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An Eye Tracking Study of Cognitive Effort Allocation across Translation Subtasks

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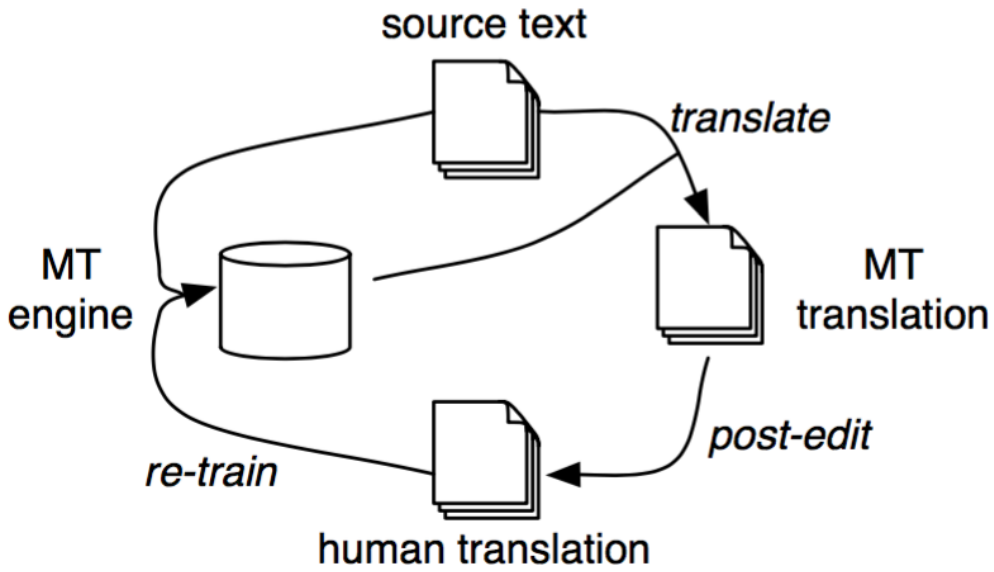
Project Overview

- Translation for
  - Dissemination
  - Assimilation
  - Information exchange
  - Information access



- Increasing need and use of machine aids for cost-effective translation

Project Overview

- In the foreseeable future, it is hard for MT to fully replace human translators
- How can machines support human translators?
  - Human-assisted machine translation (HAMT)
  - Computer-aided translation (CAT)
- Editors + additional (computerized) aids:
  - Bilingual dictionary
  - Spell checker, grammar checker
  - Monolingual concordancer
  - Terminology/ memory database
  - Web search

Project Overview

- Wide application of CAT tools in industry
- Acknowledged benefits to current business environment

- Still having call for better user experience

Project Overview

- Why study translation process?

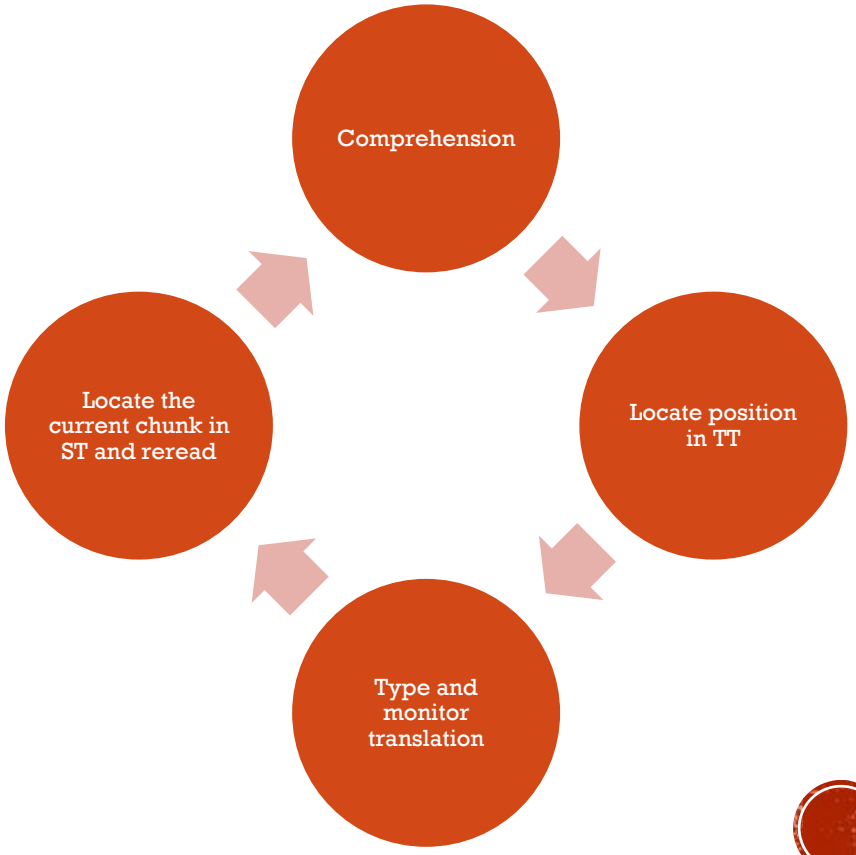
- Improvement of translation education
- Improvement of user experience translation technology

Background

- Efforts have been dedicated to reformulate the translation process

Eg.

