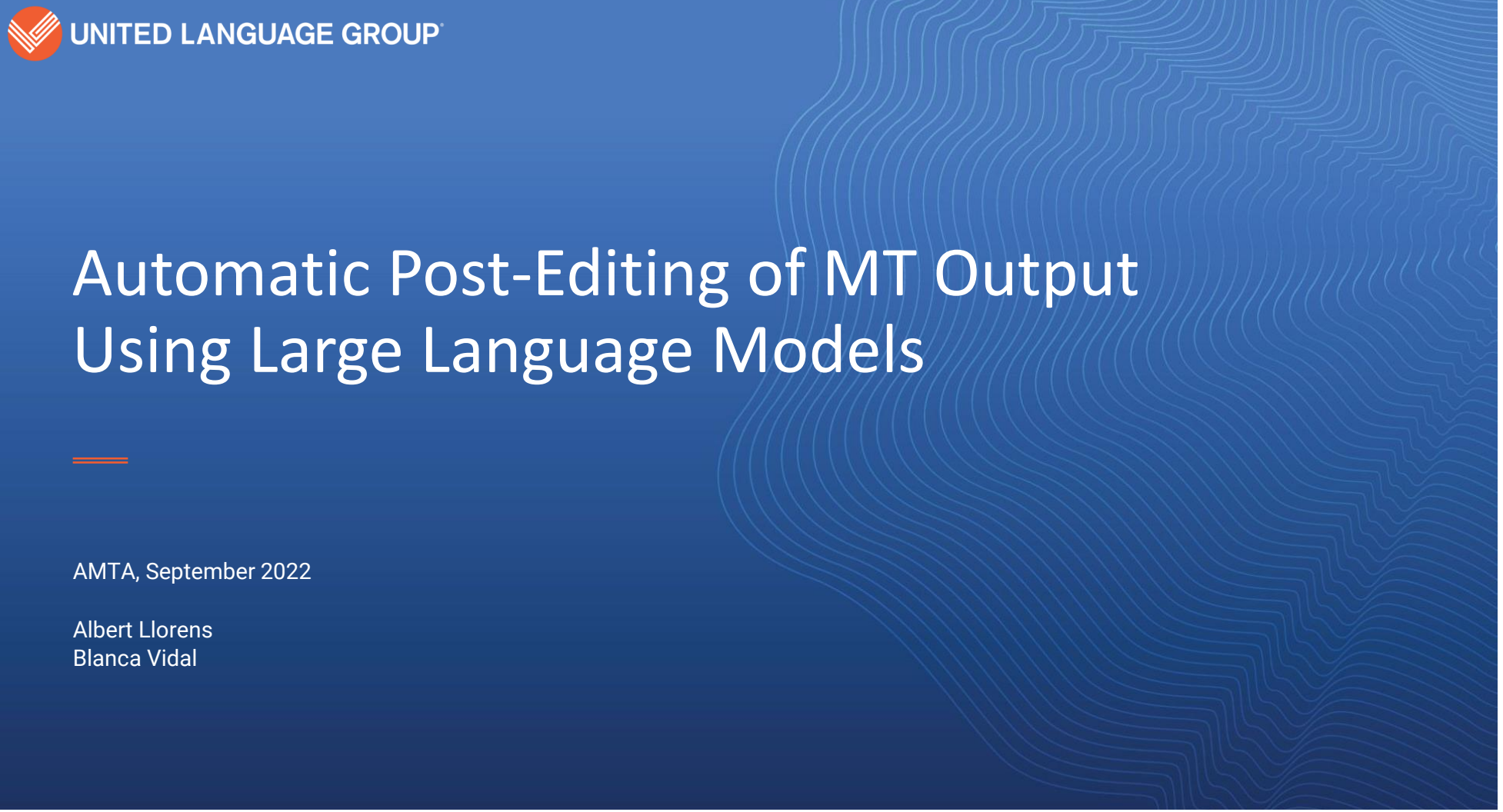
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Automatic Post-Editing of MT Output
Using Large Language Models
AMTA, September 2022
Albert Llorens
Blanca Vidal

