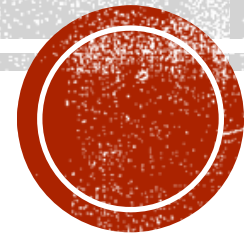


# An Eye Tracking Study of Cognitive Effort Allocation across Translation Subtasks

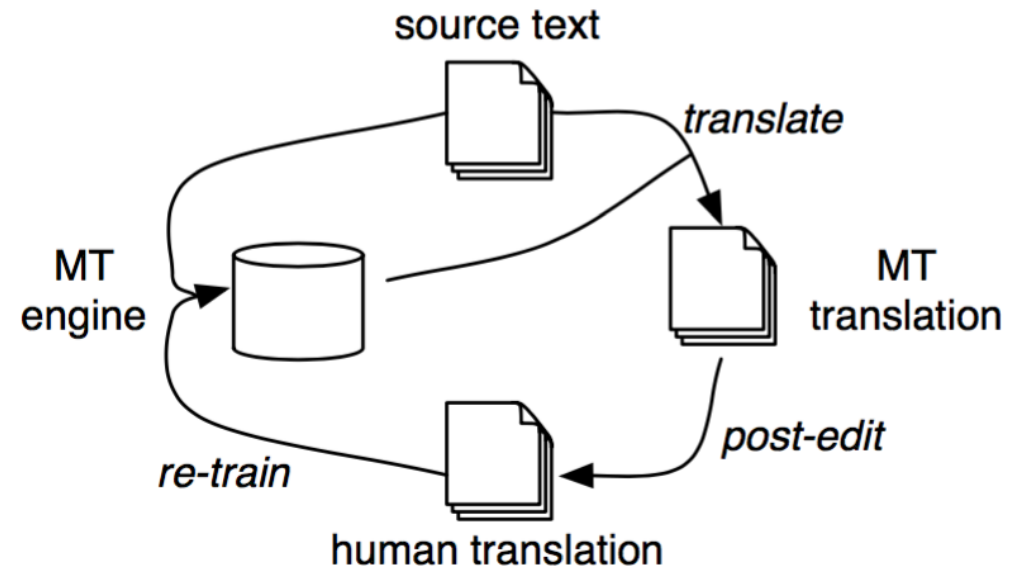
Dr. Kit Chunyu

Wu Ting-Wei Tiffany



# 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

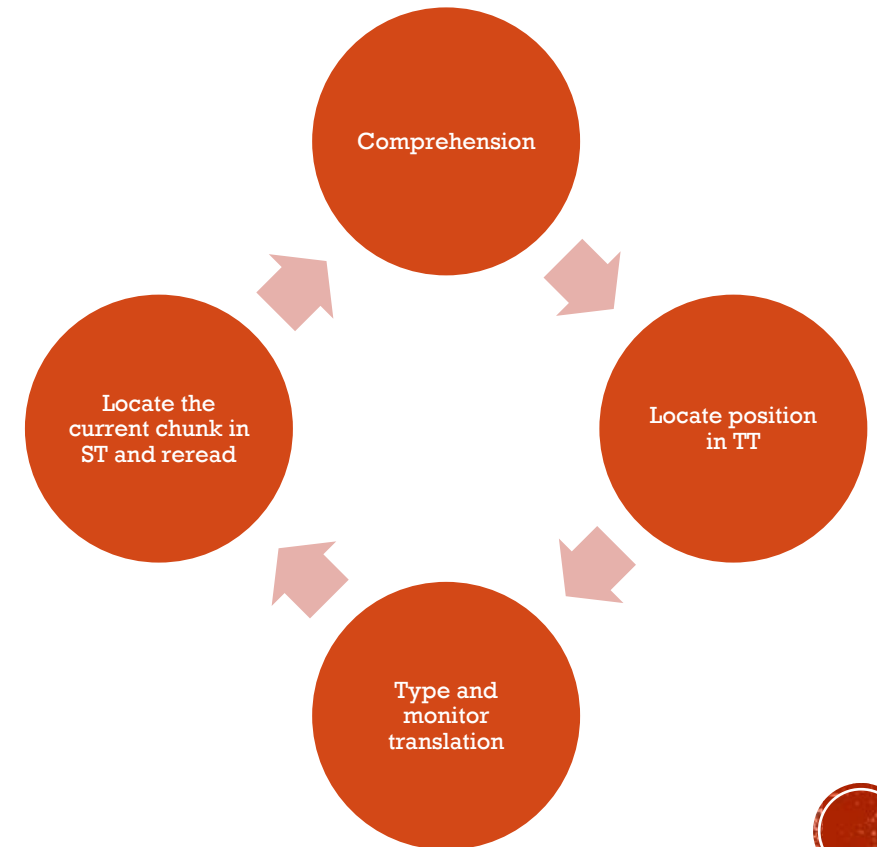


# Background

- 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

## Source Text:

WHO's priority in the area of health systems is moving towards universal health coverage. WHO works together with policy-makers, civil society, academia and the private sector to support countries to develop, implement and monitor solid national health plans. In addition, WHO supports countries to assure the availability of equitable integrated people-centred health services at an affordable price; facilitate access to safe and effective health technologies; and to strengthen health information systems and evidence-based policy-making.

