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Galileo*Plot:

User Manual and Tutorial

Rev. June, 1993

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PLOT

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Galileo*PLOT

The main reason most analysts use a perceptual mapping (or multidimensional scaling program) is to obtain a visualization of their data. Often, the complex relationships among a set of words or numbers can be more easily understood when they are displayed in the form of a map.

Two distinct steps are always involved in constructing any map. First, some mathematical procedure is required to transform raw data into a set of coordinates which can be plotted as a spatial diagram. And secondly, these coordinates must be transformed into the actual picture we can see.

There are many different analytic procedures that can produce a set of coordinates. These include: non-metric multidimensional scaling, metric multidimensional scaling, principle components, discriminant analysis, and correspondence analysis.

Regardless of the method used to obtain a set of coordinates, Galileo*PLOT can read these coordinates and generate a technically superior map, and then be used to conduct several value-added analyses which are not obtainable from any other program. Let us now review some of the capabilities of Galileo*PLOT

Running the DEMOPLOT Program

DEMOPLOT is the demonstration version of **Galileo*PLOT**. It has the full functionality of **Galileo*PLOT**, but is only able to read the demonstration data files supplied with the program. To run **DEMOPLOT**, insert the diskette into one of the drives on your computer, then re-set your default drive to that drive. For example, If you put the diskette in drive A, type **A:** and then press the **[ENTER]** key. Then type the word **DEMO** and then press the **[ENTER]** key.

There will be a brief pause while your computer loads the program from the diskette into RAM. The program will run much faster if you copy the files on your diskette into a directory on the hard drive, but will still work just fine even on your floppy drive. After a few moments, **DEMOPLOT** will produce a three-dimensional perceptual map. Mapped on the coordinates are three concepts -- **TERRA**, **PRECISION**, and **SOFTWARE**. To the left of the map is a menu of the basic commands you use to run Galileo*PLOT.

Running Galileo*PLOT

Galileo*PLOT can either be run as a stand alone program or as part of the Galileo System.

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To run **Galileo*PLOT** by itself, simply type

c:\galileo\runner\plot and then press the **[ENTER]** key

If you have put the \galileo\runner directory into your path, you will only have to type

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and then press the **[ENTER]** key.

If you are operating **Galileo*PLOT** within the Galileo System, **Galileo*PLOT** is option 13 on the menu at the left of the Galileo screen. Simply type 13, and then press the **[ENTER]** key. **Galileo*PLOT** will instantly produce a three-dimensional perceptual map. Mapped on the coordinates are three concepts -- **TERRA, PRECISION, and SOFTWARE**. To the left of the map is a menu of the basic commands you use to run **Galileo*PLOT**.

Selecting a file to display

Press the **[F1]** function key (Get Coordinate File) and at the prompt, type **SHOBIZ.CRD** and then press the **[ENTER]** key. This command tells the program to make a map using the coordinates contained in the file SHOBIZ.CRD and display the image in the window at the right side of the screen. (You may name a coordinate file anything you wish, but at Terra, we end all coordinate file names in the qualifier .CRD)

Magnifying and Shrinking the Plot

What you are looking at is a three-dimensional plot containing the names of several popular entertainers, and a set of attributes that might be used to describe these entertainers. At first glance, you might find this image too small to read comfortably. In an ordinary plotting program, if this happens, well, there's not too much you can do about it. But with Galileo*Plot, there's no problem; **Galileo*PLOT** has the capability to increase the size of the visual display, just press the **[m]** key on your keyboard.

"M" stands for "magnify," and **Galileo*PLOT** will then ask you how much you want to magnify the picture using the prompt (GAIN?).

Type in the number **1.5** and then press the **[ENTER]** key.

Galileo*PLOT will produce a picture that is 1.5 times larger than the first image you saw.

