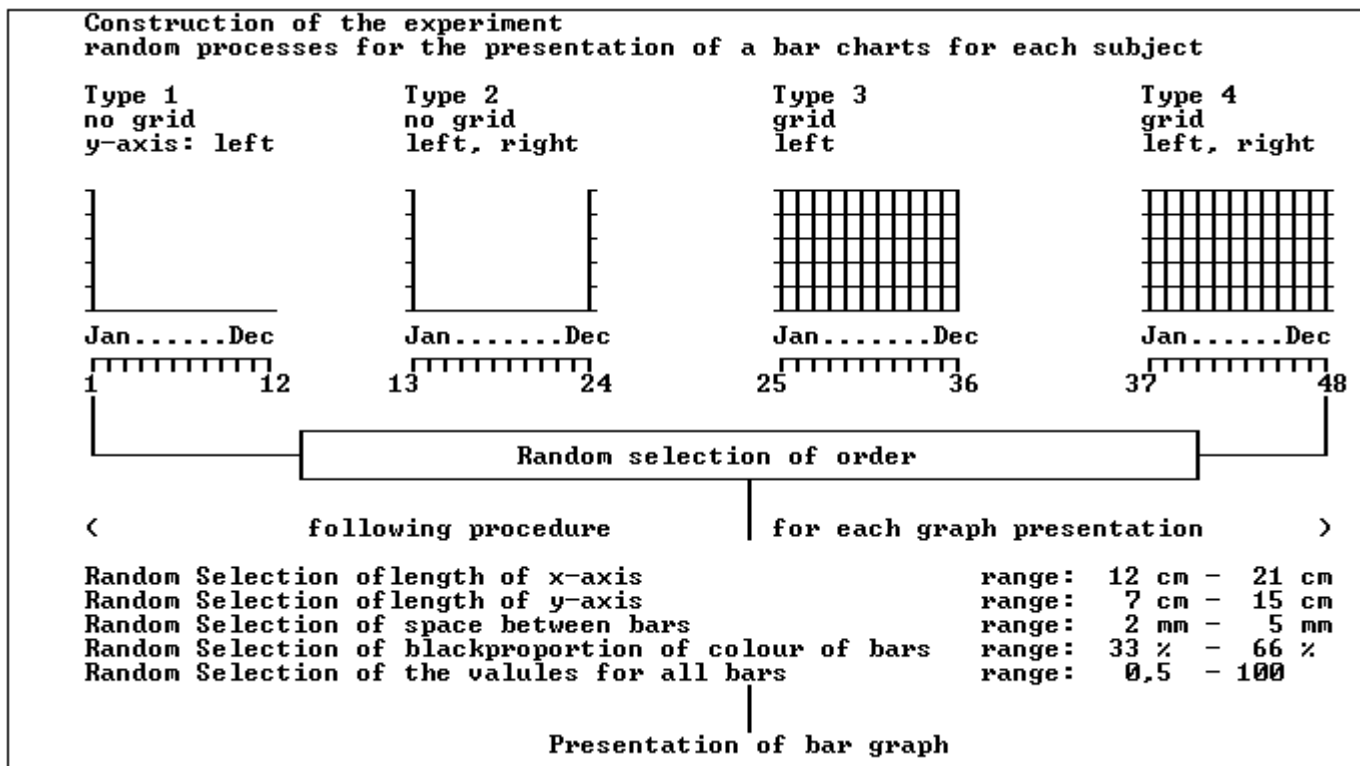


Summaries about former Works of Jacobs

Point Reading in bar chart (Jacobs 1989)