Promoting good health through the life-course cuts across all work done by WHO, and takes into account the need to address environment risks and social determinants of health, as well as gender, equity and human rights.

Source Text

## Target Text:

世界衛生組織的醫療衛生重點項目是推行全面醫療保障。世衛與政府、社會、學者和私營機構共同合作，支持不同國家發展、實施和監管健全可靠的國家醫療計劃。除此之外，世衛亦給予國家支持，確保人們可以合理價錢，享有以人為本的整合醫療服務；促進安全和有效的醫療科技應用；以及加強健康資料系統和證據為本的政策制訂。

推廣終生健康一直是世衛工作的宗旨，另外還關注環境風險、影響健康的社會因素、性別、平等和人權。

Target Text



Oxford Advanced Learner's English-Chinese Dictionary

**health**

/ heɪlθ; hælθ/ n [U]

↳ condition of a person's body or mind 人的身体或精神状况; 健康状况:  
*have poor health* 身体不好 \* *be in/enjoy the best of health* 身体非常好 \*  
*Exercise is good for the health.* 锻炼身体有益於健康. \* *Your (very) good health!* eg said when drinking a toast to sb 祝你健康! (如向某人敬酒时之用语) \* [attrib 作定语] *health insurance/care* 健康保险(保健) \* *He retired early for health reasons.* 他由於健康上的原因而提前退休.

↳ state of being well and free from illness 健康: *be restored to health* 恢复健康 \* *be bursting with health and vitality* 身体健康、精神抖擞.

↳ (idm 习语) *a clean bill of health => clean*<sup>1</sup>. *drink sb's health; drink a health to sb => drink*<sup>2</sup>. *in rude health => rude*. *propose a toast/sb's*