You can "blow-up" the size of the image produced by **Galileo*PLOT** to any size, but as the image becomes larger, you'll notice that some of the labels (like Madonna) will be pushed off the screen. If you would like to view this example without losing any of the labels -- press the letter **[m]** and type **1.25**

Interpreting the Plot

The image you see is a 3 dimensional perceptual. To help you visualize the third dimension, a "floor" is projected on the xz plane, and "stems" have been dropped from the name of each entertainer to the floor to help you grasp the location of each concept on the third (z) dimension.

If the entertainer's name is under the xz plane, the stems are raised up to meet the floor. Where each stem touches the floor, a little "foot" -- i.e., a small cross -- is drawn.

Some people have a knack for reading maps, while others have a hard time judging spatial relations. Fortunately, the map made by **Galileo*PLOT** is quite easy to understand, and is interpreted in the following manner: concepts that are highly associated (or similar) are located near each other; the further apart the concepts, the less similar (or associated) they are.

To the right-side of the space you'll see the concept FEMALE, and clustered close to FEMALE are MADONNA, JANE FONDA andMICHAEL JACKSON (?)

On the left side of the screen, you'll find the concepts MALE, GEORGE BURNS and WALTER CRONKITE. Notice that close to GEORGE BURNS and WALTER CRONKITE is the concept OLD. Close to WalterCronkite is also the concept RELIABLE, and close to GEORGE BURNS is the concept FUNNY.

Near the top of the map you'll find the concepts PUNK and THE RAMONES. You'll also notice the concept YOURSELF is located in left-center of the plot.

These coordinates were made by the perceptual mapping program Galileo*MICROGAL, and represent the responses of one middle-aged male respondent. This man ("You" in the plot) is between

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GEORGE BURNS and WALTER CRONKITE, who are older than he is, and THE RAMONES, MADONNA, and MICHAEL JACKSON, who are younger. He's not too far from JANE FONDA, though, who is definitely in his age group.

Many analysts have been led to believe that you must have several cases to make a good perceptual map, but this plot was made from the responses of JUST ONE PERSON.

Alternative Displays -- 2D and 3D

You might not be accustomed to a 3 dimensional map -- in fact, most conventional mapping programs can only make a 2 dimensional plot. If you would like to see a 2 dimensional representation, press the [F6] function key. This map is definitely easier to read, but also provides a great deal less information than the 3-D version.

You can toggle back and forth between the two dimensional and three dimensional display by pressing the [F6] function key. After toggling a few times, return to the 3-D mode.

Comparing Maps -- Rotations and Reflections

There's a lot more to learn about **Galileo*PLOT**, but it might be best to leave this example and choose another. Press the [F1] function key again and at the prompt, type FEMALES.CRD and then press the [ENTER] key.

What you're seeing is a map representing the opinions of about 150 female voters living in and around Albany, NY about the candidates and issues involved in the 1988 presidential election. These coordinates were also made by the Galileo method, this time by the renowned Galileo Version 5.5 mainframe program. We think it provides a classical picture of the political spectrum.

At the far left we see the concepts LIBERAL and, almost at the same spot, DUKAKIS. Near these two concepts, you will also see the concept PRO-CHOICE.

On the right side of the screen, you will see the concept CONSERVATIVE, along with the concepts RONALD REAGAN and GEORGE BUSH. Near the top and at the back of the plot is the term EVIL, and, closest to EVIL (surprise!) TAXES.

If you study the picture carefully, you will notice that the perceptions of these women follow

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conventional political wisdom. You'll also notice that the concept YOURSELF lies toward the left of the plot, closer to DUKAKIS than to BUSH. Women in Albany and environs voted heavily for Dukakis in 1988. Albany is a traditionally Democratic city, and has a Democratic mayor for the past 50 years!

If the plot is not clear to you, try magnifying and shrinking it until you can see every concept clearly. (How clear the plot is depends entirely on your computer...the **Galileo*PLOT** program studies your computer and automatically makes the most precise plot your screen is able to display.)

Remember, type **[m]** and then press the [RETURN] key to change the size of the display -- typing a number larger than 1.0 will magnify the picture, while a number smaller than 1.0 will shrink it. If you want to view the image in 2 dimensions instead of 3, press the **[F6]** function key.