- "Micro-cycle" by Jakobsen (2011)
- "Monitor model" by Tirkkonen-Condit (2005)

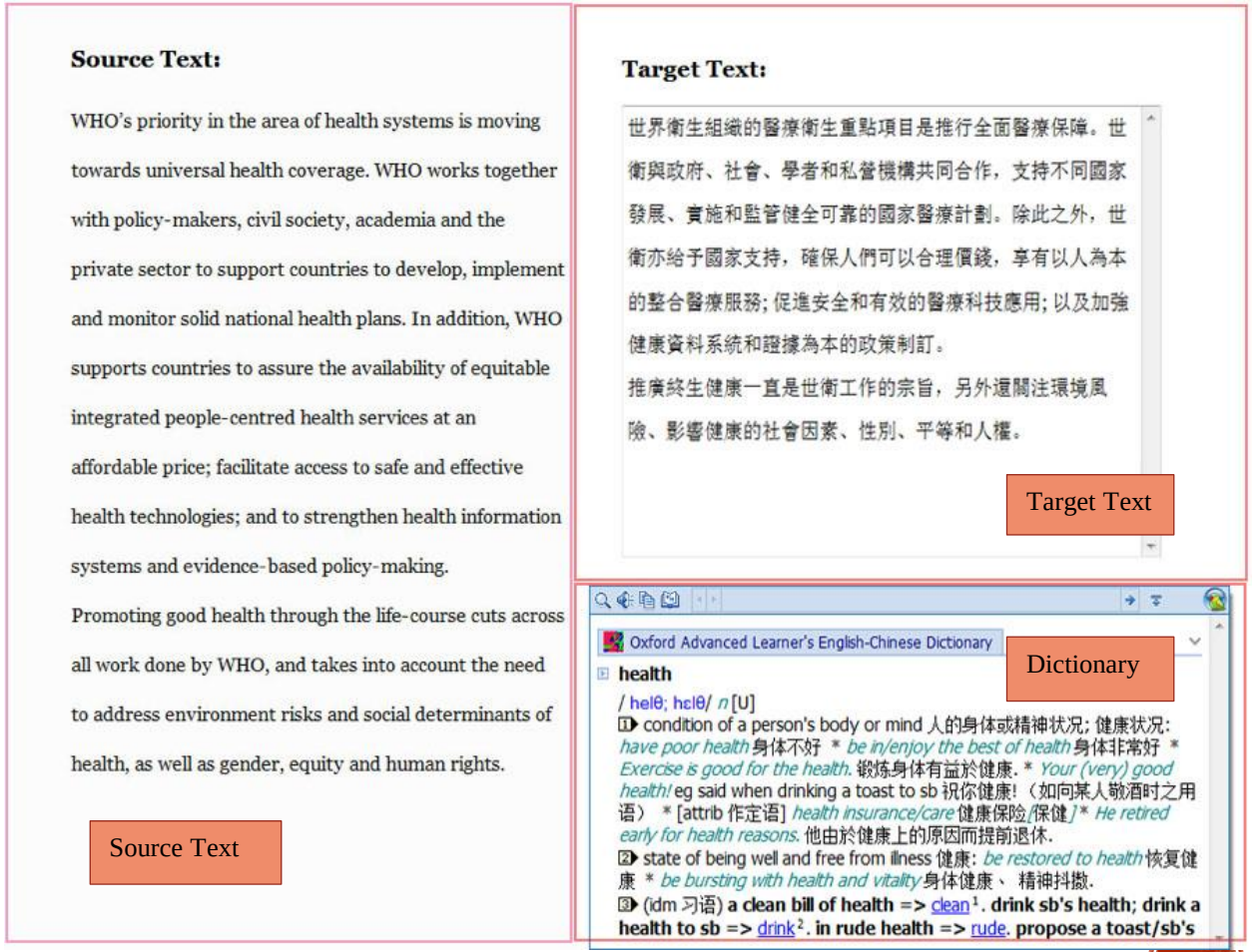


Research Questions

- What subtasks can be identified throughout the translation process?
- What is the general distribution of cognitive efforts observed by eye movements during translation process?
- How are cognitive efforts distributed among subtasks in translation? Are there any identifiable eye movement patterns within or across each domain/ subtask?
- To what extent will the text complexity affect different measures of eye movements during translation process?
- Is translation conducted in a sequential fashion as suggested by Gile (2011) or overlapping process can be identified (Hvelplund, 2011)?

