Abstract

In emergency and immigrant health service departments, medical professionals frequently have no language in common with a patient. When no interpreter is available, doctors need another means of collecting patient anamneses. Machine translation was shown to be dangerous and is not available for all languages. BabelDr, a speech-enabled phraselator, was developed for this purpose in a collaboration of the Geneva University Hospitals (HUG) and the Faculty of Translation and Interpreting of Geneva University. In this paper, we focus on the development of the target language resources for the BabelDr system.

Reference


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http://archive-ouverte.unige.ch/unige:111776

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Abstract

In emergency and immigrant health service departments, medical professionals frequently have no language in common with a patient. When no interpreter is available, doctors need another means of collecting patient anamneses. Machine translation was shown to be dangerous and is not available for all languages. BabelDr, a speech-enabled phraselator, was developed for this purpose in a collaboration of the Geneva University Hospitals (HUG) and the Faculty of Translation and Interpreting of Geneva University. In this paper, we focus on the development of the target language resources for the BabelDr system.

1 Introduction

In emergency and immigrant health service departments, medical professionals often find they have no language in common with a patient. Interpreters are not always available, especially in emergency situations. A number of other solutions are available today. Google Translate (GT) and other machine translation (MT) tools, used increasingly often by medical staff, remain unreliable for medical communication (Patil et al. 2014 and more recently Bouillon et al. 2017). They also do not offer all relevant languages. At the Geneva University Hospitals (HUG) for example, in the context of the current European refugee crisis, an important language is Tigrinya, which is not available in GT. Additionally, these tools currently do not ensure compliance with regulations and standards relating to security and privacy. Another alternative are phraselators like MediBabble or UniversalDoctor. Specifically designed by medical staff for the medical diagnosis scenario, phraselators consist in a set of pre-translated canonical sentences (questions and instructions). They allow medical professionals to perform a preliminary medical examination dialogue, using a decision-tree method. While they are reliable, they are not always efficient to use (Boujon et al. 2017). To improve on this, HUG have developed BabelDr, a speech-enabled phraselator. Focussing on the HUG’s needs, BabelDr currently translates from French into Arabic, Spanish and Tigrinya, and work on Albanian and Farsi is ongoing.

In this paper, we focus on the development of the target language resources for this system. We describe the translation process and present an evaluation of this process by the translators. The paper is structured as follows: Section 2 introduces BabelDr and the underlying technologies; Section 3 describes the translation platform and process; Section 4 presents and discusses the evaluation results, and Section 5 concludes.

2 BabelDr

BabelDr uses speech recognition to process the doctor’s utterance and then applies linguistic rules (synchronized Context-free grammar, Rayner et al, 2016) to map the recognition result to the canonical sentence which is closest in meaning. After approval by the doctor, the
canonical sentence is translated and spoken for the patient, who responds non-verbally by nodding or pointing. The canonical form thus acts both as a pivot translation and as a backtranslation to verify recognition. The canonical forms were defined with the help of HUG doctors to ensure explicitness and unambiguity. Mapping from many utterances to unique canonicals is a compromise between ensuring a sufficient set of distinct meanings and keeping the number of items to translate as low as possible.

Due to the repetitive nature of the content, BabelDr source and target language grammars make use of compositional sentences to make resources more compact. These sentences contain one or more variables, which are replaced by different values at system compile time, as shown in Figure 1. Covering 11 different diagnostic domains, the system currently has around 5,000 rules, which expand to about 20,000 canonicals once variables are replaced by values, and by mapping these canonicals to variations, the system has a source language coverage of tens of millions of surface sentences.

<table>
<thead>
<tr>
<th>Sentence</th>
<th>Avez-vous pris $$\text{un médic contre sympt}$$ $$\text{durée médic}$$ ? (Did you take $$\text{medication}$$ $$\text{med_duration}$$ ?)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables</td>
<td>$$\text{un médic contre sympt}$$ ($$\text{medication}$$) (showing 3 of 141 values)</td>
</tr>
<tr>
<td></td>
<td>• des antiarythmiques (antiarrhythmics)</td>
</tr>
<tr>
<td></td>
<td>• des médicaments à base de cortisone (cortisone-based drugs)</td>
</tr>
<tr>
<td></td>
<td>• un traitement pour bloquer les réactions immunitaires (a treatment to block immune reactions)</td>
</tr>
<tr>
<td></td>
<td>$$\text{durée médic}$$ ($$\text{med_duration}$$) (showing 3 of 6 values)</td>
</tr>
<tr>
<td></td>
<td>• pendant plusieurs jours (for several days)</td>
</tr>
<tr>
<td></td>
<td>• pendant deux jours (for two days)</td>
</tr>
<tr>
<td></td>
<td>• pendant une semaine (for one week)</td>
</tr>
<tr>
<td>Expanded</td>
<td>• Avez-vous pris des antiarythmiques pendant plusieurs semaines ? (Did you take antiarrhythmics for several weeks?)</td>
</tr>
<tr>
<td>sentences</td>
<td>• Avez-vous pris des médicaments à base de cortisone pendant plusieurs mois ? (Did you take cortisone-based drugs for several months ?)</td>
</tr>
<tr>
<td>(=canonicals)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>etc.</td>
</tr>
</tbody>
</table>

Figure 1. Examples of compositional sentences

3 Building target language resources for BabelDr

High translation quality is essential for a medical phraselator. Aside from the difficulties of translating medical discourse in a way that maintains precision while ensuring understandability by patients (Cardillo, 2015), translating for BabelDr presents technical challenges. Due to the system’s architecture, language resources must be in a specific structured data format not easily accessible to translators. To facilitate the translators’ task and ensure the quality and coherence of the translations, we have developed an online translation platform. It presents these resources in a simple interface so that translators and revisers do not have to edit grammar files directly. Once a task is complete, the platform generates valid grammar files which can be incorporated into the BabelDr system. The translation process is organised into tasks, which each have three steps: 1) translation, 2) revision and 3) correction, where steps 1 and 3 are carried out by the same person.
3.1 Translation

The platform presents the translator with two tabs: one with sentences with placeholders for variables, another with variable values. Figure 2 shows the translation interface, which is designed following the standard tabular layout used in most translation memory tools, with the source on the left and the target on the right. Clicking on a segment opens it for editing. On the source side, below the canonical sentence to translate, the translator can view other source examples, which are a random subset of variations mapped to the current canonical, providing alternative ways of expressing the same question. On the target side, for compositional sentences, translators can view the sentences with variables replaced by values (in the sentences tab), or view the values in context (in the variables tab), enabling the translator to see the complete translations exactly as they will be presented to patients.

![Translation interface](image)

**Figure 2: Translation interface**

In cases where a sentence treated compositionally in the source language cannot be treated in the same way in the target language, which can happen for different reasons, for example word agreement issues or lexical gaps, the platform allows the user to add specific non compositional translations. Figure 3 shows an example where the variable value “longtemms” (a long time) needs to be translated differently depending on the sentence it is inserted into: “durante mucho tiempo” is correct for one sentence, but for the other “mucho tiempo” is needed, thus the translator added a new non compositional translation for one of the cases.
Values for $\textit{durée}$ (showing 3 of 37)

- French: "longtemps" Spanish: "durante mucho tiempo"
- French: "seulement une seconde" Spanish: "solo unos segundos"
- French: "seulement une minute" Spanish: "solo un minuto"

Sentence 1
French: avez-vous perdu la vue $\textit{durée}$?
Spanish: ¿Perdió la visión $\textit{durée}$?

Sentence 2
French: la douleur au ventre dure-t-elle $\textit{durée}$?
Spanish: ¿El dolor abdominal dura $\textit{durée}$?

# new non compositional rule for sentence 2 with variable $\textit{durée}$ taking value “long-temps”
French: la douleur au ventre dure-t-elle longtemps?
Spanish: ¿El dolor abdominal dura mucho tiempo?

Figure 3. Example of new non compositional rule for Spanish

To ensure translation consistency and accelerate the translation process, the platform includes a translation memory (TM), using the Wordfast Anywhere API. The TM stores translations of sentences and variables each time the user closes a segment and provides matches when a segment is opened.

Since the difficulties encountered by translators for different languages are often similar, we have also included an annotation functionality, which allows translators to share their insights and translation choices by appending shared comments to the canonical sentences.

### 3.2 Revision

To make the revision task less complex, and make sure that the final content is correct, we have chosen to present the reviser with expanded sentences, i.e. sentences with variables replaced. To keep these sentences to a reasonable amount, we perform a minimal expansion, ensuring that each variable value is used at least once. In the revision interface, users cannot edit the translations directly, but add comments to individual sentences. For revisers who prefer working offline or on a printed version, the same content as shown in the revision interface can also be downloaded as a Word document.

### 3.3 Correction

Since the format presented to the reviser does not match the “real” compositional target language resource format, a third correction phase is necessary, where the translator can implement the changes suggested by the reviser in the sentences and variables which will be used to generate the BabelDr target language grammar. This task is carried out in the same view as translation, with the reviser’s comments shown as annotations to the appropriate sentences. If the reviser has added a comment to an expanded sentence, it is linked to the corresponding compositional sentence.

### 4 Evaluation

A first version of the platform is currently in use by multiple translators, completing translations from French into Albanian, Arabic, Farsi, Spanish and Tigrinya. We asked the
five translators to complete an anonymous questionnaire about technical and linguistic aspects of the translation task. The following sections present a summary of the responses received. Due to the anonymity of the questionnaire, we cannot draw any target language specific conclusions.

4.1 Technical aspects

Three of the translators had worked with BabelDr resource files before the development of the translation platform, and they all found that the platform simplified the translation process. All translators found the variable replacement functionalities (cf. Section 3.1) helpful to produce a correct translation. The translators differ in their customary usage of TMs (two always work with TMs, one often, two rarely), but all found they gained time through the TM integrated into the platform. In terms of technology use, the translators are also a heterogeneous group, two working exclusively or often in online interfaces while the other two only rarely do. Experience with non-standard content such as code is also varied. Overall, when asked to judge the technical difficulty of the translation tasks on a four point scale (very high/high/average/low), three translators chose low, two chose average.

4.2 Linguistic aspects

The translators were asked to judge on a four point scale whether different elements of the medical discourse were difficult to translate into their target language. While body parts and drugs present little difficulties, names of diseases were found somewhat difficult by two of the translators. Diagnostic methods as well as symptom descriptions (such as nausea, shivering, etc.) each presented difficulties to three out of five translators. All translators agree that the absence of context makes the translation of some sentences difficult.

Regarding compositional sentences, we asked the translators whether the segmentation into sentences and variables as it is done in the French source could be transposed into their target language. For two of them, this often presented difficulties. Another aspect we enquired about was the difficulty of producing sufficiently generic translations of compositional sentences, in order to work with all variable values. This also presented difficulties for the same two translators. Overall, on a four point scale (very high/high/average/low) the translators judged the translation tasks to be of average difficulty from a linguistic point of view.

5 Conclusion

Globally, the translation platform appears to fulfil its purpose in facilitating the creation of target language resources for BabelDr. Based on the translator’s feedback, the difficulties encountered when translating BabelDr resources are more often of a linguistic nature rather than technical. The BabelDr system is currently being tested at the HUG outpatient emergency department, and feedback is collected from patients and doctors. This will allow us to assess the functional quality of the translations in a real use scenario.

Acknowledgements

This project is financed by the ”Fondation Privée des Hôpitaux Universitaires de Genève”.

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