Now you can learn something very important about the real power of **Galileo*PLOT**. Press the **[F1]** function key again. This time at the prompt, type **MALES.CRD** and then press the **[ENTER]** key.

What appears now is a map representing the opinions of about 150 men drawn from the same geographic area (Albany, NY). If you study this map carefully, you will notice that *the men's plot is exactly backward from the women's plot*.

Look at the concepts CONSERVATIVE, REAGAN and BUSH. They are now on the left-side screen, before, they were on the right-side of the screen. Similarly, the concepts DUKAKIS and LIBERAL are on the right-side of the screen; before, they were on the left.

Does this mean the men's opinions were radically different from the those of the women? Not exactly.

What few people realize about perceptual mapping algorithms is that none of them -- not even the extremely precise Galileo algorithm -- have any idea what orientation people prefer to view. In the world of mapping, there is no such thing as UP, or DOWN, or LEFT or RIGHT.

It has only been quite recently that people have agreed (on an international level) to draw maps of physical space with "north" at the top of maps and "east" at the right. But no multidimensional scaling or perceptual mapping software "knows" about these agreements.

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Perceptual mapping programs are like cameras dangling on a string. They can make an accurate picture, but the direction the camera is facing at the moment the picture is snapped is determined by the shape of the space without any regard for conventional standards. Before you can compare any two "pictures" made by a perceptual mapping program, you must adjust for the arbitrary orientation of the pictures.

Galileo*PLOT makes this simple. Just press the **[right arrow]** key on your keyboard. It looks like this [->]. At the prompt, type **180** and then press the **[RETURN]** key.

Galileo*PLOT will rotate the picture 180 degrees to the right. Now you'll see the men's map using the same orientation that was used to display the women's map.

If your memory serves you well, you will see that both the men and the women pretty-much agree about where the candidates and issues lie in the space. But you should also notice one very important difference, the location of the concept **YOURSELF**.

In this (the men's) space, the location of **YOURSELF** is considerably further to the right than it was in the women's space. That is, these men positioned themselves much closer to concepts **CONSERVATIVE** and **BUSH**.

Previous research has shown that political candidates positioned closest to the concept **YOURSELF** tend to gather more votes. Consequently, after viewing this map and comparing it the women's map we discussed earlier, we would conclude that the men preferred (and were more likely to have voted for) **BUSH**, while the women preferred (and were more likely to have voted for) **DUKAKIS**.

The World as we Know It

There is still a great deal to tell you about what **Galileo*PLOT** can do, but let's leave this example and turn to another. Press the **[F1]** function key again, and at the prompt type **WORLD.CRD** and then press the **[RETURN]** key.

What you see now is a map of the world. But its looks are deceiving.

Do you REALLY think that Cairo and Johannesburg are close to each other?

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How about Havana (hot hot hot) and Toronto (brrrrr!)?

Paris and Rio de Janeiro?

What's going on? Let's start simplifying the picture.

Press the **[F6]** function key to change to a 2 dimensional display.

YIPES! That didn't help much did it?

Do you think Cairo, Johannesburg and Moscow(!) are near each other?

How about Sidney and Tokyo?

And why are Havana and Tokyo right on top of each other?

Now for some really bad news.

*This is not a perceptual map based on human judgments of distance. This plot is based on the actual straight-line geographic distances between these cities. The coordinates were produced using Galileo***MICROGAL** and are accurate to the nearest mile! Yet the map you see on the screen, while technically correct, is hard to read and quite misleading. How can this be?*

Try this.

First, press the **[up arrow]** key and at the prompt type **90** and then press the **[ENTER]** key. This will rotate the plot 90 degrees upward.

Now, press the **[right arrow]** key and at the prompt type **180** and then press the **[ENTER]** key.

This string of commands has changed the orientation of the map and provided you with a view of the world as it would look if you were travelling in a satellite above the Pacific Ocean.