Experimental Design

- Eyelink 1000 head-mounted tracker
- Primitive editor + offline dictionary

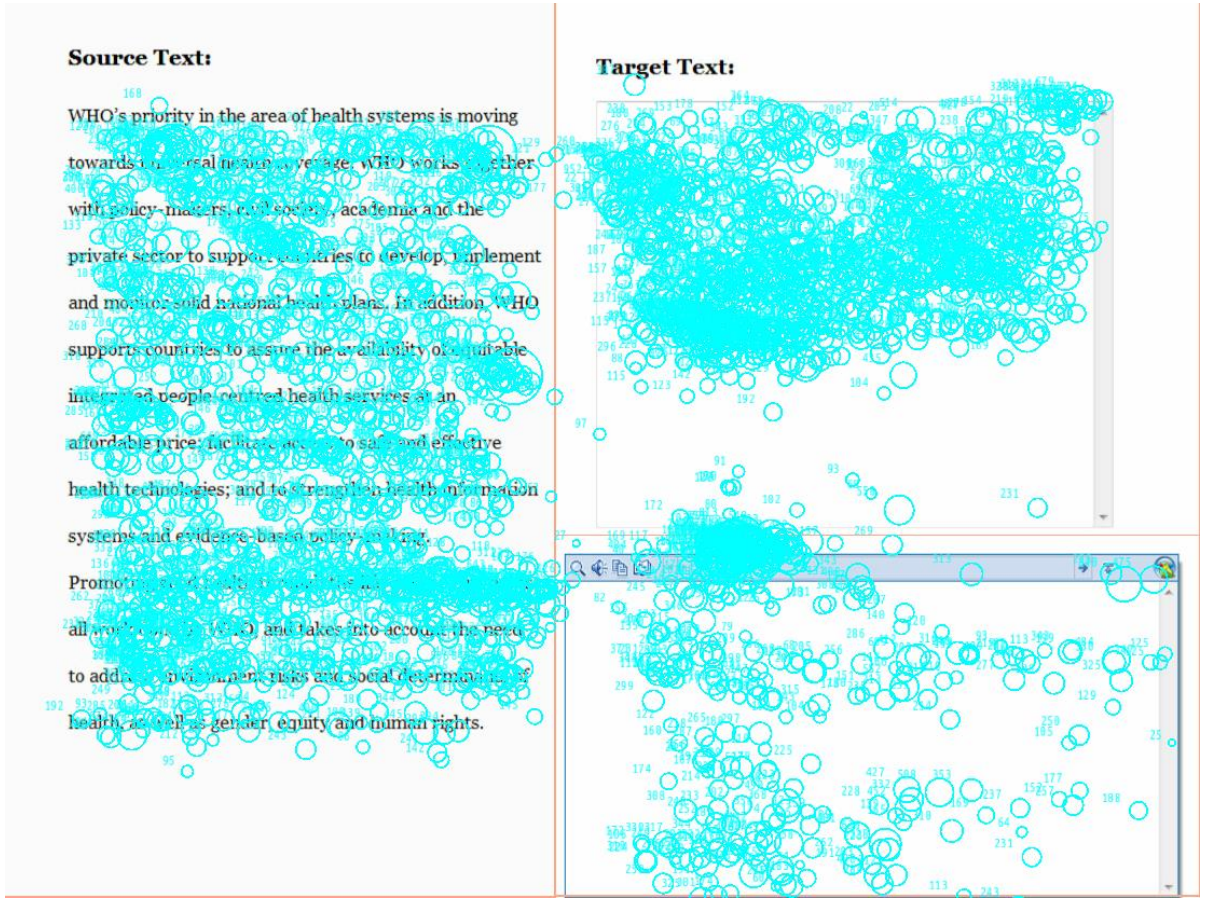


Experimental Design

- Task:
  - 1 warmup task + 2 experimental texts of varied complexity
  - Text 1 > Text 2 (according to the text complexity indicators by Jensen (2011))
  - All texts has <110 words

- Scope of participant:
  - Translation major students with completion of >1 year of studies
  - Chinese as the native language

Findings & Data Analysis



Findings & Data Analysis

- Two ways of categorizing subtasks
  - Predefined interest areas
  - Eye-tracking data + typing events

Fixation falls in	Typing event	Subtask Type
ST	✗	ST comprehension
ST	✓	Parallel attention (PA)
TT	✗ or ✓	TT production
Dictionary	✗ or ✓	Dictionary lookup

Findings & Data Analysis

- Overall distribution of cognitive effort
  - Dwell time
- Cognitive workload of different subtasks
  - Fixation duration
  - Pupil size
- Working style
  - Cross interest area saccades
    - Shift probabilities between interest areas
    - Reading patterns of dictionary

