagram



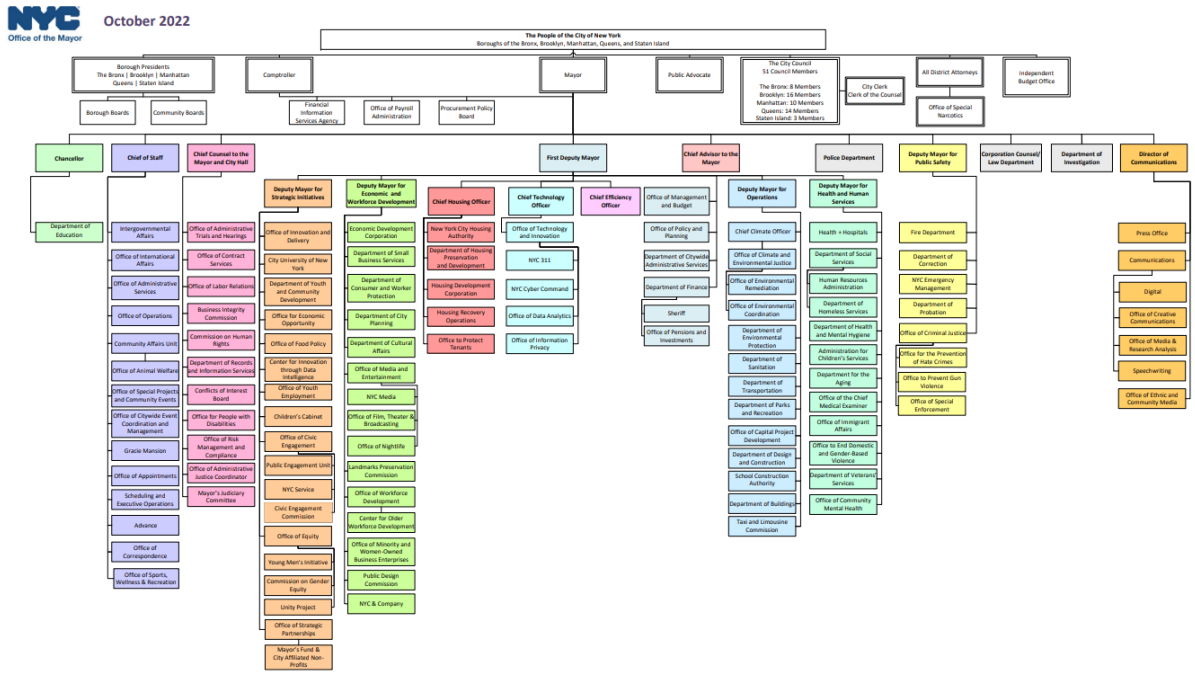
Policy (intervention) aims to shape the environment or change the calculus of the social group it targets

Source: Baker, K. (ND) PAD 680.61: What is Public Policy? *Derived from:*
Ostrom et. al (2014), Peters, B. G. (2014, Sabatier & Mazmanian, (1980,) and Easton (1953).
B Guy Peters (2014) American Public Policy 9th Edition, Thousand Oaks: CQ,
David Easton (1953) The Political System, NY: Knopf
Elinor Ostrom, Michael Cox, and Edella Schlager (2014) An Assessment of the Institutional Analysis and Development Framework and Introduction of the Social-Ecological Systems Framework in C. Weibe and PA Sabatier (eds) Theories of the Policy Process (pp. 267 - 306)

Comment:

A set of complex relationships can be made more understandable with a flow diagram. The objective of the flow diagram should be to help the reader see the key variables and the nature of the postulated relationships. Simplifications are often necessary. The diagram should show the base outline, not all the details.

Example 3: How Much in One Diagram



Source: New York City Office of the Mayor, *NYC Organizational Chart*

Comment:

How much information can be put into one chart? What portion of it can be understood? The answers to these questions differ depending on the audience and the skill and ingenuity of the chart maker. One way to demonstrate complexity in an organization chart is to have a multitude of boxes with lines going in all directions. In large organizations that probably is a good description of reality. But that may not help understanding at every level. The chart presented here is neat and tidy. If one works at it, one can follow the flows, but there are too many boxes presented. The need for all the information is not clear to this reader. Some of the details could have gone in the text or could have been omitted.

A flow diagram or organization chart can be a great way for an analyst to think through a complex problem. It can be as big or complex as desired to establish the elements of the process considered. But that kind of chart is not something to be published except in a technical paper for others interested in technical detail. In most cases, a very complex diagram can be broken into some component parts. If these parts are important, they may well deserve separate treatment.

An analogy to graphs can be made for flow diagrams. When there are three lines on a chart, adding any more should be considered with care. When there are three or four major divisions in a flow diagram, think carefully about the number of interactions you want to add to maintain clarity and reader understanding.

JUDGING YOUR FINAL PRODUCT

Readers tend to be more aware of tables and charts that are hard to read than those which are clear and easy to understand. Carefully prepared materials may go unappreciated. But this helps a reader focus on the ideas behind the chart or table and not on the diagram itself. Making good charts is not a science, but careful work will make a difference. Clarity, simplicity, and order are the fundamental rules of the game.

After constructing a set of tables and charts, a quick review of a set of questions like the following may suggest a few more improvements.

1. Is there a clear central focus for each table and chart?

2. Does the title for each tell the reader what, where and when?

3. How is the table or chart integrated into the text?

4. Are all the numbers, lines, and information really necessary?

5. Does each table fit across the page?

6. Is the source of the information clearly stated if it is not original to you?

7. Have you used a variety of ways to present numerical data? Would a chart work in place of one or more of the tables?

8. Will each table and chart stand by itself and be understandable?

Good tables and charts provide their own rewards. They lead to a clearer understanding to most readers and are worth the effort.