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THE IMPACT OF GRAPHICAL DISPLAYS ON PERSUASION: AN EMPIRICAL STUDY

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ABSTRACT

Computer generated presentation graphics are increasingly becoming a tool to aid management in communicating information and to cause an audience to accept a point of view or take action. Unfortunately, technological capability significantly exceeds current levels of user understanding and effective application. The research reported here experimentally examines the persuasive impact of characteristics of computer-generated presentation graphics. The underlying model of persuasion is drawn from the communications literature. The study compares use of color versus black and white, and text versus image enhancement. Treatments were presented in association with a videotaped presentation intended to persuade subjects to invest time and money in a set of time management seminars. Pre-measure, post-measure, and post-measure followup questionnaires tracked changes in subject commitment. Subject perceptions of the presenter were also recorded. Overall, presentations supported with overhead transparencies were 46% more persuasive than unaided presentations. Visual aids had a major positive impact on audience perceptions of a presenter. The overall persuasion process model was only partially confirmed.

INTRODUCTION

Computer graphics hardware and software capability, availability, and utilization have increased significantly over the past few years; these trends are forecast to continue. In particular, computer-generated presentation visuals are an increasingly important tool to aid management in communicating information and to cause an audience to take action. Two surveys of graphics users (Lehman, Vogel, and Dickson, 1984; ISSCO, 1986), in fact, have shown that graphic support for written and oral presentations is more common than other managerial areas of application (e.g., decision support, data analysis, or project control). Unfortunately, technological capability with the range of options provided may exceed user capability for effective use in this area of application. Additionally, there is the question of whether or not the time and money spent to acquire and use presentation graphics is returned in more effective communication and/or persuasion.

Vendors and supporters of computer graphics technology certainly claim greater impact, influence and persuasive capability in the marketplace. Few of these claims, however, are based upon formal research studies. The bulk are combinations of folklore, individual impressions, and wishful thinking. There is little solid empirical support concerning the communicating ability and persuasive impact of computer-generated graphics.

Most formal graphics research has addressed support for decision making (e.g., Lucas, 1981; DeSanctis, 1984; Benbasat and Dexter, 1985; Jarvenpaa, Dickson, and DeSanctis, 1985). It is important to expand systematic experimental research to develop empirical evidence relative to the communications and persuasive impact of computer-generated presentation graphics in managerial areas of application. The term "presentation graphics" includes text, charts, and images of people, places and things (i.e., "clip art") used singularly or in combination to provide visual support for a presenter.

Persuasion is basic to the process of organizational management and serves in achievement of both managers' and the organization's goals. Mintzberg (1973), in his classic study, noted that the vast majority of executive management time is spent in verbal communications collecting, interpreting, and disseminating information. Persuasion is of particular importance to the process of management as it is an integral part of the symbolic nature of decision oriented communication. Given the importance of persuasion in the management process and given the increasing use of graphics technology in this activity, research on the persuasive impact of computer-generated presentation graphics is clearly needed. Yet, to date, little has been conducted.

One research study conducted at the Wharton school (Wharton, 1981) has been widely cited in the computer graphics literature as justifying the use of computer graphics as a persuasive tool. The results of this study have become the basis of several advertising campaigns by vendors of computer graphics hardware and software. Actually, this study examined only the issue of whether the use of a mix of overhead transparencies was more persuasive than no visual aids. The study concluded that, "presenters were perceived as better prepared, more professional, more persuasive, more highly credible, and more interesting when they used overhead transparencies than when they did not."

The research reported upon in this paper extends the Wharton study in that the effects of computer-generated graphic features (e.g., color and image enhancement) can be isolated. Furthermore, our research is based upon a rigorous theoretical framework and conducted in a carefully controlled environment. Our study was designed as a base (or foundational) experiment

from which additional experiments can be conducted as part of a research program performed according to an underlying framework (Jarvenpaa, *et al.*, 1985; Dickson, *et al.*, 1986).

THEORETICAL FRAMEWORK AND SELECTION OF VARIABLES

Figure 1 presents the persuasion process model which served as the basis for this study. The model is an adaptation of the message learning approach to persuasion first developed by Hovland (1953) and extended by McGuire (1969). The model suggests that action, the ultimate goal, is influenced by several intermediate factors (attention, comprehension, yielding, and retention) which, in turn are influenced by such conditions as audience characteristics, task characteristics, presentation support, "fixed" or demographic factors, and perceptions of the presenter. According to this model, persuasion results from active thinking by a recipient about relevant information involved in the issue under consideration.

Our major goal in this research was to test the persuasion process model illustrated in Figure 1. In other words, our goal was to see if a presentation given to an audience with fixed (or measured) characteristics and supported with computer-generated graphics would cause action. More importantly, we set out to test whether or not the degree of action could be explained on the basis of intervening variables as suggested by the model. Thus, the intent of the research was not only to determine whether or not a presentation supported by computer-generated graphic visual aids was more persuasive, but also to explore how the persuasiveness was achieved.

In designing our base experiment, we established the "fixed" factors in the model by setting the task environment. We either fixed or measured the audience characteristics, and we manipulated the presentation support by using different variations offered by computer-generated graphics. We measured the dependent variable, action, and also measured the intervening variables such as perceptions of the presenter, attention, yielding (agreement with the presenter's position), comprehension, and retention.

