

DIFFERENCES IN EFFECTS OF HELP SEQUENCE'S DELIVERY MEDIUM ON USERS OF DIFFERING LEVELS OF FIELD DEPENDENCE

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ABSTRACT

The purpose of this study was to examine the effects of the medium of a commercial software package's help sequences for software users of varying levels of field dependence. Subjects either received audio or textual help sequences and their performance on a set series of tasks was measured. Sixty subjects were administered the Group Embedded Figures Test (GEFT) to determine their level of field dependence, and based on their scores, subjects were assigned into three groups, field dependent, field neutral, or field independent. Each subject was assigned to a treatment group, either textual help sequences or audio help sequences. The computerized tasks consisted of opening a graphic file, manipulating the contents, and subsequently creating two new files. Nine different tasks were to be performed. The subjects' performance was measured by the number of these tasks successfully completed. The total time to complete the tasks was the other dependent variable measured. A significant difference was found for the field dependence variable with the field independent group completing faster than the other groups and the field dependent group being the least accurate of the three.

Keywords: Information Technology (IT), Field Dependence, Help Sequences, Sensory Channels

INTRODUCTION

The modification of help systems to better meet an individual user's learning style has been shown to provide a more positive user environment (Goodenough, 1976). The cognitive style of some people is shaped by a concept termed field dependence. Field dependence is a measure of a person's ability to impose structure on information received from his or her environment (Witkin, 1973). This cognitive style is well documented and easily identifiable. It is an ideal characteristic toward which to modify the presentation of the help sequences in software to better meet the needs of individual students.

We know that cognitive styles play an important role in the way people interact with their environment (Goodenough 1976, Goodenough, Witkin, 1977, Jonessen, Grabowski, 1993, Witkin, 1973). Field dependence is one end of a bi-polar dimension of the subject's cognitive functioning, ranging from field dependence on one pole to field independence on the other. It has been shown that field dependence measures are stable over time and that field dependence is resistant to modification (Witkin, 1949, 1950, Gulliford, 1980).

Goodenough and Witkin (1977) defined field dependence as "the tendency to rely primarily on internal references in information processing" and field independence as "the tendency to place greater reliance on external referents." Theoretically, this reliance on internal or external references would extend to the computer screen. Research provides clues that modifying the presentation of messages based on a subject's level of field dependence can effect performance.

Thus, field dependence relates to the way people impose structure on information that is provided to them. A dual channel presentation may make it easier for those closer to the field dependence pole of this scale to impose structure on any help information provided. Users with a higher level of field dependence will have the appropriate visual structure in front of them when they try to incorporate the information contained in the help sequence.

Presenting information in the most effective way is critical in high-information output devices, such as computers and mobile phones. Utilizing dual channel information flow could allow people to better utilize the capabilities of

such high-volume devices. Additionally, allowing the user to select a help sequence medium that better fits his or her own cognitive learning style might provide a higher overall level of user satisfaction with the software.

Research on dual channel information flow was initiated in the early 1900's. Most of it involved the acquisition of new information and focused on the relative effectiveness of vision and sound in the lowest levels of information, simple recall (Bennett, 1916; Gates, 1916; Henmen, 1912; Koch, 1929).

While using audio to present information has been recommended for field dependent students, the ability to apply the help information while it is being heard by the user will provide field independent students the opportunity to use more participatory learning techniques. Providing help via the audio sensory channel will actually initiate a dual channel environment.

Purpose of this study

This study examined the use of audio help sequences on subjects' with differing levels of field dependence navigate the effectiveness of help sequences in commercial software. The subjects' performance was measured by the accuracy of the completed work and the amount of time taken to complete a task. The number of times that the help sequences were accessed was tabulated but was not part of the design.

On-line help sequences are increasingly being relied upon as the main source of instruction for software users. Utilizing a graphic user interface, these text-based help sequences open a new window over the application window. Since computer hardware is capable of speech, it would be possible to use audio help sequences instead of the current text-based help. This dual channel mode of instruction could be even more useful to people with a high level of field dependence.

