

- Interpreting data
- Using visuals
- Visuals definition

From the Edanz  
"Reading and Reviewing" course



# Reading and interpreting data and graphs

# Table of contents

1. Interpreting data	.....	3
2. Using visuals	.....	4
3. Visuals definitions	.....	5

## Interpreting data

This page presents some general tips for reading and interpreting data in any data visualization. Here, “interpreting” refers to initially understanding the data within the context of the illustration, as well as interpreting the data’s meaning in the field and context of the literature. If you have any questions or require language or publishing support, please email [global@edanzgroup.com](mailto:global@edanzgroup.com).

Step	Tips
1. Identify data presentation	<ul style="list-style-type: none"> <li>Recognize the chart/graphic type</li> <li>Assess what is shown in the illustration</li> <li>Get clues from the title, axis labels, legend, color/line keys</li> <li>Identify independent/dependent variables, setting, system, sample</li> </ul>
2. Study data features	<ul style="list-style-type: none"> <li>Look for data types: quantitative/qualitative, continuous/categorical, means or medians, values or percentages</li> <li>Check units, scales in axes (natural log, <math>\log_{10}</math>, magnification factors) or in photographs (magnification bar, ratio bar)</li> <li>Look for other key features indicated in illustration (arrows, arrowheads, circles, stars), with explanations in legend</li> <li>Compare values, trends, and proportions within and between groups <ul style="list-style-type: none"> <li>Bar heights within a group, heights of each bar type among groups</li> <li>Closeness of data points in a scatterplot to fit a regression line; steepness and direction of line</li> <li>How a line in a line graph changes with time: steepness and direction of line; sharpness of a direction change; any flat region (plateau); relationship between lines and where they cross</li> <li>Distribution of sections in a pie/donut or stacked bar graph</li> </ul> </li> </ul>
3. Look for results of analyses	<ul style="list-style-type: none"> <li>Read the legends for statistical results; look for significance level indicators in illustration which groups they apply to</li> <li>Identify which data/groups are similar, significantly different, or significantly associated</li> <li>Identify any negative, inconclusive, or unexpected (outlier) findings</li> <li>Consider whether relationships are causative</li> </ul>
4. Check your initial interpretations	<ul style="list-style-type: none"> <li>Beware of misreading: <ul style="list-style-type: none"> <li>Cramped/small or busy/complex graphics (eg, network diagrams)</li> <li>Multi-panel graphics</li> <li>Combined or newer formats (eg, bar-and-line graph, bubble plots, radial plots [radar charts], choropleth maps, tree maps)</li> <li>3D graphs</li> <li>Two y-axes</li> <li>Distorted pie charts</li> <li>Similar colors or lines</li> <li>Error bars (eg, standard deviation, standard error, confidence interval)</li> </ul> </li> </ul>
5. Critical thinking	<ul style="list-style-type: none"> <li>Summarize relationships and trends</li> <li>Think of reasons and underlying mechanisms for relationships; then compare with those given in title/legend, abstract, and main text</li> <li>Consider meaning and consistency of all findings together, and in light of what you know and have read elsewhere</li> </ul>

## Using data visualizations with DI<sup>3</sup>KUWDAI<sup>6</sup>

This page suggests a general approach to make full use of the data visualizations in what you read, including graphs, tables, photographs, diagrams, and other images. The bottom-up method and tips of DI<sup>3</sup>KUWDAI<sup>6</sup>, as explained in the table, can help you progress from looking at data to putting new knowledge to practical use in your study, research, assignment, or manuscript. If you have any questions or require language or publishing support, please email [global@edanzgroup.com](mailto:global@edanzgroup.com).

DI <sup>3</sup> KUWDAI <sup>6</sup> Stage	Approach to transform and increase value of data
1. <b>D</b> Data	<ul style="list-style-type: none"> <li>Consider the <b>data type/s</b> and visualization type/s</li> <li>Look for <b>variables</b>, units, symbol/color/line key, scales, groupings, models</li> </ul>
2. <b>I<sup>3</sup></b> Information Interpretation Insight	<ul style="list-style-type: none"> <li>Read title and legends for relevant context (method, results, definitions) and <b>information</b> from data processing, transformation, and analysis (eg, trends, patterns, distributions, group differences/relations, statistics)</li> <li>For each illustration, find corresponding text in Results and Discussion of paper to read highlights, <b>interpretations</b>, <b>insights</b></li> </ul>
3. <b>K</b> Knowledge	<ul style="list-style-type: none"> <li><b>Actively read</b> relevant text; check against illustrations and methods to confirm validity/reliability and logic of findings, explanations, and meaning</li> <li>Check <b>generalizability</b>, scope, and certainty of conclusions and new theories</li> </ul>
4. <b>U</b> Understanding	<ul style="list-style-type: none"> <li>Assess <b>wider context</b>: compare new knowledge with past/current literature</li> <li>Analyze <b>alternative</b> interpretations, limitations, unexpected findings</li> <li><b>Integrate</b> new knowledge into your existing knowledge and mental model of the topic or phenomenon</li> </ul>
5. <b>W</b> Wisdom	<ul style="list-style-type: none"> <li>Think about <b>implications</b> for future research, theory, and practice in your field, beyond your field, and in the wider world; consider ethical aspects</li> <li>Consider how the new knowledge could be directly or indirectly <b>relevant</b> to your own work/study, experiences/skills, and research interests</li> </ul>
6. <b>D</b> Decision	<ul style="list-style-type: none"> <li>Find practical steps to <b>apply</b>, modify, or extend the new knowledge in your future work/study in the best way; formulate strategic and back-up plans</li> </ul>
7. <b>A</b> Action	<ul style="list-style-type: none"> <li><b>Include/use</b> and cite the new knowledge in your work/arguments, with citation; apply new methods to get new data and new knowledge</li> <li>If needed, <b>repeat</b> the tests/procedures of the other researchers, find out more information, reanalyze their original data, or modify their methods</li> <li>If needed, <b>contact</b> the original researchers, for materials, details, protocols, clarifications</li> </ul>
8. <b>I<sup>6</sup></b> Inspiration Ideas Intervention Innovation Invention Impact	<ul style="list-style-type: none"> <li><b>Inspired</b> by your new knowledge or your new study results, modify your arguments or study direction or find new ways to apply the knowledge</li> <li>Develop new <b>ideas</b> to apply to your work or approach</li> <li>Assess new ideas by testing <b>interventions</b>, processes, and variables</li> <li>Formulate <b>innovative</b> research questions, directions, or approaches; apply technology in new ways; form new research collaborations</li> <li><b>Invent</b> or improve products, processes, programs, services, or strategies</li> <li>Improve or upscale the societal <b>impact</b> and usefulness of knowledge</li> </ul>