Dictionary

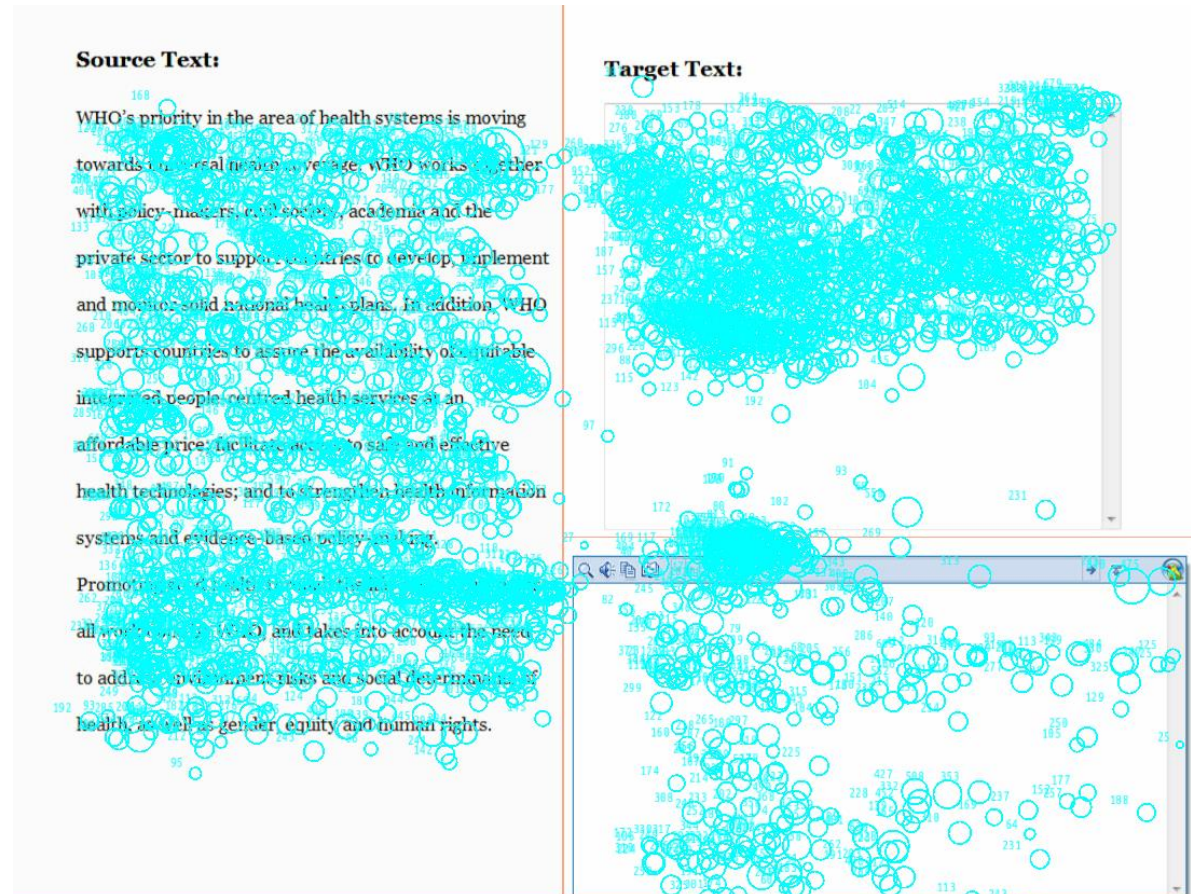


# Experimental Design

- 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	X	ST comprehension
ST	✓	Parallel attention (PA)
TT	X or ✓	TT production
Dictionary	X or ✓	Dictionary lookup