Overall Distribution

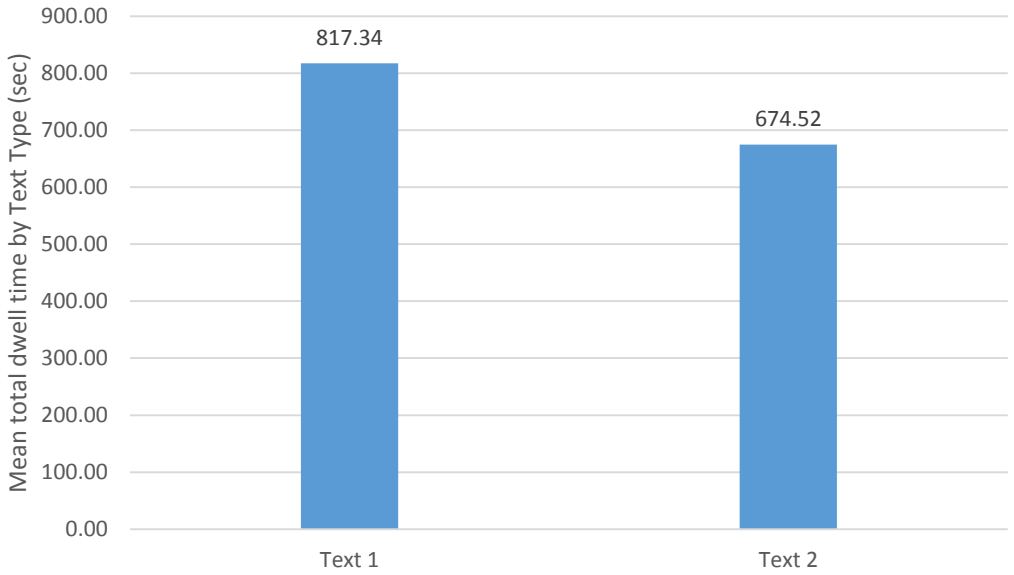
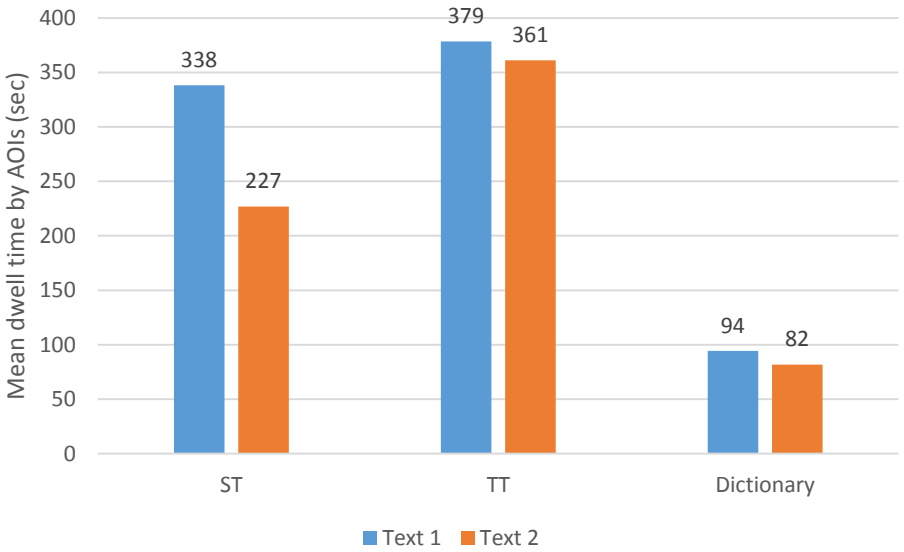
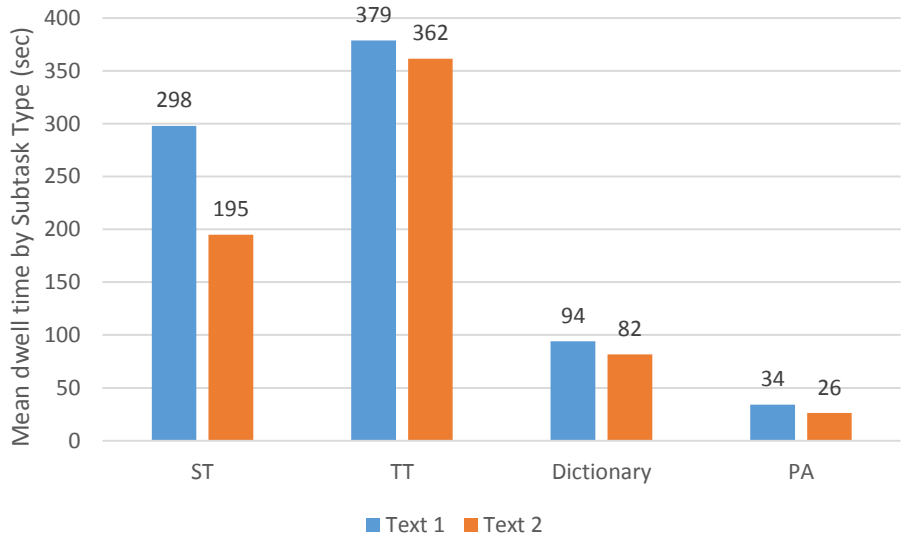


Figure 6 Mean total dwell time by Text Type (seconds).