## Terms used in data visualizations

This table lists the definitions (and some examples) of common features of data visualizations. If you have any questions or require language or publishing support, please email [global@edanzgroup.com](mailto:global@edanzgroup.com).

Term	Definitions / Examples
1. Data	<ul style="list-style-type: none"> <li>Observations or measurements of particular subjects/samples <ul style="list-style-type: none"> <li>Can be numerical, textual, or descriptive qualities that can be based on <b>primary data sources</b> (eg, interviews, surveys, sound/video recordings, pictures, machine images/tracings/readings, diaries, artifacts) and <b>secondary data sources</b> (eg, existing databases, articles)</li> </ul> </li> </ul>
2. Data type	<ul style="list-style-type: none"> <li><b>Quantitative:</b> data that are measurable numerical values <ul style="list-style-type: none"> <li><b>Discrete:</b> data in whole numbers;</li> <li><b>Continuous:</b> data whose number scale can be subdivided</li> </ul> </li> <li><b>Qualitative:</b> “attribute” data that can be observed but not measured</li> <li><b>Categorical:</b> data that can be divided into groups: <ul style="list-style-type: none"> <li><b>Binary/binomial:</b> two groups, opposites (eg, yes/no, correct/incorrect)</li> <li><b>Nominal:</b> categorical data that cannot be ranked (eg, names of things)</li> <li><b>Ordinal:</b> categorical data that can be ordered (eg, scores, age groups, satisfaction level)</li> </ul> </li> <li><b>Parametric:</b> data with parameters/constants that characterize and identify the distribution (eg, Normal)</li> <li><b>Nonparametric:</b> data without a predictable distribution type (eg, skewed)</li> </ul>
3. Dataset	<ul style="list-style-type: none"> <li>Structured collection of data from a particular study, as shown in a particular data visualization (eg, a table); one or more datasets are stored as a database</li> </ul>
4. Data source	<ul style="list-style-type: none"> <li>Where the dataset comes from: usually the study in an article, but can be from a public or private database or another study (named/cited in the article and within the legends of data illustrations)</li> </ul>
5. Chart type	<ul style="list-style-type: none"> <li>Format of data visualization, illustration, or representation; usually has graphical or pictorial elements such as colors, data-point shapes/sizes (<b>scatterplot</b>), lines (<b>line graph</b>), bars (<b>bar chart</b>, <b>box plot</b>), or other shapes/sections (eg, <b>pie charts</b>) but can also be numbers/text in <b>tables</b></li> </ul>
6. Axes	<ul style="list-style-type: none"> <li>Reference lines surrounding edges of a chart: <ul style="list-style-type: none"> <li>In a 2-dimensional chart: bottom horizontal reference line (<b>x axis / abscissa</b>) and left-handside vertical reference line (<b>y-axis / ordinate</b>) are used to plot data (ie, show positions of data points or length of bars); the axes cross at the “origin”, which has (x, y) coordinates of (0, 0)</li> </ul> </li> </ul>
7. Axis labels	<ul style="list-style-type: none"> <li>Text/numbers showing variable/category names, units, scale of each axis</li> </ul>
8. Axis values	<ul style="list-style-type: none"> <li>Numbers showing how an axis is subdivided by quantity (minimum/maximum range, intervals with or without tickmarks [tiny perpendicular lines])</li> </ul>
9. Scale	<ul style="list-style-type: none"> <li>Type of unit of axis values (eg, log scale, millions, thousands)</li> </ul>
10. Variables	<ul style="list-style-type: none"> <li>Factors that can change in a study (eg, traits, properties, conditions): <ul style="list-style-type: none"> <li><b>Independent variable:</b> manipulated/changed by the researcher</li> <li><b>Dependent variable:</b> measured by the researcher</li> <li><b>Controlled variable:</b> held constant by the researcher</li> </ul> </li> </ul>
11. Key	<ul style="list-style-type: none"> <li>Visual explanation of graph categories, elements, or symbols (groupings, colors, lines, shapes, map features); sometimes also called “legend” (not same as figure/table legend)</li> </ul>
12. Legend	<ul style="list-style-type: none"> <li>Text accompanying a visualization to explain features and add meaning; also called “caption”</li> </ul>
13. Error bar	<ul style="list-style-type: none"> <li>Hairlines showing variability (error, uncertainty) of data (eg, SD, SEM, 95%CI)</li> </ul>
14. Outlier	<ul style="list-style-type: none"> <li>Data points that lie outside the normal or reference range of data</li> </ul>