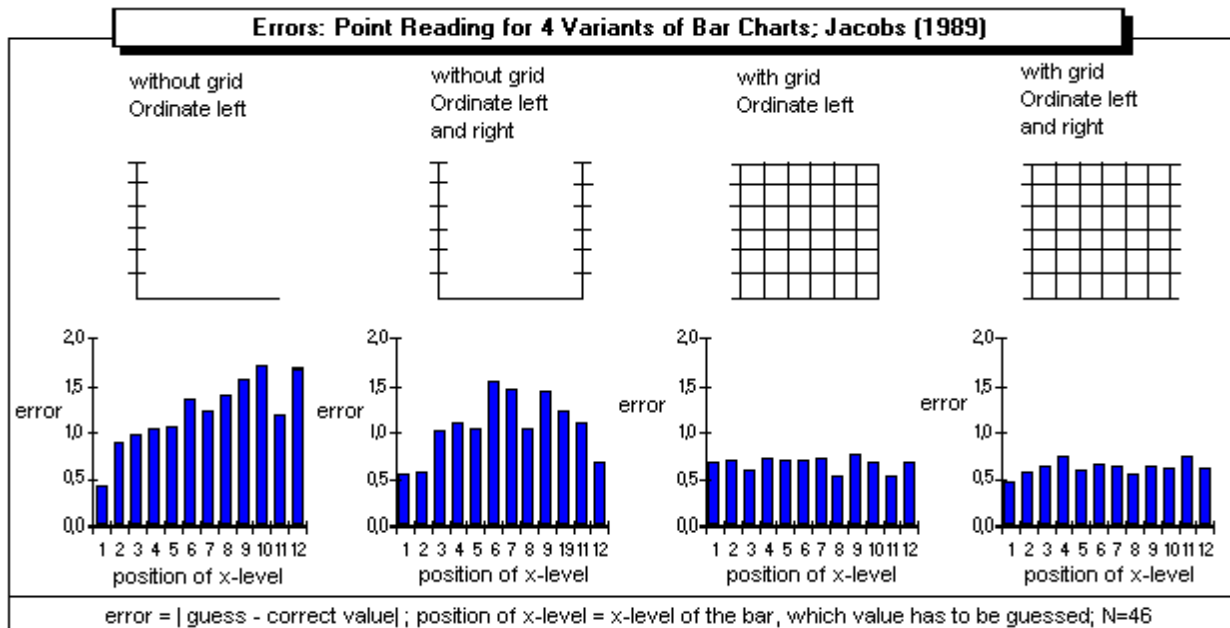
Source: Jacobs, B. (1989). Schnelligkeit und Genauigkeit beim Abschätzen von Größenwerten aus einem Säulendiagramm. Saarbrücken. Arbeitsberichte des Medienzentrums der Universität des Saarlandes, Nr. 2.

48 different bar graphs were shown in the experiment (12 graphs each graph variant). 46 experimental subjects were asked to estimate the values of each category (x-level of the x-axis, here rainfall for a month) with each graph variant (one computer each person). The graphs were generated in the following manner:



The values for each category, the intercepts of y- and x-axis, the distance between the bars and their lightness were determined by chance for each of the 48 bar graphs. The persons were asked to estimate only one value each presentation. The sequence of the presentations was varied by chance. The following data are the means of all the experimental subjects (n=46):

Results



Important Results:

- Both grid variants differ significantly from the bar graphs without grid (this also holds for the times, about 300 msec advantage for the grid variants)
- Errors grow with a rising category position approximately linear with the conventional bar graph (see the left graph).
- An additional ordinate reduces significantly the number of errors and the time with the last categories (but only marginally on the whole).
- The category position loses any influence on the number of errors with a grid.

The results confirm Kosslyn (1994, S.282): "need for a second Y axis I recommend using inner grids, rather than duplicate Y axes, when the reader is to see relatively precise values because I assume that it is easier to trace along a grid line to a single Y axis than visually to track a shorter distance through empty space to a second Y axis."

Additional Results:

During the experiment additional variations (described above) were generated. They lead to the following results:-

- The number of errors decreases with an increasing height of the ordinate, because the resolution turns better.
- There is no significant influence of the length of the x-axis, the distance between the bars, their breadth, their lightness or their length (=value) on accuracy and time.
- Persons differ reliably according to their exactness of estimation and the time needed to estimate.

