



LINGUISTIC BEHAVIOUR BROUGHT ABOUT BY THE MACHINE

D. Luzzati*, F. Néel*

ABSTRACT

This paper presents a linguistic analysis of traintimetable requests uttered twice by users of a public telephone information service : they first formulate their request to a human operator, and then repeat the same request to what they believe to be a machine (in fact, the same operator using a vocoder). The purpose is to study the influence of the introduction of the machine on the users' linguistic behaviour and therefore to observe to what extent these unconsciously controlled utterances may be processed automatically. We evaluated this influence with a parser (ALORS) particularly designed for accepting unconstrained and dislocated production, as it frequently occurs in speech.

1. INTRODUCTION

An experiment was carried out under the auspices of the CNRS-GRECO CP (Speech Communication) and with the financial and technical support of the CNET. Real dialogues were recorded in a telephone public information service of the SNCF (French National Railway Company). The domain involved was strictly limited to traintimetable enquiries. Recordings were transcribed in two particular main situations : the first situation dealt with unconstrained human-human conversations as they naturally occur in such a question answering system ; in the second situation, unselected callers were asked if they accepted to speak to a machine. In that latter case, no instructions were given to them : they were just asked to speak normally and formulate their request as they wanted. To make them believe they were speaking to a machine, the same protocol used in the ORSO project (Computer Spontaneous Oral) (ref 3) was chosen : a speech processor (SCH) fixed the operator's fundamental frequency to a constant value. A general linguistic analysis of all the conversations was performed.

In this paper, we focus our study on timetable initial requests. The corpus consisting of 125+125 utterances is homogeneous as the same caller formulated the same request, first to the operator, then to what he believed to be a machine. The purpose of this work is to study the influence of the machine on the linguistic behaviour of callers and evaluate to what extent they unconsciously constrain themselves as far as lexicon, syntax ... are concerned. Our ultimate goal is to design parsers and dialogue strategies that may cope both with technical limits and with users' requirements. From a technical point of view, we attempted to take the recognition capabilities into account (for instance, in the selection of the words to be recognized). From the users' point of view, we observed two simultaneous tendencies in the corpus studied, as the type of oral was both spontaneous (utterances conceived and perceived during enunciation) and constrained (more attention was paid by the speakers when speaking to the machine) : therefore, messages, though terser, could not afford disfluencies such as repetitions, near-misses, hesitations ... The parser ALORS presented here as it is specially designed for processing oral production is an attempt to select only semantic word sequences and ignore the overall ungrammatical structure.

2. COMPARISON OF THE INITIAL REQUESTS

As can be expected from such a highly restricted topic domain (a public telephone traintimetable enquiry service), the main elements appear to be spatio-temporal references : departure stations (DS), arrival stations (AS), day of travel (DT) and length of time during

* LIMSI-CNRS - B.P. 30 - 91406 ORSAY CEDEX - FRANCE

which the person is willing to travel (LT). These items may be preceded by an introducing group, composed of a verbal group (VG) and of a noun group (NG). The logical structure VG+NG+DS+AS+DT+LT rarely occurs and the semantic groups may often be separated by non-informative or superfluous elements (SE). Here is an example (ex 1) showing a user's utterances to the operator (OR) and the machine (MR) :

- SNCF bonjour (SNCF good morning)
- OR : *bonjour je voudrais avoir un petit renseignement j'aimerais connaître les horaires des trains le mardi 25 décembre mais partant de province de ruffec en enfin pour arriver à austerlitz (hello I'd like a little information I'd like to know the times of the trains on Tuesday December 25 but leaving the provinces from Ruffec at finally arriving at Austerlitz <station>) ...*
- SNCF renseignements téléphoniques quels renseignements désirez-vous obtenir (SNCF telephone information what information would you like)
- MR : *voilà j'aimerais connaître le les horaires pour e revenir de ruffec et arriver donc à paris austerlitz le mardi 25 décembre (well I'd like to know the all the times to ah come back from Ruffec and arrive at Paris Austerlitz <station> on Tuesday December 25)*

example 1

From these examples, we can extract two different frames gathering the main information :

