

*** "Black and White is How It Should Be
But Shades of Grey Are the Colors I See"**

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Introduction

Choosing colors becomes an issue when creating color slides for professional meetings. If greyshades are poorly chosen for maps, the legend cannot be easily interpreted. This paper presents a two-part SASTM program to enable one to quickly test different foreground and background color or greyshade combinations. The first part of the program uses the WINDOW statement from SAS/BaseTM to enable a user to enter up to 16 foreground and background color combinations. The second part of the program displays these color combinations in 16 rectangles using annotate macros provided with SAS/GraphTM software.

Program Part 1: Entering Colors with the WINDOW Statement

The WINDOW statement is included in SAS/BaseTM software. Figure 1 shows the SAS window for entering foreground and background colors on the screen. The colors are saved as values of variables named TEXT1-TEXT16 and BAR1-BAR16 in a SAS data set. Then these values are converted to SAS macro values using the CALL SYMPUT command. The macro values are then used in the annotate macros %BAR and %LABEL. The following portion of the SAS program produces the window in Figure 1:

The screenshot shows a SAS window titled "X SAS COLORS". Inside the window, there is a command prompt "COMMAND ===>". Below this, a message reads: "Please enter background colors and text colors for up to 16 rectangles. when done, enter DONE at the command prompt." There are two columns of input fields. The left column is labeled "BACKGROUND:" and contains two identical rectangular boxes, each with the text "GRAY" and "GRAY" stacked vertically. The right column is labeled "FOREGROUND:" and contains two identical rectangular boxes, each with the text "BLACK" and "BLACK" stacked vertically.

Figure 1

* "Shades of Grey" by Billy Joel, The River of Dreams Album, 1992 Impulsive Music (ASCAP)

```

* this is c:\mwsug94\viewcolor.sas;

* activate the graph macros from annomac.sas;
%annomac;

* open a user interface window named colors1 to enable entry
* of background rectangle colors and foreground text colors;
data a;
window colors1 color=blue
#2 @5 'Please enter background colors and text'
    c=yellow
#3 @5 'colors for up to 16 rectangles. When done,'
    c=yellow
#4 @5 'enter DONE at the command prompt.'
    c=yellow
#6 @5 'BACKGROUND:' @25 'FOREGROUND:' c=white
#7 @5 bar1 $char8. c=cyan attr=rev_video autoskip=yes
    @25 text1 $char8. c=cyan attr=rev_video autoskip=yes
#8 @5 bar2 $char8. c=cyan attr=rev_video autoskip=yes
    @25 text2 $char8. c=cyan attr=rev_video autoskip=yes
#9 @5 bar3 $char8. c=cyan attr=rev_video autoskip=yes
    @25 text3 $char8. c=cyan attr=rev_video autoskip=yes
#10 @5 bar4 $char8. c=cyan attr=rev_video autoskip=yes
    @25 text4 $char8. c=cyan attr=rev_video autoskip=yes
#11 @5 bar5 $char8. c=cyan attr=rev_video autoskip=yes
    @25 text5 $char8. c=cyan attr=rev_video autoskip=yes
#12 @5 bar6 $char8. c=cyan attr=rev_video autoskip=yes
    @25 text6 $char8. c=cyan attr=rev_video autoskip=yes
#13 @5 bar7 $char8. c=cyan attr=rev_video autoskip=yes
    @25 text7 $char8. c=cyan attr=rev_video autoskip=yes
#14 @5 bar8 $char8. c=cyan attr=rev_video autoskip=yes
    @25 text8 $char8. c=cyan attr=rev_video autoskip=yes
#15 @5 bar9 $char8. c=cyan attr=rev_video autoskip=yes
    @25 text9 $char8. c=cyan attr=rev_video autoskip=yes
#16 @5 bar10 $char8. c=cyan attr=rev_video autoskip=yes
    @25 text10 $char8. c=cyan attr=rev_video autoskip=yes
#17 @5 bar11 $char8. c=cyan attr=rev_video autoskip=yes
    @25 text11 $char8. c=cyan attr=rev_video autoskip=yes
#18 @5 bar12 $char8. c=cyan attr=rev_video autoskip=yes
    @25 text12 $char8. c=cyan attr=rev_video autoskip=yes
#19 @5 bar13 $char8. c=cyan attr=rev_video autoskip=yes
    @25 text13 $char8. c=cyan attr=rev_video autoskip=yes
#20 @5 bar14 $char8. c=cyan attr=rev_video autoskip=yes
    @25 text14 $char8. c=cyan attr=rev_video autoskip=yes
#21 @5 bar15 $char8. c=cyan attr=rev_video autoskip=yes
    @25 text15 $char8. c=cyan attr=rev_video autoskip=yes
#22 @5 bar16 $char8. c=cyan attr=rev_video autoskip=yes
    @25 text16 $char8. c=cyan attr=rev_video autoskip=yes;

do while (upcase(_cmd_) ne 'DONE');
display colors1 blank;
end;
output;
stop;

