



Rapid serial visual presentation in reading: The case of Spritz



Simone Benedetto^{a,b,*}, Andrea Carbone^{a,b}, Marco Pedrotti^{c,d}, Kevin Le Fevre^{a,b}, Linda Amel Yahia Bey^{a,b}, Thierry Baccino^{a,b}

^a CHArt/LUTIN (EA 4004), Cité des Sciences et de l'Industrie de la Villette, 30 Avenue Corentin Cariou, 75930 Paris, France

^b Université Paris 8 – Vincennes St. Denis, 2 rue de la Liberté, 93200 Saint-Denis, France

^c Centre de Sciences Cognitives, Université de Neuchâtel, Rue de la Pierre-à-Mazel 7, 2000 Neuchâtel, Switzerland

^d Swiss Center of Affective Sciences, University of Geneva, Geneva, Switzerland

ARTICLE INFO

Article history:

Available online 10 January 2015

Keywords:

Reading
Rapid serial visual presentation
Comprehension
Visual fatigue
Spritz

ABSTRACT

In the era of small screens, traditional reading (i.e. left-to-right, top-to-bottom) is called into question and rapid serial visual presentation (RSVP) represents one of the main alternatives. RSVP consists of displaying in sequential order one or more words at a time, thus minimizing saccades and eye blinks. Recently, a RSVP application has received a lot of media attention: it is the case of Spritz. According to Spritz's developers, the elimination of saccades should reduce visual fatigue and improve comprehension. In this study, we had people read on a computer screen a selected part of a book either with Spritz or in the traditional way. Results seem to contradict these claims. The fact that Spritz suppresses parafoveal processing and regressions (i.e. rereadings of words) negatively affected literal comprehension. Furthermore, the important reduction of eye blinks observed for Spritz might contribute to the increase of visual fatigue.

© 2015 Elsevier Ltd. All rights reserved.

1. Introduction

The diffusion of personal communication devices has rendered the access to information ubiquitous and pervasive. The growing amount of accessible information contrasts with the time that we have to process it. The smaller and smaller digital supports (e.g. mobile phones, smart watches, head mounted displays) that we use to access information play an important role in shaping our reading habits. In this context, alternative methods to present textual information might become crucial to expedite information consumption while preserving our capacity to capture the meaning of what we read. According to [Castelhana and Muter \(2001\)](#), those methods include: the moving window, the times square, the line-stepping, the sentence-by-sentence presentation, and the rapid serial visual presentation or RSVP. Originally conceived as an experimental paradigm for studying attentional mechanisms, the RSVP has been proposed for the first time in the context of reading in the late 50s by [Gilbert \(1959\)](#) and employed for studying comprehension and processing of written language by [Forster \(1970\)](#). The RSVP consists of displaying one or more words at a time and in sequential order, thus minimizing the eye movements generated during reading, and increasing the attentional focus. According to

[Lemarié, Eyrolle, and Cellier \(2008\)](#), text size, presentation unit, visual structure, and segmentation unit are the main factors affecting text comprehension with RSVP. However, although in the last 50 years many variants of RSVP have been proposed and many studies have been carried out, it is still difficult to determine the ideal presentation parameters for RSVP ([Proaps & Bliss, 2014](#)). According to [Rayner \(1998\)](#), comparisons of RSVP to normal reading have revealed that with short sentences, results that are typical of normal reading can be obtained as long as the rate of presentation does not pass a certain threshold beyond which attentional blinks might occur (see [Raymond, Shapiro, & Arnell, 1992](#), for further details). [Proaps and Bliss \(2014\)](#), suggested that four words per second (i.e. 250 wpm) may elicit performance comparable to traditional text presentation formats. Significant reductions of reading comprehension and retention often take place when such rate increases (e.g., [Chen & Chien, 2007](#); [Juola, Ward, McNamara, 1982](#); [Just & Carpenter, 1980](#); [Potter, 1984](#); [Potter, Kroll, & Harris, 1980](#)). Furthermore, with sentences and passages getting longer, the processing system quickly gets overloaded, and comprehension breaks down (see [Masson, 1983](#)). Although there is almost a broad agreement on the superiority of traditional reading over RSVP, some studies have shown some potential. For example [Juola et al. \(1982\)](#) demonstrated that the RSVP is as efficient as a normal page-format reading. [Rubin and Turano \(1992\)](#) found that RSVP reading rates were consistently higher, with adequate comprehension levels, however just few participants felt comfortable. [Fine, Peli, and Reeves \(1997\)](#) investigated the possible