Overall Distribution

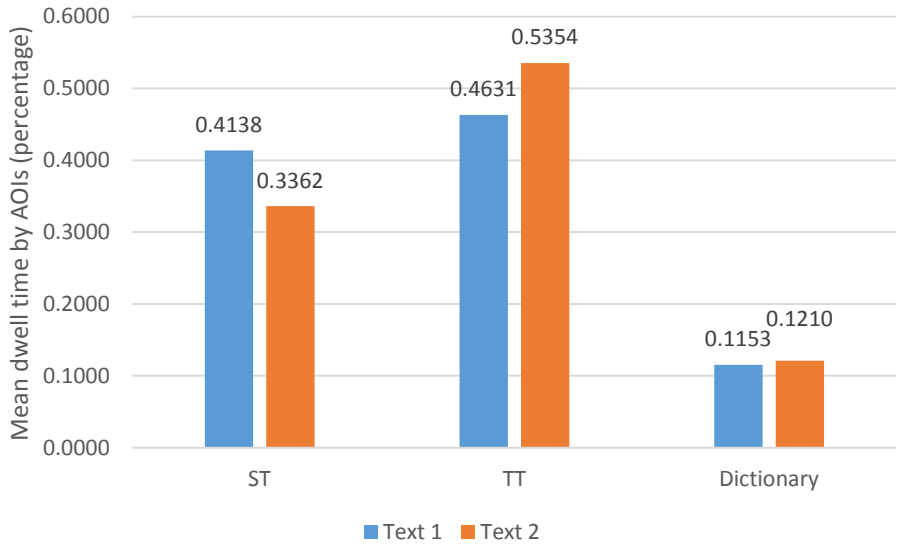


Mean dwell time by Text Type in different AOIs (seconds).

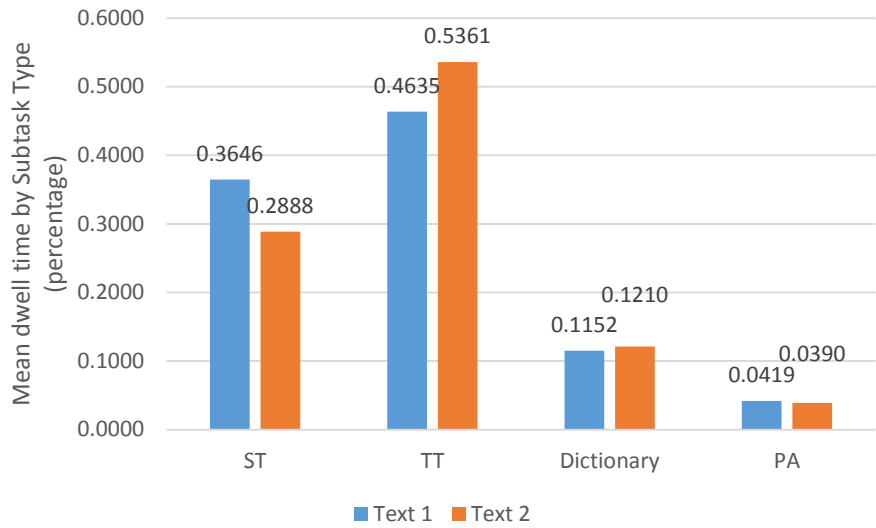


Mean dwell time by Text Type in different subtasks (seconds).

Overall Distribution

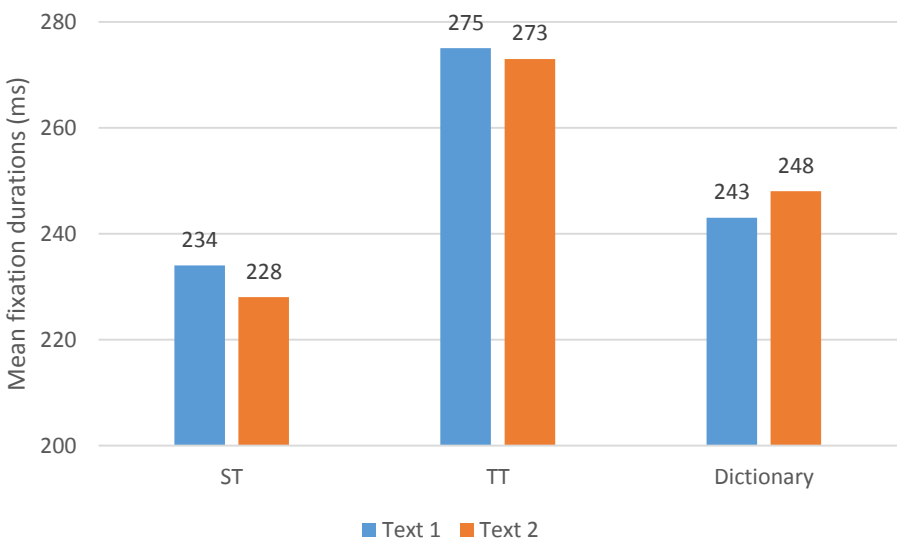


Percentage distributions of dwell time by Text Type in different AOIs.

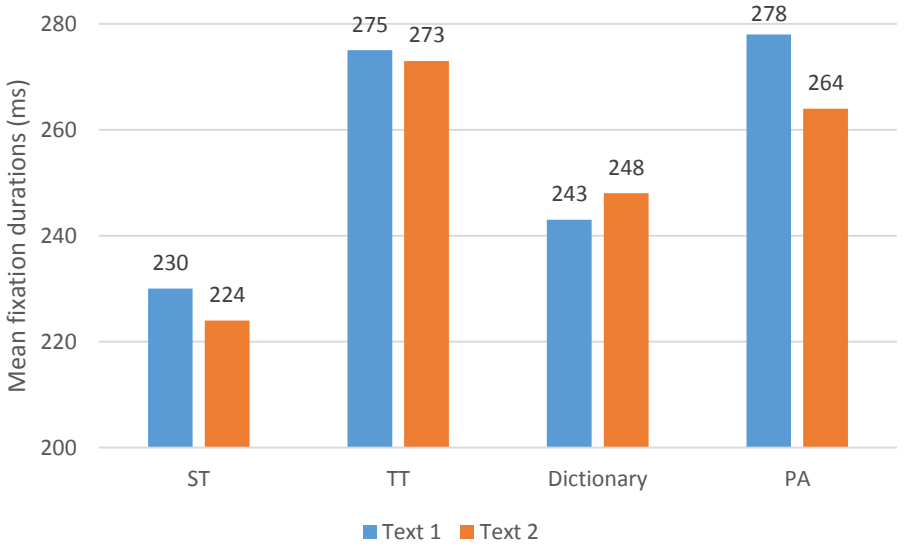


Percentage distributions of dwell time by Text Type in different subtasks.