Field dependence is a cognitive style that measures the range of a person's ability to impose structure on his or her environment. Cognitive style has been shown to be an important measure of a student's ability to assimilate information from different methods of presentation. Moore and Dwyer's (1991-2) work showed how modifying the presentation of information can affect a student's ability to assimilate new information. Since with computers allow us to modify presentation techniques fairly easily, it seems logical to look at different ways of presenting material using current technology to enhance the effectiveness of commercial software for people with different levels of field dependence.

Field dependent individuals have a harder time restructuring information to deal with different environments according to Goodenough and Witkin (1977). Johnassen and Grabowski (1993) concluded that field dependent learners should be helped by providing auditory cues. Subjects who are highly field dependent should benefit from removal of the structure imposed by overlapping windows utilized by most help functions in software.

Even if there is greater efficiency for both field dependent and field independent subjects, the dual-channel environment may be more beneficial to subjects with a higher level of field dependence. If the material in the two channels is related but not redundant, it would likely improve the transfer of information

RESEARCH METHODOLOGY

The research hypotheses to be tested are as follows:

H₁: Subjects with higher levels of Field Dependence would perform better, measured in accuracy and speed, on a task when the help sequences were in audio format.

H₂: Subjects with lower levels of Field Dependence would perform better, measured in accuracy and speed, than subjects with higher levels of Field Dependence.

The first hypothesis focuses on the Medium of the help sequences and any interactions with the Field Dependence while the second only deals with the impact (if any) of the Field Dependence.

Subjects

Sixty subjects volunteered for the study. Subjects were recruited at a large urban university. The subjects ranged in age from 18 to 65 years old. The Institutional Review Board of the University approved the collection of data.
Research Design

The subjects were separated into three groups based upon their scores on the Group Embedded Figures Test. The three groups were defined as Field Dependent (FD), Field Independent (FI), and Field Neutral (FN). The criteria for the grouping was $\pm .5$ Standard Deviations from the mean. Each of the subjects in the field dependent groups was randomly assigned to one of two treatment groups, either audio help, or textual help. It should be noted that this design did not guarantee equal number of subjects in the field dependent groups.

After administration of the Group Embedded Figures Test, subjects were assigned to either the FD, FN or FI group. As each subject in each of the field dependence group started the treatment a random assignment was made to the treatment group (audio or text). Subjects then alternated between assignment into the two treatment groups.

Subjects were given a written instruction sheet and give a sample output to recreate, which required nine different steps. The subject's files were then graded on a nine point scale. Help for the different software functions was available as icons across the bottom of the computer screen. Selecting one of these icons opened either a text window or played an audio clip containing help on that subject. The audio clips were straight transcriptions of the textual help, which was taken verbatim from the Paint Shop Pro software's help system. Clicking on the help icon for a specific function either opened a text window with the textual help in it, or open a small audio control window in the lower right of the screen as the audio help was played through the speakers attached to the computer. Subjects accessed the help as often as they wished in completing the task. There was no time limit on completion of the task.

The Group Embedded Figures Test (GEFT), is a 25 item test that is administered and scored in approximately twenty minutes. Subjects were asked to trace simple figures embedded in a more complex figure.

RESULTS

Analysis of the Data

The 60 subjects were equally divided between the audio and textual help sequence treatment groups. The number of subjects in each group is shown in table 1.

Table 1. Subjects in the Experimental Groups

	Field Dependent	Field Neutral	Field Independent	Totals
Textual help	11	10	9	30
Audio Help	11	9	10	30
Totals	22	19	19	60

The Pearson correlation coefficient between the two dependent variables, total time to complete the task and accuracy of responses, was $r = .323$.

An Analyses of variance (ANOVA's) were used to test for mean differences on the individual dependent variables. The results showed no significant interactions (Wilk's-Lambda = .997, $p < .9744$), but a significant main effect for

the field dependent groups (Wilk's-Lambda = .625, $p < .0004$) and no significant main effect for the medium of the help sequences group (Wilk's-Lambda = .870, $p < .0634$).