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AUDIENCE CHARACTERISTICS
    Verbalizer/Visualizer
    Predisposition                    ATTENTION
    Demographics
    Location in Room                  COMPREHENSION
                                                        ACTION
PRESENTATION SUPPORT                  YIELDING
    Color/B&W
    Imagery                           RETENTION

                                  PERCEPTIONS
FIXED FACTORS                     OF THE
    Culture                       PRESENTER
    Context                           Prepared      Credible
    Content                           Concise       Interesting
    Speaker                           Professional
    Medium                            Clear
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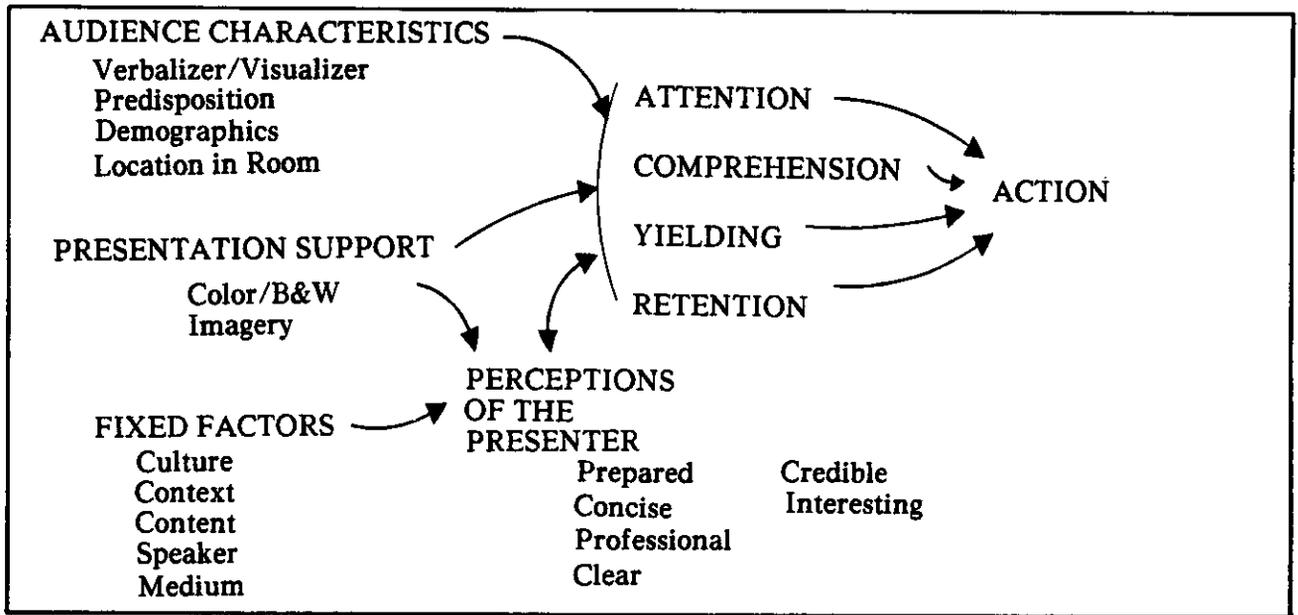
Figure 1. Persuasion Process Model

Obviously, the concern of the researcher in a base experiment such as we were conducting is to select the most appropriate set of independent variables to begin testing the explanatory framework. In this instance, we were especially interested in: (1) establishing a task environment which would support a series of studies involving various audiences, (2) selecting a critical set of graphic treatments, (3) establishing a well controlled experimental environment, and (4) beginning development of valid and reliable measures for the intervening and dependent variables. The key ingredients selected for inclusion in this study by the researchers were:

1. A task environment in which a situation was constructed such that a presenter attempted to convince a set of subjects to commit time and money to taking seminars in time management.

2. Graphic support of this presentation by use of computer generated overhead transparencies that were either black and white or in color and were either plain text or image enhanced by using graphs or pictures (i.e., clip art).

3. A presentation given on videotape ensuring that for each graphic treatment there was no variability in the

presenter. Additionally, all presentations were given in the same physical environment (room, lighting conditions, etc.).

4. Measurement scales which were pretested several times and, in some cases, alternative measures constructed for the same variable.

Research Method

Before going on to describe the method used to conduct the experiment it is useful to describe some of the preliminary work performed prior to the experiment. As mentioned above, the goal of the research team was to conduct a series of experiments to explore the persuasive use of computer-generated graphics. Thus, much consideration was given to developing a research framework and choosing the nature of a first experiment. In this instance, considerable interaction took place between the research team and vendors and users of graphic visuals. One organization, in particular, participated in the design of the study and provided considerable support to the project. 3M Corporation not only served as a sounding board for ideas developed by the researchers, but also made facilities such as graphics hardware, software and professional videotaping facilities available to the project would not normally have been available to the

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researchers. More importantly, 3M personnel, with their experience in the use of graphics technology, were extremely helpful in realistically implemented the support required by the theoretical model. The construction of the task environment, the visual treatments, and the videotaped presentation are but a few examples.

It was through discussions with 3M personnel, and professionals in other organizations, that the task environment was set. In selecting a task environment, we wanted a setting which would be such that a variety of subjects (students as well as business persons) could relate to it and which would not require special knowledge or training. After consideration of many alternatives, convincing an audience to commit to some number of time management seminars was selected. This is an environment which is familiar to most potential subjects, is easily understood, and has the property that commitment can be measured as a continuous variable (in terms of time and money one is willing to spend). The latter property is in contrast to a situation which represents a "go/no go" task (as in the Wharton study) that is not as desirable from the standpoint of statistical analysis and is lacking in the ability to measure the degree of commitment.