```

```

* next convert the sas vars bar1-bar16 and text1-text16 to
* macro variables which will be used in the annotate macros %label
* for text and %bar for rectangles for selected colors;
options nosymbolgen nomprint;
data _null_;
  set a;
  call symput('bar1',bar1); call symput('text1',text1);
  call symput('bar2',bar2); call symput('text2',text2);
  call symput('bar3',bar3); call symput('text3',text3);
  call symput('bar4',bar4); call symput('text4',text4);
  call symput('bar5',bar5); call symput('text5',text5);
  call symput('bar6',bar6); call symput('text6',text6);
  call symput('bar7',bar7); call symput('text7',text7);
  call symput('bar8',bar8); call symput('text8',text8);
  call symput('bar9',bar9); call symput('text9',text9);
  call symput('bar10',bar10); call symput('text10',text10);
  call symput('bar11',bar11); call symput('text11',text11);
  call symput('bar12',bar12); call symput('text12',text12);
  call symput('bar13',bar13); call symput('text13',text13);
  call symput('bar14',bar14); call symput('text14',text14);
  call symput('bar15',bar15); call symput('text15',text15);
  call symput('bar16',bar16); call symput('text16',text16);
run;

```

Program Part 2: Displaying the Foreground/Background Color Combinations in 16 Rectangles

Because this paper is being produced in black and white, the figures for this written paper will be produced in grey shades instead of in color. The examples for the oral presentation will include both grey shades and colors. If one is using a non-color printer for producing maps, it is very important to choose greyscale so that the shades can be distinguished from each other. It is also desirable to assign light shades to low values in the legend and darker shades to higher values. There are 256 named greyscale values in SAS/Graph™. Figure 2 displays 16 greyscale rectangles ranging from color grayf0 to gray20. Note that gray20 was chosen as the darkest grey shade because any darker greys were unable to display black text for labeling. The following SAS code uses the values which were input from the color entry window to produce 16 rectangles :

```

* created three annotate data sets:
* (1) bars- to draw and color in the rectangles
* (2) centers- to place and color the text in the center of rectangle
* (3) top- to denote the color of the rectangle at the top of rectangle;;

goptions device=xcolor cback=white colors=(black) rotate=portrait;
data bars;
* set default lengths for macro variables;
%dclanno;
* set reference coordinates to x,y grid ranging from 0 to 100 data values;
%system(2,2,.);