Comparison: Table versus Graphs (Jacobs 1990)

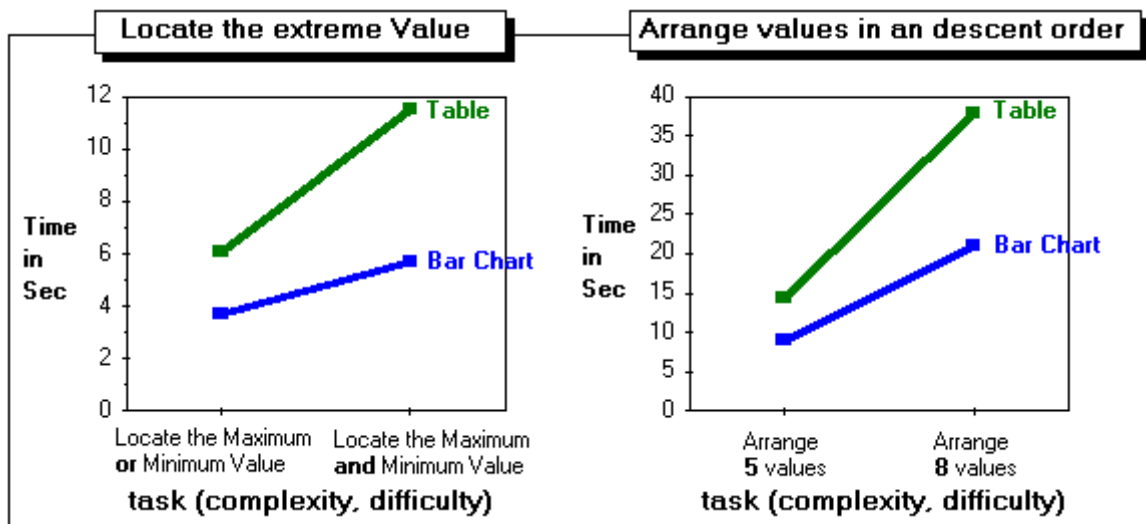
Source: Jacobs , B. (1990). Ein Vergleich der Auswirkungen graphischer und tabellarischer Präsentationsformen auf die Schnelligkeit und Genauigkeit beim Erkennen und Interpretieren statistischer Daten. Saarbrücken. Arbeitsberichte des Medienzentrums der Philosophischen Fakultät der Universität des Saarlandes. Nr. 3

Identifying of Relations between values (Jacobs 1990)

„Bigger" and „smaller" were the relations between values we were concentrated on in this investigation. 40 experimental subjects were asked to identify the maximum or minimum value in a bar graph or a table (each 12 values). The complexity was also varied. The easier question was to identify either the minimum or the maximum value. The more difficult question was to identify both, the minimum and the maximum value.

The second kind of question was to put 5 values (easy task) or 8 values (hard task) in an descent order. Each value was generated by chance for every experimental subject.

Results: Proved superiority of the bar graph to the table



Important Results:

- The bar graph achieved always a significantly higher percentage of right answers than the table.
 - The table needed significantly more time than the bar chart. The times divergences between the kinds of presentation always correspond an effect size of significantly more than 1.
 - The interactions between the kinds of presentation and the complexity according to time could be proved statistically on the promille-level.
-

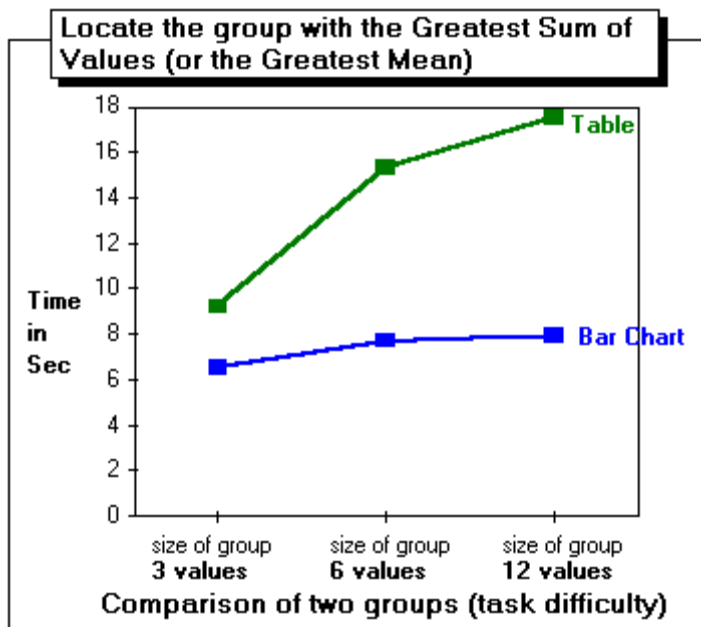
Comparison of Data Groups (Means) within a data serie (Jacobs 1990)