Cognitive Workload of different Subtasks

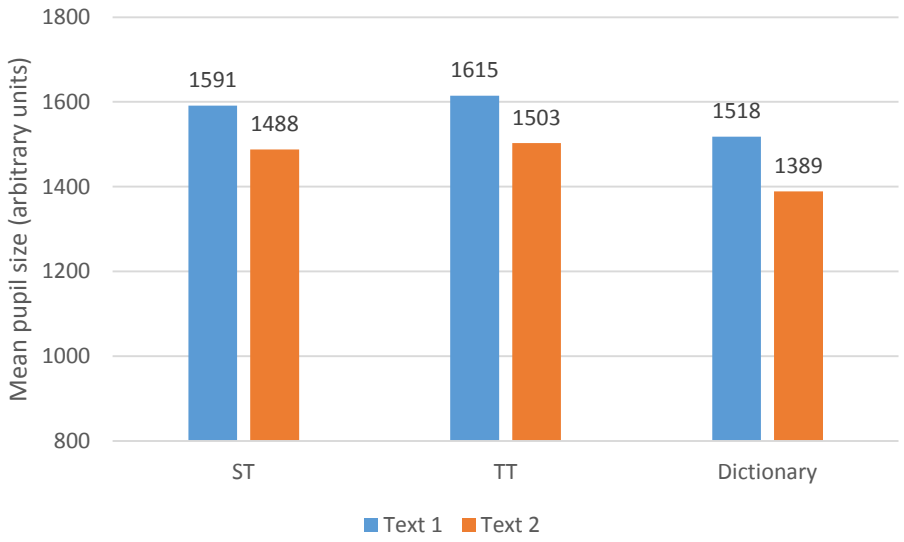


Mean fixation durations by Text Type in different AOIs (seconds).

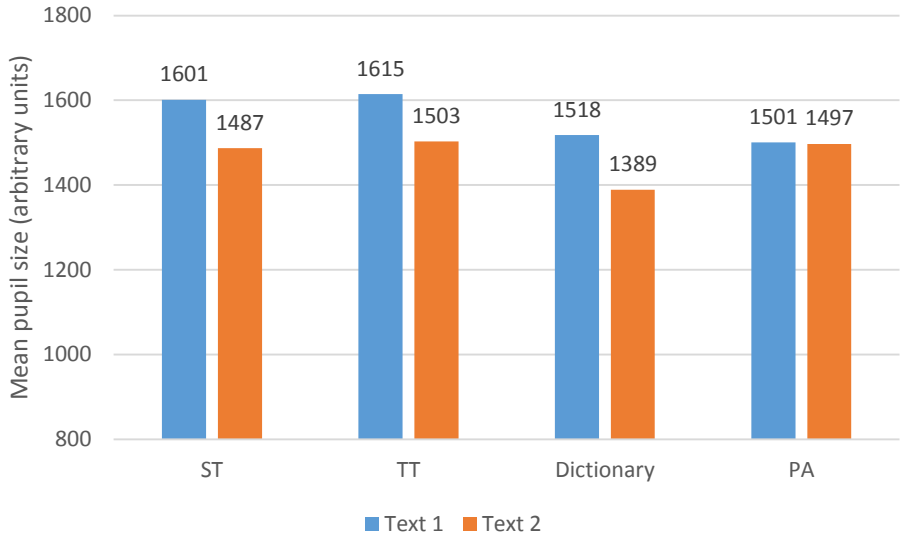


Mean fixation durations by Text Type in different subtasks (seconds).