Similarly, the selection of the independent variables (black & white vs. color, image enhancement vs. plain text) was based upon degree of support in the research literature combined with practical considerations plus their relative degree of interest. The presentation, which lasted approximately ten minutes, was supported by 20 visuals. Each of these visuals was carefully constructed in consultation with graphic artists and with knowledgeable users. The actual overhead transparencies were made by 3M using the best available technology. In this sense, they were "high quality" visuals and not what one might prepare in a "quick and dirty" fashion. Figure 2 gives examples of two of the black and white treatments (one image enhanced, one plain text). In the case of the color treatments, the background was dark blue and the text was yellow. Image enhanced color treatments used the same basic color scheme supplemented by additional colors or shades to accent imagery, i.e., symbols of people or things. The color version of the visual shown in the bottom half of Figure 2, for example, had the light bulb in cyan with white accents and the clocks in white. The details of all of the overhead transparencies were the result of extensive discussion with graphic artists and designers from 3M and other organizations. Thus, the treatments were very
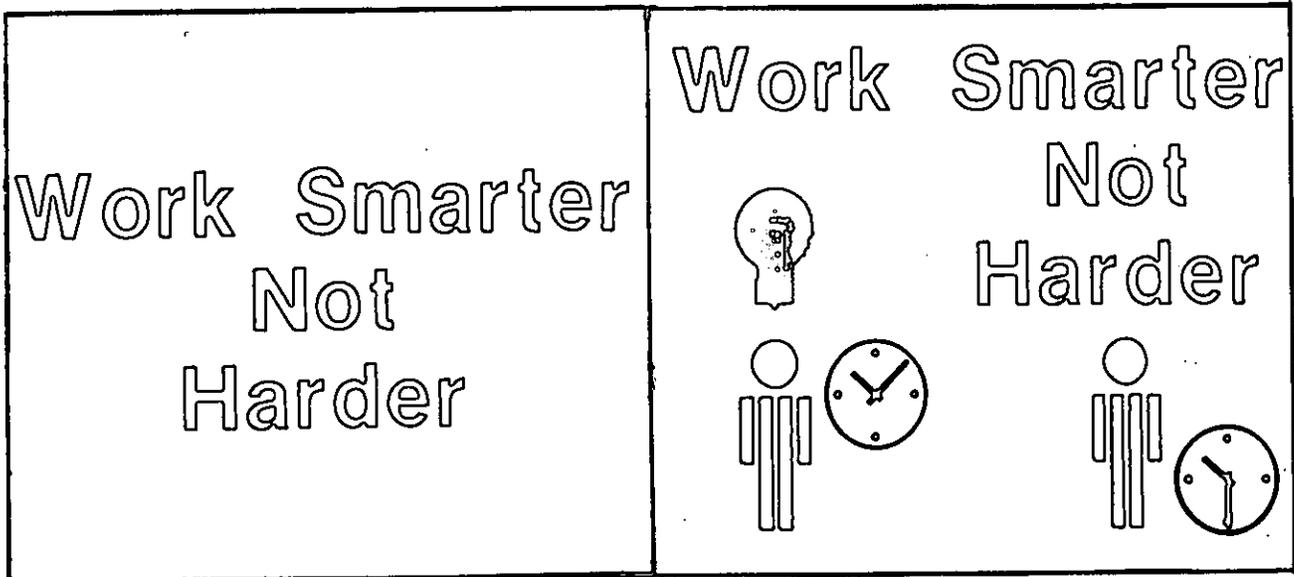
Figure 2. Image Enhanced Text.

representative of what would be used within a large organization having a good level of resources and by a presenter spending a substantial amount of time on support for a presentation.

The script for the presentation was written in consultation with 3M personnel. Several potential presenters were pretested in videotape sessions. The goal was to select a presenter who was typical or average in presentation quality and who had individual characteristics appropriate for intended audiences (neither too young nor too old, for example). A 32 year old woman was selected from the several potential candidates. 3M made the final videotape in their professional studios. Concurrent with this activity, we developed and tested measurement instruments.

A pilot study involving 150 subjects receiving four treatments was held in the fall of 1985. Several changes were made based upon the pilot study. For one thing, the importance of conducting the experiment in the same room (this was not done in the pilot) became apparent. The ambient lighting in one room "washed out" one of the color treatments. Changes were also made in several measures, especially those involving the final degree of commitment to action (willingness to spend money and time). Finally, a number of the visuals needed revision, especially those with image enhancement. All these changes were made and retested late in 1985. The actual experiment was conducted during the winter of 1986.

Subjects

The subjects participating in the experiment were 174 undergraduate students (mostly juniors majoring in business administration) enrolled in an introductory class in management information systems. The class met in a large lecture section with laboratory sections of approximately 35 students each. It was the laboratory session in which the experimental treatment was administered. Although students were not randomly assigned to laboratory sections by the researchers (they were assigned by the registrar), there is no evidence to suggest that any section differed from the others in any important way.

Experimental Controls

As was mentioned, the speaker was selected by audition and made a presentation by means of a ten minute videotape. The experiment was conducted in a common room (all laboratory sections were moved to the same room). Pretesting in this room ensured that any person with normal eyesight would have no trouble seeing either the videotape or all the material on the visuals. At the conclusion of the experiment, one of the questions dealt with perceived legibility and we were able to confirm that all the subjects could see all the visuals. Another question dealt with subject color blindness which was determined by analysis not to be an important factor.

EXPERIMENTAL PROCEDURE

There were four steps in the procedure: pre-measure, experimental treatment, post-measure, and post-measure followup. The pre- measure was obtained approximately five weeks prior to the experimental treatment. One member of the research team visited the large lecture section and explained that they were there to assess student interest in attending some time management seminars which were being considered for offering by the School of Management. It was explained that ten seminars (e.g., setting goals, speeding up meetings) were under consideration and that each would cost $15.00 and would take 6 hours. The students were told that they could take as few or as many of the ten as they wished. On a one page questionnaire, they were asked to indicate the total amount of time and money they would be willing to commit should these seminars be made available. The students were told nothing about the seminars other than their titles. This process established a baseline level of interest.

The Experiment

Five weeks after the pre-measure was taken, each laboratory section was asked to move to a special room for a presentation. Late arriving students were asked to attend another session so that the experiment was not contaminated in this way. In this session, the same member of the research team explained that a presentation

was to be given which would provide more information on the time management seminars which had been mentioned earlier in the term. It was explained that a videotape of an administrator associated with the university group that might conduct the seminars would provide some additional information. The students were told that some visual material had been prepared to *accompany* the presentation and that these would be shown as the speaker was presenting.

In other words, the treatments were decoupled from the presentation. Thus the presentation, the presenter, and the environment were exactly the same except that what the subjects saw in parallel with the videotape differed across treatments. There were five treatments. One laboratory section saw only the videotape with no visuals at all. The four other laboratory sections saw the videotape with some form of overhead transparency supporting the verbal presentation (black and white text, black and white with image enhancement, color text, or color with image enhancement). Each treatment involved 20 visuals in support of the ten minute presentation so the overhead projector was running continuously during each experiment.

The Post-Measure

At the conclusion of the presentation, each subject was asked to complete another questionnaire. All the questions on the pre- measure were repeated. Thus we obtained a measure in terms of both time and money concerning how much more (or less) committed each subject was after the presentation. In addition, we gathered subject demographic information and data on the intervening variables presented in the message learning model (perceptions of the presenter, comprehension, yielding, attention,). In order to measure retention, we needed a post-measure followup.

The Post-Measure Followup

Ten days after the experiment, the same researcher returned to the large class and asked the students to fill out one more questionnaire in association with the time management seminars. In this questionnaire, the same questions as were asked on the previous questionnaire about comprehension were repeated. Comparison of the results on these questionnaires was how we measured retention. In other words, facts about the presentation that a subject knew immediately after the presentation and still knew ten days later were measured as "retained."

DATA ANALYSIS

Data analysis was carried out in four phases. First, homogeneity of subjects across sections was verified. Second, the aggregate results of the persuasiveness of visuals compared to use of no visuals was examined. Third, Aova and Manova were used to explore the persuasive impact of characteristics of presentation visuals. Fourth, confirmation of the persuasive model illustrated in Figure 1 was addressed.

Homogeneity of Subjects Across Groups

As previously noted, subjects were not randomly assigned to groups. The assignment by the registrar of students to lab sections was deemed to be reasonably random and treatments were randomly assigned to laboratory sections. Conformation of the randomness of subjects across sections was performed using oneway ANOVA on the matrix of sections versus pre-measure indications of the amount of time and money subjects were willing to devote to a set of time management seminars as well as a Chi-Squared statistic on subject demographics (e.g. age, sex, year of study, experience with graphics, perceived time management competency). In no case were any statistically significant differences found (at the $p > .10$ level).

Aggregate Results Compared to Control Group

Results reported in this section reflect comparison of the aggregate results of the subjects who viewed the presentation accompanied by presentation support to the control group that saw only the videotaped speaker's portion of the

presentation. Presentations accompanied by *any* form of presentation support examined outperformed the control group on every measure. Detailed examination of differences as a function of *characteristics* of presentation support will be addressed in a later section.

RESULTS

Influencing Action

Aggregate results of the persuasiveness of visuals compared to no use of visual support are shown in Figure 3. Action (or commitment) was measured in terms of the amount of time and the amount of money which subjects were willing to devote to the set of seminars on time management. In the analysis, differences in both time and money were calculated between the pre-measure and the post-measure. Figure 3 shows the percentage change in commitment levels between these two measures. Note that the bars represent (for both time and money) the treatment group with no visual presentation support and the aggregated groups that saw a presentation with some type of visual support.

As illustrated in Figure 3, subjects who saw the presentation accompanied by visual support were positively influenced to spend 18.8% more time ($t=2.12$, $p=.037$) and 34.2% more money ($t=3.49$, $p=.001$) on time management seminars. Significance levels are based on a matched pairs t-test. Subjects who saw only the presentation with no visual support dropped 23.8% in their willingness to spend their time on the seminars ($t=1.75$, $p=.094$) and were willing to spend no more money than before the presentation.

