J. M. ULIJN, J. GOETSCHALCKX, P.C. SCHOUWSTRA: THE PARTIAL PARALLEL CHARACTER OF LANGUAGE RECEPTION AND PRODUCTION

Abstract
The Institute for Technology and Linguistics will perform research on communication, in the fields of negotiating and translating, on the basis of the theory of partial parallelism. This theory sees language reception and production as similar processes having a symmetric structure.

During language reception, a text is analyzed until comprehension is complete (conceptual analysis). This is continuously checked and controlled by a monitor in the reception process (conceptual check). Conceptual analysis consists of textual analysis, syntactic analysis and lexical analysis. Emphasis lays on lexical analysis.

Language production is a similar process: conceptual synthesis also being checked and controlled by a monitor. Conceptual synthesis consists of textual, syntactic and lexical synthesis. The difference between language production and language reception is that emphasis, in the production process, lays on textual synthesis; syntactic and lexical synthesis fill in the structure supplied by the textual synthesis.

1. Introduction

The Faculty of Philosophy and Social Sciences at the Eindhoven University of Technology is, with the support of both government and industry, setting up the "Institute for Technology and Linguistics". This institute is developing, on an international scale, a post-graduate programme aimed at preparing and training graduates, from Universities of Technology, for specific roles in the area of interface between technology and society (e.g. business).
The program is based upon the general principles of human communication and interaction, both in written and oral language. It focuses on two main topics:

1. Technical Writing and Translating

With the emphasis on:

- acquiring a thorough knowledge of scientific and technical terminology and of terminological sources
- learning to use advanced tools for translation for professional purposes.

2. Intercultural Negotiation

With the emphasis on:

- acquiring proficiency in negotiating processes
- developing awareness and understanding of the differences in cultural settings.

This will be done on the basis of on-going research, in close collaboration with other centres of knowledge and competence from a variety of countries and cultures. This article is intended to provide the outline of a theoretical basis for the research to be performed by the Institute for Technology and Linguistics.

It can therefore, be considered as a positioning paper.

2. Communication

This article focuses on communication both written and oral. A model will be developed, with which these processes can be described.

Reading and listening (language reception skills) and writing and speaking (language production skills) are interrelated in one communicative chain. A writer of a text, for example, is supposed to know how this text should be read, a reader ought to know how this text was written. This chain is shown in the communication model of SHANNON and WEAVER (see figure 1) (SHANNON & WEAVER, 1949) (HAMLIN & HARKINS, 1980)

![Figure 1. The Shannon and Weaver communication model](image-url)
To study cross-linguistic transfer processes, we consider it a prerequisite to approach the two skills (language production and reception) in a single, mirror-like, view. Both models can be derived from the psycholinguistic literature concerning the human language user, since only this permits an integrated view of the conceptual, syntactic and lexical aspects. The theoretical and experimental aspects are mainly based upon work by KEMPEN at the University of Nijmegen (see for instance, DIJKSTRA & KEMPEN, 1984, KEMPEN & HOENKAMP, 1987, and KEMPEN, 1988).

3. The human language user

3.1 The human language user: reception

In figure 2 a model for the human language user as a receiver is given.

![Figure 2. The human language user: reception.](image-url)
First of all, a message is physically received: the ear hears sounds, the eye perceives script symbols.

Then the input is recognized as a message: the recipient tries to identify the script (or the speech). The recipient asks, for example, whether the graphemic conventions are familiar, what language the text is written in, etc. In addition, the recipient also identifies phonological units such as phonemes and syllables.

The functioning of the components of the parser is crucial since its task is to detect the "conceptualization" underlying each sentence of an input text. The components of the parser begin with the results obtained by the recipient and have access to the conceptual system and either the textual, syntactic or lexical knowledge bases for such information. The total operation is controlled by the monitor which also divides the analysis of the text into a textual, syntactic, and lexical component. More details about the operation of the parser will be given below.

In language reception, emphasis is mostly on lexical analysis whereas textual analysis seems to play only a minor role. The final result is comprehension: the meaning of the message is made conscious, as a representation, to the conceptual system.

3.2 The human language user: production

Language production involves, in part, the same mechanisms as that shown in figure 3. The symmetry is obvious: the same knowledge bases provide knowledge for language production as well as for language reception.
The operation of the components of the text and sentence generator is crucial within this framework.

A text is conceptualized, designed by the conceptual system, controlled by the monitor, formulated by putting the arguments in the right order. Next the text is divided into sentences (according to the rules in the textual knowledge base), provided with a correct syntactic structure (from the syntax) and finally the correct words are retrieved from the lexicon. Then, the speech or script producer, chooses the appropriate sounds to express the sentence, or, for a written sentence, the appropriate script, splitting it up into letters, words, and blank spaces. Finally, it is the human hand or speech organs which make the sentence visible to a reader or audible to a listener.
Further details concerning the conceptualizing and formulating process will be given below. All mechanisms are supervised and operated by the monitor in constant mutual interaction with feedback and anticipation circuits.

4. Levels in communication

Traditionally, levels are used in linguistic description, such as phonology, morphology and syntax in these minimal sets. These levels are depicted in a model, in which a hierarchy is suggested (see figure 4). This hierarchy is determined by the size of information units involved: the textual level concerns the largest amount of text and consequently it is placed at the top; whereas the grapho-phonemic level, which concerns only parts of words, is placed at the bottom.

![Figure 4](image)

Figure 4. Linguistic levels in the communication process.

