

Cause-and-Effect Diagram

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Summary

The **Cause-and-Effect** or **Fishbone Diagram** illustrates the causes of a problem or effect by creating a diagram resembling the skeleton of a fish. It is often used to help identify the factors responsible for a problem that needs to be corrected. The diagram may also be used to display the variables that have an effect on a response that is to be optimized.

Sample StatFolio: *fishbone.sgp*

Sample Data

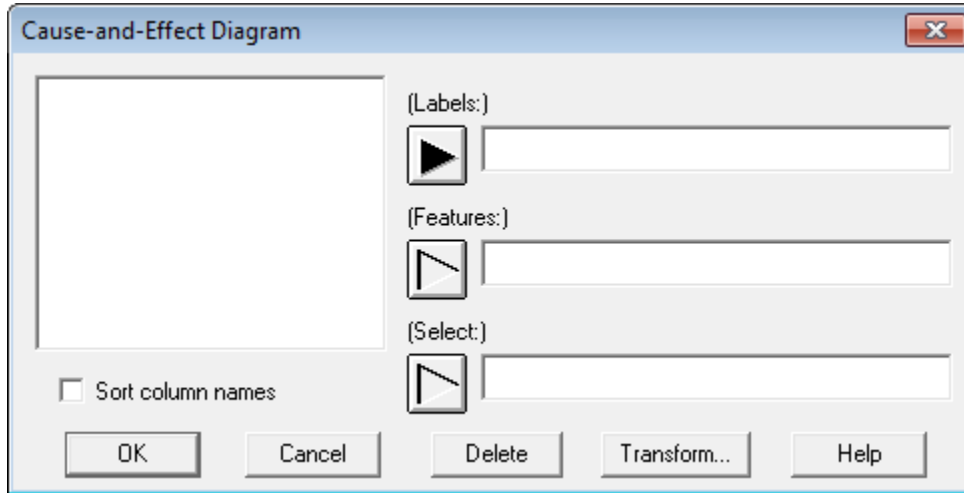
The file *fish.sgd* contains the definition of a cause-and-effect diagram created to illustrate why defects were occurring in printed circuit boards. The example is from Montgomery (2005). The table below shows a partial list of the data in that file:

<i>Labels</i>	<i>Features</i>
Circuit board defects	Size1:8
Raw card	Size2:9
.Short circuit	Size3:7
.Shroud	Size4:5
.Moisture content	Color1:32768
..Time	Color2:255
..Temperature	Color3:8388608
Solder process	Color4:128
.Splatter	Style1:1
.Chain speed	Style2:1
.	Style3:0
.Wave pump	Style4:0

The first column holds all of the labels in the diagram. The second column holds formatting information. This file is not meant to be created by hand. Rather, the procedure contains a wizard that helps users build the diagram interactively.