Components of Persuasion Preceding Action

Figure 1 indicates that the components of persuasion should be impacted directly by presentation support as well as indirectly by the impact of presentation support on perceptions of the presenter. The components in question are the previously presented attention, comprehension, yielding, and retention. *Attention* was measured by the degree to which subjects perceived they focused their attention on the presentation
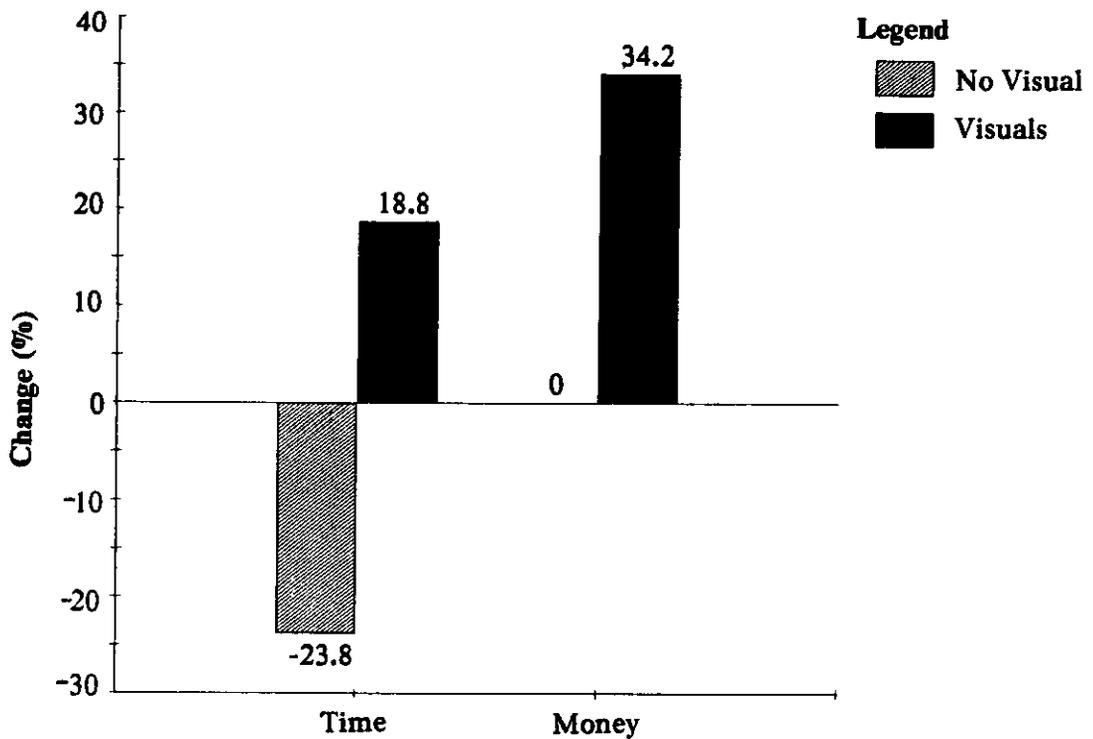
Figure 3. Resource Committment Level

Table 1. Components of Persuasion Preceding Action.

Variables & Scales ( )	Means Contrl/Visual		Std. Dev. Contrl/Visual		F-Value	Significance
Attention (1-5)	3.457	3.793	.701	.827	F(1,173)= 4.888	p=.028
Comprehension (0-14)	10.886	11.921	1.811	1.632	F(1,173)=10.788	p=.001
Yielding (1-5)	3.514	3.736	.659	.619	F(1,173)= 3.495	p=.063
Retention (0-14)	9.067	10.116	2.196	2.293	F(1,140)= 5.059	p=.026

as a whole as it was given. *Comprehension* questions used a multiple choice format to capture subject ability to grasp, understand, and integrate information presented. A total score based on the number of correct answers by each subject was used for analysis. *Yielding* was measured in terms of the degree to which subjects agreed with the opinions expressed in the presentation. *Retention* was measured by the ability of the subjects to answer questions correctly on the post-measure followup ten days after the presentation that they also answered correctly in terms of comprehension immediately after the presentation.

Analysis of pilot study data was carried out to see if question scale intervals were equal and sample variances were reasonably equivalent with normal populations, enabling the use of parametric statistics. This proved to be the case. One way Anova was used to compare the aggregate results of the subjects who viewed the presentation accompanied by presentation support to the control group subjects who saw only the videotaped speaker's portion of the presentation.

As shown in Table 1, attention (p=.028), comprehension (p=.001), and retention (p=.026) were significantly improved as a result of use of presentation support and, to a lesser extent, yielding (p=.063). The lower degrees of freedom for retention reflects the necessity to consider only those subjects who had both seen the presentation and been present for the post-measure followup. Recall that retention was measured based on multiple choice questions that the subjects could answer *both* immediately after the presentation and, again, ten days later.

Perceptions of the Presenter

Perceptions of the presenter were measured using semantic differentials identical to those used in the Wharton study e.g., prepared/-unprepared on a seven point scale. One way Anova was used to compare aggregate results of the subjects viewing the presentation accompanied by presentation support to subjects from the control group who saw only the videotaped speaker's portion of the presentation.

Visual treatments were always better than no visual treatment in terms of all perceptions of the presenter. As shown in Table 2, the differences were statistically significant in most cases.

When visual support was used, subjects perceived the videotaped presenter as better prepared (p=.012), more concise (p=.000), clearer (p=.000), more persuasive (p=.016), more credible (p=.019), more interesting (p=.003), stronger (p=.034), and as making better use of supporting data (p=.029).