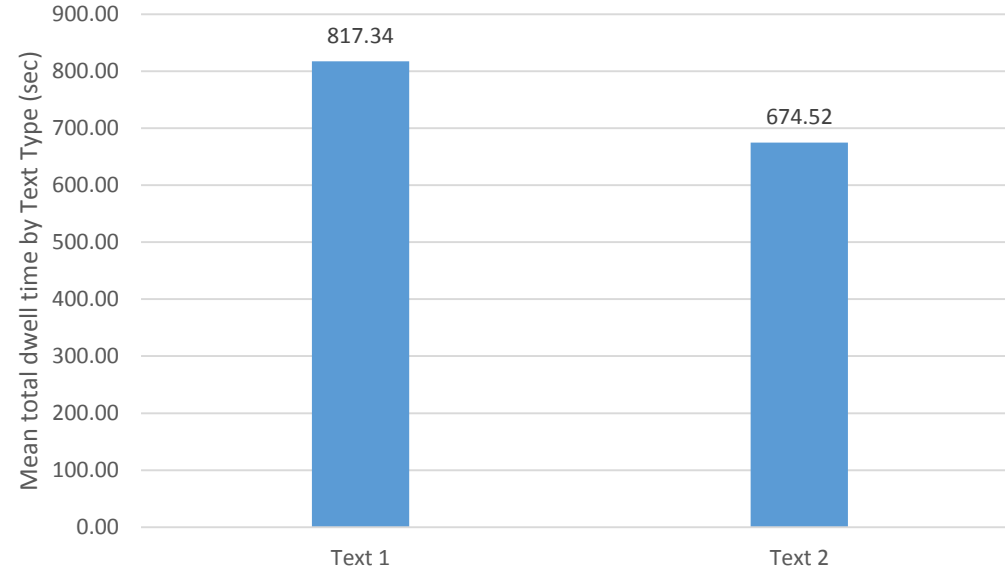


# Findings & Data Analysis

- 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



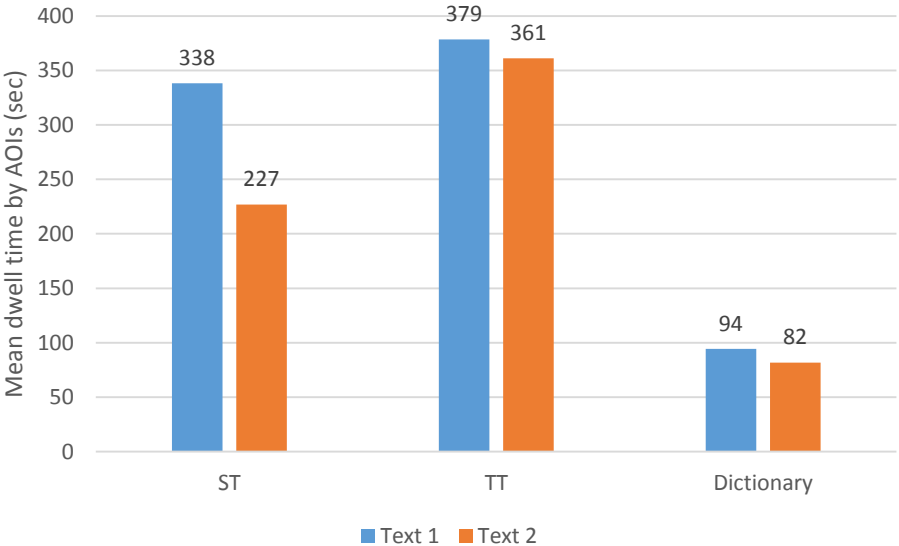
# Overall Distribution



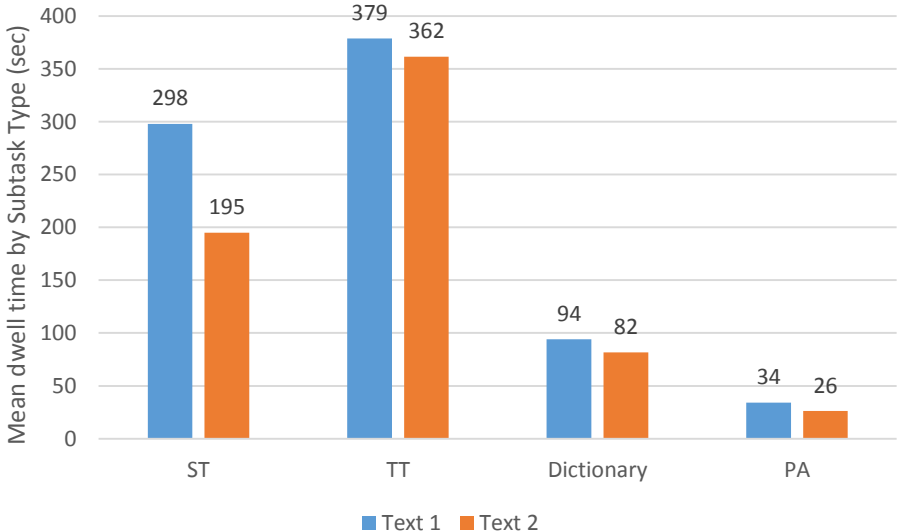
**Figure 6** Mean total dwell time by Text Type (seconds).



# Overall Distribution



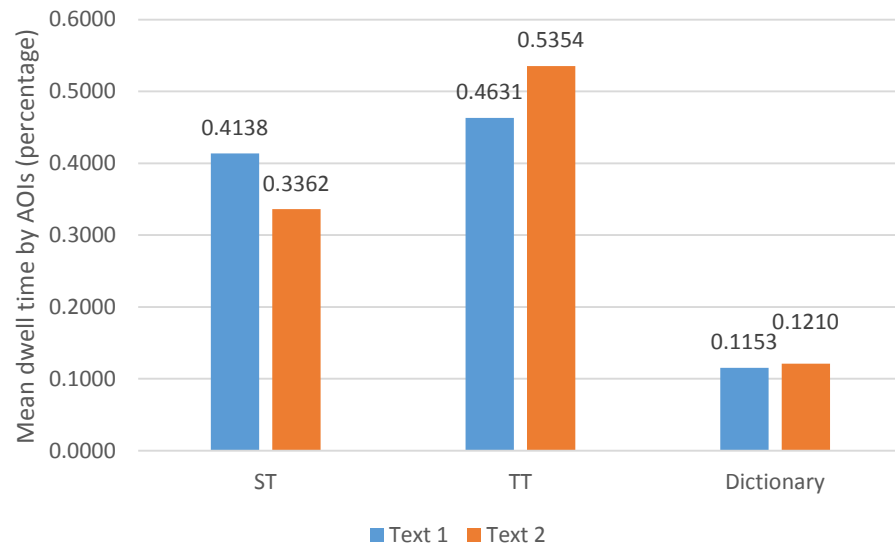
Mean dwell time by Text Type in different AOIs (seconds).



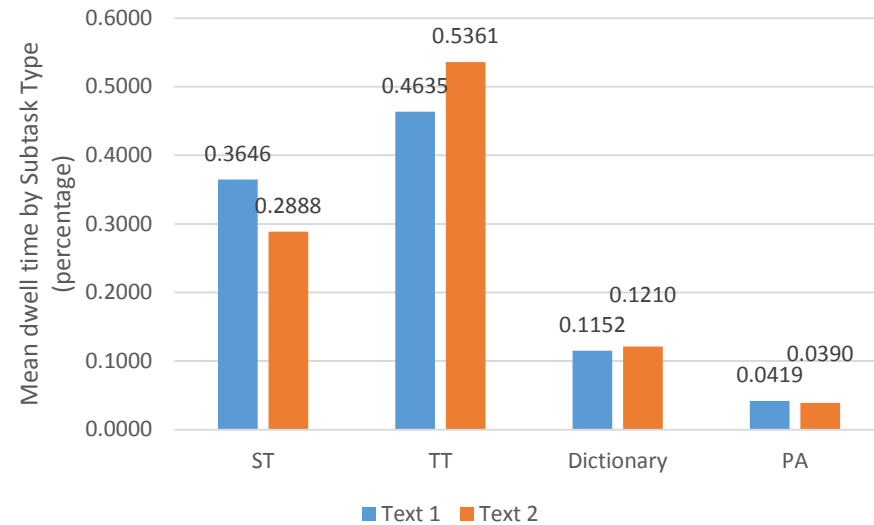
Mean dwell time by Text Type in different subtasks (seconds).