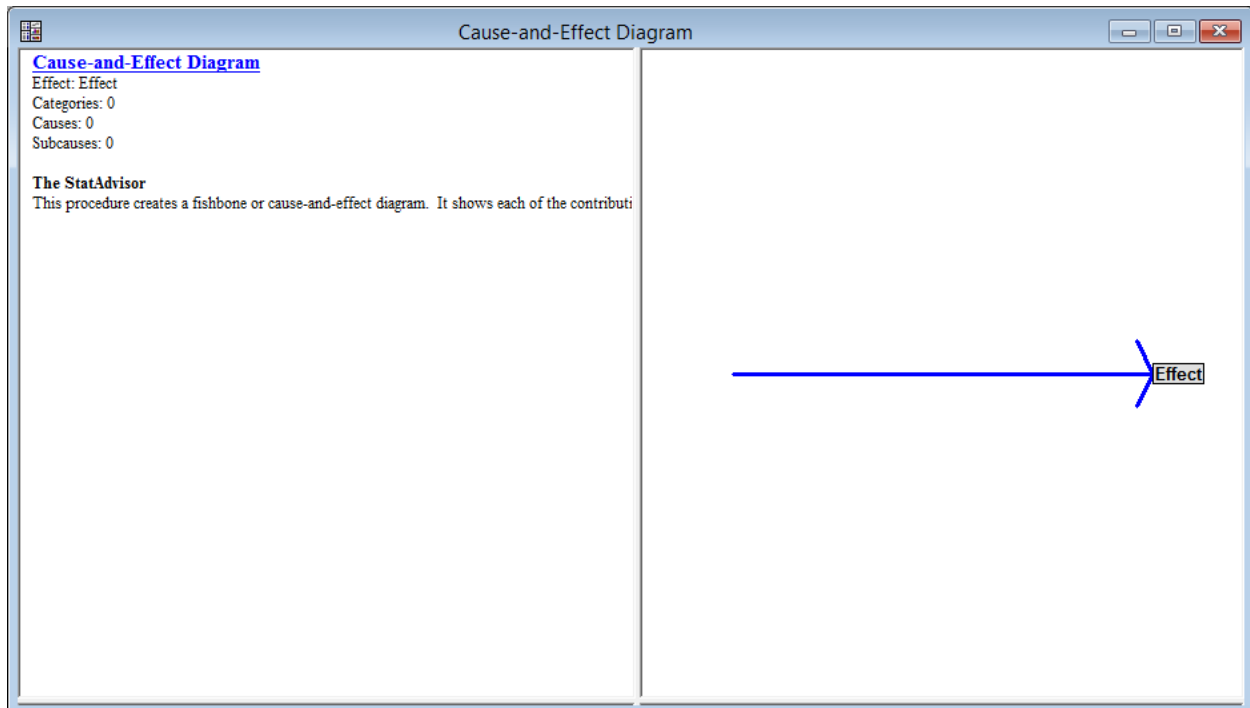
Data Input

The columns used to store the labels and features are specified on the data input dialog box shown below:

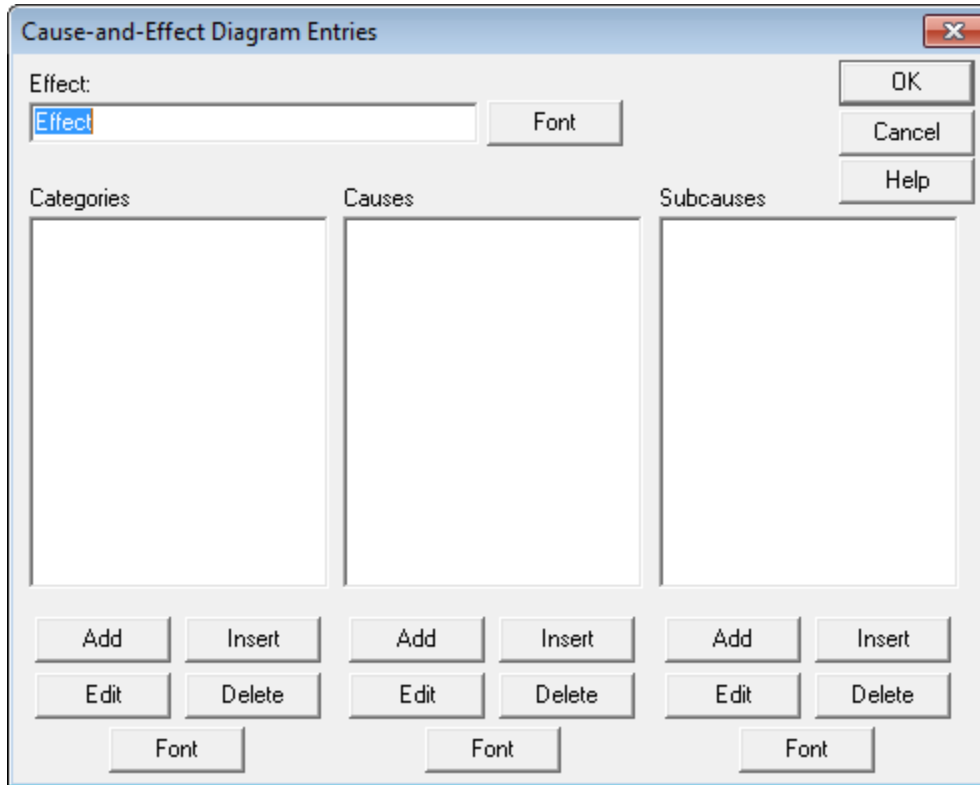


If you are creating a new diagram, leave all of the fields blank and press *OK*. If you have previously created a diagram and saved the definition of the items in that diagram, enter the column names in your datasheet that contain those definitions. (Saving the definition of a cause-and-effect diagram is discussed later in this document.)