Description of the Experiment:

Data of monthly percipitations of a year were shown. The experimental subjects had to decide, for instance, if there was more percipitation in the first or in the last quarter. To be able to answer this question the experimental subjects had to sum 3 categories for the first and 3 for the last quarter and to compare them with each other. Six months (6 values as a group) and whole years (12 values each group, arranged in juxtaposition) had to be compared later. The Focus of this Experiment: Which kind of presentation achieves the shortest time to answer the question? The basis of this experiment is an design with the factors *kind of presentation* (table, bar graph) and *complexity or difficulty* (3,6 or 12 values each group).

Results

Proved Superiority of the Bar Graph to the Table. (Jacobs 1990)



Important Results:

- Data groups in bar graphs achieve (with similar accuracy) highly significant quicker times (promille-level) than data groups in tables.
- The time divergences between the kinds of presentation grow with rising complexity (in this case with a rising size of groups; significant interaction between the kind of presentation and the complexity on the promille-level).
- The group size 12 was a comparison of 2 dataseries, (for each dataserie a special graph (=juxtaposition)). The time divergence between bar graph and table achieved an effect size of .79.

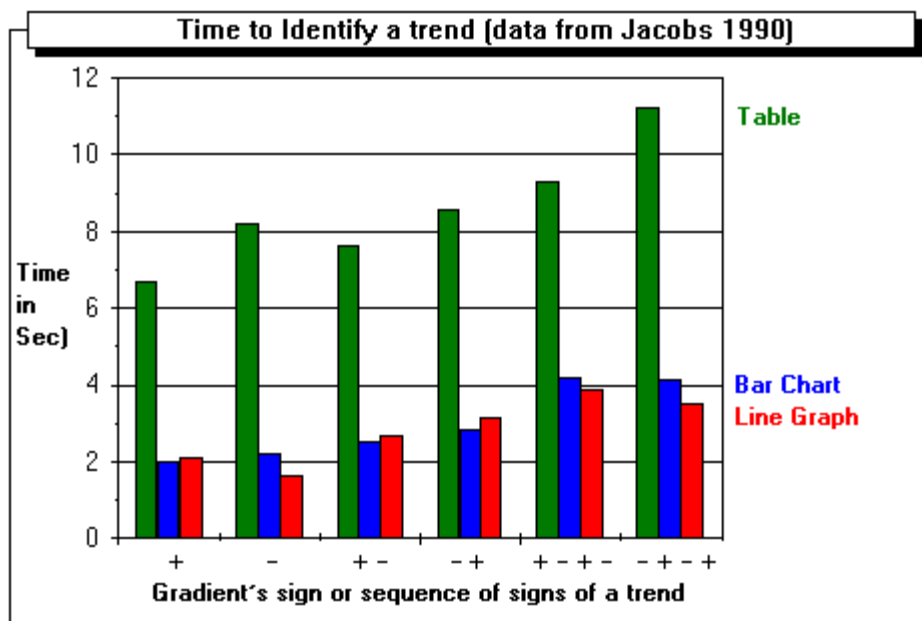
Proved Superiority of the Graphs to the Table (from Jacobs 1990)

The 40 experimental subjects were asked (analogue to the course of Experiment 1) to identify the gradient's sign or sequence of signs of a trend. 21 presentations were shown to each person (3 kinds of presentation x 7 possible trends).

Means concerning the Identifying described above for all trend types (n=40):

	error in %	time in sec
line graph	1	2.82
bar chart	2	2.98
table	11	8.61

Means concerning the Identifying described above for each presentation and each trend types (n=40):



Important Results:

- Both graphical presentations achieve in contrast to the table a significant higher percentage of correct answers (Comparison line graph vs table: Wilcoxon: $z = 3.2$, $p < .01$; Comparison bar chart vs table: Wilcoxon: $z = 3.2$, $p < .01$).
- The subjects need significantly more time to identify the sign(s) with a table than with graphs. The time divergence between the graphs and the table corresponds an effect size of 2.
- No significant interaction between the kind of presentation and the complexity of the trend's gradient can be proved statistically.
- Bar graph and line graph achieve similar values of accuracy and time.