Cognitive Workload of different Subtasks

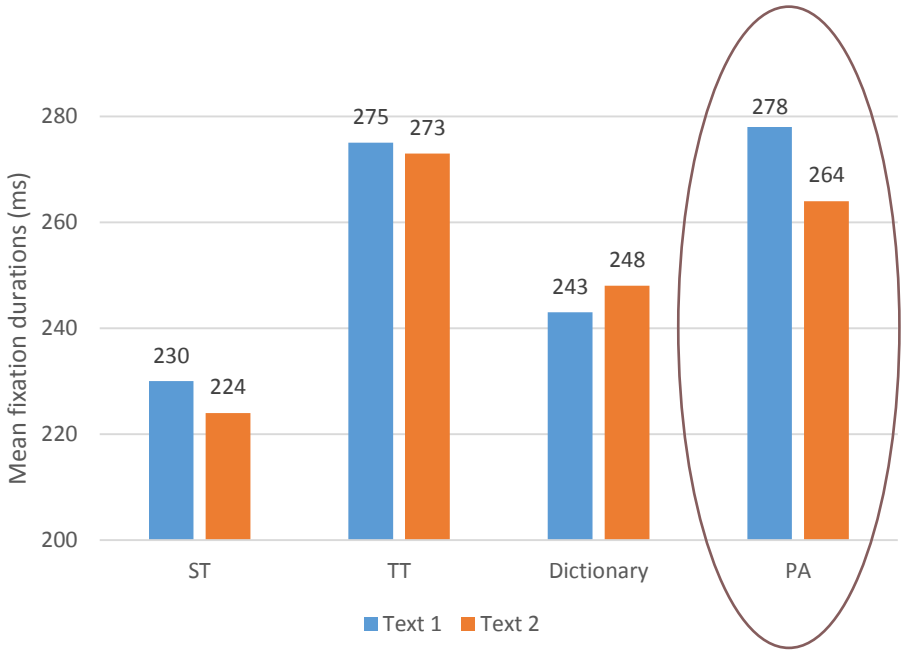


Mean pupil size by Text Type in different AOIs (arbitrary units).

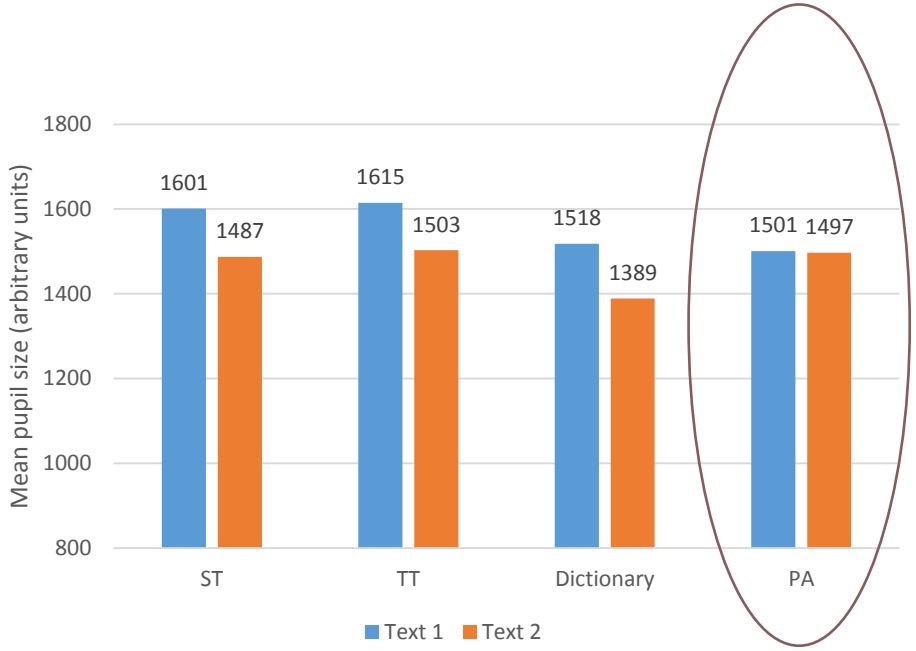


Mean pupil size by Text Type in different AOIs (arbitrary units).

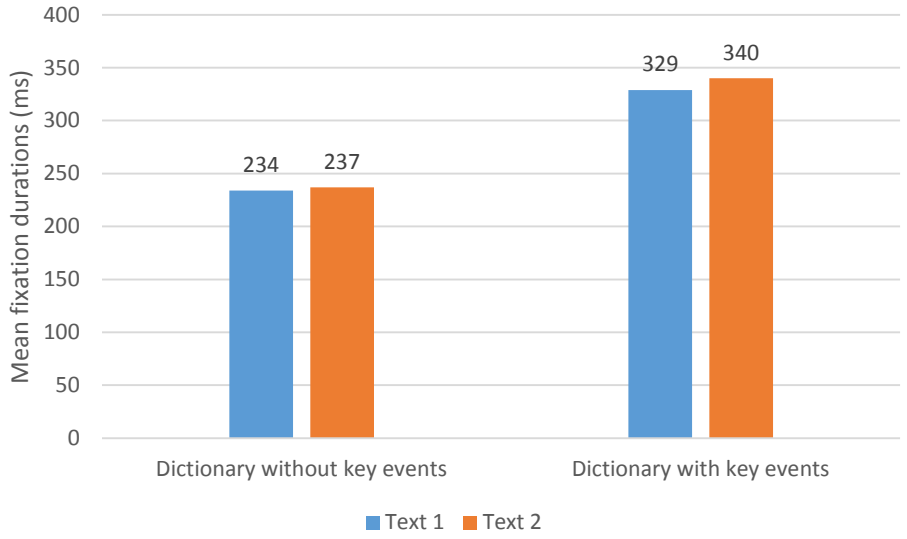
Parallel processing: Workload?