* Corresponding author at: CHArt/LUTIN (EA 4004), Cité des Sciences et de l'Industrie de la Villette, 30 Avenue Corentin Cariou, 75930 Paris, France. Tel.: +33 1 40 05 77 13.

E-mail address: benedetto.simone@gmail.com (S. Benedetto).

advantages of RSVP on an aging reading population, finding that the benefits of RSVP did not decrease as visual acuity and contrast sensitivity decreased. Finally, visually impaired, dyslexic and less efficient readers have also been proposed to benefit from RSVP displays (Chen, 1986; Potter, 1984; Williamson, Muter, & Kruk, 1986).

Many RSVP commercial applications have been recently developed for both Android and Apple platforms (e.g. A Faster Reader; Balto Speed Reading; RapidRead; Speed Book Reader; Speed Reader Spritzer; Speed Reading; Speedy-Speed Reading; Spree; Spritz; Velocity), however one of those – that we investigate here – has recently gained visibility: we are talking of Spritz. The novelty of Spritz lies in the combination of a single-word stationary RSVP with the Optimal Recognition Point (ORP) also known as Optimal Viewing Position (OVP), the letter most crucial for the brain to process the meaning of a word. The location of the ORP has been largely investigated and depends on the length of the word: the longer the word, the farther to the left of center the eyes must move to locate the ORP (for a review see Brysbaert & Nazir, 2005). In Spritz every ORP is highlighted in red and displayed in the same location on the Spritz's display, so that the reader's eyes are always focused on the same location and no saccades – even very small ones – are required. Other innovations of Spritz concern the time words are displayed and the pause length between sentences. In Spritz longer words are displayed longer and longer sentences have longer pauses at the end of the sentence (see Maurer, Klein, & Waldman, 2014, for further details).

The general idea that RSVP has a disadvantage over traditional reading lies in the fact that – with RSVP – eye movements are almost removed from the reading process (Masson, 1983; Rayner, 2009). Although few studies support the idea the elimination of eye movements would lead to a possible reduction in cognitive load (e.g. Potter, 1984), this assumption cannot be supported (Castelano and Muter (2001)). By requiring eye movements to be suppressed, RSVP may actually increase cognitive load and distract the reader from the content of the passage being read (Bouma & De Voogd, 1974). During reading, the eyes follow the direction the text is written. However, about 10–15% of the time spent for reading is made of regressions. Regressions are backward gaze moves within a line, produced to re-examine material not clearly perceived or understood (Rayner, 2009). According to Schotter, Tran, and Rayner (2014), the control over the sequence and duration of word processing, as well as the control of the oculomotor system, are crucial to accurate comprehension of text, and the functional removal of regressions jeopardizes comprehension. However, the possibility to make regressions is not the only element that discriminates traditional reading from RSVP. A large body of literature has proven that readers access information from words before fixating them by means of the so-called parafoveal processing (Rayner, 2009). The acquired information is then used to ease processing once the words are directly fixated (Schotter, Angele, & Rayner, 2012). Since in Spritz words are presented one at a time, parafoveal processing cannot occur.