# Overall Distribution



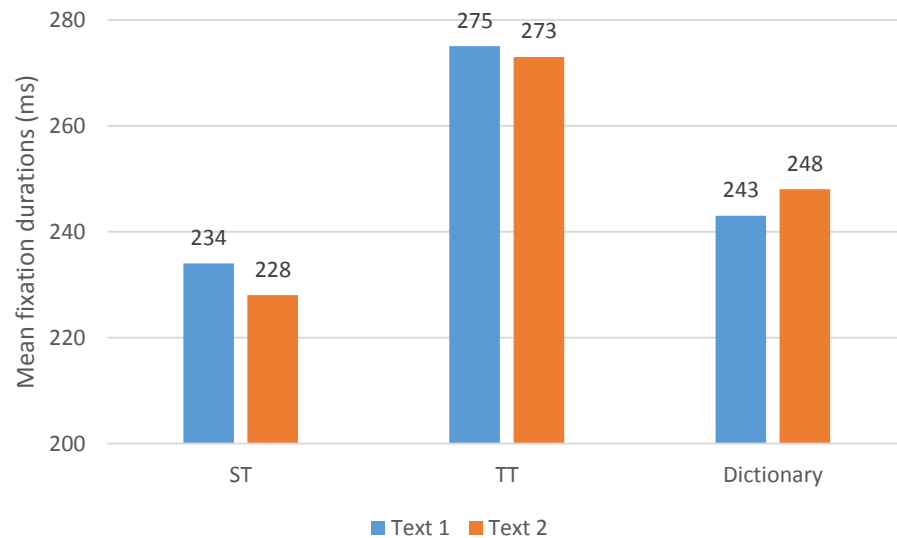
Percentage distributions of dwell time by Text Type in different AOIs.



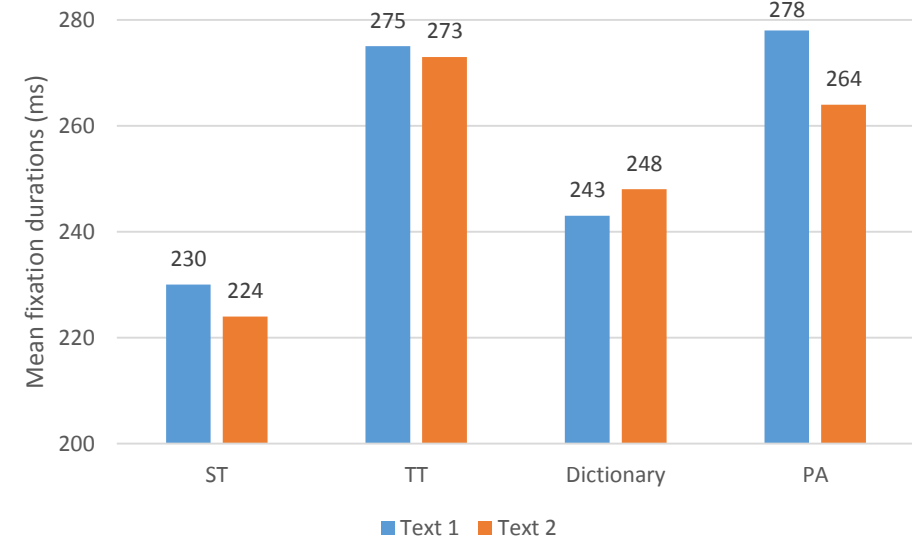
Percentage distributions of dwell time by Text Type in different subtasks.



# Cognitive Workload of different Subtasks



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

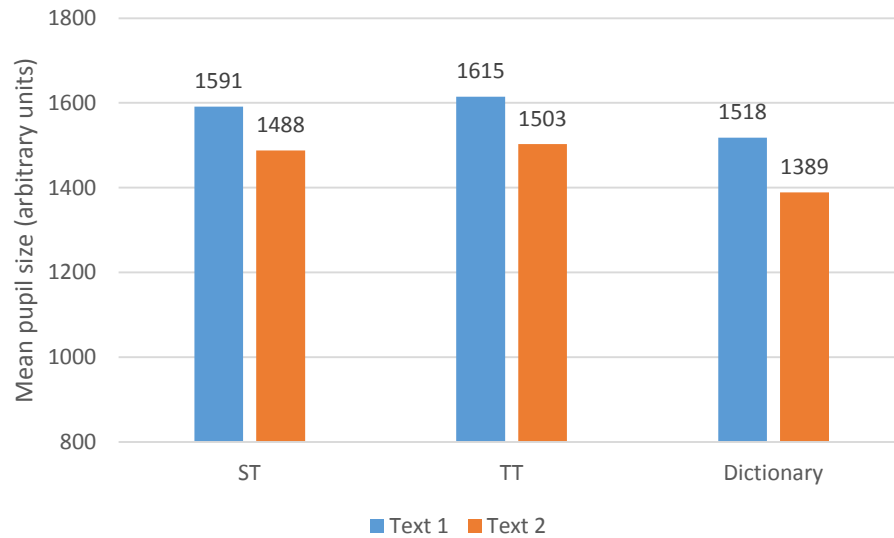


Mean fixation durations by Text Type in different subtasks (seconds).

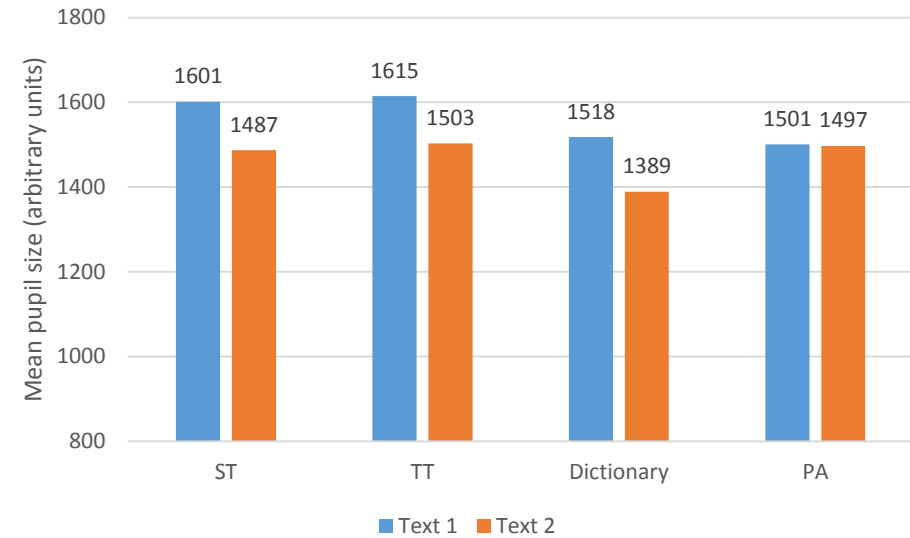




# Cognitive Workload of different Subtasks



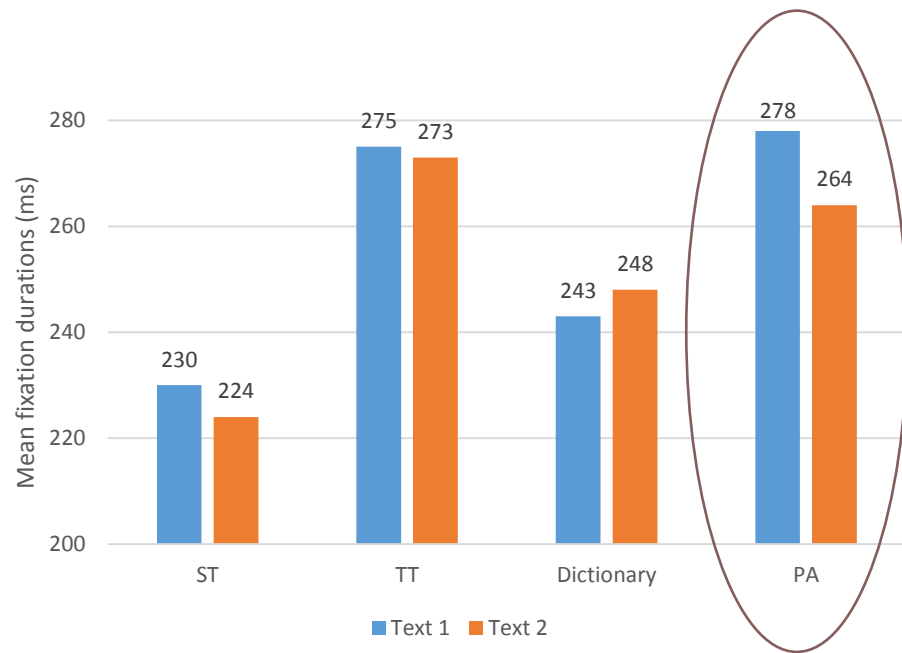
Mean pupil size by Text Type in different AOIs (arbitrary units).



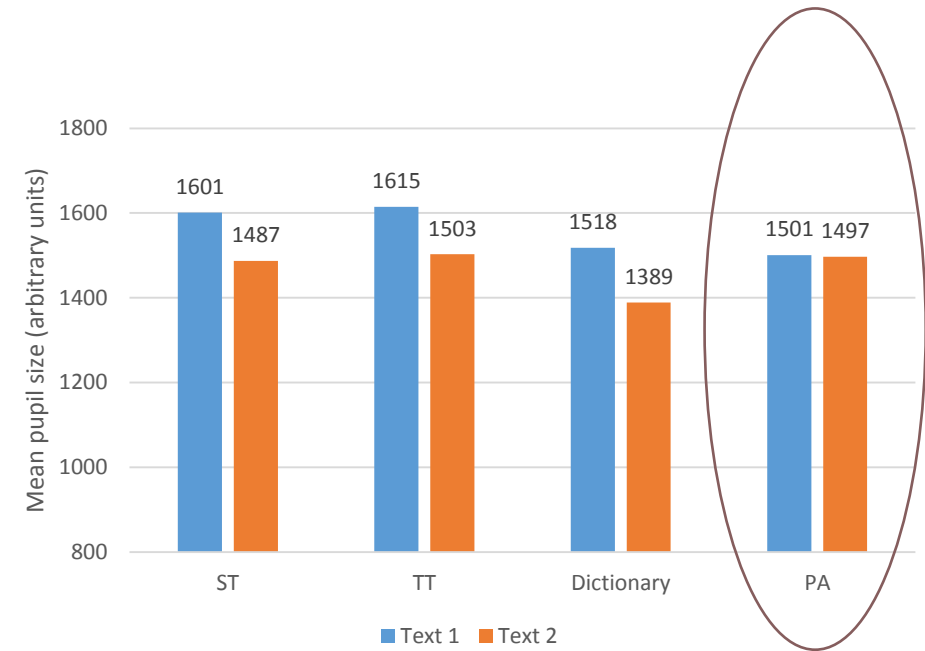
Mean pupil size by Text Type in different AOIs (arbitrary units).