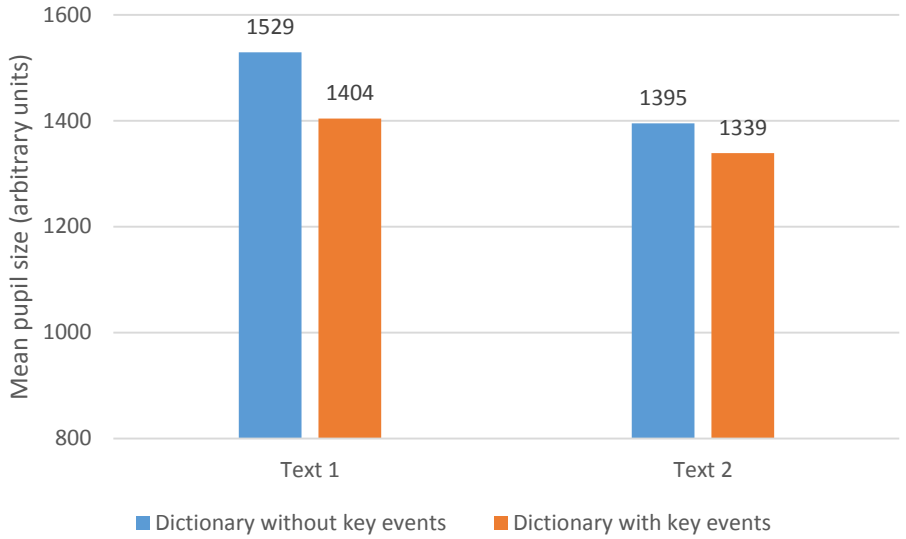
Mean fixation durations by Text Type in different subtasks (seconds).



Mean pupil size by Text Type in different AOIs (arbitrary units).



Mean durations of fixations in dictionary area with/ without key events being detected (seconds).



Mean pupil size in dictionary area with/ without key events being detected (arbitrary units).

Working style by Saccades

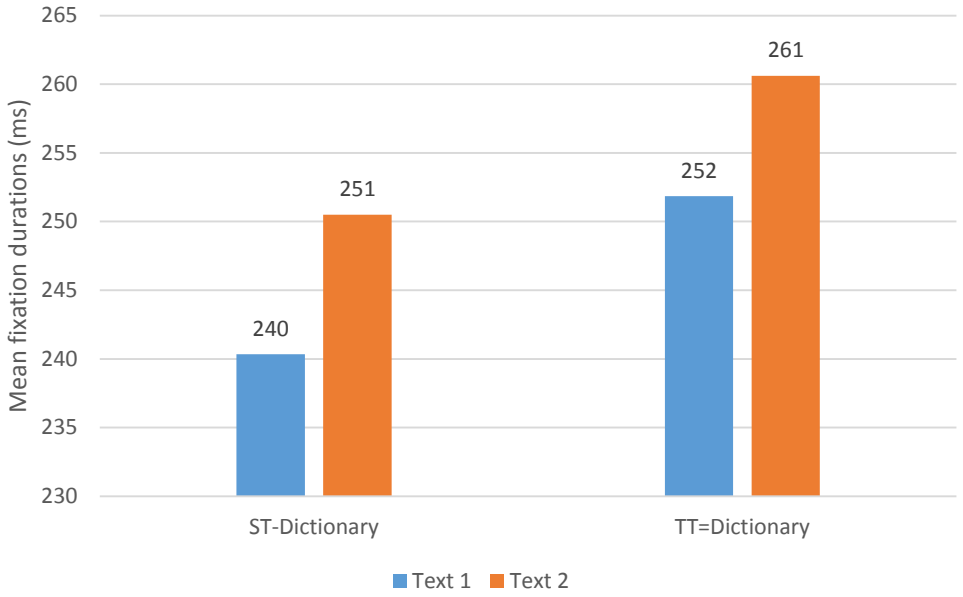
Shift Probabilities

			Cross AOIs saccades			
			ST-TT	ST-Dict	TT-Dict	Total
Text Type	Text 1	Count	1210	158	232	1600
		Percentage	75.6%	9.9%	14.5%	100.0%
	Text 2	Count	1044	170	218	1432
		Percentage	72.9%	11.9%	15.2%	100.0%
Total		Count	2254	328	450	3032
		Percentage	74.3%	10.8%	14.8%	100.0%

Dictionary reading patterns: from ST/TT

- Assuming different reading patterns can be identified due to distinctive needs for the subtask
- Calculating duration of fixations after cross-interest-area saccades
- No significance founded

- Limitations
  - "Micro-cycle" of translation by Jakobsen
  - No small-scale text analysis conducted in this project



Mean duration of fixations in dictionary area after ST-Dictionary and TT-Dictionary saccades (ms).

Summary

- To investigate and map out a generalized pattern of translation process, and propose possible avenues for future researches
- Mainly three aspects of translation process (general distribution of cognitive attentions, cognitive workload of various subtasks and working style of translators) were investigated

Summary

- Overall distribution (dwell time)
  - TT > ST > Dictionary
  - No main effect from text complexity
- Cognitive workload (fixation duration; pupil size)
  - TT production, ST comprehension ?> Dictionary, PA
  - Pupil size has positive relationship with text complexity in ST, TT, Dict
  - More discreet identification of subtasks required
- Working style
  - Shift frequency: ST-TT > ST/TT-Dictionary
  - Dictionary reading pattern: no significance