Operator Request	Machine Request
SE <i>je voudrais avoir quelques renseignements</i>	...
VG <i>j'aimerais connaître</i>	VG <i>j'aimerais connaître</i>
NG <i>les horaires des trains</i>	NG <i>le les horaires</i>
DT <i>le mardi 25 décembre</i>	DS <i>pour revenir de ruffec</i>
DS <i>partant de province de ruffec</i>	AS <i>et arriver à paris-austerlitz</i>
AS <i>pour arriver à austerlitz</i>	DT <i>le mardi 25 décembre</i>
LT

From the 125 pairs of requests, we focused on the structure modification and the evolution of the elements, particularly the introducing verbal group (VG), the superfluous elements and the spatio-temporal references.

2.1. Structure. The logical structure (VG+NG DS+AS DT+ST) is respected in only 5% of the requests. In the other cases, the order of the different groups is completely free. Callers may either introduce in the MR the elements missing in the OR, or rectify an irregular structure. Their being disturbed by the machine provokes two opposite behaviours ; they may adopt a terse structure, using keywords (*horaire sur la ligne paris lille (schedule Paris Lille)*) or show wordiness (ex 2) :

- OR : *oui bonjour madame j'aimerais avoir les horaires du train paris paris saint-jean-de-luz oui e en date du dimanche sop (hello I'd like to have train schedule for Paris Paris Sain-Jean-de-Luz on Sunday)*
- MR : *j'aimerais obtenir e le renseignement suivant j'aimerais avoir les horaires du des trains en date du dimanche 23 décembre à destination de saint-jean-de-luz au départ de paris merci (I'd like to have the following information I'd like to have train schedule on Sunday December 23 to arrive in Sain-Jean-de-Luz starting from Paris thanks)*

example 2

2.2. Introducing Verbal Group. The VG is generally composed of an auxiliary verb (often in the conditional) and of an infinitive. In the whole corpus, only 2 verbs are really employed as auxiliaries (*aimer-vouloir (to like-to want)*) and only 3 as infinitives (*avoir-savoir-connaître (to have-to know-to learn)*) whereas language possesses a great number of possible expressions. This lexicon simplicity is much more apparent in the MRs (13 exceptions) than in the ORs (23 exceptions). In the MRs, the exceptions correspond to requests more sophisticated than the corresponding ORs ; in the ORs, 15 of the 23 exceptions use *vous (you)*, which does not appear in front of the machine, and the VGs lexicon increases, including *pouvez-vous me donner (could you give me)*.

2.3. Superfluous Elements. Preambles such as *je voudrais divers renseignements (I'd like various informations)* tend to disappear : from the 12 examples found in the ORs, only 2 remain in the MRs. At the same time, 4 new ones appear, showing that some callers are really disturbed by the machine (ex 2) :

2.4. Spatio-Temporal References. The main difference deals with the evolution of the spatio-temporal references. When they are talking to an operator, the callers refer much more to the moment they speak and the place they are than when they speak to what they think to be a machine (ex 3) :

OR : *oui bonjour madame je voudrais connaître les trains e paris e le mans e ce soir à partir de 6 H (hello I'd like to know schedules Paris Le Mans this evening from 6)*
MR : *horaire des trains paris montparnasse le mans de vendredi e 28 e décembre à partir de 18 H (train schedule Paris Montparnasse station Le Mans Thursday December 28 from 6 p.m.)*

example 3

6 h (6) becomes 18 h (6 p.m.). The date is completed with the weekday. Some precisions are added to AS DT and LT to render the reference more absolute. In the above ex 2 for instance, *Sunday* becomes *Sunday December 23*, and *Paris Saint-Jean-de-Luz* becomes *to arrive to Saint-Jean-de-Luz starting from Paris*. This evolution is pragmatic : it is a "mental model" (ref 2) revision phenomena. It can be justified by a natural tendency to an impersonalization. It also explains the non-occurrence of such expressions as *10 to 10 (replaced by 9.50)*, and the scarceness of "quarter" or "half", which is only used in a particularly ambiguous context : *9 h et demie 9 h 45 (9:30 9:45 a.m.)*.

