



Manipulating Time Perception of Web Search Users



Cheng Luo, Fan Zhang, Xue Li, **Yiqun Liu**, Min Zhang, Shaoping Ma, Delin Yang
Information Retrieval Group, Department of Computer Sci. & Tech., Tsinghua University
yiqunliu@tsinghua.edu.cn

Background & Motivations

- Time plays an essential role in multiple areas of Information Retrieval (IR) researches
 - The *time* factor in search evaluation
 - Time-biased gain (TBG) & Time Well Spent (TWS)
 - An indicator of *user efforts* in Benefit/Cost framework
 - The *time* factor in user behavior analysis
 - Dwell time in identify satisfied clicks
 - The *time* factor in intent understanding
 - Time sensitive queries: "today's weather"
 - Time critical search: "baby choked by food"
- Time in previous works is the **objective time** measured by timing devices
- Psychological studies show that time perception could be influenced by many subjective factors

Temporal Relevance (TR)

- In this work, we focus on the impact of TR
 - Temporal Relevance** is one of the main determinants of the level of temporal awareness
 - Definition:** level of relevancy and importance of time dimension in a specific state required for the optimal adaptation to the external environment
 - It remains uninvestigated **whether TR will affect the time perception of Web search users** and further have influence on the perception of system effectiveness
- RQ1:** What is the **impact of TR** on time perception in Web search scenario?
- RQ2:** Are the results consistent across **different tasks** and **different search users**?

Experiment Setup

- Manipulating Temporal Relevance (TR):**
 - Treatment group: "**timing block**", a flashing colored block (visually informing the user about elapsed time — high TR)
 - Control group: no "timing block" (low TR)

Search tasks:

- 16 informational search tasks created based on queries from search logs
- Backstories spoken directly to the participants

Settings:

- Participants are **not allowed to acquire time** from devices in external environment
- Participants are required to **estimate the time** spent during the task in seconds, e.g., the duration of the whole search session



Time	Color	Flash Frequency
0-3 min	Green	0.3
3-5 min	Orange	1.2
After 5 min	Red	5

Search Time Estimation

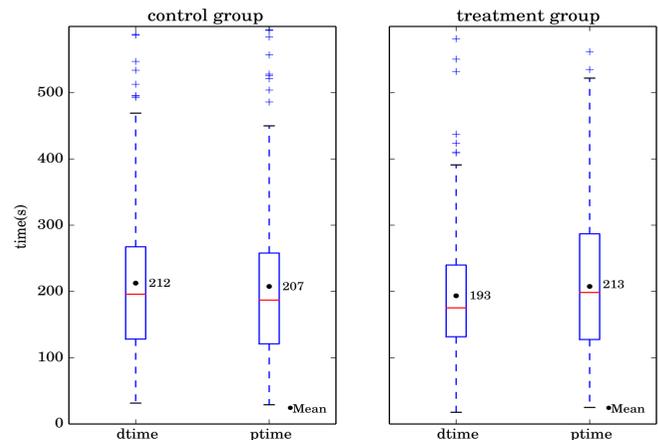
Please estimate the time you spent during the search session.

We provide a timeline to help you estimate the time. The further the bar is moved to the right, the longer time you have spent.

Time: 2 mins 5 seconds

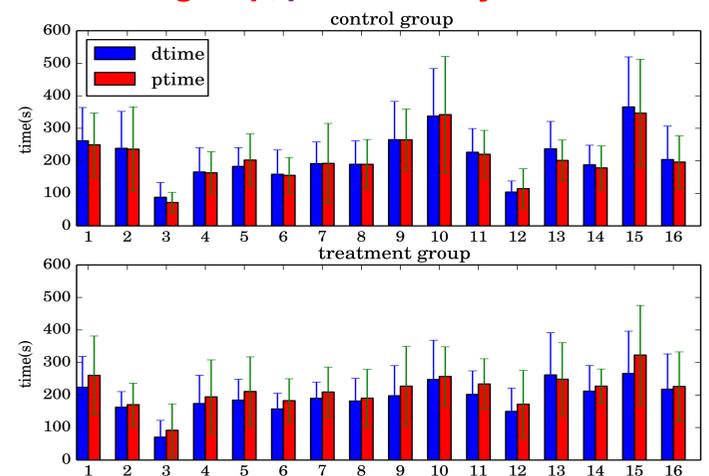
The Impact of TR on Time Perception

- Treatment (high TR): the perceived time (*ptime*) in the treatment group is **significantly longer** (10.36% with p-value < 0.01) than the dwell time (*dtime*)
- Control (low TR): **No significant difference** between dwell time and perceived time.



The Impacts of Tasks and Users

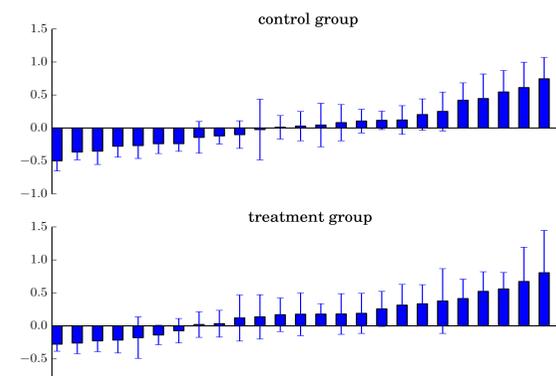
- For 15 of the 16 tasks, the average *ptime* in the **treatment group is longer** than the average *dtime*
- In the **control group**, *ptime* is **very close to dtime**



Average Estimation Offset (AEO)

$$AEO = \frac{1}{\#tasks} \sum_{t \in tasks} \frac{ptime_t - dtime_t}{dtime_t}$$

- More participants are with **positive AEOs** in the **treatment group**



Conclusion & Future work

- Users tend to perceive longer duration in high TR settings, for example, in some time critical situations.
- We would further explore other factors' impacts in perceived time (e.g. relevance, satisfaction, etc.)