



HAL
open science

What Does Neural Machine Translation learn?

Behnoosh Namdarzadeh, Nicolas Ballier

► **To cite this version:**

Behnoosh Namdarzadeh, Nicolas Ballier. What Does Neural Machine Translation learn?: A Snapshot from Google Translate & DeepL (September 2021-February 2022). Enseigner la traduction et l'interprétation à l'heure neuronale, Université Libre de Bruxelles, Université de Mons, Sep 2022, Bruxelles, Belgium. hal-03915659

HAL Id: hal-03915659

<https://hal.science/hal-03915659>

Submitted on 29 Dec 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

What Does Neural Machine Translation learn?

A Snapshot from Google Translate & DeepL¹ (September 2021-February 2022)

Behnoosh Namdarzadeh and Nicolas Ballier

Université Paris Cité – School of English Studies

CLILLAC-ARP

behnoosh.namdarzadeh@etu.u-paris.fr

Nicolas.ballier@u-paris.fr

This paper shows that traditional traductology examples can be used to carry out a longitudinal analysis of Google Translate and DeepL outputs over a five-month time span, enriching the probe technique (Isabelle et al., 2017; Isabelle & Kuhn, 2018).

One of the ways of evaluating MT systems' outputs is the integration of Isabelle's Challenge Sets, which aim at probing the systems' function when translating difficult linguistic features. To give an example, proper use of subjunctive mood is considered to be troublesome and systematically tested on several toolkits. Translating the English source text, *He will come provided that you come too*, the Google translation has the indicative mood *venez* instead of *veniez* (Isabelle et al., 2017: 15). Four major categories are constructed based on the divergences between the two languages at morpho-syntactic, lexico-syntactic, syntactic, and lexical levels.

We have supplemented Isabelle's initial challenge sets with selected examples taken from the traductology tradition (Chuquet & Paillard, 1989; Soulié, 1991; Vinay & Darbelnet, 1995; Celle, 1997; Guillemin-Flescher, 1998; Salkoff, 1999; Loock, 2016) which analyses notoriously difficult areas of translation from English into French² (and vice versa³). This can be beneficial to the professionals-to-be in industry, since it enriches them with "MT literacy" (Bowker & Buitrago Ciro, 2019; Loock & Léchauguette, 2021).

We will discuss seven series of observations:

1. NMT translations seem to align with textbook examples of transpositions, such as *Ils l'emballaient avec prudence*. Vinay & Darbelnet [1995] initially translated with a prepositional phrase by Google and then rendered with the expected category shift *carefully*.

2. Using frequency in reference corpora as a proxy for the analysis of "training data" (Sennrich et al., 2016), we realized that some observed changes were consistent with

¹ September 2021 version: 2.8.12302 & February 2022 version: 3.2.3939

² 62 examples

³ 204 examples

idiomaticity, judging by frequency. It seems to suggest that the toolkit ends up with the linguistic phrase or segment that has the highest frequency in the applied training data.

3. A certain form of “convergence” between the two translation toolkits can be observed over time in 40 examples out of 292. For example, *Depuis cinq ans, Paul a lu trois livres. Salkoff [1999]* initially translated by Google as *In the past five years, Paul has read three books* was later translated *Over the past five years, Paul*, which was DeepL initial translation. In all “convergence” cases, the second version of Google and both versions of DeepL converged.

4. In initial outputs, gender bias was prevalent (Stanovsky et al., 2019). For *Max le lui a donné. Salkoff [1999]*, *lui* was initially translated as *him* and then rendered with the feminine indirect object *her* in the second version. This may reflect changes in training data or fine-tuning as Google released a specific dataset for gender in August 2021 (Garnerin et al., 2021; Stella, 2021).

5. The choice of register is consistent in the outputs. Translating the ST, *It makes a lot of noise and we cannot tolerate it. Vinay & Darbelnet & Salkoff [1999]*, Google suggested informal register in its first output *Ça fait beaucoup de bruit et on ne peut pas le tolérer*, and seemed to use a more formal register in its second translation *Cela fait beaucoup de bruit et nous ne pouvons pas le tolérer*.

6. There is a drawback in challenge sets as they are based on a single sentence. This may bring about incorrect and sometimes reverse outputs. For example, in the French ST *Elle s'engage à tâtons dans l'escalier. Guillemain-Flescher [1981]*, the French verb contains dual meaning, which leaves the illative case ambiguous. That is why the toolkits chose different illative cases (*up* or *down*) in their translations.

7. The machine output is better than the reference translation in certain cases. To give an example, we compare the English ST *people on drugs suffer. Salkoff [1999]* with its translation *Les gens prenant de la drogue souffrent*. The subject in the reference translation actually sounds like English (*take drugs*). The first version of Google is *les personnes droguées*, which is quite akin to a transposition strategy. The second output is even better since the system produced *Les toxicomanes*, which seems to apply the linguistic strategy of “nominalization”.

The remainder of our paper will discuss more observations that will be seen in the July version of the toolkits. As a case study, we will also try to show that the challenge sets can be used to teach how to analyse a translation model. We will illustrate this with an experimental model we designed with Systran Advanced Model Studio.

Keywords: Challenge Sets, DeepL, Google Translate, French<->English Language Pairs, Neural Machine Translation

References

- Bowker, L., & Buitrago-Ciro, J. (2019). *Machine translation and global research: Towards improved machine translation literacy in the scholarly community* (First edition). Emerald Publishing.
- Celle, A. (1997). *Étude contrastive du futur français et de ses réalisations en anglais*. Ophrys.
- Chuquet, H., & Paillard, M. (1989). *Approche linguistique des problèmes de traduction anglais-français*. Ophrys.
- Garnerin, M., Rossato, S., & Besacier, L. (2021). Investigating the Impact of Gender Representation in ASR Training Data: A Case Study on Librispeech. *Proceedings of the 3rd Workshop on Gender Bias in Natural Language Processing*, 86–92.
<https://doi.org/10.18653/v1/2021.gebnlp-1.10>
- Guillemin-Flescher, J. (1998). *Syntaxe comparée du français et de l'anglais: Problèmes de traduction* (Réimp., [Nachdr.]). Éd. Ophrys.
- Isabelle, P., Cherry, C., & Foster, G. (2017). A Challenge Set Approach to Evaluating Machine Translation. *Association for Computational Linguistics*, 2486–2496.
<https://doi.org/10.18653/v1/D17-1263>
- Isabelle, P., & Kuhn, R. (2018). A Challenge Set for French—> English Machine Translation. *ArXiv:1806.02725 [Cs]*. <http://arxiv.org/abs/1806.02725>
- Loock, R. (2016). *La traductologie de corpus*. Presses universitaires du Septentrion.
- Loock, R., & Léchaugette, S. (2021). Machine translation literacy and undergraduate students in applied languages: Report on an exploratory study. *Tradumàtica: Tecnologies de La Traducció*, 19, 204–225.
<https://doi.org/10.5565/rev/tradumatica.281>
- Salkoff, M. (1999). *A French-English grammar: A contrastive grammar on translational principles*. Benjamins.
- Sennrich, R., Haddow, B., & Birch, A. (2016). *Improving Neural Machine Translation Models with Monolingual Data* (arXiv:1511.06709). arXiv.
<http://arxiv.org/abs/1511.06709>
- Soulié, D. (1991). *Traduire en anglais: Index alphabétique des mots grammaticaux et entraînement à la traduction*. Hachette.
<https://books.google.fr/books?id=a1wwHAAACAAJ>

- Stanovsky, G., Smith, N. A., & Zettlemoyer, L. (2019). Evaluating Gender Bias in Machine Translation. *Association for Computational Linguistics*, 1679–1684.
<https://doi.org/10.18653/v1/P19-1164>
- Stella, R. (2021). A Dataset for Studying Gender Bias in Translation. *Google AI Blog*.
<http://ai.googleblog.com/2021/06/a-dataset-for-studying-gender-bias-in.html>
- Vinay, J.-P., & Darbelnet, J. (1995). *Comparative stylistics of French and English: A methodology for translation*. J. Benjamins Pub.. Co.