# Parallel processing: Workload?

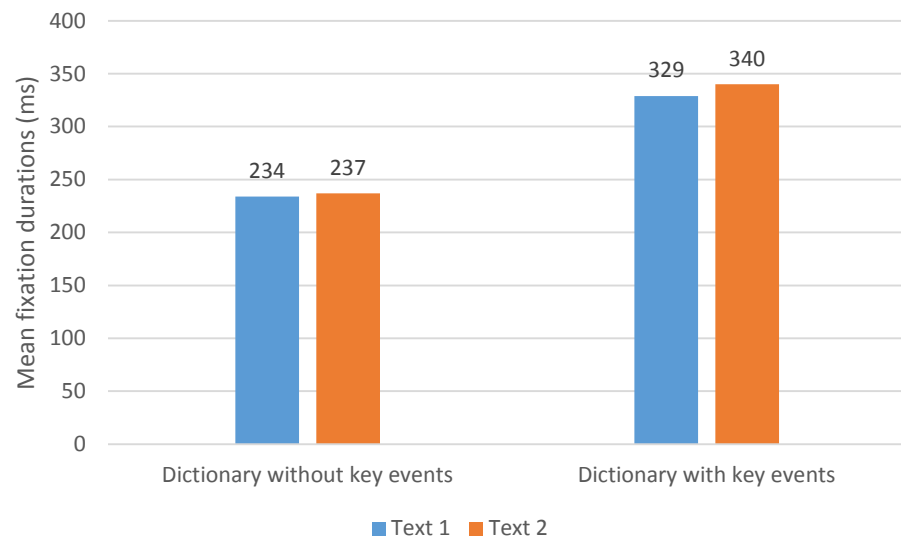


Mean fixation durations by Text Type in different subtasks (seconds).

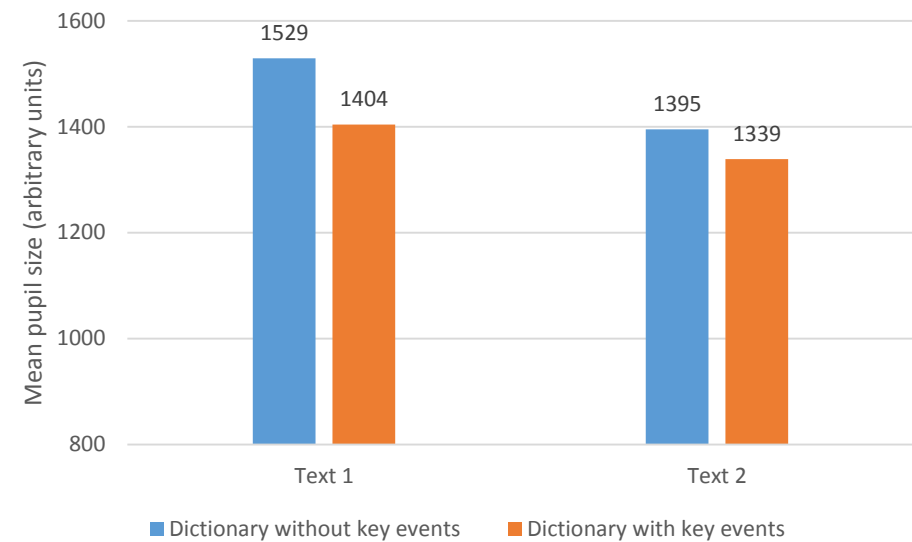


Mean pupil size by Text Type in different AOIs (arbitrary units).





