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Abstract

The IS profession will soon be called upon to integrate multimedia into the mainstream of software design. Yet, usable guidelines to support this effort are only now beginning to emerge in the literature. This paper, supported by a laboratory study, provides initial insight into the impact of sound on information recall, especially as it relates to the gender of the user. The results of our study indicate that the advantages (or disadvantages) of sound-supported information delivery is significantly influenced by the gender of the user.

Introduction

The importance of gender on decision processes has been an important element in societal morays for some time. The positivist examination of this decidedly interpretivist phenomenon has been discussed in the literature across academic research venues, but has only recently been recognized as an item of interest in MIS. In pre-MIS research, Corso (1963) discussed differences in attitudinal and behavioral differences between male and female brains, which was extended by Kimura (1982) to the examination of musical behaviors. Cox and Kellaris (1988) and Kellaris and Rice (1988) directed this with consumer research. idea into cosumer research, examining the effects of music on sales and purchasing effects. Most recently in MIS research, Gefen and Straub (1997) found that men and women differ in their perceptions, but not their use, of email. This paper extends gender research in MIS to a neglected realm of multimedia—specifically, the effects of sound-based multimedia on information recall tasks. Both gender in MIS and sound-multimedia represent an important, but under-researched field of inquiry important to our profession.

In this laboratory experiment, subjects were exposed to a variety of sound stimuli while performing a computer-based recall task. We carefully modeled the experiment after previous industrial sound studies where background music was found to exhibit a positive impact on repetitive assembly-line tasks in an industrial environment. Using a similar methodology, our study examined the impact of background sound on a knowledge-oriented task in a simulated corporate environment.

The experimental methodology involved first presenting information to subjects on a computer screen and then requiring them to recall this information—all while we simultaneously subjected them to a background sound treatment. We conducted multiple experimental sessions, and varied a pre-recorded sound treatment for each group session. The treatments included musical selections by Vivaldi, Beethoven, Debussy, and Horner, as well as office noise and silence control groups. The subjects, students at a moderately large university in the southwestern United States, were randomly assigned to a sound treatment group and were compensated for their participation. Subjects also completed for a "best overall performance" award to encourage their "best effort."

General Results

While the direct reaction to individual sound treatments demonstrated nominal differences in performance, a significant finding is the relationship between the subjects' reaction to background sound (IMPACT) and recall performance (SCORE), as shown in Table 1. We also detected relationships between the reaction to background sound (IMPACT) and subject scores on the Visualizer-Verbalizer Questionnaire (VVQ) (study variables VISUAL and VERBAL). We suggest these results may have ramifications for the design of multimedia systems which utilize a sound component. This analysis also indicates a clear relationship between VISUAL and VERBAL scores, i.e., subjects with higher visualizers were also higher verbalizers (and vice versa).

Gender-Based Results

This paper, while recognizing the relationships indicated above, focuses on detected gender differences. An examination of Table 2 reveals nominal differences between GENDER and key study variables. That is, we observed no significant differences between GENDER and SCORE, VERBAL or IMPACT when analyzed at the "overall" level. However, a significant relationship between GENDER and VISUAL suggests that male subjects were higher visualizers (mean male score was 9.14, where mean female score was 8.49). In addition, the data suggests that male subjects were slightly older. (We note that although the subjects' average classification was "second-semester junior," with an average age above 24, the participants would not normally be classified as traditional students. Furthermore, in excess of 65% of the subjects were employed.)

The exceptionally strong relationship indicated between GENDER and VISUAL prompted us to further analyze the gender-based data. Below, in Tables 3 and 4, we segment the data into MALE and FEMALE groups and repeat the analysis demonstrated in Table 1. (Note: We eliminated AGE from the analysis below because we found no significant relationships for either gender group.) A comparison of the results presented in Tables 3 and 4 indicates, that while relationships exist among the key study variables, the pattern of relationship is somewhat different for MALE versus FEMALE subjects.

One primary relationship established in the initial analysis was that SCORE was related to IMPACT, i.e., if a subject had a positive (favorable) reaction to the sound treatment, they would tend to have a higher level of recall. When inspecting Table 3, we see no apparent relationship between SCORE and IMPACT for MALE subjects. However, Table 4 documents a significant relationship between SCORE and IMPACT for FEMALE subjects.

Table 1 further indicates a positive IMPACT relationship with higher VISUAL and VERBAL scores. After segmenting the data, our findings indicate these relationships indeed may exist for MALE subjects (see Table 3), but there is no clear indication they exist for FEMALE subjects (see Table 4).

Finally, overall analysis indicates a relationship between VISUAL and VERBAL scores of the respondents. However, Tables 3 and 4 suggest this relationship may be more characteristic of the MALE subjects than the FEMALEs. Finally, one new significant combination was produced by this analysis. In Table 4, we observe a significant relationship between performance SCORE and VERBAL for FEMALE subjects.