Why Glossaries Matter in the Translation Business

Accuracy of translation

- Not using the industry or company specific translation of a term may lead to inaccurate translations

Glossaries ensure the **consistency** of the translation of key terms, both within and across documents

Client glossaries typically include

- Product names
- Company names
- Ambiguous words
- Abbreviations
- Borrowed words
- Terminology (specialized industry/field terms)

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Glossaries and Machine Translation

- Pre-translation with NMT is widely used in the Translation business
- NMT is a black box to users, developers, and researchers
- NMT models can be trained, but not forced
- Glossaries are more about “forcing” than “training”
- It is not straightforward to “force” a NMT system to translate terms according to a glossary

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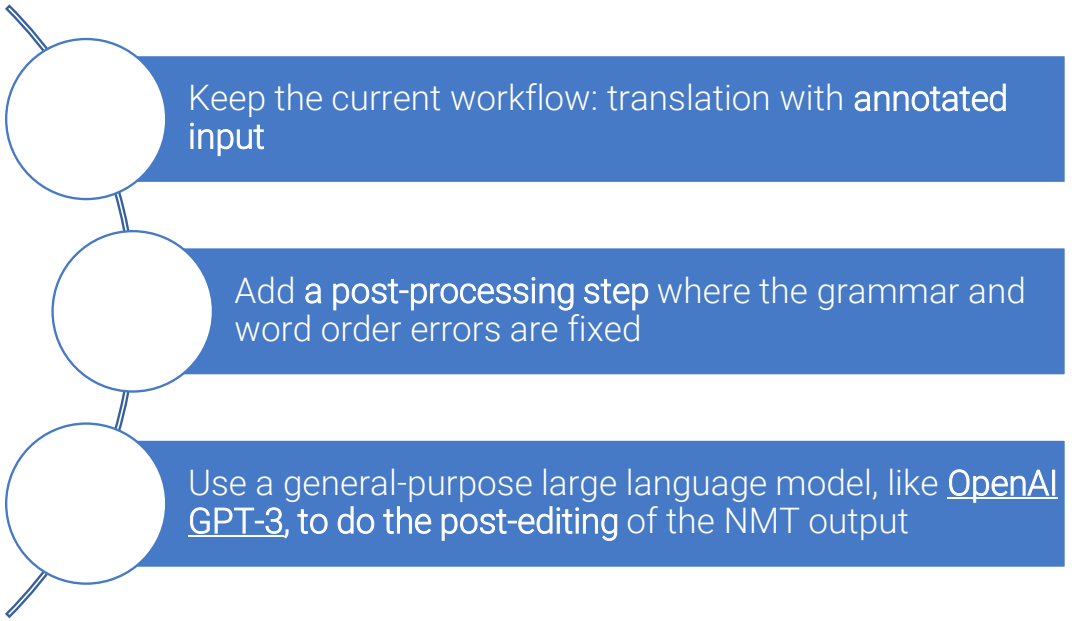
ULG Use Case

- ULG main NMT provider handles **glossaries** by doing a brute force find-and-replace operation
- This approach **guarantees close to 100% consistency** of machine translations with glossary translations
- But it has **negative side effects** in the translation quality, mostly in:
  - Grammatical agreement (gender, number, case)
  - Word order
- ULG Glossaries are used in MT in two different ways:
  - As bilingual dictionaries that can be referenced at request level with a category id
  - At runtime, by annotating the terms that require a specific translation with xml tags in the input string of the request

Proposed Solution



About OpenAI API and GPT-3 Models

- The **OpenAI API** can be applied to virtually any task that involves understanding or generating natural language
- The API is **powered by GPT-3**, a set of models with different capabilities
- The API requests are headed by a **prompt** that describes the task to be done by the model

- The **prompts** used in the experiment are:
  - "Corregir la gramática en español“
  - "Corregir el orden de las palabras en español“
  - "Traducir al español con el glosario {}={}:\n\n{}.“

- The **models** used in the experiment are:
  - text-davinci-edit-001
  - text-davinci-002

- The **endpoints** used in the experiment are
  - /completions: input text as a prompt, and get a text completion that matches the prompt instruction
  - /edits: change existing text via a prompt, instead of completing it

