Using Paper, E-ink device or Desktop-PC for office work and subjective strain – a comparative study

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Background
- A new generation of large mobile devices enable digital uses similar to paper. Unlike studies concerning the use of tablet-pcs, so far, it is unclear to what extent e-ink devices are more like paper or computers in respect of resulting strain.
- It was reported that people use paper, as it is easier to navigate through multiple pages [1]. Handwritten commentaries are usually inserted easier and faster than their digital counterparts [2]. So people often get frustrated and distracted when using digital formats for these tasks [1].
- Reading from computer monitors was found [3] to be significantly slower compared to paper. Other performance parameters like reading comprehension, or textual productivity differed between studies.
- On the other hand, people often prefer digital over analogue documentation [1]. And reducing information loss due to media breaks is an appreciated goal in most workplaces.
- The aim of this study was a comparison between an e-ink device, a conventional desktop-pc and common paper for a reading and a correction task.

Method
- Tasks: *proofreading* 40 lines of pseudo words, reading double-sided texts with multiple choice questions
- Material: large-size e-ink device (DPT-S1 Sony, US-letter format), Desktop-PC (22"-LCD-Monitor), paper hardcopy
- Data: subjective strain (NASA-TLX [5], scale 1= low, 21= high), Performance parameters (lines edited, errors, reading time), Media preference: for 5 different tasks
- Participants: 36 Participants (15 man, 21 women), within-design experiments, Age: Ø 37 years (min: 20 max: 62 years), Technical affinity Ø 3.5 (SD= 0.59) (TA-EG [4]), scale 1= low to 5= high

Results and Discussion

Subjective strain:
- Overall the strain for the tasks were of medium intensity with a significant difference between conditions (F(2, 70) = 14.92, p < .001, n² = .30). Compared to the desktop condition (Ø: 11.43 SD: .414) subjective strain for paper handling (Ø: 8.74 SD: 3.60) and the e-ink device (Ø: 9.58 SD: 3.67) was significantly lower.
  ➢ So a digital paper variant may help to optimize strain for similar tasks especially if executed over a longer period of time.

Performance parameters:
- Divergent from data reported in [3] no difference for reading velocity was found between the media (F(2, 70) = 1.68, p = .194, n² = .05).
  ➢ Reasons may be a greater display size and quality compared to [3] or a higher familiarity for reading from a computer display, probably both.
- Proofreading showed an effect of media used for lines edited (F(2, 70) = 42.73 p < .001, n² = .55), Lines progressed from desktop-pc (Ø: 24.11 SD: 6.62) via e-ink device (Ø: 28.31 SD: 6.76) to hardcopy (Ø: 31.59 SD: 6.09). No differences for errors were found (F(2, 70) = 0.15, p = .859, n² = .01).
  ➢ Tagging the pseudo words on the desktop-pc using a mouse caused a divide between hand and text. For both paper variants participants were able view text and handwritten together, which could have caused the higher speed.

The participants had indicated a high preference for paper prior to the experiment, especially for reading (first choice paper 90%) and correcting (71%). After using all three media 17% of the participants would have swapped the paper for the e-ink device for the reading task, and 14% for correcting.
  ➢ Even though this was not a high change in paper preference, it seems a noticeable amount for the short device use time.

Conclusion
- Paper like digital devices combine the memory capacity and potential for organizing material with the paper like handling and subjective strain.
- User acceptance for the tested e-ink device was good and independent of age, gender or technical affinity.
- The results indicate that paper like digital devices like an e-ink device can be an alternative or a useful addition to using paper in the (mobile) workplace.

Further projects partners: