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## Reading from a Palm Pilot™ Using RSVP

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This study is a continuation of our ongoing research into the feasibility of using the text presentation method known as Rapid Serial Visual Presentation (RSVP) as a possible means of reading on small screen interfaces. In a previous issue of Usability News, we reported on an exploratory study comparing RSVP and two other text presentation methods -- ten lines and three lines of automatic text presentation (Bernard, Chaparro, & Russell, 2000). We then reported on a study concerned with a comparison of reading efficiency with text presented in RSVP using different sized fonts (Russell, Hull, & Wesley, 2001). Based on these initial experiments, we were encouraged about the possibility of RSVP as a method of text presentation for small electronic devices such as PDA's, cellular phones, and pagers.

However, those studies were conducted on a traditional desktop computer simulating a PDA screen, as no application was available at the time to present text in RSVP on a hand-held device. The current study presents data on reading efficiency using RSVP on a hand-held device. We compared performance between RSVP conditions at three speeds to a traditional text presentation format used by Palm Reader™. Reading comprehension, user satisfaction, and preference were examined as dependent variables.

### METHOD

#### *Participants*

Twenty college students volunteered for this study (4 men, 16 women) and ranged in age from 18 to 52 ( $M = 26.7$ ). Participants were 34% Freshmen, 5% Sophomores, 45% Seniors, and 15% Graduate Students. Twenty percent of participants had experience using a personal digital assistant (PDA), and 10% had previous experience with RSVP. All subjects were screened for 20/20 or 20/20 corrected vision before testing using a Snellen near acuity chart.

#### *Materials*

Text was presented on a Palm™ m505 handheld computer (see picture at right). The testing software included a beta version of Ace Reader Pro™ for the Palm, which was used to present the text in RSVP format. The text was presented in the traditional, page-like format using the paging function on the Palm Reader™. The text passages read by participants, as well as the associated comprehension tests, ranged in length from 127 to 269 words ( $M = 204$ ). The passages were comprised of excerpts from short stories. The Palm screen backlight was turned on during testing.



## Procedure

The two variables of interest were (1) the text presentation format, which was comprised of the RSVP and the traditional page-like format of Palm Reader<sup>TM</sup>; and (2) reading speed. Within the RSVP condition, the text presentation was automated and was set to the rates of 250, 450 and 650 words per minute (wpm). Presentation rate in the traditional reading format was not controlled, but average reading times for participants in each condition was collected. This provided a total of four possible conditions: RSVP at 250 wpm, RSVP at 450 wpm, RSVP at 650 wpm, and Palm Reader<sup>TM</sup>. The order of presentation format, presentation rate, and passage number was counterbalanced across participants, with each participant being presented three passages for each of the four conditions. The dependent variables were reading comprehension, satisfaction, and preference.

Participants were tested under each of the four conditions, reading first a practice passage followed by three test passages for each condition. In addition to the initial practice passage, all participants were given three preliminary practice passages before testing began under any RSVP condition, in order to provide some familiarity with this format. After answering the comprehension questions for the three test passages in each condition, participants then answered a reading satisfaction questionnaire. The questionnaire asked them to rate their level of satisfaction with the format they had just experienced on a 10-point scale with regard to various aspects of reading, including ease of reading, physical and mental fatigue, the ability to concentrate, and desire to read in RSVP format for leisure or work. Upon completion of all testing, participants completed a post-experiment questionnaire in which participants' ranked their preference across conditions.

## Results and Discussion

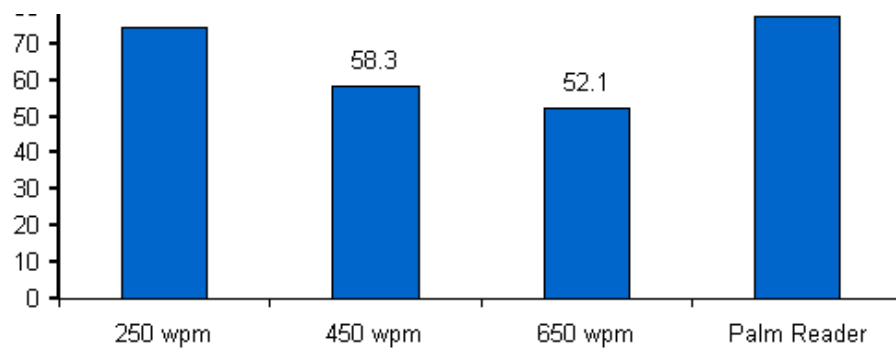
### *Reading Performance*

Each reading passage had an associated set of four multiple-choice questions. Mean scores for the percentage of correct responses for the three tests given under each condition were calculated (see below).