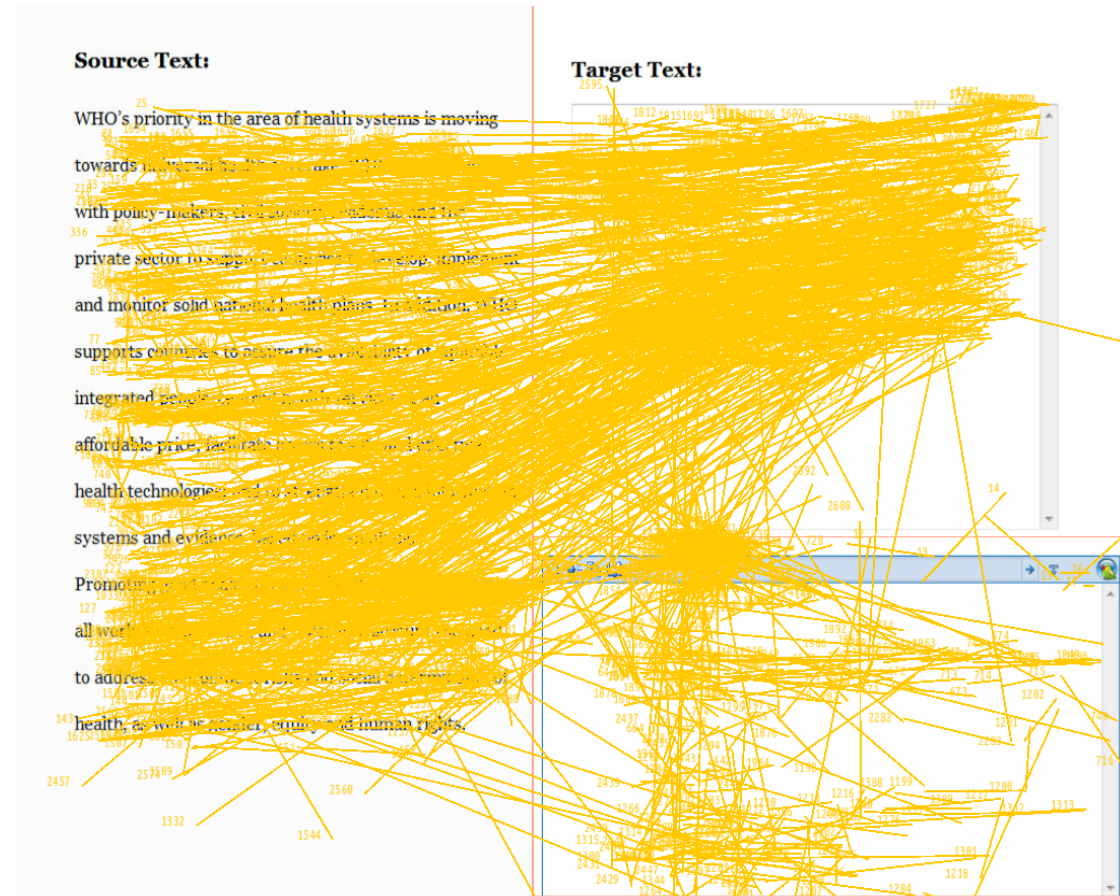
Mean durations of fixations in dictionary area with/ without key events being detected (seconds).



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



# Working style by Saccades



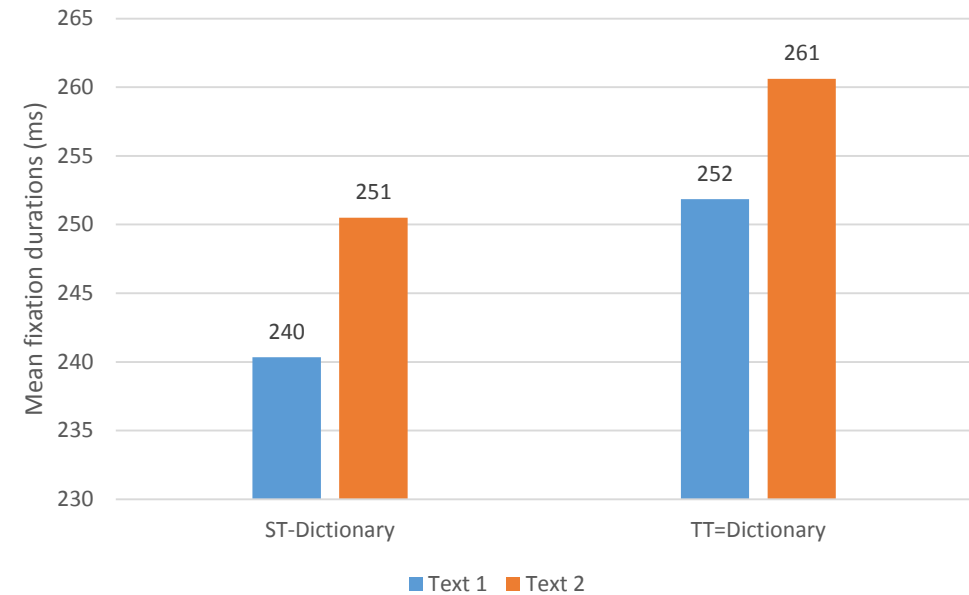
# Shift Probabilities

Cross AOIs saccades						
Text Type	Text 1	Count	ST-TT	ST-Dict	TT-Dict	Total
		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)
  - $TT > ST > \text{Dictionary}$
  - 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:  $ST-TT > ST/TT\text{-Dictionary}$
  - Dictionary reading pattern: no significance