If you're like most Americans and have no sense of geography, get a globe (preferably a transparent globe) and look at it from this perspective. This view of the world should makes a little

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more sense to you, but there is still a small problem with the display.

Stereographic Projection

To grasp the problem, you'll need to put on the stereographic glasses provided with this program. Place the blue lens over your right eye, and the red lens over your left eye.

Press the [F6] function key to change to a 2 dimensional plot. Then, press the [F9] function key to switch to a stereographic projection.

Put on the glasses.

It will probably take you a few moments to stop laughing and adjust to wearing the glasses, but once you do, the map should take on a solid or 3 dimensional perspective.

If you carefully study the plot, you will notice that MOSCOW, PARIS, and CAIRO are "close" to you, while TORONTO, LAS VEGAS, and HAVANA are "far" from you. This is wrong, or, perhaps more accurately, unconventional. What has happened is that the third dimension (depth) has been "reflected."

Walk away from the computer, and go to the nearest mirror. Look in the mirror, and notice that what you see is, well, a MIRROR IMAGE of reality. But notice that *the distance relations in the mirror, although backward, are identical to the distances in real life*. NO multidimensional scaling or perceptual mapping program -- not even the super precise Galileo program -- can tell the difference between "mirror world" and the real world.

Often (about one chance in 2) ANY perceptual mapping program will produce mirror coordinates instead of "real" coordinates. In this case, the scaling solution has reflected the third dimension, giving a mirror image of the depth.

Galileo*PLOT was designed to deal with reflection, and provides you the ability to reflect any map, and thereby increase the number of perspectives from which you may study it.

With your stereographic glasses on, type the letter [r] and then press the [ENTER] key. "R" stands for REFLECT. The prompt will ask you the number of the dimension you want to reflect. In **Galileo*PLOT**, the number 1 represents the x axis, 2 represents the y axis, and 3 represents the z axis.

Since we want to reflect the map along the z axis, type **3** then press the **[ENTER]** key. **Galileo*PLOT** will reflect the map, and suddenly the world looks a little more familiar.

Mathematical Analysis: Moving Beyond Mere Appearances

The examples we have discussed thus far were not only developed to show you what **Galileo*PLOT** can do, they were also meant to caution analysts who interpret maps by simple visual inspection. While we all know that maps that "look good" tend to get used more often than maps that don't, you must keep in mind two things:

- (1) even "bad looking" maps still contain a considerable amount of technically correct information that is available for analysis; and
- (2) sometimes, "good looking" maps can be extremely misleading.

This is because most complex(multidimensional) relationships cannot be fully expressed in just 2 or 3 dimensions. That is, the map is incapable of giving you complete information about the nature of these relationships. In as much, important information may be difficult to grasp, appear distorted, or (worse) completely hidden from view.

While perceptual maps can be very useful, drawing conclusions by only viewing the picture is (pardon the pun) short-sighted, and can lead to serious problems. Fortunately, **Galileo*PLOT** has some very powerful mechanisms to keep you from being misled by appearances. Press the **[F1]** function key again, and this time call up the file **TOTAL.CRD**

This perceptual map is a representation of the opinions of both the men and women voters we discussed earlier. We simply combined the two data sets, and made a perceptual map using **Galileo*MICROGAL**.

Press the **[right arrow]** key, then press the **[ENTER]** key, and at the prompt type **180 [ENTER]**. This string of commands will rotate the map so that concept LIBERAL now appears on the left-side of the screen, and the concept CONSERVATIVE is on the right-side of the screen.

Those of you who like to use political jargon like... "the conservative right-wing", or "leftist liberals" should enjoy the intuitive logic underlying this map.

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Suppose you've been retained by the Bush campaign to provide strategic advice about how to win in Albany. Using this map you notice that the concepts HONEST and LIKEABLE are located near the concept YOU.

You know from previous research that these attributes are important to voters, so you postulate that one way of improving Bush's chances of winning might be to try and somehow associate him with these two attributes.