Discussion

Based on the foregoing analysis, we reach a very clear conclusion. Within the context of this study, males and females *were* different and *responded* differently. We present a summary of significant results in Table 5.

Although the recall performance (SCORE) of male subjects was apparently not impacted by their reaction (IMPACT) to the sound treatments, females were significantly impacted. This suggests that a "well-tuned" sound environment may have significant benefits for females as a group. It also suggests that unpopular background sound may have negative performance impacts on females, as well.

While positive reaction to sound treatments in our study tended to be related to higher visual and verbal scores for male subjects, a positive reaction to sound is not clearly related to the visual-verbal dimension for female subjects. It is also interesting to note that female subjects with lower verbal scores tended to have a higher recall score. Finally, the relationship between the visual and verbal dimension is more clearly delineated for male subjects (higher visualizers were also higher verbalizers) than for females.

Conclusion

Although previous studies have suggested certain differences between male and female subjects exist, the we conclude that significant differences exist in reaction and performance when both groups are exposed to background sound, including musical sound. Further investigation of this phenomenon could have far-reaching implications for future system designs, specifically in the adaptive computer interfaces and in multimedia computer systems. Our results also suggest that factors related to the ambient sound environment can be identified and manipulated, either for the benefit or the detriment of computer-based tasks in the corporate environment. Finally, if male and female users really do perform differently based on certain dimension of information delivery, then system designers need to entertain the possibility that they should provide a human interface tailored to the gender of the computer user.

References

References available from the authors upon request (spence@unt.edu; dpeak@unomaha.edu).

Table 1. Interrelationships of Key Study Variables for All Subjects (n = 205)

Var.	Score		Verbal		Visual		Impact	
	X^2	Corr.	X^2	Corr.	X^2	Corr.	X^2	Corr.
Verbal	1.680 p=.195	-0.030 p=.673	-	-	-	-	-	-
Visual	4.120 **p=.042**	0.109 p=.126	5.343 **p=.021**	0.151 **p=.034**	-	-	-	-
Impact	4.280 **p=.039**	0.143 **p=.043**	4.355 **p=.037**	0.205 **p=.004**	4.826 **p=.028**	0.220 **p=.002**	-	-
Age	0.535 p=.465	-0.061 p=.392	0.092 p=.762	-0.094 p=.187	0.589 p=.433	0.089 p=.211	0.113 p=.373	1.104 p=.144

Table 2. Descriptive Analysis of Key Study Variables*

Variable	Mean			With Gender	
	Overall (n = 205)	**Male** (n = 116)	**Female** (n = 94)	X^2	**Spearman** Correlation **
Score	5.34	5.54	5.13	2.251 p=.134	-0.071 p=.316
Verbal	6.43	6.41	6.43	0.402 p=.517	0.015 p=.832
Visual	8.85	9.14	8.49	10.257 **p=.001**	-0.203 **p=.004**
Impact	15.46	15.15	15.82	0.740 p=.390	-0.070 p=.323
Age	24.27	24.48	23.99	0.495 p=.402	-0.177 **p=.012**

*Note: Five subjects did not specify gender.
**Correlations present in this and other tables were performed utilizing the Spearman procedure.

Table 3. Interrelationships of Key Study Variables for Male Subjects (n = 116)

Var.	Score		Verbal		Visual	
	X^2	**Corr.**	X^2	**Corr.**	X^2	**Corr.**
Verbal	0.011 p=.915	0.098 p=.305	-	-	-	-
Visual	0.548 p=.459	0.028 p=.771	5.549 **p=.018**	0.162 p=.089	-	-
Impact	0.250 p=.617	0.031 p=.774	2.160 p=.142	0.231 **p=.016**	5.199 **p=.023**	0.199 **p=.038**

Table 4. Interrelationships of Key Study Variables for Female Subjects (n = 94)

Var.	Score		Verbal		Visual	
	X^2	**Corr.**	X^2	**Corr.**	X^2	**Corr.**
Verbal	**4.146 p=.042**	-0.196 p=.066	-	-	-	-
Visual	2.982 p=.084	0.180 p=.091	1.584 p=.208	0.151 p=.159	-	-
Impact	7.274 **p=.007**	0.287 **p=.005**	2.455 p=.117	0.177 p=.097	0.495 p=.482	0.215 **p=.043**

Table 5. Summary of Significant Interrelationships of Key Study Variables

Variable	Score						Verbal						Visual					
	X^2			**Corr.**			X^2			**Corr.**			X^2			**Corr.**		
Verbal			F			f	-			-			-			-		
Visual	A		f			f	A	M		A	m		-			-		
Impact	A		F	A		F	A			A	M	f	A	M		A	M	F

Legend: A = All; M = Male; F = Female
Uppercase: Significant at or below .05
Lowercase: Significant at or below .10