This approach should not be confused with the skills-approach (HERRIOT 1970, LEVELT 1975), where a hierarchy does indeed suggest levels of operation. Such a hierarchy is said to be bottom up or top down and a reader will first process textual blocks or, conversely, graphemes (script) or phonemes (speech).

Yet, a non-hierarchical model is more appropriate in linguistic description, as can be seen from the models for language reception and production. This non-hierarchical model should describe functions rather than measure the size of information units concerned. Such a model is developed in section 5.
5. Partial parallel processes

Important to efficient communication, is the operation of the components of both the text and sentence parser and the text and sentence generator. Since, in their most primitive stage, language reception (reading and listening) relates form to meaning and language production (writing and speaking) relates meaning to form, this operation will deal with both.

Reception consists of continuous processing until the meaning is totally clear. During the process of analyzing a text, it is constantly monitored to see whether the meaning is clear and, if not, what kind of additional information is required, i.e., lexical, syntactic or textual information. The process of lexical, syntactic and textual analysis is named conceptual analysis; the monitoring function is called conceptual check (see figure 5).

Production is a similar process: a text is synthesized and continuously monitored to see what kind of additional information is required to make it comprehensible, i.e., lexical, syntactic or textual information or, in short: conceptual information.

![Figure 5. Feedback in communication](image)

In figure 5, in the case of language reception (conceptual analysis), input means text, and output the understanding of that text, whereas, in the case of language production (conceptual synthesis), input means a message, and output a text which contains that message.
5.1 Partial parallel process: reception
Elsewhere it has been argued that a serial bottom up or top down approach in reading, as, for instance, HERRIOT (1970) and LEVELT (1975) propose, would be time-consuming and inefficient (ULIJN, 1980 and 1984). It would be more in line with current experimental evidence to suppose a simultaneous and interdependent interaction between the different analyses of the text and sentence parser.

A completely parallel operation would however, put heavy constraints on short term memory. Textual Analysis (TA), Syntactic Analysis (SA), Lexical Analysis (LA) and Conceptual Check (CC) operate in a partially parallel way (see figure 6).

The analysis components (TA, SA and LA) are controlled by the monitor (CC), which brings the components into action when required. First a superficial syntactic analysis (SA) and textual analysis (TA) is made, then the lexical component is activated (LA), finally the monitor will revert to SA and TA as and when need arises. Experimental research has shown that readers, for instance, simply overlook all kinds of syntactic varieties in a text, in that syntactic simplification is not a real simplification (ULIJN & STROTHER, 1989).

Figure 6. Partially parallel reception process

Lexical analysis has a special role in normal comprehension orientated reading. Very convincing evidence was given on this
A successful computer simulation of reading was done which was strongly driven by eye fixation data from human readers. It appeared that, in the semantic and syntactic analysis of sentences, gaze duration was more strongly influenced by semantic aspects, such as ambiguity, novelty and repetition throughout the text, than by formal perceptual aspects such as length and frequency. Readers of scientific texts fixated 83% of the content words and only 38% of the function words. Syntactic and textual analysis need not be thorough, whereas lexical analysis should be.

As said before, the parser first makes a superficial TA and SA, then focuses on LA and reverts only to thorough TA and SA if, according to the conceptual check, comprehension is still incomplete (see ULIJN, 1981: 133-134). The question how much textual analysis is required for efficient comprehension remains to be subjected to careful experimentation.

5.2 Partial parallel process: production
On the basis of available experimental evidence KEMPEN (1979) argues that conceptualization and formulation cannot be serial processes in L1 speaking since, completing the conceptualizing before formulating would be too cumbersome for short term memory. The reverse would be even more nonsensical: first formulating something which had not yet been thought out (see also ULIJN & GOBITS, 1985).

A complete parallelism, however, would suppose a one-to-one form concept correspondence with a universal word order within and across languages. Since such a strict word/concept order is absent, the parallelism between conceptualising and formulating can only be partial. This is especially true for writing where more time is used to revise content and make it fit the current formulating capacity of the writer.

When a message is going to be expressed as a text, the generator retrieves a structure for the text and certain conceptual fragments, within the given theme, from the conceptual system (textual synthesis). It then tries to formulate them into sentences, by retrieving the correct words from the lexicon (lexical synthesis), and provide them with a suitable syntactic structure or structures) (syntactic synthesis).

A continuous check is made to ascertain whether this is possible and, if not, what kind of information is needed to produce the text, i.e. textual, syntactic or lexical. Because of the continuous conceptual check, revision is an element in the language production process that is constantly present (YAZDANI, 1987).
tual synthesis, syntactic synthesis, lexical synthesis and conceptual check operate in a partially parallel way (see figure 7).

![Diagram of partially parallel production process]

**Figure 7: Partially parallel production process**

Production differs from reception in that, during language production the importance of the components increases bottom up with the size of the information units involved. Emphasis laying on textual synthesis, while lexical synthesis, on the other hand, is least important.

6. Research

The theory of partial parallelism as expressed in the previous paragraphs is the basis for research to be performed at the Institute for Technology and Linguistics.

Since the institute aims at educating negotiators as well as translators, research is limited to the processes which occur in the respective areas. Therefore, two lines of research have been started: one in the field of negotiating and the other in the field of translating.

The central question in both lines of research is; what happens in the mind of a negotiator or a translator? In what sense are negotiating and translating more than just language reception and
production? During this research, actors (so-called) will be identified and their existence will be tried to be proven (actors are functions in the communication process, such as the monitor, the components of the parser etc., which operate on knowledge bases, such as syntax or lexicon).

Subsequent articles will present these research-projects in more detail.

References:
