

# MTrill: Machine Translation Impact on Language Learning

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## Abstract

This paper presents the MTrill project which aimed at investigating the impact of popular web-based machine translation tools on the cognitive processing of English as a second language. The methodological approach and main results are presented.

## 1 Introduction

The MTrill project was funded by the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 843455. The project started on the April 25<sup>th</sup> 2019 and ended on July 16<sup>th</sup> 2021. The project aimed at investigating the impact of popular web-based machine translation (MT) tools on the cognitive processing of English as a second language.

The proposed research project was motivated by the observation that students of English as a second language are using web-based MT systems as a tool to support their English learning, due to the easy access to the systems through applications on their phones which provide instant translations for the input entered either by voice, text or image. The general research question of the project was: *Would the interaction with the output of the MT result in changes in the cognitive processing of English as a second language, reflected by the learning of structures seen in the output of the MT?*

To answer the research question, two laboratory studies were implemented in which participants

recruited were tested whether they would be primed by the MT output, i.e., whether the MT system would be capable of influencing the language production of participants. The specific objectives of the experiments are listed below:

- 1) Investigate whether MT systems are capable of eliciting syntactic priming effects;
- 2) Investigate whether any priming effect elicited is of an explicit, i.e., conscious or implicit, i.e., unconscious nature.

In the next section, we describe the methodological approach used in the experiments.

## 2 Methodology

The MTrill project adopted the syntactic priming paradigm widely used behavioural method to study syntactic processing and encoding. *Syntactic priming* can be defined as the tendency speakers have to use a syntactic structure that has been previously encountered (Bock et al., 1989). Both experiments involved a pre-test phase, a priming test phase and an English proficiency test<sup>1</sup>. In experiment 2, a post-test phase was included.

The pre-test phase was considered as the baseline, as in this phase, participants were not exposed to the MT output when translating sentences from Portuguese into English. The priming phase involved a task in which participants were requested to translate sentences from Portuguese into English using Google Translate (GT) application on their own mobile device and repeat the output out loud. Immediately after this task, they were asked to describe images in English using words provided on the screen. If participants

described the images in English using the syntactic structures previously seen in the output of the MT more frequently than the syntactic structures they used in the pre-test phase (which did not involve any interaction with MT), then our results would suggest that the MT system is capable of eliciting syntactic priming effects, that is, our results would suggest that MT system is influencing users linguistic behaviour in the second language. The post-test phase was included in experiment 2 with the aim of investigating whether any syntactic priming effect observed would be of implicit or explicit nature.

### 3 Results

#### 3.1 Results of Experiment 1

Experiment 1 was considered a preliminary study with the aim of investigating whether MT systems are capable of eliciting syntactic priming effects. For this preliminary experiment, 20 participants were asked to complete 3 tasks involving translation of sentences without Google Translate (pre-test phase, task 1); using Google Translate (priming test phase, task 2). Participants were also asked to complete an online proficiency English test (task 3). Participants who have not completed the online survey were invited to complete it after the experimental session if they so wished (task 4). Through this preliminary experiment, specific objective 1 was achieved (see section 1), as results of this preliminary experiment have shown that, after exposure to the MT output more 55% of the descriptions of images were influenced by the structures seen on the MT output, i.e., an increase of 45% compared to the baseline pre-test (Resende et al., 2020).

#### 3.2 Results of Experiment 2

With the objective of a more in-depth study and analysis as well as to achieve specific objective 2 (see section 1), i.e. investigate whether any syntactic priming effect observed would be of an implicit (conscious) or explicit (unconscious) nature, in experiment 2, 40 participants were recruited to take part in the study. Experiment 2 included the same tasks of the experiment 1 (pre-test, task 1, priming test, task 2; English proficiency test, task 3 and online survey completion, task 4) as well as a post-test phase (task 5). The post-test phase was carried out 24 hours after completing the pre-test and the

priming test. In this experiment, the English proficiency test as well as the completion of the online questionnaire were carried out after the post-test.

Overall, results of experiment 2 showed a long-lasting priming effect, suggesting that MT output has elicited subconscious learning of the grammatical structures seen in the MT output. For instance, we observed an increase (from 25.9% in the baseline pre-test to 51.1% in the priming phase) of the alternative grammatical structures seen in the output of the MT. In the post-test phase this increase in the production of the MT grammatical structure remained, as participants used the MT syntactic alternative in 45.8% of the target trials after 24 hours versus the 25.9% observed in the baseline pre-test 24 before (Resende, Way, 2021).

### Acknowledgements

ADAPT: the Science Foundation Ireland Research Centre for AI-Driven Digital Content Technology at Dublin City University, is funded by the Science Foundation Ireland through the SFI Research Centres Programme (Grant 13/RC/2106\\_P2).

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