Table 2 presents the cell and marginal means and standard deviations of the time to task completion measure. Table 3 presents the cell and marginal means and standard deviations for the accuracy measure.

Table 2. Means and Standard Deviations for Time to Complete Task (Seconds)

	Textual Help		Audio Help		Totals	
	Mean	SD	Mean	SD	Mean	SD
Field Dependent	1541.63	798.89	1447.56	878.98	1494.59	821.07
Field Neutral	1062.30	313.99	1052.88	336.21	1057.84	315.53
Field Independent	662.33	402.37	768.00	360.35	717.94	373.93
Totals	1118.06	654.92	1102.63	649.92	1110.35	646.92

Table 3. Means and Standard Deviations for Accuracy (Number of Errors)

	Textual Help		Audio Help		Totals	
	Mean	SD	Mean	SD	Mean	SD
Field Dependent	1.54	1.12	1.45	1.12	1.50	1.10
Field Neutral	1.30	1.41	1.77	2.27	1.52	1.84
Field Independent	0.44	0.52	0.20	0.42	0.31	0.48
Totals	1.13	1.16	1.13	1.54	1.13	1.36

An ANOVA was performed to determine which groups differed significantly. The results of that ANOVA are shown in Table 4.

Table 4. ANOVA Summary Table for Time to Completion

Source	df	MS	F	P
Medium	1	7.757	<.001	.996
Field Dependence	2	3129912.883	9.204	<.001
Interaction	2	50873.752	.150	.861
Error	54	340074.005		

The Tukey-Kramer procedure was used to test for pairwise mean differences among the field dependence groups. Significant differences, $p < .05$, were found between the field dependent group and both the field neutral and field independent groups.

The ANOVA indicated no significant main effect for the medium of the help sequences; therefore it does not appear that there is a main effect for the medium of the help sequences in terms of time to completion.

The ANOVA resulted in no significant interaction effects between the subject's relative level of field dependence and the medium of the help sequences provided in the software as measured by the accuracy of the subjects' work (Wilk's-Lambda = .997, p#.9744). Therefore, it does not appear that there is an interaction between the relative degree of field dependence and the medium of the help sequences in terms of the accuracy of the subjects' work.

An ANOVA was performed to determine which Field Dependence groups differed significantly. The results of that ANOVA are shown in Table 5.

Table 5. ANOVA Summary Table for Accuracy

Source	Df	MS	F	P
Medium	1	.034	.020	.887
Field Dependence	2	9.269	5.628	.006
Interaction	2	.693	.421	.659
Error	54	1.647		

The Tukey-Kramer procedure was used to test for pairwise mean differences among the field dependence groups. Significant differences, $p < .05$, were found between the field independent group and both the field neutral and field dependent groups.

The ANOVA produced no significant main effect for the medium of the help sequences; therefore it does not appear that there is a main effect for the medium of the help sequences in terms of the subjects' accuracy.

SUMMARY

There was no significant interaction between the subject's relative level of field dependence and the medium of the help sequences provided in the software as measured by the time taken to complete the task or by the accuracy of their work (Wilk's-Lambda = .997, $p < .9744$). Therefore the first Hypothesis is rejected.

Subjects in the field dependent group took a significantly longer time to complete the tasks than the other groups, with the field independent group taking the shortest amount of time, $p < .0004$. Subjects in the field independent group were significantly more accurate in their work, with the field dependent group making the most errors, $p < .0004$. Therefore the second hypothesis is accepted.