The Cause-and-Effect diagram is displayed in a standard analysis window as shown below:



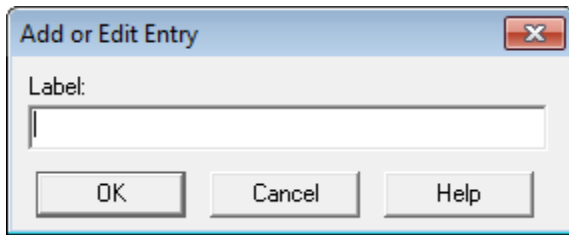
To create a new diagram, press the *Analysis Options* button on the analysis toolbar to display the dialog box shown below:



You should enter:

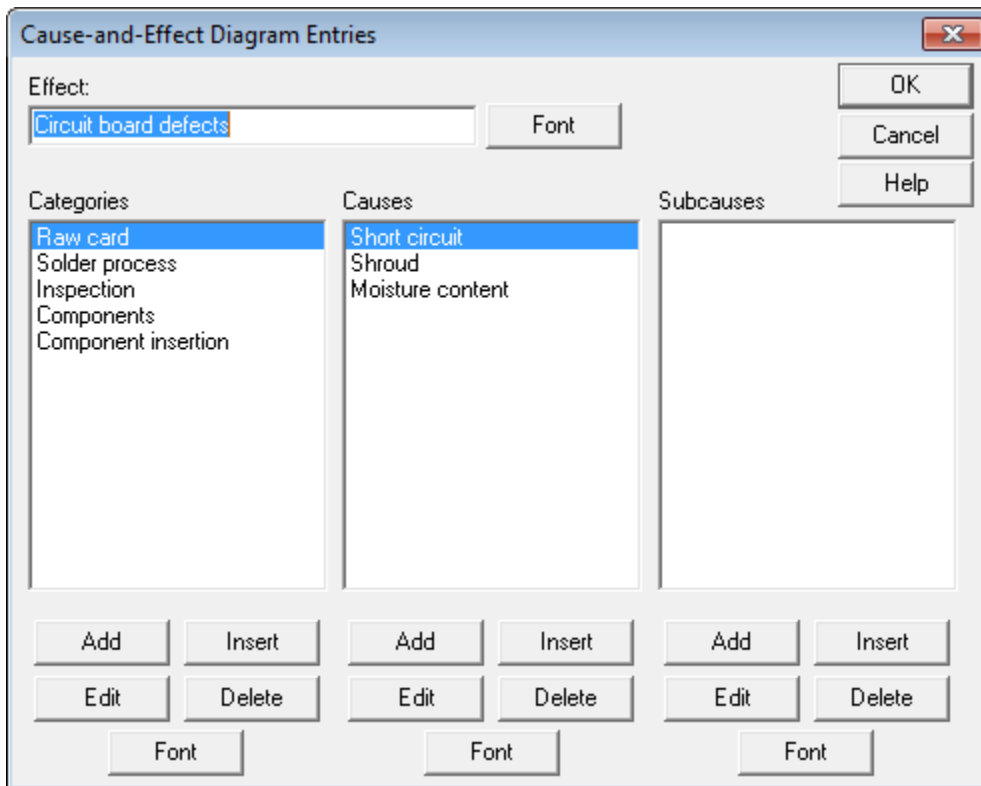
- **Effect:** a label for the problem or effect to be placed at the far right of the diagram.
- **Categories:** labels for the major ribs of the diagram.
- **Causes:** one or more primary causes for each category.
- **Subcauses:** sub-categories of each primary cause (if any).
- **Add:** press to add an entry to the bottom of the indicated list.
- **Insert:** press to insert an entry above the selected item.
- **Edit:** press to change the text of the selected item.
- **Delete:** press to delete the selected item *and all of its associated entries*. Deleting a category also deletes its associated causes and subcauses. Deleting a primary cause also deletes its associated subcauses.
- **Font:** press to change the font for all the labels of a particular type.
- **OK:** press to save any new entries and close the dialog box.
- **Cancel:** press to discard any new entries and close the dialog box.

When adding or changing an entry, the text for that entry should be typed in the dialog box shown below:

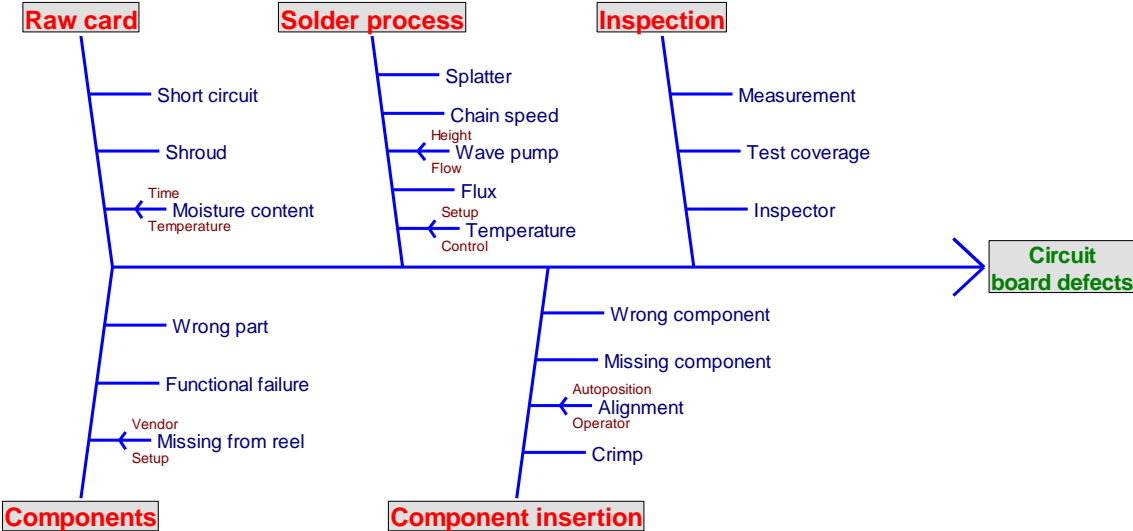


Example

Montgomery (2008) presents a cause-and-effect diagram related to the occurrence of defects in circuit boards. As shown in the dialog box below, the causes for those defects are divided into 5 main categories:

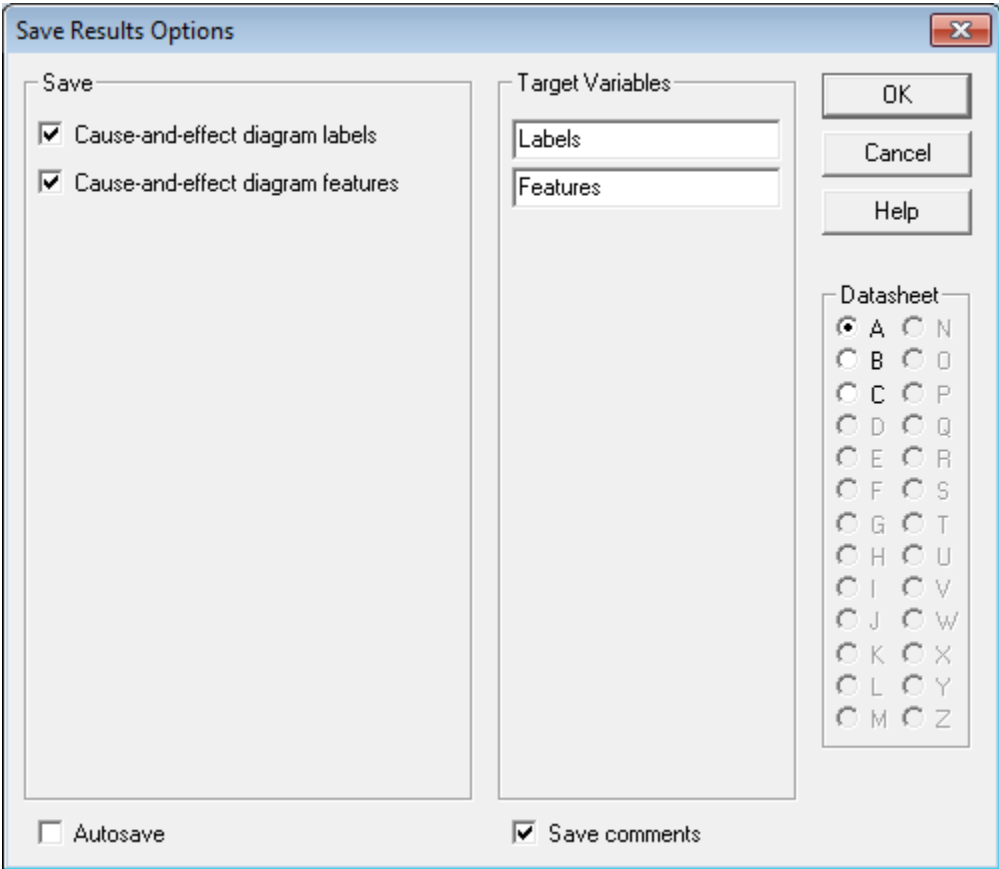


The first category, "Raw card", has 3 causes. As each entry is added to the dialog box, the cause-and-effect diagram will be automatically updated. After making all of the entries and changing the colors of some of the fonts, the diagram appears as shown below:



Saving Cause-and-Effect Diagram Definition

To save the labels and features for a new cause-and-effect diagram, press the *Save Results* button on the analysis toolbar. This will display the dialog box shown below:



This dialog box allows you to specify the names of 2 columns in which the diagram labels and features will be saved. If you select both variables and press *OK*, the information will be saved in your datasheet.

References

Montgomery, D. C. (2008). Introduction to Statistical Quality Control, 6th edition. New York: John Wiley and Sons.