Now, even though several paragraphs have passed since our very stern warning, you remember that even the best perceptual maps can often be misleading, masking complete information, making things which are really quite far apart seem close together. *So you think to yourself, is there a way to check your intuitive judgments in an objective way? You bet!*

Press the **[F4]** function key, and the program will ask you to name the START concept (or concepts). The START concept(s) are the concepts you wish to reposition (or move).

Type the word **BUSH** at the prompt, then press the **[RETURN]** key, then press the **[F5]** function key.

The program will display a prompt which ask you for a TARGET. The TARGET is the location toward which you want to move. At the prompt, type the word **YOU**, then press the **[RETURN]** key, and then press the **[F5]** function key.

Finally, the program will ask you to enter the MESSAGE concepts. The MESSAGE concepts are the one you wish to associate with the START concept. Type the word **HONEST**, press the **[RETURN]** key, then type the word **LIKEABLE**, press the **[RETURN]** key, and then press the **[F5]** function key.

The program will almost instantaneously evaluate the strategy you have concocted, using the complete information about all concept relationships contained in the *entire* coordinate matrix -- not only the first three dimensions from which the visual display is derived. The message you see displayed on the left-side of your screen provides you with information on the potential effectiveness of your strategy. The program has run a simulation of the strategy, and then displayed the projected result.

When looking at a two dimensional euclidean projection of what is perhaps a fifteen, twenty

or even more dimensional non euclidean space, even the most brilliant analyst may often be misled.

But no matter how many dimensions may underlie a space, and regardless of whether the space is euclidean or riemannian, the Strategy algorithm will not be misled.

These results show that the distance between the concepts BUSH and YOU is 57.33 units. It also tells you that a strategy which attempts to associate BUSH with the concepts HONEST and LIKEABLE, if successful, will leave you 29.6 units from your target (the concept YOU). Finally, it tells you that 29.6 units is 50.69 percent of the present distance, which means that your strategy has the potential to improve Bush's position by about one-half.

The important point to keep in mind here is that these procedures can produce meaningful, useful results regardless of the appearance of the visual display. *Whether you find the plot interpretable or not is largely irrelevant*; the strategy algorithm uses information contained in the coordinate matrix, and so, can always be used to perform advanced analyses and provide you with effective strategic advice. Moreover, the program can do this no matter how many dimensions are in the space -- or even if the space is non-euclidean.

(To exit STRATEGY, press the [F7] function key.)

Displaying Crowded Spaces

Until now, most perceptual maps were made using only a few concepts. This was because maps which displayed a lot of concepts were often quite difficult (and costly) to make. Further, when working with a lot of concepts, maps like these often become very crowded and difficult to read. But now, new analytic technologies (like neural networks) are making it quite easy to make maps containing scores of concepts. More importantly, as the global economy grows and our world becomes increasingly complex, the need to make brand (or perceptual) maps that can contain a large number of concepts is becoming more and more acute.

To see how **Galileo*PLOT** can help you deal with complex images, press the [F1] function key, type **CITIES.CRD** and then press the [ENTER] key.

What you will see is a perceptual map made from text. This "text" represents the verbatim comments of three people describing Buffalo, Detroit and San Diego. This text is on your diskette in the file CITIES.TXT. (If you've installed your software, it's in the \GALILEO\DATA directory.)

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A computer program called Galileo*CATPAC read these interviews, and then created the coordinates contained in the file CITIES.CRD.

As you can see, there are three distinct clusters of concepts in this plot, but some of the concepts are so close together they can't be read at all. Fortunately, using Galileo*PLOT, you can simplify and clarify the picture very easily. Here's how:

First, magnify the space by pressing the **[m]** key, type **2** and then press the **[ENTER]** key.

Now, rotate the map to the right 45 degrees. Do this by pressing the **[right arrow]** key, then type **45** and then press the **[ENTER]** key. This should clear up the SAN DIEGO cluster very nicely.

Now rotate the map upward 45 degrees -- using the **[up arrow]** key, then typing **45** and then pressing the **[ENTER]** key.

You should see three distinct clusters. Within each cluster is the name of a city, and the attributes most associated with each city. (You can review the interviews by examining the file CITIES.TXT, and you'll find that the solution is remarkably accurate.)

Now press the **[F2]** function key. This command allows you to control 2 features: (1) how fast the map is made, and (2) the number of concepts that will be displayed.

The first prompt will ask you if you want to use the quick (Q) or slow (S) display option. Type the letter **[s]** for slow, and then press the **[ENTER]** key.

At the next prompt, the program will ask you if you wish to review concepts by their labels (L) or their number (N).

For now, lets use the label (L) option... so type the letter **[L]** and then press the **[ENTER]** key.

Almost immediately, the program will list the first concept-label contained in the coordinate file, and wait for you to make a decision on whether or not you want this concept displayed in the plot.

If you want the concept displayed, you would press the **[F2]** function key to skip to the next concept-label. If, however, you do not wish to have the concept displayed in the map, you would first press the **[F1]** function key, which tells the program to suppress this particular concept-label, and then

press the [F2] function key to skip to the next concept-label.

You can tell if a concept will be displayed or not by the asterisk which precedes the concept-label. If an asterisk precedes the concept-label, that concept will be included in the display. If the asterisk is not present, the concept will be deleted from the display.

Once you have made a decision regarding each concept, the program will begin creating the map. With each tap of any key, a new concept will be added to the map. Concepts are added to the display, one by one, until all the concepts that you requested be displayed have been added to the map.

This "slow display" option can be quite useful when you want to study the relative location of concepts. Just remember, "looks" aren't everything.

Summary

This brief demonstration only touches on a few aspects of the capabilities of **Galileo*PLOT**. **Galileo*PLOT** greatly expands the usefulness of perceptual maps, and provides new and powerful ways to use them. Rather than simply viewing a single two-dimensional map, usually printed on paper, that may or may not be oriented in the most convenient and viewable way, **Galileo*PLOT** lets you *interact* with the plot. You can turn it around, blow it up or shrink it, flip it over, reflect it, remove or add concepts, move closer to it or farther from it, and see it in ways that are just not possible without **Galileo*PLOT**. And, as you form judgments about distances and strategies for repositioning products or candidates, you can test them to surpassing precision with **Galileo*PLOT**'s built in proprietary mathematical routines.

We encourage you to call up any of the demonstration plots provided on the diskette and experiment with the features we have discussed.

Of course, **Galileo*PLOT** has context-sensitive on-line help, and you can learn a great deal about the program by simply pressing the [F3] function key at any prompt.

Input to Galileo*PLOT

Galileo*PLOT reads coordinate files in any standard ASCII format. The program expects to find four elements in the coordinate file: the *format header*, the *coordinates*, the *concept labels*, and

the standard errors.

The format header

The format header is a standard format statement, followed by three 3-digit integers which give, respectively, the number of concepts, the number of real dimensions, and the total number of dimensions. Following these numbers a title up to 40 characters may follow:

(8f10.4) 018012018 Auto Test Data .

This header says that the coordinates will be found in (8f10.4) format, that there are 18 concepts, 12 real dimensions and 18 total dimensions in the space, and that the title of these coordinates is "Auto Test Data."

The Coordinates

Following the header come the actual coordinates, in the format described in the header.

The Concept Labels

Following the coordinates, Galileo*PLOT expects to find the concept labels, one per line, in A40 format.

The Errors

Several Galileo programs are able to calculate confidence intervals around the location of points in the perceptual map. If these are available, they are arrayed following the concept labels in (11F7.3) format. Galileo*PLOT uses these errors to determine the size of the circle used to represent the concept's position. If these errors are not present, Galileo*PLOT provides default values.

