

ASSOCIATION OF VISUALLY CODED FUNCTIONS WITH AN ALTERNATE KEY

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ABSTRACT

This study examined the effect of three variables on users' interpretation of an Alternate key. On the Alternate key, the position of the word "Alternate", the color of the word "Alternate", and the presence of a colored background were manipulated. Eighty subjects from IBM and 32 subjects from outside of IBM responded to the 8 stimuli created by crossing the three factors. None of the factors seemed to have a significant influence on the responses by IBM employees, but the color of the word "Alternate" and the position of the word "Alternate" on the key significantly affected responses by the non-IBM group. The two groups also differed in the frequency of which feature was first stated to be the salient feature in making the response.

INTRODUCTION

When designing a control panel for a device such as a copier or printer, a decision must be made regarding the number of function buttons. If the number of functions is small, then a one-to-one mapping of functions to keys can be easily achieved. However, if there are too many functions, or if the user should be protected from accidental activation of a function, then one key may be designated the "Alternate" key. Then two functions may be assigned to the other keys: the primary function and the alternate function. How can the panel be designed so it is obvious to users which function on a key is primary and which is alternate?

This study examined the effect of three variables on subjects' determination of which function of a key on a control panel is primary and which function is alternate. The three variables examined were:

1. Position: The word "Alternate" may appear at the position of the primary or the alternate functions.
2. Color: The word "Alternate" may be printed in the color of the primary or the alternate functions.
3. Background: The Alternate key's background may or may not be color-coded for association with the alternate functions.

From a designer's point of view, two rationales exist for the design of the Alternate key. Since the primary function of the Alternate key is to place the panel in an alternate mode, one can argue that the word "Alternate" should be in the same position and color as the other primary functions. On the other hand, users may be more likely to associate the Alternate key with the alternate functions if it looks as much like the alternate functions as possible. Finally, the presence of a color-coded background could override the effect of color and position of the word "Alternate".

METHOD

Eighty subjects (employees of IBM) were asked to respond to one of eight different stimuli. The subjects had as much time to respond as they wished. A stimulus was a 3x5" card with a representation of two keys: an Alternate key and a function key. The function key was the same on every card, with one black lettered function in an upper position and one blue lettered function in a lower position. For this study, the upper black function was defined as the primary function, and the lower blue function was defined as the secondary function. (See Appendix Figure 1 for a sample arrangement.) Two sets of cards were made in order to counterbalance the function names (Function R and Function C). Each set contained eight cards made by the factorial combination of position (upper or lower), color of letters (black or blue), and color-coded background (present or absent) of the Alternate key. These manipulations of the Alternate key could be expected to affect the frequency of incorrect association of the Alternate key with the upper black function.

Since stimuli were administered by two experimenters, the variable of experimenter was also counterbalanced. Subjects were randomly assigned to cards (5 subjects per card), and asked which function would be active if the Alternate key was pressed. One dependent variable was the number of times each function (upper black or lower blue) was chosen. Another dependent variable was the first feature (background, color of letters, or position) reported by the subject to be the salient feature used to make the choice.

The experiment was replicated on a group of 32 non-IBM subjects. The subjects had previous personal computer experience, with a wide range of experience represented.

RESULTS

Table 1 shows the difference in the frequencies with which the functions were chosen by each subject group. The table has been analyzed with a Chi-squared statistic with a single degree of freedom, using Yate's correction for continuity (Ref. 1). (See Appendix Table 1 for the raw data.)

Table 1

IBM Vs. Non-IBM Frequencies

Function	Employment	
	IBM	Non-IBM
Upper Black:	19	12
Lower Blue :	61	20

Chi-squared: 1.358
Probability: Between .1 and .25

Tables 2, 3, and 4 show the main effects of the variables for the IBM employees. The tables were analyzed using Fisher's Exact Probability Test (Ref. 1).

Table 2

Main Effect of Color of Background (IBM employees)

Function	Color	
	White	Blue
Upper Black:	11	8
Lower Blue :	29	32

Probability: .300

Table 3

Main Effect of Color of "Alternate" (IBM employees)

Function	Color	
	Black	Blue
Upper Black:	10	9
Lower Blue :	30	31

Probability: .500

Table 4

Main Effect of Position (IBM employees)

Function	Position	
	High	Low
Upper Black:	8	11
Lower Blue :	32	29

Probability: .300

As can be seen, none of these tables suggest that any of the factors are significant. Tables 5, 6, and 7 show the same main effects for the non-IBM employees. Again, the tables are analyzed with Fisher's Exact Probability Test.

Table 5

Main Effect of Color of Background (Non-IBM employees)

Function	Color	
	White	Blue
Upper Black:	7	5
Lower Blue :	9	11

Probability: .358

Table 6

Main Effect of Color of "Alternate" (Non-IBM employees)

Function	Color	
	Black	Blue
Upper Black:	10	2
Lower Blue :	6	14

Probability: .0045

Table 7

Main Effect of Position
(Non-IBM employees)

Function	Position	
	High	Low
Upper Black:	3	9
Lower Blue :	13	7

Probability: .033

In contrast to the IBM employees, both the main effects of the color of the word "Alternate" and the position of the word "Alternate" are significant for the non-IBM employees.

The color of the word "Alternate" was also significant for the non-IBM employees in two conditional tables, shown as Tables 8 and 9 below. These tables have been analyzed with Fisher's Exact Probability Test.

Table 8

Effect of "Alternate" Color
Given A White Background
(Non-IBM employees)

Function	Color	
	Black	Blue
Upper Black:	6	1
Lower Blue :	2	7

Probability: .020

Table 9

Effect of "Alternate" Color
Given A Low Position
(Non-IBM employees)

Function	Color	
	Black	Blue
Upper Black:	7	2
Lower Blue :	1	6

Probability: .020

Finally, the IBM and non-IBM employees are compared using the dependent variable of the first feature (background, color of letters, or position) reported by the subject to be the salient feature used to make the choice. Table 10 has been analyzed using a Chi-squared test with two degrees of freedom. (See Appendix Table 2 for the raw data.)

Table 10

Employment By First-Stated Feature

Employment	Feature		
	Background	Alt Color	Position
IBM	7 (9%)	28 (35%)	45 (56%)
Non-IBM	8 (25%)	14 (44%)	10 (31%)

Chi-squared: 9.09

Probability: Between .01 and .025

Table 10 indicates that there are significant differences between the subject groups as to the feature considered when making the choice.

DISCUSSION

Table 10 and comparison of Tables 2-4 with Tables 5-7 point out the problem of using employees of a high-tech company as subjects in this type of study. There appear to be population differences, even though the non-IBM group was a select group of users with personal computer background and the IBM group was a collection of secretaries, technical writers, engineers, programmers, and procurement agents. If the IBM employees alone had been studied, the conclusion would have had to be that apparently none of the variables affected the tendency for users to associate an Alternate key with the appropriate secondary functions. Looking at the non-IBM subjects indicates otherwise, and the rest of the discussion will concern these subjects.

The strongest feature (among the non-IBM employees) is the color of the word "Alternate", black or blue. When the word is black, 10/16 subjects incorrectly selected the upper black function as the secondary one. When the word was blue, only 2/16 made the incorrect selection.

Another strong feature was the position of the word "Alternate" on the key. When the word was located in the upper position, only 3/16 subjects incorrectly chose the upper black function. When it was in the lower position, 9/16 subjects made the incorrect selection.

It is surprising that the background of the Alternate key (white or blue) seemed to have no influence on the selection. In discussions with product developers, this technique is often suggested when coding operator panels.

These findings suggest that the best arrangement (of those examined in this study) would be to have the word "Alternate" in blue and in a high position on the key. 0/8 subjects made the incorrect response under these conditions.

The conditional table in Table 8 indicates that if the background is white, it is very important that the word "Alternate" be color-coded with its secondary functions. The conditional table in Table 9 indicates that if the word "Alternate" must be placed in the lower position, it is again very important that the word "Alternate" be color-coded with its secondary functions.

REFERENCE

1. Siegel, S. Nonparametric Statistics for the Behavioral Sciences.
New York: McGraw-Hill, 1956.

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APPENDIX TABLES AND FIGURE

Appendix Table 1

Functions Chosen for Each Alternate Key Arrangement

Panel	Alternate Key Features			Employment			
	Backgrnd	Alt Color	Position	IBM		Non-IBM	
				Upper Black	Lower Blue	Upper Black	Lower Blue
A	White	Black	High	3	7	2	2
B	White	Black	Low	3	7	4	0
C	White	Blue	High	2	8	0	4
D	White	Blue	Low	3	7	1	3
E	Blue	Black	High	2	8	1	3
F	Blue	Black	Low	2	8	3	1
G	Blue	Blue	High	1	9	0	4
H	Blue	Blue	Low	3	7	1	3
Total				19	61	12	20

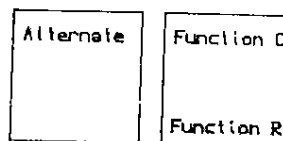
Appendix Table 2

First Stated Salient Feature for Each Alternate Key Arrangement

Panel	Alternate Key Features			Employment					
	Backgrnd	Alt Color	Pos	IBM			Non-IBM		
				Backgrnd	Alt Color	Pos	Backgrnd	Alt Color	Pos
A	White	Black	High	0	2	8	0	1	3
B	White	Black	Low	0	3	7	0	4	0
C	White	Blue	High	0	4	6	0	4	0
D	White	Blue	Low	0	7	3	0	3	1
E	Blue	Black	High	3	1	6	3	0	1
F	Blue	Black	Low	2	0	8	1	0	3
G	Blue	Blue	High	1	7	2	3	1	0
H	Blue	Blue	Low	1	4	5	1	1	2
Total				7	28	45	8	14	10

Appendix Figure 1

Sample Arrangement (Panel A)



Note: In this sample, Function C is black and Function R is blue.