Table 6. Conclusions Based on Hypothesis

Hypothesis	Conclusions
H1: Subjects with higher levels of Field Dependence would perform better, measured in accuracy and speed, on a task when the help sequences were in audio format.	Rejected
H2: Subjects with lower levels of Field Dependence would perform better, measured in accuracy and speed, than subjects with higher levels of Field Dependence.	Accepted

There was no significant difference between the treatment groups in terms of the time to completion or accuracy of the work, $p = .063$. Clearly there were no interactions between the text and audio group in terms of either the subject's performance or their efficiency in performing the tasks (Wilk's-Lambda = .997, $p < .9744$). This would agree with past researchers, such as Larsen & Feder (1940), Kroll (1974) and Barron & Kysilka (1993) who found either sensory channel was an effective medium for the recall of information. Larsen and Feder's conclusion, "That

comprehension is largely a centrally-determined function operating independently of the mode of presentation of material” (Larsen & Feder, 1940, 251) leads directly to the result of this present study being reported. The medium of the information was irrelevant, but that a cognitive style, field dependence, relates directly to a subjects’ performance.

Similar to this study, Kroll found no differences in performance across the treatment (media) groups, but found that the better the reading ability the better the performance of the subjects across groups. This builds on Larsen and Feder’s work and conforms with the results of this study. That is, the medium of the information is not nearly as important as the subjects’ ability to process it. In both Larsen & Feder, and Kroll’s studies, how the message was presented to the subjects did not matter when it came to their ultimate performance. In this present study the interactions between the different field dependence groups and the information flow cannot simply be accounted for by the groups’ abilities to process information in different media. The interaction of the interface design and users is more complex, and subtle, than would first appear. It might be that the subjects in the different field dependence groups utilized the help sequences in a different manner.

Barron and Kyslika’s (1993) work in this area, where they found no differences in post-test scores for subjects who had used a CBI program with three different modes of presentation, reinforces this premise. Not only were there no differences among the groups, but one group, which scored as well as the other groups, pulled information out of the audio channel that was not reinforced in the visual channel. This last group should have had a lower score, since they had somewhat obscured information, and they were asked to recall information that hadn’t been reinforced visually. Why did they, like Kroll’s poor readers, and the subjects in this study, not have any problems gathering information in a situation where they were supposedly at a media disadvantage?

One possibility is that the media disadvantage is real, but such a small part of the overall performance measure as to be insignificant. Another possibility is that the message is so poorly designed, that the media disadvantage is insignificant, since the message is fairly useless to all subjects. A third possibility is that the subjects are able to compensate in some other way for the media disadvantage imposed on them. In this study, it appeared to the investigator on more than one occasion, that even after selecting the appropriate help sequences, subjects still struggled to complete the task. Subjects who did not struggle appeared to be comfortable searching the display for something that matched their needs.

If the design of the message is a key aspect of these results, then a theory that would have supported the use of the audio channel to supplement that information in the visual channel is cue summation. Clearly the simple addition of the audio help to the visual information shown on the computer screen did not improve the subjects’ performance at all. Yet cue summation involves more than the simple addition of another medium.

Subjects in the field dependent group took a significantly longer time to complete the tasks than the other groups, with the field independent group taking the shortest amount of time, $p < .0004$. Subjects in the field independent group were significantly more accurate in their work, with the field dependent group making the most errors, $p < .0004$.

A subject’s level of field dependence does impact their performance on this computerized task as measured by the time taken to completion and accuracy. With time to completion, there was a very significant difference for the field independent group, finishing in less than half the time of the field dependent group. Since there were no significant differences between the groups when they used different media for receiving help, we can assume all three field dependence groups could gather information from either medium effectively. It would appear that the tasks, which were visually oriented, were the deciding factors. This would tend to support past research, such as that conducted by Moore and Dwyer (1991) who suggested that the coding of information in a presentation does effect the performance of subjects with different levels of field dependence. They found that color-coding graphics increased the performance of subjects who had scored low on the GEFT. The layout of the screen, or the identification of the correct icons, which was discussed previously, may be areas that separate the field dependence group’s performance.

Witkin, who developed the concept of field dependence, writing with others, noted that more field-independent people tend to view objects as discrete from their backgrounds. This ability to separate the objects from their backgrounds would be of great value when searching an unfamiliar, cluttered, computer screen for an unfamiliar icon. This is one factor that would tend to differentiate the field dependent groups, in either treatment (media) group.

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