OUTSIDE THE BLACK BOX:
MACHINE TRANSLATION AND THE IMPORTANCE OF WHAT WE DON’T KNOW
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But first, an opinion statement:

I think MT is actually pretty good, and a very useful tool for both professionals and non-professionals.

Acknowledging its challenges and potential consequences does not mean giving up on it.

As Google Translate tells us, Ne jetons pas le bébé avec l’eau du bain!
## MT APPROACHES

<table>
<thead>
<tr>
<th>Approach</th>
<th>Era</th>
<th>Based on…</th>
<th>Current use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rule-based MT (RBMT)</td>
<td>- 1980s</td>
<td>Rules to analyze &amp; generate language</td>
<td>Low-resource languages</td>
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<tr>
<td></td>
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<td>Rules to transfer between languages</td>
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<td></td>
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<td>Bilingual dictionary</td>
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<tr>
<td>Corpus-based approaches</td>
<td></td>
<td><strong>Large collections of (usually) translated and aligned documents</strong></td>
<td></td>
</tr>
<tr>
<td>Example-based MT (EBMT)</td>
<td>~1980s-1990s</td>
<td>Adjustment and assembly of known “chunks”</td>
<td>Rare</td>
</tr>
<tr>
<td>(Phrase-based) Statistical MT</td>
<td>~2006-2016</td>
<td>Calculations of most probable bilingual equivalents and monolingual sequences (sub-sentence)</td>
<td>Less used</td>
</tr>
<tr>
<td>Neural MT</td>
<td>~2016-</td>
<td>Neural networks’ prediction of typical equivalents and sequences (sentence-level or [more rarely] beyond)</td>
<td>Dominant (e.g., Google Translate, DeepL Translator)</td>
</tr>
</tbody>
</table>
NMT TECHNOLOGY: THE BOTTOM LINE

- NMT learns from examples (lots and lots and LOTS of examples)
  - Training data largely determines (for better or worse) MT output
  - Tendency to choose “typical”, “usual” or frequent solutions: “leveling out”
- Neural networks are largely black boxes
  - Ability to learn things we are not always aware of (or happy about)
  - Hard to isolate specific sources of translation choices (and therefore fix problems)
MT CHALLENGES

WHY IS MACHINE TRANSLATION HARD?
(Share your ideas in the chat.)
MT CHALLENGES: AMBIGUITY

- **Semantic ambiguity**: one word form with more than one sense
- **Part of speech ambiguity**: one word form corresponding to more than one grammatical category
- **Structural ambiguity**: a sequence of word forms corresponding to more than one sentence structure
MT CHALLENGES: AMBIGUITY (2)

How many ways could we interpret this sequence?
Many possible sequences of parts of speech lead to many possible sentence structures. For example, attachments of modifiers ([camping trip] and fall, or camping [trip and fall]?)
By the end of the sentence, does MT still know what “it” is?
Previous sentence sometimes required to resolve:
• ambiguity (steal/fly)
• anaphora (e.g., pronoun references)
Accumulation of challenges and unknown items may even cause systems to “hallucinate” – i.e., make stuff up that has little to do with the input text.
MT CHALLENGES: IDIOMATIC EXPRESSIONS
MT CHALLENGES: IDIOMATIC EXPRESSIONS (2)

Some examples taken from
https://myenglishroutine.com/funny-english-idioms/

It's raining cats and dogs.
It's like looking for a needle in a haystack.
This is such a heartwarming story.
Hold your horses.
Hold your horses, I'll be there in two shakes of a lamb's tail.
You're just saying that to get my goat.

Il pleut des saus d'eau.
C'est comme chercher une aiguille dans une botte de foin.
C'est une histoire tellement touchante.
Calmez-vous.
Tenez vos chevaux, je serai là en deux coups de queue d'agneau.
Tu dis ça juste pour avoir ma chèvre.

Il pleut des chats et des chiens.
C'est comme chercher une aiguille dans une botte de foin.
C'est une histoire si réconfortante.
Retiens tes chevaux.
Tenez vos chevaux, je serai là en deux coups de queue d'agneau.
Tu dis ça juste pour m'énerver.
Diabolically difficult challenge: idiomatic, rare, ambiguous, without a stable equivalent…

Source: larousse.fr

Source: linguee.fr
The café next to the Supreme Court is called Just Deserts.

Getting towed when you steal someone's parking spot is called just deserts.

Le café à côté de la Cour suprême s'appelle Just Deserts.

Se faire remorquer quand on vole la place de parking de quelqu'un s'appelle juste des déserts.
MT CHALLENGES: STYLE

- Level of formality (e.g., tu vs. vous)
- Vocabulary
- Syntax
- Creativity and innovation
- Voice

But soft! What light through yonder window breaks? It is the east, and Juliet is the sun.

Mais doux ! Quelle lumière à travers cette fenêtre se brise ? C'est l'est, et Juliette est le soleil.
MT CHALLENGES: FAULTY INPUT

- Spelling, grammar and punctuation mistakes can interfere with translation and lead to errors
The nature of language and human communication makes it very unlikely that errors in MT can be completely avoided or resolved.

Users need to weigh the benefits and risks of imperfect MT to find appropriate use cases (and reject others).

Some applications will be predictably worse (i.e., more problematic) than others.

- Implications for output quality, and in turn in other areas.
### MT USE CASES

<table>
<thead>
<tr>
<th>Communication</th>
<th>Assimilation (Gisting)</th>
<th>Dissemination</th>
</tr>
</thead>
<tbody>
<tr>
<td>e.g., travel, socializing, business meetings and exchanges</td>
<td>e.g., reading communications and websites in unknown languages, identifying materials that should be professionally translated</td>
<td>e.g., providing professionals with a draft translation for postediting, publication of documents</td>
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<tr>
<td>Typically non-professional</td>
<td>Typically non-professional</td>
<td>Non-professional or professional</td>
</tr>
<tr>
<td>Other translation options often unavailable or prohibitive</td>
<td>Prioritization of professional work, cost reductions, filling gaps in services</td>
<td>Productivity, turnaround times, cost reduction</td>
</tr>
</tbody>
</table>

**Other factors:**
- Domain
- Text type
- Audience
- Life cycle
- Desired quality: “fit-for-purpose”
What are the wider implications we need to consider in these scenarios?

Is this scenario a good use of MT? (Use reactions to share your opinion).
The Canadian federal government makes a “language comprehension tool” available to all federal public servants to aid in understanding of materials in their second language and with internal, informal communication.
SCENARIO: GOVERNMENT (II)

A natural disaster forces evacuation of a city with a large immigrant and refugee population with low literacy in the native language. The city uses MT to make evacuation orders and information available to residents.

### Assimilation

<p>| | |</p>
<table>
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<tbody>
<tr>
<td>Government use</td>
<td></td>
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<tr>
<td>Emergency situation</td>
<td></td>
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<tr>
<td>Limited human resources</td>
<td></td>
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<tr>
<td>Limited time</td>
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</table>
There is a shortage of paramedics in New Brunswick. Some residents demand that the current requirement for bilingualism be waived, as Google Translate can be used to communicate with patients and bystanders if necessary.
A passerby notices an older lady who speaks only a foreign language apparently in distress. She uses MT to find out what is wrong, so that she knows to call an ambulance and can explain what is wrong to the paramedics.
Hotel staff translate communications received in an unknown language, process reservations, and provide information to potential clients. (Kamocki et al. 2016)

<table>
<thead>
<tr>
<th>Assimilation &amp; (informal) Communication</th>
</tr>
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<tbody>
<tr>
<td>Commercial use</td>
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<tr>
<td>Language variety</td>
</tr>
<tr>
<td>Available resources</td>
</tr>
<tr>
<td>Privacy</td>
</tr>
</tbody>
</table>
During discovery, a lawyer uses machine translation to identify potentially relevant documents for their client's case.

**Assimilation**

- Professional use
- Financial implications
- Legal implications
- Privacy
- Professional code of ethics
- Gateway to professional translation
SCENARIO: LEGAL (II)

During a traffic stop, a police officer uses MT to communicate with a driver and to get permission to search their vehicle, finding evidence leading to an arrest.

### Assimilation

<p>| |</p>
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<tr>
<td>Professional use</td>
</tr>
<tr>
<td>Legal implications</td>
</tr>
<tr>
<td>Human rights</td>
</tr>
<tr>
<td>Limited time?</td>
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</table>
SCENARIO: SCHOLARLY (I)

Scholars use MT to translate research from English to their native languages to follow progress in their fields.

<table>
<thead>
<tr>
<th>Assimilation</th>
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</thead>
<tbody>
<tr>
<td>Progress of research</td>
</tr>
<tr>
<td>Professional use (instrumental)</td>
</tr>
<tr>
<td>Expertise</td>
</tr>
<tr>
<td>Language level</td>
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</table>
SCENARIO: SCHOLARLY (II)

Scholars use MT to translate their research to English for publication.

<table>
<thead>
<tr>
<th>Dissemination</th>
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</tr>
<tr>
<td>Language level</td>
</tr>
<tr>
<td>Lingua franca</td>
</tr>
<tr>
<td>Privacy</td>
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</table>
IMPLICATIONS OF MT USE

MT user
Recipient(s)
Industry
Language, culture & society
Environment
# IMPLICATIONS OF MT USE: SOME POTENTIAL ISSUES

<table>
<thead>
<tr>
<th>Level</th>
<th>Some implications</th>
</tr>
</thead>
</table>
| User                          | Communication may be ineffectual  
Reputation may be harmed                                                 |
| Recipients                    | Errors, low quality may interfere with usability and/or result in harm  
Personal information may be compromised                                   |
| Industry                      | Industry can suffer when professionals are under-valued and working conditions deteriorate                                                    |
| Language, culture & society   | Performance for different language pairs can be highly variable  
Inadequate quality can imply lack of respect for language, culture, community  
Voice, creativity, innovation can be “leveled out”, and then recycled (and amplified)  
Biases and language inequalities can be perpetuated                         |
| Environment                   | Training systems is resource-intensive, with a significant carbon footprint                                                                     |
WHAT CAN WE DO TO MAKE MACHINE TRANSLATION WORK BETTER?
(Share your ideas in the chat.)

HOW CAN WE USE MT RESPONSIBLY AND EFFECTIVELY?
Check input carefully for correctness.

**Where appropriate:**
- Replace rare and ambiguous words with more straightforward and common ones
- Shorten and clarify sentence structures (e.g. by making links more explicit)
- Avoid (especially infrequent) idiomatic expressions, metaphors, and wordplay
- Prioritize content and clarity over style.

Also helps non-native readers and in situations where simplicity, precision and speed of comprehension matter.

<table>
<thead>
<tr>
<th>Original</th>
<th>Pre-edited version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Let’s eat Grandma!</td>
<td>Let’s eat, Grandma!</td>
</tr>
<tr>
<td>Bear witness to camping trip and fall</td>
<td>A bear sees a camper trip and then fall.</td>
</tr>
<tr>
<td>It’s raining cats and dogs.</td>
<td>It’s raining very hard.</td>
</tr>
<tr>
<td>But soft, what light through yonder window breaks?</td>
<td>I wonder what that light coming through the window is?</td>
</tr>
</tbody>
</table>

Always a judgment call!
### USING MT RESPONSIBLY: BEYOND THE TEXT

<table>
<thead>
<tr>
<th>Issue</th>
<th>Possible solutions</th>
</tr>
</thead>
</table>
| Quality                | • Use when output can be verified and corrected, or when consequences/risks of errors are acceptable to user and recipient (and others)  
                           • If necessary and feasible, use MT adapted to relevant domain, text type, vocabulary  
                           • When quality really counts (e.g., high-risk contexts), use qualified translators/interpreters |
| Privacy                | • Do not submit (potentially) confidential or personal information                  
                           • If necessary and feasible, use a private option (e.g., DeepL Pro)                |
| Industry               | • Recognize important role of professionals and support acceptable working conditions and fair remuneration |
| Language, culture & society | • Invest in appropriate level of quality for purpose                               
                           • Monitor potential for bias, long-term effects on language and culture            |
EVALUATING MT’S POTENTIAL AND PERFORMANCE

- Use authentic samples of texts similar to intended translations
  - Avoid over-representing challenges (unless doing so on purpose, e.g., as a challenge set)

- Use a reasonably large sample
  - Variability of individual texts can skew results

- Consider recipients when evaluating fit for purpose
  - Risk tolerance
  - Options for verification/correction
  - Impression and reputation
Back-translation: translating to the target language and then back to the source language to check for consistency
WHAT ABOUT BACK-TRANSLATION? (2)

- Two levels of translation means twice the opportunities for shifts!
  - Identical output does not always mean it was the same in the target language
  - Different output does not always mean the target language was not correct
  - Errors in back-translation may be similar to or different from those in the target language
- Back-translation can be an indicator, but is not reliable

just deserts ≠ juste des déserts ≠ just called deserts
WRAPPING UP

- Awareness of how MT functions and where it is likely to encounter problems allows you to choose appropriate contexts of use and minimize translation problems and their consequences – though never eliminate them completely
  - Informed judgment always important to determine priorities
- Awareness of potential impacts at various levels allows you to consider implications of MT use beyond the text
- Combining the two elements can help you to make effective and responsible use of MT as a valuable tool
QUESTIONS?

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SOME USEFUL READINGS


OTHER SOURCES USED

- Google Translate: https://translate.google.ca/?hl=en