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Experiment Objectives

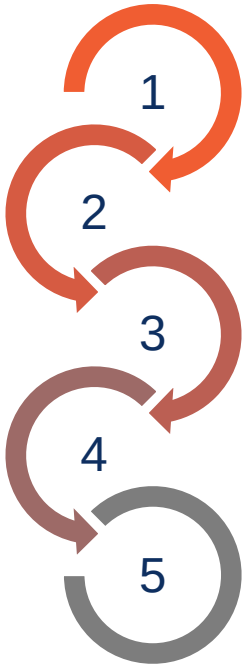
The experiment we implemented wanted to check the following points:

1. Check if **GPT-3** can be used as **an MT engine**
2. Check if **GPT-3** can be used as an **Automated Post-Editor**
3. Check if **GPT-3** can **improve its own Post-Editing** by requesting **word order correction**
4. Check if **GPT-3** can be used as an **MT engine using Glossary annotations**

Test Data Selection

- Translation Memory and glossary of a ULG client
- Both TM and glossary must be big enough, and TM must be highly consistent with the glossary
- Choice of languages: English to German and to Spanish
- Data size: ~500k TM segments and ~600 glossary terms

Test Data Preparation



- Restricting the set to English-Spanish
- Filtering the data set by
  - Lemmatizing source and target segments
  - Removing all segments that don't match any pair in the glossary
- Data size after preparation: ~2,000 segments
- Annotating source segments with glossary translations. Examples:
  - Side view <term trans=disco de ruptura>rupture disk</term>
  - Sensor < term trans =procesador central extendido>extended core processor</term>
- Selecting a sample of 250 segments from the test data

Experiment Requests and Outputs

		Tasks, requests, prompts, outputs
1	ULG MT	Source file without annotation sent to ULG MT
2	ULG MT	Source file with Glossary annotation sent to ULG MT
3	GPT-3	Output of (2) sent to GPT-3 ‘edits’ endpoint with prompt "Corregir la gramática en español" ["temperature": 0 , engine="text-davinci-edit-001"]
4	GPT-3	Output of 3 sent to GPT-3 ‘edits’ endpoint with prompt "Corregir el orden de las palabras en español" ["temperature": 0, engine="text-davinci-edit-001"]
5	GPT-3	Source file without annotation sent to GPT-3 ‘completions’ endpoint with prompt "Traducir al español" ["temperature": 0, engine="text-davinci-002"]
6	GPT-3	Source file with Glossary annotation sent to GPT-3 ‘completions’ endopoint with prompt "Traducir al español con el glosario {source term}={target term}" ["temperature": 0, engine="text-davinci-002"]

Experiment Results

BLEU, TER and Terminology Consistency scores

		BLEU	TER	TC
1	ULG MT without glossary	57.6	26.0	87.12%
2	ULG MT with glossary	54.8	27.4	99.24%
3	GPT-3 PE grammar	54.8	30.5	98.11%
4	GPT-3 PE grammar and order	49.6	34.6	83.71%
5	GPT-3 MT without glossary	49.7	35.8	75.00%
6	GPT-3 MT with glossary	43.2	54.4	85.61%

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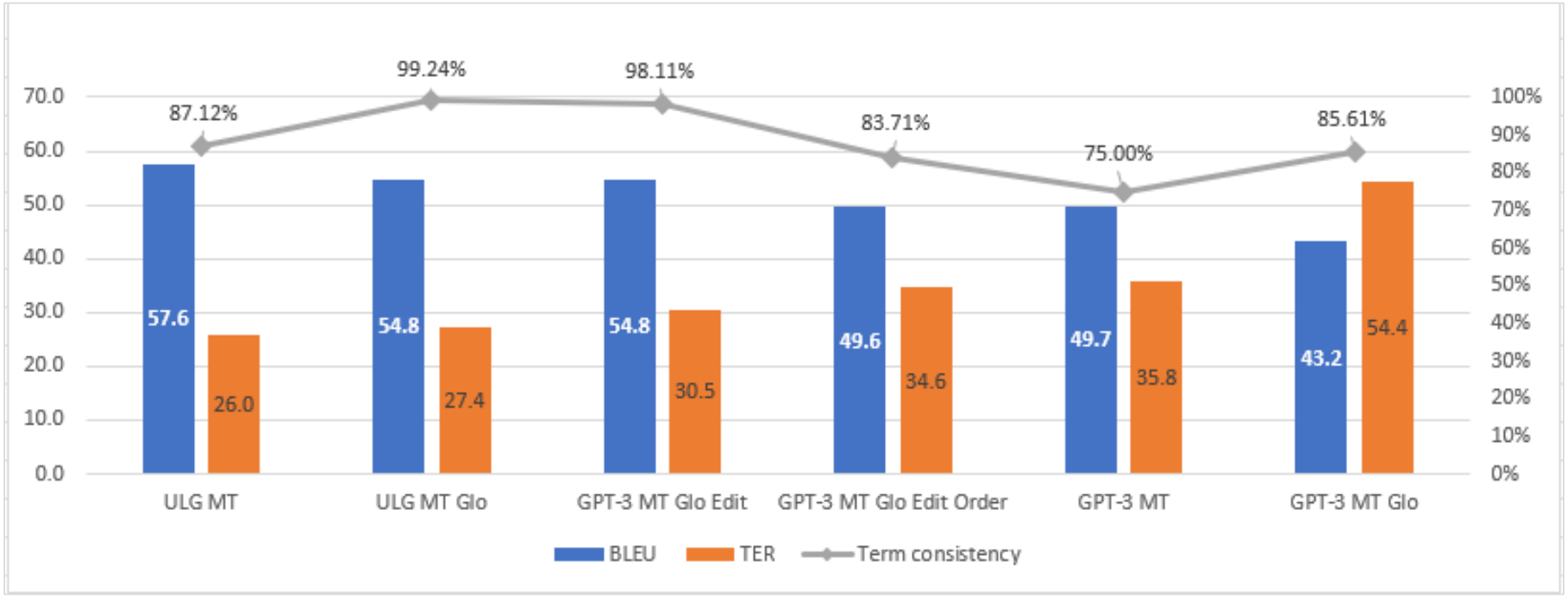
Results: Output Scores

BLEU, TER and Terminology consistency scores



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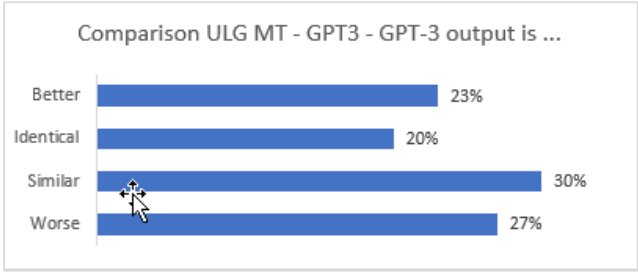
Results: Comparative Analysis

1 Check if **GPT-3** can be used as **an MT engine**

RESULTS

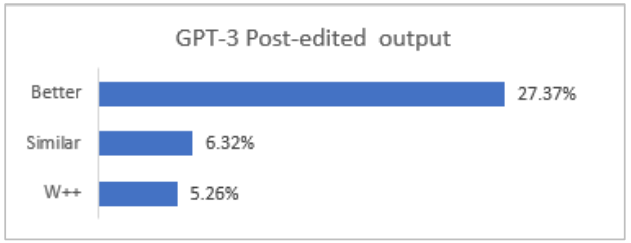
- Most outputs are either similar or identical to the ones of our current models.
- GPT-3 is less conservative in the preservation of the source.
- Makes changes that need to be contrasted with the input.
- Need to fix GPT-3's addition of extra dots (and blanks)

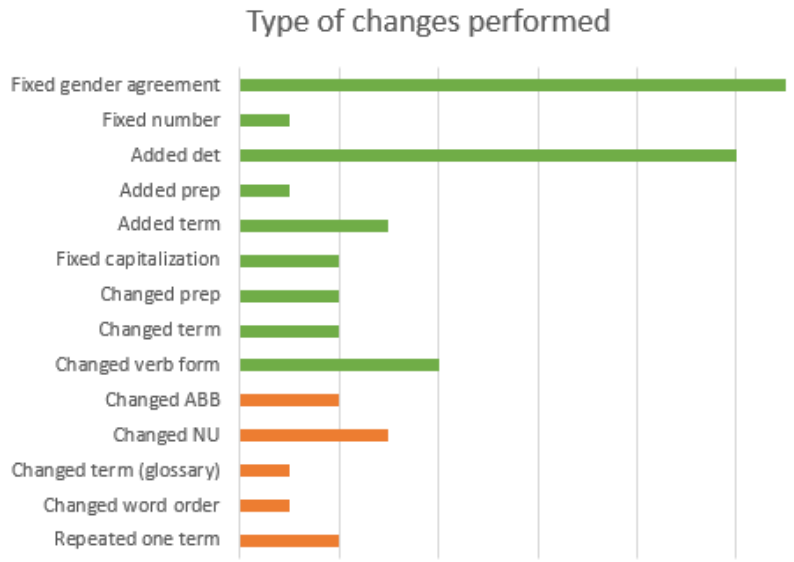


34	(for example, **argon**{***argón***})	34	(por ejemplo, argón)	<>	Por ejemplo, el argón.
35	**dry inert gas**{***gas inerte seco***}	35	gas inerte seco	<>	Gas inerte y seco.
36	Simultaneously available 4-20 mA **active output**{***salida activa***}, represents on-line density or temperature	36	Salida activa de 4-20 mA disponible simultáneamente, representa la densidad o la temperatura en línea	<>	Disponible simultáneamente 4-20 mA salida activa, representa en línea densidad o temperatura.

Results: Comparative Analysis

2 Check if **GPT-3** can be used as an **Automated Post-Editor**





RESULTS

- GPT-3 managed to fix gender agreement problems
- It also fixed number agreement
- Addition of determiners and prepositions added fluency
- Addition of other terms also added fluency

Results: Comparative Analysis

EXAMPLES OF IMPROVED OUTPUTS

★★★	78	Test points with **Product01**{*Product01*} tool	Puntos de prueba con Product01 herramienta	<>	Puntos de prueba con la herramienta Product01
★★★	19	For Model 1500, output voltage is +15 VDC ±3% with a 2,2 kohm internal **pull-up resistor**{*resistencia pull-up*}.	Para el modelo 1500, el voltaje de salida es de +15 VCC ±3% con un resistencia pull-up interno de 2,2 kohm.	<>	Para el modelo 1500, el voltaje de salida es de +15 VCC ±3% con una resistencia pull-up interna de 2,2 kohm.
★★☆	95	If you are installing a cable gland at the I.S. barrier, a standard cable gland with a sealing washer, **lock washer**{*arandela*}, and lock nut is required.	Si está instalando un prensaestopas en la barrera I.S., se requiere un prensaestopas estándar con una arandela de sellado, arandela y tuerca de bloqueo.	<>	Si está instalando un prensaestopas en la barrera I.S., se requiere un prensaestopas estándar con una arandela de sellado, una arandela y una tuerca de bloqueo.
★★☆	241	One exception is **nitric acid**{*ácido nítrico*}, for which 304 stainless steel has better corrosion resistance.	Una excepción es ácido nítrico, para el cual el acero inoxidable 304 tiene una mejor resistencia a la corrosión.	<>	Una excepción es el ácido nítrico, para el cual el acero inoxidable 304 tiene una mejor resistencia a la corrosión.
★★☆	104	**infrared port**{*puerto infrarrojo*} write-protection	puerto infrarrojo protección contra escritura	<>	puerto infrarrojo con protección contra escritura
★☆☆	66	To poll an **external temperature device**{*dispositivo de temperatura externo*}, configure polling for temperature as described in.	Para sondear un dispositivo de temperatura externo, configure el sondeo para la temperatura como se describe en.	<>	Para sondear un dispositivo de temperatura externo, configure el sondeo para la temperatura como se describe en la sección.
★☆☆	107	If you are using the **infrared port**{*puerto infrarrojo*}, position the infrared device for communication with the infrared port (see).	Si está utilizando el puerto infrarrojo, coloque el dispositivo infrarrojo para la comunicación con el puerto infrarrojo (consulte).	<>	Si está utilizando el puerto infrarrojo, coloque el dispositivo infrarrojo para la comunicación con el puerto infrarrojo (consulte la figura).

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Results: Comparative Analysis

EXAMPLES OF WRONG CORRECTIONS

Changed glossary term

238	**config I/O custom**{*E/S configurables personalizadas* }	E/S configurables personalizadas	<>	E/S personalizadas configurables
239	**config I/O default**{*E/S configurables predeterminadas* }	E/S configurables predeterminadas	<>	E/S configurables por defecto

Acceptable worsening

133	Maximum distance between remote **booster amplifier**{*amplificador booster* } and sensor is 18m.	La distancia máxima entre el amplificador booster remoto y el sensor es de 18 m.	<>	La distancia máxima entre el amplificador booster remoto y el sensor es de 18 metros.
76	External means that an external **pull-up resistor**{*resistencia pull-up* } and source are required.	Externo significa que se requieren resistencia pull-up y una fuente externas.	<>	Externo significa que se requieren resistencia pull-up y una fuente externa.
18	**engineering unit of measurement**{*unidad de ingeniería de medición, unidad de ingeniería de medida* }	unidad de ingeniería de medición, unidad de ingeniería de medida	<>	unidad de ingeniería de medición, unidad de ingeniería de medida, unidad de ingeniería de mediciones

CORRECTION NOT SUPPORTED

63	For F-Series sensors with a junction box or an **extended core processor**{*procesador central extendido* }, the maximum ambient temperature is 60°C (140°F).	Para los sensores de la serie F con una caja de conexiones o un procesador central extendido, la temperatura ambiente máxima es de 60 ° C (140 ° F).	<>	Para los sensores de la serie F con una caja de conexiones o un procesador central extendido, la temperatura ambiente máxima es de 60 ° C (140 ° F).

Results: Comparative Analysis

3 Check if **GPT-3** can **improve its own Post-Editing** by requesting **word order correction**

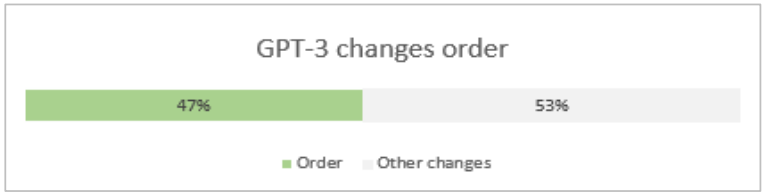
RESULTS

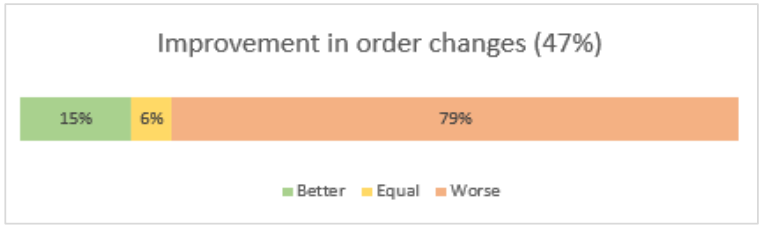
ORDER CHANGES

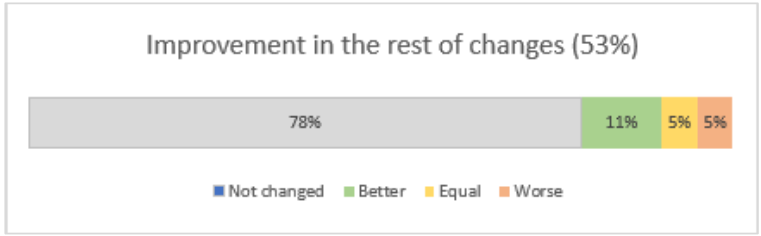
- Improve: apposition of proper names
- Similar: order of exchangeable noun modifiers
- Worsening: change order in glossary terms, change in term meaning, change of the translation of a glossary term

REST OF CHANGES

- Improve: added fluency (adding determiners)
- Worsening: adds a duplicated term







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Results: Comparative Analysis

EXAMPLES OF IMPROVED OUTPUTS

★★☆

249	**Product01|Product01| 5-pin Product02 connector in M20 housing**	Product01 conector Product02 de 5 pines en carcasa M20.	<>	Conector Product01 Product02 de 5 pines en carcasa M20.

EXAMPLES OF WRONG CORRECTIONS

!

236	(or pin 2-3 of Product02™ Product01|Product01|™ connector)	(o pin 2-3 del conector Product02™ Product01 ™).	<>	(o pin 2-3 del conector Product01 ™ Product02™).

!

2	Using a **DeviceNet**{***DeviceNet***} tool, three methods are available for totalizer and inventory control:	Utilizando una herramienta de DeviceNet, hay tres métodos disponibles para el totalizador y el control de inventario.	<>	Utilizando una herramienta de DeviceNet, hay tres métodos disponibles para el control de inventario y el totalizador.

!

13	**DIN rail enclosure**{***cubierta de carril DIN***}	cubierta de carril DIN.	<>	cubierta de DIN carril.
14	**core processor entity parameter**{***parámetro de entidad del procesador central***}	parámetro de la entidad del procesador central	<>	parámetro de la entidad central del procesador
15	**Construction Identification Code**{***código de identificación de construcción***}	código de identificación de construcción.	<>	código de construcción de identificación.
16	Side view with **rupture disk**{***disco de ruptura***}	Vista lateral con disco de ruptura.	<>	Vista lateral con ruptura de disco.
18	**engineering unit of measurement**{***unidad de ingeniería de medición, unidad de ingeniería de medida***}	unidad de ingeniería de medición, unidad de ingeniería de medida, unidad de ingeniería de mediciones	<>	unidad de medición de ingeniería, unidad de medida de ingeniería, unidad de mediciones de ingeniería

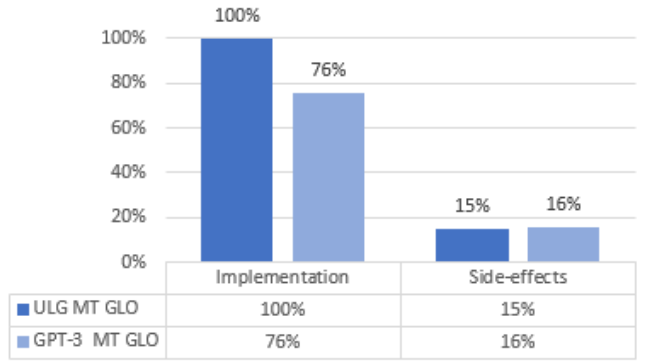
Results: Comparative Analysis

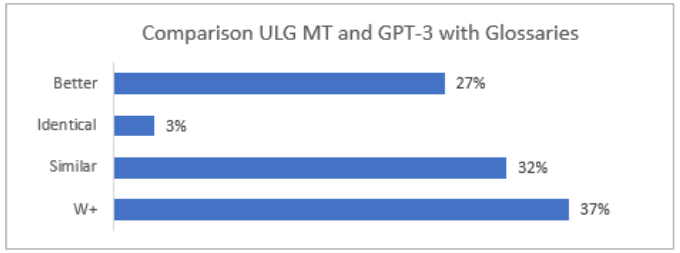
4

Check if **GPT-3** can be used as an **MT engine using Glossary annotations**

RESULTS

- ULG MT Glossary gets applied in all segments (100%)
- GPT-3 is only applied in 76% of the segments due to different reasons
- In both cases there are side effects already found in previous tests





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Conclusions

1. Using GPT-3 as an MT Engine shows interesting improvements in style and readability, but important "creativity" problems

2. Using GPT-3 for Post-Editing shows very promising results, with a clear improvement in the outputs

3. Using GPT-3 to fix Word Order problems results in many unnecessary and sometimes incorrect changes

4. Using GPT-3 as an MT Engine with Glossary annotations results in many "creativity" problems and consistency errors

Future Work

Prompt engineering

- Prompt language makes a difference
- Adding examples, find the most appropriate wording of the instructions

Adjusting request parameters

- temperature: lower temperature, less risks
- top_p: select tokens with top probability mass

Fine-tuning the GPT-3 models with ULG data

Using logprobs and beam search with higher temperature to filter undesired responses

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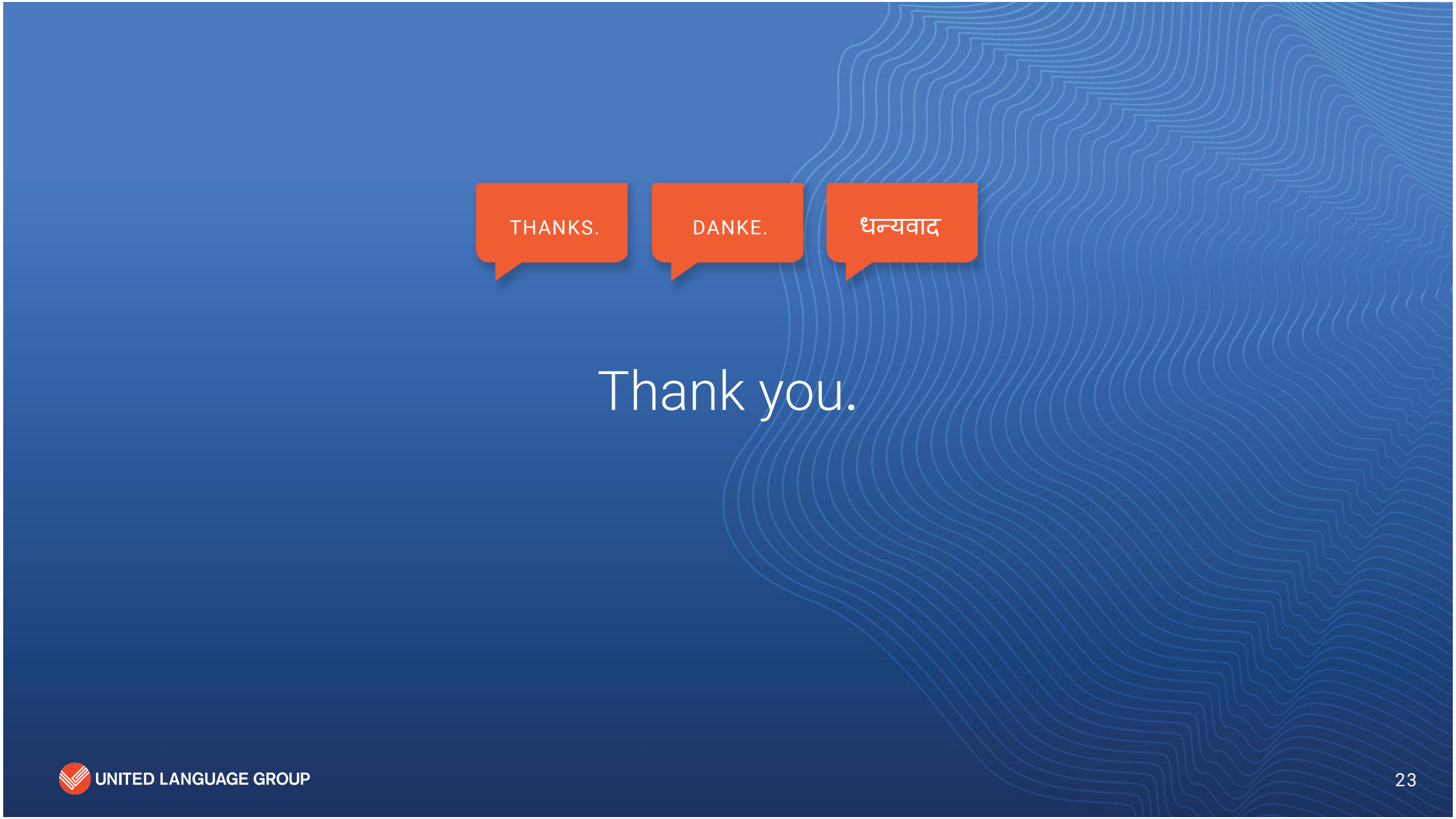
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