Besides comprehension, a very interesting and unexplored topic seems to be the relationship between visual fatigue and RSVP. Visual fatigue (sometimes referred to as asthenopia or eye strain) is a subjective visual disturbance, characterized by fatigue, pain around the eyes, blurred vision or headache (ICD-10, H53.1). According to Sheedy, Hayes, and Engle (2003), external visual fatigue symptoms could be attributable to the dry eye syndrome, an eye disease caused by either decreased tear production or reduced blinking. Therewith, changes in visual fatigue can be easily detected by monitoring changes in eye blinks, namely decreased frequencies as visual fatigue raises (Benedetto, Drai-Zerbib, Pedrotti, Tissier, & Baccino, 2013; Rosenfield, 2011; Benedetto, Carbone, Drai-Zerbib, Pedrotti, & Baccino, 2014). Blinks are generally inhibited during tasks that require sustained visual attention

and tend to occur immediately before or after the task (for a review see Stern, Walrath, & Goldstein, 1984). According to Nakano, Kato, Morito, Itoi, and Kitazawa (2013) eye blinks are actively involved in the process of attentional disengagement during cognitive tasks by momentarily activating the default-mode network (usually involved in wakeful rest), while deactivating the dorsal attention network. Since the RSVP entails large amounts of visual attention, a drop in the frequency of eye blinks should be expected. Additionally, the radical minimization of saccades induced by this reading modality, might even amplify the negative effect on visual fatigue. Since saccadic gaze shifts are often accompanied by blinks, a reduction of saccades will generate a consistent drop in eye blinks (e.g. Evinger et al., 1994; Watanabe, Fujita, & Gyoba, 1980).

According to Spritz's developers, the elimination of saccades should reduce eye fatigue and improve comprehension, even when dealing with long texts (Maurer & Locke, 2014; Maurer et al., 2014). Since these claims do not seem to be supported by any scientific evidence, we believe they need to be investigated. In this study, we had people read on a computer screen a selected part of a book (Orwell, 2004) either with Spritz or in the traditional way (i.e. left-to-right, top-to-bottom), and tested the effects of the two reading modalities (i.e. Spritz vs. Traditional) on comprehension, visual fatigue, performance, task load and ocular behavior using ocular, performance and subjective measures.

2. Materials and methods

2.1. Participants

Sixty participants (30 females, mean age = 28 years, SD = 9) were recruited and gave written informed consent before the experiment begun. All of them were native French speakers, were naïve as to the aims and the expected outcomes of the experiment and had normal or corrected-to-normal vision (contact lenses were accepted but not glasses). None of them had previous experience with the Spritz application. According to the International Standard Classification of Education (ISCED, 2011) participants' median level of education was 6 (i.e. Bachelor or equivalent). Either a monetary compensation (10 €) or school credits were offered to participants for their participation in the study. The study was performed in keeping with the Declaration of Helsinki. An internal committee board approved the protocol.

2.2. Apparatus

Eye movements were recorded with an infrared video-based eye tracker (SMI RED 5; www.smivision.com). Sampling rate was set to 500 Hz, and a 5-point calibration was made for each participant at the beginning of each reading trial. Ambient lighting and screen luminance were kept constant during the whole experiment, as assessed by a digital light meter (Extech 403125; www.extech.com). The average distance between participants and the 22" LCD screen (Dell P2210; www.dell.com) employed for the reading task was 70 cm. Screen size was 474 (horizontal) × 297 (vertical) mm. Screen resolution was set to 1280 × 768 px.

2.3. Stimuli

Two types of reading modalities were compared in this experiment: Spritz vs. Traditional. Variables such as font size and typeface were not manipulated and were kept constant during the whole experiment and across the two experimental conditions. In this way, that the only difference resided in the way the text was displayed. As to Spritz, the software employed for simulating the RSVP procedure was developed according to the information

Download English Version:

<https://daneshyari.com/en/article/350489>

Download Persian Version:

<https://daneshyari.com/article/350489>

[Daneshyari.com](https://daneshyari.com)