3. AUTOMATIC PROCESSING

From the linguistic analysis, three main lessons may be drawn : the absence of a stable syntactic structure or order, the tendency for non-informative elements (introducing group, repetitions ...) to disappear, and the importance of a very restricted set of lexical entities that mostly deals with spatio-temporal references. The vocabulary is more restricted and stereotyped (less than 50 items, without the station names).

A parser (ALORS) has been developed with the objective not so much to understand the entire request as to recognize the pertinent elements. The purpose is to extract from the utterance the elements (DS AS DT ST) necessary to fill the right frame. Therefore, a selective analysis based on the semantic label of items is achieved and whenever these items are selected, they are validated by a local syntax analysis. The parser, for the moment, is used in simulation with a keyboard input. But in the selection of the pertinent vocabulary to be recognized, we avoid monosyllables to allow word spotting recognition. ALORS does not pretend to be a parser with strong virtual possibilities, capable of processing a great variety of utterances. There may be a few expressions that the parser will not be able to process ; we consider the problem to be more of the relevance of these expressions than of the parser performances.

3.1. Strategy. Syntax-driven strategies, even flexible ones, should be eliminated with such oral utterances : the problem is not to tolerate some mistakes with respect to a standard but to complete an analysis when this standard does not almost exist. Therefore, the problem is not to determine succession rules, but to palliate their absence. The analysis has to be semantically and pragmatically driven. The frame we try to get from each request can be considered as a sketchy script : ALORS is a skimming parser, ignoring some words and releasing different kinds of parse (ref 1). Each selected item is considered depending on its environment. Sometimes, items label changes : *heure* for instance can indicate the time as well as the task (*l'heure d'un train à 10 heures 10 (train schedule at 10:10 a.m.)*). Some items can be refused (*après tout je voudrais un train après 10 h (after all I'd like a train after 10 a.m.)*). Local syntax nuclei, even divided (*samedi après-midi 1er janvier (Saturday afternoon January 1)*), are processed whenever it is possible. Basically, the system has a very precise knowledge representation and it takes a great number of default decisions.

3.3. Results. We obtain an error rate of 1,8% in a human-machine situation and of 4,2% in a human-human situation. This error rate is less than half with the MRs than with the ORs, as we can see in the following frames (ex 4) (ex 5) :

OR : *bonjour j'aurais aimé connaître les horaires des trains pour blois au départ le lundi 24 décembre entre 10 h et 15 h de paris austerlitz (hello I'd like to know train schedule for blois leaving Monday December 24 between 10 and 3 p.m. from Paris Austerlitz station)*

example 4

OR : *oui bonjour excusez-moi de vous déranger surtout vers midi est-ce que vous pourriez me donner les horaires des trains s'il vous plaît pour le week-end du 5-6 janvier pour lens (yes excuse me for disturbing you near noon could you give me train schedule please for the week-end of January 5-6 for Lens)*

example 5

TASK = TIMETABLE
 DS = BLOIS
 AS = PARIS
 DT = LUNDI 24 DECEMBRE
 LT = <> 10 H - 15 H
frame ex 4

TASK = TIMETABLE
 DS = (PARIS)
 AS = LENS
 DT = 5-6 JANVIER
 LT = (=) 12 H
frame ex 5

With ex 4, ALORS does not succeed in processing an excessively divided syntax nucleus. With ex 5, ALORS processes a SE (*excuse me for disturbing you near noon*) and understand *noon* as LT. These errors depend, for the first one, on an irregular structure, and for the second one, on the presence of a SE. However, there is not any problem with corresponding MRs.

4. CONCLUSION

From this study of the linguistic behaviour brought about by the machine, there are two conclusions to be drawn :

- Generally, the requests are more complete, more regular and more concise. The contrary may happen in some cases, though, when callers are much disturbed.
- The callers' whole discourse is less personalized. It deals with the disappearing or the transformation of the VGs including *you* and with the evolution of the spatio-temporal references.

According to human-machine communication, such corpus gives interesting information so as to realize dialogue systems. It shows that a task lexicon is spontaneously limited, and that even in front of a machine, the syntax is an oral one, supposing specific parsers, capable of processing non-standard utterances. Such corpus, gives a quite precise idea of a possible human-machine dialogue, which has to be forged according to what the callers expect and tolerate of a conversing machine.

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