Summary of Aggregate Results Compared to Control Group

Presentation support makes a difference. As demonstrated in this section, subjects were more inclined to act in accordance with the wishes of the presenter and exhibited enhanced levels of attention, comprehension, yielding, retention, and perceptions of the presenter when presentation support was used compared to when it was not. This presentation of aggregate results sets the stage for examination of differences in dependent measures as a function of the *characteristics* of presentation support.

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Table 2. Perceptions of the Presenter

Perceptions Scales = 1-7	Means Contrl/Visual		Std. Dev. Contrl/Visual		F-Value	Significance
Prepared	5.400	5.879	1.168	.948	F(1,173)= 6.475	p=.012
Concise	4.343	5.393	1.136	1.149	F(1,173)=23.498	p=.000
Professional	4.771	5.114	1.003	1.179	F(1,173)= 2.327	p=.132
Clear	5.171	5.993	1.248	.844	F(1,173)=21.508	p=.000
Persuasive	3.800	4.364	1.052	1.158	F(1,173)= 6.885	p=.016
Committed	4.514	4.857	1.040	1.227	F(1,173)= 2.316	p=.130
Credible	4.343	4.814	1.083	1.050	F(1,173)= 5.576	p=.019
Interesting	3.457	4.166	1.172	1.255	F(1,173)= 9.144	p=.003
Strong	3.914	4.389	1.246	1.152	F(1,172)= 4.587	p=.034
Attractive	4.371	4.712	1.374	1.009	F(1,172)= 2.729	p=.106
Using good idea	4.143	4.686	1.417	1.276	F(1,173)= 4.848	p=.029

IMPACT OF CHARACTERISTICS OF PRESENTATION SUPPORT

The primary focus of the research was to examine differences in audience impact and perceptions of the presenter as a function of *characteristics* of presentation support. As previously discussed, the characteristics examined were color versus black and white and plain text versus image enhanced graphics. Anova and Manova using a randomized block factorial design was used to take into consideration treatment interaction as well as main effect differences. The basic model used for analysis is illustrated in Figure 4. Verbalizer/visualizer tendencies of the subjects measured using the Richardson Verbalizer Visualizer Questionnaire (Richardson, 1977) and subjects' perceived legibility of the visuals were used as blocking factors.

Influencing Action

The impact on audience action as a function of presentation support was implemented using Manova with change in time and money as dependent variables. Results are summarized in Table 3 for black and white versus color and Table 4 for plain text versus image enhanced graphics.

As shown in Table 3, subjects who viewed the presentation accompanied by color visuals were willing to allocate increased amounts of both time and money compared to those subjects who saw the presentation accompanied by black and white visuals but the results were not statistically significant. As shown in Table 4, there were no significant or even consistent differences in subject willingness to allocate increased amounts of time or money as a function of visuals with plain text versus those with graphic enhancements.

There were no significant differences in action as a function of verbalizer/visualizer tendencies of the audience or perceived legibility of the visuals. There was, however, interaction (p > .05) between perceived legibility and color vs. black and white. Subjects who perceived the legibility as high in conjunction with the black and white visuals and subjects who perceived the legibility as low in conjunction with color visuals were willing to allocate larger increases in both time and money than their counterparts.

Perceptions of the Presenter

Perceptions of the presenter as a function of characteristics of presentation support were ex-

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SOURCE OF VARIATION		DEGREES OF FREEDOM
TREATMENTS		3
A -- Color versus B/W	1	
B -- Text vs Image Enhanced Graphics	1	
A X B	1	
BLOCKING FACTORS		8
D -- Visualizer/Verbalizer	2	
E -- Perceived legibility	2	
D X E	4	
TREATMENTS X BLOCKING FACTORS		24
A X D	2	
A X E	2	
B X D	2	
B X E	2	
A X B X D	2	
A X B X E	2	
OTHER INTERACTION	12	
WITHIN VARIATION		138

TOTAL		173

Figure 4. Sources of Variation

amined using the model previously illustrated in Figure 4 excluding the blocking factors of verbalizer/visualizer tendencies and perceived legibility of the visuals in accordance with the persuasion process model presented in Figure 1. When color visuals were used, subjects perceived the presenter as more attractive ($F(1,135)=3.815$, $p=.053$) and as making better use of supporting data ($F(1,135)=9.539$, $p=.002$) than when black and white visuals were used. When image enhancement was used, subjects perceived the presenter as more confusing ($F(1,145)=5.361$, $p=.022$) than when the visuals were in plain text. No significant interaction

was noted between color vs. black and white and plain text vs. image enhanced graphics.

Components of Persuasion Preceding Action

The impact of characteristics of presentation support on components of persuasion preceding action was examined using the model illustrated in Figure 4. Perceptions of the presenter were treated as a covariate. Main effects are sum-

Table 3. Action -- Black and White vs. Color

	Means		Std. Dev.			
	B & W/Color		B & W/Color		F-Value	Significance
Change in time (hrs.)	1.000	2.314	7.299	7.355	$F(1,60)=0.469$	$p=.496$
Change in money ($)	4.357	9.569	20.955	17.466	$F(1,60)=1.334$	$p=.253$
	Multivariate Hotellings test		$F(2,59)=.681$	$p=5.10$		

Table 4. Action -- Text vs. Image Enhanced graphics

	Means		Std. Dev.			
	Text/Imagery		Text\Imagery		F-Value	Significance
Change in time (hrs.)	1.915	1.522	7.800	6.876	F(1,60)=0.081	p=.778
Change in money ($)	6.319	8.130	20.846	17.522	F(1,60)=0.137	p=.712
	Multivariate Hotellings test		F(2,59)=.388	p=.680		

marized in Table 5 for black and white versus color and in Table 6 for plain text versus image enhanced graphics.

