ABSTRACT. We discuss the possibility of modelling the dialogue as a system of action in the sense of [6], pondering on the linguistic formalization of the rules governing the correct development of the process and their relationships with the type of the language determined.

1. INTRODUCTION

In what follows, we shall understand the dialogue as a "conversation between two or several persons" [2]. In fact, we shall use as synonymous the words "dialogue" and "conversation".

We shall consider dialogue as an exchange of rejoinders (belonging to a fixed finite set of rejoinders) rather than an exchange of information taking place in certain space and time. In other words, we focus on the syntactic level of the dialogue, on its formal development.

Just at this level of abstraction, the following formalism for describing a conversation was proposed in [8]. Let $X$ be the set of participants which a given dialogue involves, $X = \{1, \ldots, n\}$, and let $R$ be the finite set of rejoinders which the persons labelled by $1, 2, \ldots, n$ are uttering. The rejoinders in $R$ are, in fact, semantic marks associated with classes of rejoinders. For instance, we can take the following: $q =$ question, $a =$ answer, $aa =$ affirmative answer, $c =$ comment, etc. At each moment, exactly one participant from $X$ is speaking (let us denote them by $s$), uttering a phrase which belongs to some semantic category whose mark is in $R$. We say that $s$ is pronouncing a rejoinder from $R$. Each rejoinder is uttered for a set of addresses, a subset $A$ of $X$. Let us suppose that in a given moment, a participant has a special position in the conversation: it is the leader, the "chairman". We denote him by $c$. The four items, $c, s, A, r$, completely describe the dialogue at this time; the quadruple $(c, s, A, r)$ is called a state of the conversation. Let $St = X \times X \times 2^X \times R$ be the set of all states. Thus, the conversation can be described by some string in $St^*$ ($St^*$ is the free monoid generated by $St$ under the operation of concatenation and the null element $\lambda$.) Any shift in the role of the speaker, the chairman, the addressees and the occurrence of any new rejoinder marks the passing to a new state of the conversation.

In this frame, a linguistic approach to dialogue was proposed in [4] in order to model the correct evolution of the process.

We call a conversation grammar the system

\[ G = (X, R, S_0, S_\infty, \varphi) \]

where \( X, R \) are as above, \( S_0, S_\infty \subseteq S \) are the set of initial states, respectively, the set of final states, and \( \varphi: S^* \rightarrow 2^S \) is the next-state function. The set of all correct conversations is defined by

\[ L(G) = \{ x \in S^* | x = s_0s_1 \ldots s_n, n \geq 1, s_0 \in S_0, s_n \in S_\infty, s_i \in \varphi(s_{i-1}s_{i-2} \ldots s_1) \text{ for any } i = 1, 2, \ldots, n \}. \]

In [4] examples of conversations were discussed whose associated languages are regular, context-free non-regular, and, respectively, context-sensitive non-context-free languages. (See [9] for the formal language theory terminology.) Moreover, it was proved that if the next state depends only on a bounded number of preceding states (the conversation is said to have a weak historicity), then the associated language is regular.

However, the above definition of the conversational grammars has an infinite feature: the next state mapping \( \varphi \) is defined on the infinite set \( S^* \).

In real cases we do not deal (directly) with this mapping, but a set of rules are pointed out defining the correct evolutions of the conversation.

2. THE RULES OF THE DIALOGUE

Clearly, there are many rules governing the development of different types of dialogue. Our purpose is not to exhaust their formalization (this seems to be a hard task), but just to discuss a set of such rules from the point of view of their formalization in the frame of the linguistic model of action systems proposed in [6].

By examining different types of dialogue, we can set off three classes of dialogue rules:

(a) Protocol rules, i.e. rules defining the type of the conversation. Two subclasses can be distinguished:

(a1) General protocol rules acting on the dialogue as a whole.

Examples: rules about the choice/change of the chairman, the choice/change of the speaker and of addressees, the beginning and the end of a conversation, etc. Many such rules can act on the rejoinder crossing restrictions. Let us state some such rules for the case when we deal with rejoinders which are to be followed by an answer (as the questions). In this case we can