THE EFFECT OF PRESENTING LONG DOCUMENTS WITH LARGE HIGH-RESOLUTION DISPLAYS ON COMPREHENSION OF CONTENT AND USER EXPERIENCE

Seungwon Yang, Haeyong Chung, Chris North, and Edward A. Fox
fox@vt.edu
Virginia Tech, Blacksburg, VA 24061 USA
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Overview

- Introduction
- Hypotheses
- Experiment
- Results and Discussions
- Design Implications
- Conclusion and Future Work
Introduction

- Introduction
  - Problem
  - Research Questions
  - Large High-Resolution Display

- Hypotheses
- Experiment
- Results and Discussions
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- Conclusion and Future Work
Comprehending long documents (e.g., ETDs):
- Is time-consuming
- Requires a massive amount of cognitive resources

Define ‘comprehension’ in this study:
1) Seeing the forest: understand overall content
2) Seeing the trees: find/re-find/compare/contrast information detail in the content
Research Question 1

Does viewing all the pages of a long document on an LHRD improve users’ overall understanding of the content?
Research Question 2

- Does viewing all the pages of a long document on an LHRD improve users' information finding and comparisons?
Research Question 3

Does viewing all the pages of a long document on an LHRD provide a better user experience?
Large High-Resolution Displays (LHRD)
Hypotheses

- Introduction
- Hypotheses
  - Hypothesis 1
  - Hypothesis 2
  - Hypothesis 3
  - Hypothesis 4
- Experiment
- Results and Discussions
- Design Implications
- Conclusion and Future Work
Hypothesis 1

- The users of the Gigapixel display will summarize a long document with better quality compared to those in the Single Monitor or Paper on Table groups.
The participants in the Gigapixel group will find/compare information in a long document faster than those in the Single Monitor or Paper on Table groups.
Hypothesis 3

- The Gigapixel group will answer more accurately in finding/comparing information, when compared to either the Single Monitor or Paper on Table group.
Hypothesis 4

- Participants in the Gigapixel group and Paper on Table group will perceive a higher level of efficiency and effectiveness for using their display medium compared to the Single Monitor group.
Experiment

- Introduction
- Hypotheses
- Experiment
  - Participants
  - Experimental Setting
  - Gigapixel ETD Viewer
  - Tasks and Procedure
- Results and Discussions
- Design Implications
- Conclusion and Future Work
Participants (1/2)

- 12 grad students (5 female, 7 male)
  - 4 people participated in each of 3 settings
- Ages 22-40 years
- Familiarity of resource type:
  - Web pages > conference proceedings > journal articles > theses & dissertations
Participants (2/2)

- Preference for text presentation (1:least - 5:most):
  - Computer screen: 4.25 out of 5
  - Paper: 3.17 out of 5
  - Reasons: digital docs are easier to manage/search/store

- Read texts on computer screens
  - More than 8 hrs/week

- In ETDs, participants were interested in:
  - Specific info (75%)
  - Methodologies (75%), literature reviews (83.3%)
  - Overall topics (50%)
Gigapixel Experiment Video

- Example video
Experimental Setting

- A Master’s thesis, “The Design of Active Workspace,” was used
  - Approx. 70 pages
  - Easy reading, HCI-related paper
  - Font size of each page enlarged
- 3 Settings
  - Gigapixel
  - Paper on Table
  - Single Monitor
5 x 10 monitors
All pages shown, grouped by chapter

A handheld device to move pages

Notepad, Post-It on a rolling desk
Pages are grouped by chapter, on a large table

Notepad, Post-It notes are provided
Display a thesis with Adobe PDF Reader

Page thumbnails

Notepad, Post-It provided
Drag-and-drop pages using the trigger to compare figures

Red pointer from the handheld interface
Participants performed two tasks:

- **Task 1** for overall comprehension
  - Read thesis for 30 minutes, move/reorganize pages
  - Write 200-300 word summary

- **Task 2** for info finding/comparison (6 questions)
  - Q 1,2: finding specific info
  - Q 3: similarities and differences between systems
  - Q 4: finding info based on another info
  - Q 5,6: comparing figures, figure details
Results and Discussions

- Introduction
- Hypotheses
- Experiment
- Results and Discussions
  - User Performance
  - User Perception of Efficiency & Effectiveness
  - User Behaviors
- Design Implications
- Conclusion and Future Works
Group Average Time of Task 1&2

Task 1: Summary Time (min.)

- Gigapixel: [Value]
- Paper on Table: [Value] (a)
- Single Monitor: [Value]

Task 2: Total Time (min.)

- Gigapixel: [Value]
- Paper on Table: [Value] (b)
- Single Monitor: [Value]
Group Average Score of Task 1&2

Task 1: Summary Score (max. 100)

Task 2: Total Score (max. 60)
Group Average Score of Questions in Task 2

Task 2: Info Finding & Comparison Score
(max. 10 each)

Significant difference

Gigapixel  Paper on Table  Single Monitor

True/False info finding  Short answer  Find similarities differences  Apply principle  Compare figures  Compare details
User Perception of Efficiency & Effectiveness

User Perception of Efficiency & Effectiveness of Display Medium

Significant difference

Task 1: Efficiency
Task 2: Efficiency
Task 1: Effectiveness
Task 2: Effectiveness

Gigapixel  | Paper on Table  | Single Monitor

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List of Significant Results

- Group average score for task 2, question 3:
  - Gigapixel group >> Single Monitor group
  - Partially confirming Hypothesis 3

- User perception of effectiveness for task 2
  - Paper on Table group >> Single Monitor group
  - Partially confirming Hypothesis 4
Four common behaviors identified from observations and post-questionnaire analysis

1. Physical Navigation
2. Reading and Page Switching Strategies
3. Arrangement of Pages
4. Comparing Pages
Design Implications

- Introduction
- Hypotheses
- Experiment
- Results and Discussions
- Design Implications
  - Additional Features
- Conclusion and Future Works
Additional Features

- Annotation, searching, and highlighting
- Connecting related pages visually
- Changing page size
- Multiple document/reference support
- Supporting different page layouts
- Aligning pages with bezels
- Temporary move
Conclusion and Future Works

- Introduction
- Hypotheses
- Experiment
- Results and Discussions
- Design Implications
- Conclusion and Future Works
  - Summary
  - Future Plans
Hypotheses 1 and 2 have not been confirmed.

In general, compared to the other two groups, people in Gigapixel group could
1. Summarize the document with better quality
2. Find/compare information faster

But, we did **not find a statistically significant** effect.
Hypotheses 3 have been partially confirmed.

A significant performance improvement by the Gigapixel group was found:
- Could answer more accurately only for question 3 in task 2, which is to find similarities and differences of two systems, compared to Single Monitor group.
Hypotheses 4 have been partially confirmed.

A significant performance improvement by the Paper on Table group was found:
- Paper on Table group’s perception of their performance effectiveness for task 2 was significantly higher than that of Single Monitor group.
- But, the perceptions of efficiency for task 1,2 and effectiveness for task 1 were not found to be significant.
Large field of view and physical navigation helped people recognize the structure of the thesis and quickly navigate it to re-find information.

Physically navigating to nearby pages is almost instantaneous (eye glance, head rotation); scanning multiple pages or comparing 2 pages is faster.
Future Plans

- Incorporate **new features** from Design Implications section
- Study **collaborative work** using Gigapixel
  - E.g., Two people review scholarly publication together on a Gigapixel
- Use many **more participants**
Thank you!

Questions?