As illustrated in Table 5, color visuals consistently outperformed black and white visuals. However, only in the case of retention (and then only weakly) was the difference statistically significant. As shown in Table 6, no differences existed for any of the components preceding action as a function of the use of plain text visuals versus image enhanced graphic visuals.

Perceptions of the presenter (as a covariate) were significant positive factors for attention (F(1,105)=7.722, p=.006) and for yielding (F(1,105)=12.490, p=.001) but were not significant for comprehension or retention.

All results were independent of verbalizer/visualizer tendencies of the subjects as measured by the Richardson VVQ (Richardson, 1977) as well as perceived legibility of the visuals. No significant interaction was noted between color vs. black and white and plain text vs. image enhanced graphics or between the treatments and the blocking factors.

Summary of the Impact of Characteristics of Presentation Visuals

Action: Although color treatments were more effective in inducing subjects to allocate in-

Table 5. Components of Persuasion Preceding Action -- Black and White vs. Color

Variables & Scales	Means		Std. Dev.			
	B & W/Color		B & W/Color		F-Value	Significance
Attention (1-5)	3.704	3.884	.868	.777	F(1,105)=1.063	p=.305
Comprehension (0-14)	11.732	12.116	1.424	1.811	F(1,105)=2.224	p=.139
Yielding (1-5)	3.690	3.783	.667	.565	F(1,105)=0.294	p=.589
Retention (0-14)	9.731	10.450	2.206	2.332	F(1,77)=2.813	p=.098

Table 6. Components of Persuasion Preceding Action -- Text vs. Image Enhanced Graphics

Variables & Scales	Means		Std. Dev.			
	Text/Imagery		Text/Imagery		F-Value	Significance
Attention (1-5)	3.797	3.788	.776	.886	F(1,105)=0.000	p=.987
Comprehension (0-14)	11.824	12.030	1.475	1.797	F(1,105)=0.424	p=.516
Yielding (1-5)	3.730	3.742	.708	.506	F(1,105)=0.060	p=.807
Retention (0-14)	10.186	10.038	2.161	2.449	F(1,77)=0.261	p=.612

creased amounts of time and money, the results were not statistically significant. No consistent differences in either time or money occurred as a function of the use of plain text versus image enhanced graphics.

Perceptions of the Presenter: Subjects perceived the presenter as more attractive and as making better use of supporting data when color rather than black and white visuals were used. When image enhancement was used (compared to plain text), subjects perceived the presenter as more confusing.

Attention: There was no significant direct in-'fluence of color vs. black and white nor plain text versus image enhancement on attention. There was, however, an indirect impact of presentation support on attention as a function of strong covariation with perceptions of the presenter.

Comprehension: Unlike attention, there was no impact of perceptions of the presenter on comprehension. There were no significant differences between the types of support although color outperformed black and white.

Yielding: Like attention, yielding was affected indirectly through the impact of presentation support on perceptions of the presenter rather than directly. After removing the impact of perceptions of the presenter, there were no significant differences in impact on yielding between the different forms of presentation support.

Retention: Subjects exposed to treatments in color (whether text or enhanced graphic) performed better (p=.098) than subjects exposed to black and white treatments. Like comprehension (and unlike attention and yielding), there was no impact of enhanced perceptions of the presenter on retention.

MODEL CONFIRMATION

The persuasion process model illustrated in Figure 1 is basically supported in terms of the general influence of presentation support on perceptions of the presenter and the components of persuasion preceding action (attention, comprehension, yielding, and retention) . Further,

perceptions of the presenter were noted to covary with attention and yielding although not with comprehension and retention. The persuasion process model is only partially confirmed, however, in terms of ability to predict action. With all of the treatments included, the components of persuasion (i.e., attention, comprehension, yielding, or retention) did not cumulatively predict action to a high degree in terms of commitment of time and money to the set of time management seminars. Only 4% of the variability in the data was explained (i.e., R squared = .041 for time and .039 for money).

DISCUSSION

Our research provides confirmation of the results reported in the Wharton Study. As did the Wharton researchers, we also demonstrate the ability of visual presentation aids to influence action. Our results in this domain, however, go beyond those of the Wharton study. Whereas they showed the ability of visual aids to influence action regarding a dichotomous decision (go/no- go), we can quantify the changes produced by visual presentation support as a continuous variable. Overall, we found that subjects seeing visual presentation aids were willing to spend 46.2% more time and 34.2% more money on the time management seminars than subjects who were given only a presentation with no visual aids (these figures are calculated based upon normalized absolute values). Also consistent with the Wharton study is our finding that the use of visual aids substantially improves perceptions of a presenter.

Our results are more detailed than those provided by the Wharton study in that we are able to separate out the results of the various treatments. We were able to isolate the impact of the treatments by assuring consistency (with videotape) in the speakers portion of the presentation. We also were internally consistent within each treatment (e.g., color vs. black and white) to facilitate comparison based on the *characteristics* of presentation visuals. Furthermore, we conducted an initial test for an explanatory model of persuasion. The richness of this approach becomes evident as we consider details of our initial findings.