```

```

*rect1; %bar(4,76,24,96,&bar1,1,solid); output;
*rect2; %bar(28,76,48,96,&bar2,1,solid); output;
*rect3; %bar(52,76,72,96,&bar3,1,solid); output;
*rect4; %bar(76,76,96,96,&bar4,1,solid); output;
*rect5; %bar(4,52,24,72,&bar5,1,solid); output;
*rect6; %bar(28,52,48,72,&bar6,1,solid); output;
*rect7; %bar(52,52,72,72,&bar7,1,solid); output;
*rect8; %bar(76,52,96,72,&bar8,1,solid); output;
*rect9; %bar(4,28,24,48,&bar9,1,solid); output;
*rect10; %bar(28,28,48,48,&bar10,1,solid); output;
*rect11; %bar(52,28,72,48,&bar11,1,solid); output;
*rect12; %bar(76,28,96,48,&bar12,1,solid); output;
*rect13; %bar(4,4,24,24,&bar13,1,solid); output;
*rect14; %bar(28,4,48,24,&bar14,1,solid); output;
*rect15; %bar(52,4,72,24,&bar15,1,solid); output;
*rect16; %bar(76,4,96,24,&bar16,1,solid); output;
run;

data centers;
%declanno;
%system(2,2,.);
length text $16.;
* set text equal to macro text values so name of text color is displayed
* in the center of the rectangle;
*rect1; text="&text1"; %label(14,86,text,&text1,0,0,.9,triplex,5); output;
*rect2; text="&text2"; %label(38,86,text,&text2,0,0,.9,triplex,5); output;
*rect3; text="&text3"; %label(62,86,text,&text3,0,0,.9,triplex,5); output;
*rect4; text="&text4"; %label(86,86,text,&text4,0,0,.9,triplex,5); output;
*rect5; text="&text5"; %label(14,62,text,&text5,0,0,.9,triplex,5); output;
*rect6; text="&text6"; %label(38,62,text,&text6,0,0,.9,triplex,5); output;
*rect7; text="&text7"; %label(62,62,text,&text7,0,0,.9,triplex,5); output;
*rect8; text="&text8"; %label(86,62,text,&text8,0,0,.9,triplex,5); output;
*rect9; text="&text9"; %label(14,38,text,&text9,0,0,.9,triplex,5); output;
*rect10; text="&text10"; %label(38,38,text,&text10,0,0,.9,triplex,5); output;
*rect11; text="&text11"; %label(62,38,text,&text11,0,0,.9,triplex,5); output;
*rect12; text="&text12"; %label(86,38,text,&text12,0,0,.9,triplex,5); output;
*rect13; text="&text13"; %label(14,14,text,&text13,0,0,.9,triplex,5); output;
*rect14; text="&text14"; %label(38,14,text,&text14,0,0,.9,triplex,5); output;
*rect15; text="&text15"; %label(62,14,text,&text15,0,0,.9,triplex,5); output;
*rect16; text="&text16"; %label(86,14,text,&text16,0,0,.9,triplex,5); output;
run;

data top;
%declanno;
%system(2,2,.);
length text $16.;
*top1; text="&bar1"; %label(14,96,text,black,0,0,.9,swiss,2); output;
*top2; text="&bar2"; %label(38,96,text,black,0,0,.9,swiss,2); output;
*top3; text="&bar3"; %label(62,96,text,black,0,0,.9,swiss,2); output;
*top4; text="&bar4"; %label(86,96,text,black,0,0,.9,swiss,2); output;
*top5; text="&bar5"; %label(14,72,text,black,0,0,.9,swiss,2); output;
*top6; text="&bar6"; %label(38,72,text,black,0,0,.9,swiss,2); output;
*top7; text="&bar7"; %label(62,72,text,black,0,0,.9,swiss,2); output;
*top8; text="&bar8"; %label(86,72,text,black,0,0,.9,swiss,2); output;

```

```

*top9; text="&bar9"; %label(14,48,text,black,0,0,.9,swiss,2); output;
*top10; text="&bar10"; %label(38,48,text,black,0,0,.9,swiss,2); output;
*top11; text="&bar11"; %label(62,48,text,black,0,0,.9,swiss,2); output;
*top12; text="&bar12"; %label(86,48,text,black,0,0,.9,swiss,2); output;
*top13; text="&bar13"; %label(14,24,text,black,0,0,.9,swiss,2); output;
*top14; text="&bar14"; %label(38,24,text,black,0,0,.9,swiss,2); output;
*top15; text="&bar15"; %label(62,24,text,black,0,0,.9,swiss,2); output;
*top16; text="&bar16"; %label(86,24,text,black,0,0,.9,swiss,2); output;
run;

```

```
data all;
```

```
set bars centers top;
```

```
run;
```

```
* draw the graph using only instructions contained in the annotate data
```

```
* set saved with the name all;
```

```
proc gslide anno=all;
```

```
title ' ';
```

```
run;
```

When one looks at the colors in Figure 2, it is evident that one would have difficulty distinguishing grey shades in a map legend if using 16 shades. If one increases the number of shades beyond 6, it is difficult to differentiate them. The following shades appear to be visually distinct: grayf0, grayc6, gray9e, gray74, gray4a, and gray20. Statisticians have conducted experimental designs to test viewers' visual perceptions when viewing data graphics. The greyscale map legend problem would be an excellent candidate for this type of analysis to help determine how many greyscale shades are distinguishable by viewers.

Availability of this Program via the Internet

This program is available via anonymous ftp to users with access to the Internet. To obtain the program, do the following:

Using ftp, type:

```
ftp pv6608.vincent.iastate.edu
```

```
Name: anonymous.kathy
```

```
Password: your_userid@your_address (For example, my password would be kathy@iastate.edu)
```

```
ftp> cd sasgraph
```

```
ftp> get viewcolor.sas
```

```
ftp> quit
```

Alternatively, send a self-addressed stamped envelope with a formatted floppy diskette to:

Kathy Shelley
Iowa State University
117 Snedecor Hall
Ames, IA 50010

Voice: 515-294-2260

FAX: 515-294-4040

Email: kathy@iastate.edu

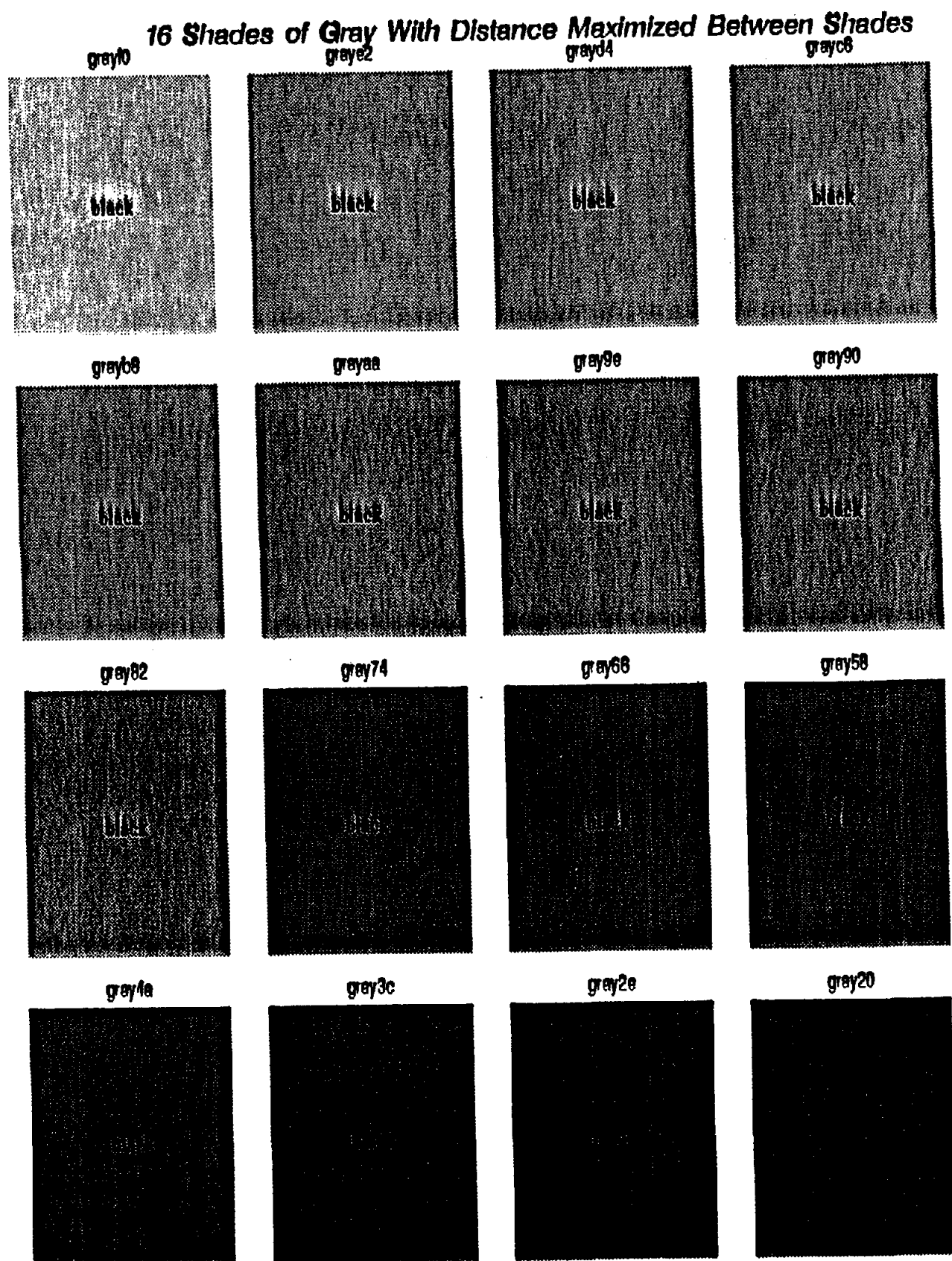


Figure 2