Format	Mean Comprehension Score
RSVP 250 wpm	74.6 (SD = 14.9)
RSVP 450 wpm	58.4 (SD = 17.7)
RSVP 650 wpm	52.1 (SD = 21.4)
Palm Reader <sup>TM</sup>	77.5 (SD = 13.8)

Results from a within-subjects ANOVA were significant [ $F(3,57) 15.29, p. < .05$ ]. Post hoc analysis revealed: (1) there were significant differences in comprehension in the RSVP at 250 wpm and the higher speeds of 450 and 650 wpm; but (2) there was no significant difference in comprehension scores between the RSVP at 250 wpm and the Palm Reader<sup>TM</sup> condition.

A dependent sample t-test was performed to compare the average reading speeds for participants under the Palm Reader<sup>TM</sup> ( $M = 229$ ) condition, and the RSVP condition at 250 wpm. No significant difference was found between the two groups [ $t(19) = 2.06, p. > .05$ ]. These results indicate that the participants were apparently able to comprehend text presented via RSVP at 250 wpm and via the Palm Reader<sup>TM</sup> (at their own reading speed) equally well. However, once the rate of presentation in RSVP increased, performance decreased (see Figure 1).



**Figure 1. Reading Comprehension across conditions (percent correct).**

### *Satisfaction*

Participants were asked to rate their level of satisfaction on a number of items after testing under each of the four conditions. Results of one-way ANOVA's were significant and similar with regard to several questions: (1) whether the passages were easy to read; (2) whether they were able to concentrate while reading; and (3) how confident participants were that they sufficiently comprehended the reading material. For all of these questions, participant responses indicated the highest satisfaction was with the Palm Reader<sup>TM</sup>, followed by the RSVP at 250 wpm, and then the remaining two RSVP conditions in order of increasing presentation rate.

On the issue of the level of perceived eyestrain experienced during the reading of the passages, an ANOVA on the satisfaction responses showed a significant difference [ $F(3,57) = 27.529, p < .05$ ]. Post hoc testing revealed only the Palm Reader<sup>TM</sup> condition as significantly different from any other condition. Participants apparently perceived significantly less eyestrain with the Palm Reader<sup>TM</sup> compared to the RSVP, regardless of the speed of presentation in RSVP.

Participants were also asked to rate their overall comfort level with the presentation rate for each of the RSVP conditions. An ANOVA on these ratings revealed a significant difference between all three presentation rates [ $F(2,38) = 40.67, p < .05$ ]. Participants were therefore more satisfied with the slower automated presentation rate.

### *Preference*

Participants were asked to rank the automated presentation rates they read with the RSVP format.

Using a Friedman test, significant differences were detected [ $\chi^2(2) = 34.9, p < .05$ ]. Post hoc analysis indicated that the 250 and 450 wpm were significantly preferred over the 650 wpm.

## **CONCLUSION**

Results from this study reveal differences in comprehension between RSVP conditions of differing presentation rates (250, 450, and 650 wpm), but not between the RSVP at 250 wpm and the Palm Reader<sup>TM</sup> condition. Participants were therefore able to read material as efficiently whether from RSVP or from the traditional page-like format at their own natural reading speed. Despite this comparable performance between these conditions, participants were generally less satisfied with the RSVP, when compared to Palm Reader<sup>TM</sup>, regardless of the rate of text presentation.

These results are in keeping with our previous research. It was not unusual for the participants to express some dislike of the RSVP format, considering it is a new and very different method of reading. However, what is interesting is the fact that, despite their preferences, users, who had little or no experience with RSVP, were still able to read as accurately as they read with Palm Reader<sup>TM</sup> and at a comparable speed.

The object of this research was not to promote the use of the RSVP format simply as an end unto itself.

Rather, it is the application of an old tool to a new problem. Small screen interfaces are a daily reality, and with them come the problem of how best to display text for the user in a limited amount of space. As this research progresses, the use of RSVP in this regard is consistently being shown to be a functionally viable means of addressing this problem. However, future research in this area should not only address the usability of the format, but ways to increase user satisfaction.

## REFERENCES

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