Analysis of Reading Patterns of Scientific Literature using Eye-Tracking Measures

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ABSTRACT

Scientific literature is crucial for researchers to inspire novel research ideas and find state-of-the-art solutions to various scientific problems. The information seeking behavior when reading scientific literature varies from one person to another. Novice researchers may exhibit different reading patterns compared to more experienced researchers. We conducted a pilot study of a reading task for novice researchers using eye-tracking measures.

The focus of the study is to analyze,
- Scan paths,
- Fixations, and
- Pupillary activity of the participants

RESEARCH QUESTIONS

1. What is the order of the sections of the research paper read by novice researchers?

2. What is the fixation count made on each section?

3. What is the cognitive load of the researcher when reading each section of the research paper?

HYPOTHESIS

The cognitive load differ with respect to various sections of the research paper.

BACKGROUND

The reading process is determined by the ability to grasp the important facts efficiently, from different sections of the research paper. Therefore, the level of expertise is expected to play a major role when interacting with scientific literature. In general, during initial of visual information processing, shorter fixations and longer saccades are observed, whereas, during later stages of visual information processing, longer fixations and shorter saccades are observed after identifying the target [1].

METHODOLOGY
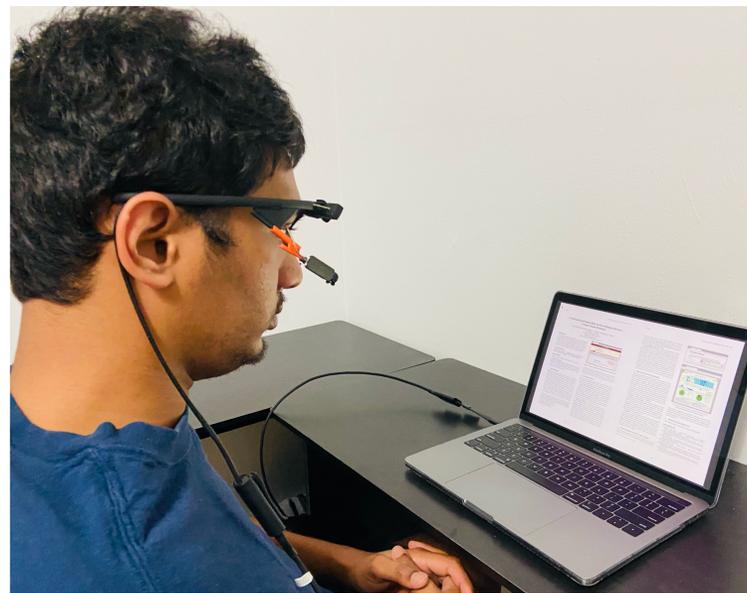
Fig 1. A participant reading the research paper while wearing the PupilLabs Core eye tracker

Participants
- Three Ph.D. students in the field of Computer Science (2 M,1 F)

Reading Task
- Two-page poster from JCDL 2018 conference

Procedure
- Participants read the research paper wearing the PupilLabs Core eye tracker
- Eye-tracker's sampling frequency - 120 Hz
- Eye-tracker's Accuracy - 0.60°
- We specified 5 areas of interest (AOIs) on the selected research paper: (1) Title, (2) Abstract, (3) Motivation, (4) Methodology, and (5) Conclusion.

ANALYSIS

We calculated the fixation counts, fixation duration, and Index of Pupillary Activity (IPA) [2] for each participant. IPA is an eye-tracked measure of pupil diameter oscillation, which is derived as an indicator of cognitive load.

RESULTS

Scan Path
- We observed 3 different scan paths among the participants.

Fixation Counts
- Participants preferred to **fixate more** on the **methodology section** and spent more time reading it.

Index of Pupillary Activity
- We observed **a higher cognitive demand** when reading the **title** section.
- We observed a **lower cognitive load** when reading the **methodology** section.
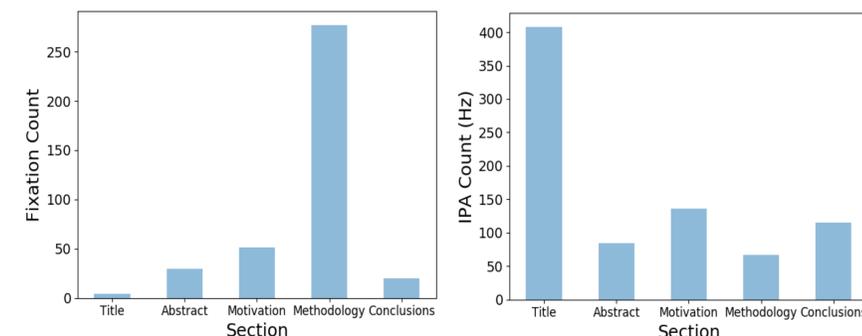

Fig 2. Mean fixation count (L) and IPA count (R) on each AOI

CONCLUSION & FUTURE WORK

- We observed different scan paths among novice researchers.
- In our analysis, novice researchers spent most time on reading the methodology section, with a low cognitive load.
- One limitation is that the reading task was performed on a two-page poster paper.
- In the future, we will explore the scan paths of both novice and experienced researchers in terms of advanced eye movement metrics in a typical length paper.

REFERENCES

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