A Sample Coordinate File

```
(6F12.4) 7 4 7DESERT PREFERENCES
56.1659 -4.6299 -6.3528 3.1023 .9094 .7301
20.6566
-49.8766 -1.8973 3.0467 9.7793 -1.8078 -8.6278
4.2251
1.2211 -18.0480 3.1706 -7.7617 .0200 -10.0956
-5.5885
28.5394 1.0056 17.5189 2.9665 .4623 9.2294
-11.2909
-40.7849 8.4968 3.6503 -7.3565 -1.6609 8.0289
15.8414
20.6520 20.3833 -4.9479 -2.0051 .3342 -10.4801
-9.6510
-15.9168 -5.3104 -16.0858 1.2752 -1.2576 11.2150
-14.1927
HOT
COLD
SWEET
CHERRY PIE
ICE CREAM
TOM
BECKY
4.537 4.360 3.889 3.005 1.827 2.593 3.359
```

Galileo*PLOT will automatically read any .CRD file created by any GALILEO program including: **CATPAC, ORESME, MICROGAL,** or **GALNET Galileo*PLOT** can also read coordinates made by **V55**, but these will need some simple editing described in the V55 manual.

GALNET is a very general program that can generate a set of coordinates using any square matrix of dissimilarities, similarities, covariances, or correlations.

GALNET can also make a set of coordinates using any rectangular (objects by attributes) matrix in which each row represents some object and each column represents some attribute.

With **GALNET**, you can access the power of **Galileo*PLOT** using almost any kind of data input. And at the heart of **GALNET** is the respected GALILEO metric scaling algorithm-- an algorithm that never distorts your data to fit into a preconceived space. Most multidimensional scaling or perceptual mapping algorithms stretch, shrink, or otherwise transform your data to force them to fit into a limited number of dimensions. Galileo programs are fully metric, however, and never modify your data. What you measured is what you get -- undistorted and unchanged.

Printing the Picture

Galileo*PLOT is mainly a screen display program and does not support printing internally. Once you have produced an image you like on the screen, the display can be captured by a screen capture utility (like the "grab" utility in WordPerfect). This image can then be imported into text files with your word processor and made a part of reports and other documents. This image can be enhanced before "grabbing" by press **F10**. This will turn all the concepts in the display white, which greatly increases their readability in a printed image.

How clear and finely detailed these pictures will be is determined solely by the degree of resolution of your own computer's graphics, since it is the actual pixel display on the screen that is captured and written to the file. If you do not have a screen capture utility, contact your Terra representative, who can help you find one that's right for you.

Appendix 1: Tools

Your Galileo installation includes a directory called GALILEO\TOOLS. On this directory Terra has supplied three helpful DOS tools. First is a simple read only editor called **LOOK**. **LOOK** is a public-domain program which allows you to examine the contents of any file interactively. It is convenient since you can page up and down or scroll up, down, left and right in the file using the cursor control keys. You can also easily read the 132 column format files that V55 writes. And, since **LOOK** is a read only editor, you don't run the risk of altering important files.

To use **LOOK**, simply enter the command

```
LOOK [filename]
```

at the DOS prompt. To leave **LOOK**, press [ESC].

Also included is a very powerful ASCII editor, **EDWIN**. **EDWIN** is a public domain program which follows the formats of WORDSTAR, and can be very helpful in modifying files produced by V55 for use in the other Galileo programs and vice versa. **EDWIN** has complete online help, accessed by pressing **F2** once in the program. To start EDWIN, simply enter the command

EDWIN

at the DOS prompt. You can also enter a file directly with EDWIN by entering the command

```
EDWIN [filename] .
```

If you already have an ASCII editor you favor, you may use that instead of **EDWIN**. For more information on installing and using EDWIN, consult the documentation provided on the \GALILEO\TOOLS directory.

The last tool provided is called **UP**. Up lets you climb up your directory tree in only three keystrokes. If your default directory, for example, is GALILEO\DATA, then issuing the command

```
UP
```

at the DOS prompt will set your default directory to \GALILEO. Issuing the command again will move you to the root directory.

All three of these utilities are public domain software and are neither warranted nor supported by The Galileo Company, Terra Research and Computing or any of their agents. They are provided at

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no charge as a convenience for the user.

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