One of our more interesting results is the fact that the overall impact on action (see Figure 3)

is different depending on whether one considers the time measure or the money measure. This is not surprising in that time and money, although both measures of action and correlated (r=.775), are not at all equivalent. It is our opinion that the time measure of action is a better one than money since all the subjects were full time students and had similar amounts of time available but may have varied substantially in their personal financial positions.

The drop in commitment of time to attending seminars on the part of the unaided subjects is also consistent with what one might expect. To a large degree, we biased the experimental situation against ourselves. The manner in which the experiment was conducted made it quite possible that the subjects would be *less* committed to action after the presentation. The fact that during the pre-measure session all the students knew about the seminars was their titles made it possible to project all sorts of good qualities to the seminars. Once they had seen the actual presentation, all uncertainty was gone in that a good bit of detail was given about each seminar. Obviously, many students, once they knew for sure what the content of a seminar was, could lose interest and easily drop in their level of commitment. Clearly this happened in the case of the time commitment on the part of the students seeing a presentation with no visual aids. Finally, the subjects saw a presentation made by a presenter carefully selected to be "average." The quality level of the presentation likely influenced some subjects to be disenchanted with attending the seminars *after* seeing the presentation. These facts provide even greater support for the effectiveness of visual aids in persuading an audience to take action.

Another very strong result from our research is the clear demonstration of the fact that visual aids positively impact audience perceptions of a presenter. Overall, our findings in this area are consistent with those of the Wharton researchers. What we did that adds to the Wharton study results was to examine the impact on perceptions of the presenter from specific visual treatments. Looking at our results, we can conclude with a fair degree of confidence that color text has the greatest positive impact on audience perceptions of the presenter. Interestingly, image enhancement (at least as used by us) did not add greatly to these perceptions. This does not suggest that image enhancement should not be used, rather image enhancement might address areas other than the audience perception of the presenter. On the other hand, if the presenter's goal is to appear "interesting," image enhancement may be in order (albeit at the possible expense of being perceived as less clear). In summary, image enhancement features should be employed carefully and selectively depending upon one's purpose.

With regard to the components of persuasion preceding action (attention, comprehension, yielding, and retention), we find that presentation support directly affects these components. Our results also suggest that presentation support indirectly affects these components through the perceptions of the presenter. As examples of the former effect, use of color is especially warranted with respect to increasing retention. Imagery can aid comprehension when utilized properly. For example, the enhanced graphic shown in Figure 2 directed subjects to the correct answer to a question addressing "working smarter" whereas another graphic which showed a stack of currency accompanying a dollar figure of organizational time loss seemed to distract subjects. Fewer subjects were able to recall the dollar amount.

Our greatest disappointment with the results of the experiment is our inability to consistently confirm the complete persuasion model. Although we are able to detect the direct effects of presentation aids on perceptions of the presenter and upon components of the persuasion model and we confirm the effects of perceptions of the presenter on the model components, we were unable to consistently predict action from the components of the model. This overall result is not at odds, however, with the work in the area of predicting persuasion. McGuire's (1969) conclusions, for example, support this contention. It is extremely difficult in persuasion research to consistently predict attitude or behavioral change as a function of model components.

FUTURE DIRECTIONS

Since our purpose in conducting the experiment we report on in this paper was to initiate a series of studies, it is appropriate to comment on what we have learned and how we might proceed in the future. First, we can examine the positive outcomes. We are quite pleased with our general approach. The task environment (time

management seminars) appears quite useful and we intend to continue working in this area. Our use of a videotaped presentation is also very positive although we certainly intend to do some checking of our pattern of results in the case of a "live" presenter. Obviously, problems of control must be dealt with and, of course, we must use the same presenter live as was videotaped. In general, our experimental procedures worked very well and we foresee no major necessity for dramatic changes in this area.

Our problems, then, are primarily in two areas: variable measurement and refinement of our model of the persuasion process. Although the researchers are not totally dissatisfied with our measures, we feel they can be improved. Of particular importance is getting better measures of actual commitment. We are pursuing this in the following way. Students indicating relatively high degrees of interest in the proposed seminars are being contacted by mail to ascertain their opinions about times when the seminars will be offered. Those responding will obviously be committed to some degree to the seminars and, once identified, they will form another subject pool for additional analysis. Finally, one seminar (based upon interest) will actually be offered to the students. Those who commit to spending real time and money will form the final subject pool.

With regard to the model itself, we intend to work in two areas. The first is to try to improve the measurement scales for the model components and second to reconsider and retest the basic structure of the persuasion model. All of these steps will be taken prior to conducting another major experiment with a new set of variables.

One of the most powerful aspects of our approach is the use of a videotaped presentation (we actually have a second tape of a much "higher quality" presenter with which to work). Having our presentation in this form not only provides complete control, but great portability and the ability to introduce new treatments at relatively little cost. Having this facility allows us to continue to refine our work rather easily. In the opinion of these researchers, we have a good start on the program of research we envision.

In conclusion, the results of this first study should be "good news" to the proponents of computer-generated presentation aids. We have strong evidence that the claims we alluded to at the beginning of this paper can be supported. In contrast to work in studying the use of graphs as decision support tools, we were able to generate very positive results from the standpoint of the practitioner. The challenge facing us, as researchers, is to do as good a job of producing a theoretical model which explains these results. In this regard, we are underway and have a good start with our proposed model of persuasion, but are far short of our desired predictive ability.

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