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PROBLEM-SOLVING MECHANISMS IN L2 COMMUNICATION

A Psycholinguistic Perspective

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This paper investigates the various ways speakers manage problems and overcome difficulties in L2 communication. Following Dörnyei and Scott (1997), we distinguish four main sources of L2 communication problems: (a) resource deficits, (b) processing time pressure, (c) perceived deficiencies in one's own language output, and (d) perceived deficiencies in the interlocutor's performance. In order to provide a systematic description of the wide range of coping mechanisms associated with these problem areas (e.g., communication strategies, meaning negotiation mechanisms, hesitation devices, repair mechanisms), we adopt a psycholinguistic approach based on Levelt's (1989, 1993, 1995) model of speech production. Problem-solving devices, then, are analyzed and classified according to how they are related to the different pre- and post-articulatory phases of speech processing, and we illustrate the various mechanisms by examples and retrospective comments taken from L2 learners' data.

In the introduction of a recent paper on managing problems in speaking, Clark (1994) wrote that "when the participants of a conversation have problems,

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they manage most of them quickly, skillfully, and without apparent effort" (p. 244). Although this statement is true when the conversation is conducted in the participants' L1, even a brief analysis of any spontaneous piece of L2 oral discourse will reveal that L2 speakers tend to spend a great deal of time and effort negotiating meaning and struggling to cope with the various problems they encounter during the course of communication (cf. Gass & Varonis, 1991). Understanding L2 problem management, therefore, is a principal issue in L2 research with important potential implications for L2 theory. The question has considerable practical relevance as well: In spite of the prominence of problem-solving behavior in learners' speech, current language-teaching course books and approaches do not tend to provide learners with strategies on how to cope with difficulties, although this might be, in principle, possible (for arguments and some evidence in favor of the feasibility of such strategy training, see Cohen, Weaver, & Li, 1995; Dörnyei, 1995).

The language devices applied to overcome communication problems have been the target of extensive research in various subfields of applied linguistics, but there have been very few attempts to provide a comprehensive treatment of the mechanisms L2 speakers employ when encountering communication difficulties. Indeed, Yule and Tarone (1991) pointed out in their discussion of the relationship between the two central domains of problem management—*meaning negotiation* (for reviews, see Gass & Selinker, 1994; Larsen-Freeman & Long, 1991; Pica, 1994) and *communication strategies* (for reviews, see Bialystok, 1990; Dörnyei & Scott, 1997; Poulisse, 1994)—that the research literatures of the two areas were almost entirely independent. Besides these fields, there are two further research areas relevant to communication problem management but not as yet integrated sufficiently: the study of the *temporal organization of L2 communication* (involving the discussion of pauses and stalling phenomena; for reviews, see Griffiths, 1991; Schmidt, 1992; Towell, Hawkins, & Bazergui, 1996) and *repair mechanisms* in discourse analysis (e.g., Kasper, 1985; Schegloff, Jefferson, & Sacks, 1977; Schwartz, 1980; Tarone, 1980; van Hest, 1996; Varonis & Gass, 1985).

The goal of this paper is to bring together several lines of research and provide a comprehensive overview of problem management in L2 communication. Following Dörnyei and Scott (1997), we distinguish four main problem sources in L2 communication: (a) L2 resource deficits, (b) processing time pressure, (c) perceived deficiencies in one's own language output, and (d) perceived deficiencies in the interlocutor's performance. In order to provide a systematic analysis of the wide range of problem-solving mechanisms associated with these problem areas, we adopt a psycholinguistic perspective based on the L2 adaptation of Levelt's (1989, 1993, 1995) model of speech production. This approach offers a theoretical framework in which problem-solving devices can be connected to the various pre- and post-articulatory phases of speech processing, thereby helping to achieve a coherent process-oriented description.

The paper is structured as follows: First we outline Levelt's model of lan-

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guage processing and then extend it to L2 oral communication on the basis of work by de Bot (1992, 1996), de Bot and Schreuder (1993), Poulisse (1993, 1995), and Poulisse and Bongaerts (1994). Having established our theoretical grounding, we begin the analysis of how L2 speakers manage problems in their speech[1] by discussing problem-solving mechanisms related to L2 resource deficits: first lexical communication strategies on the (slightly extended) basis of Poulisse's (1993) framework of strategic language processing, and then grammatical and phonological problem-solving mechanisms. Next, we examine problem-solving devices associated with processing time pressure stemming from serial rather than parallel processing in L2. Finally, we analyze problem-solving mechanisms related to deficiencies in one's own output (i.e., self-repairs and self-rephrasing) and in the interlocutor's performance (i.e., meaning-negotiation mechanisms).

We would like to note two things at the outset. First, the discussion of the last set of mechanisms, other-performance-related meaning negotiation, will be relatively brief as these mechanisms also involve speech comprehension processes (because they relate to problems in the interlocutor's speech), which are given little attention in Levelt's model. Second, our discussion will be restricted to analyzing problems that are closely related to actual language processing and will not extend to "higher order" communication problems such as pragmatic difficulties or L2 identity issues. We will return to this question in more detail at the end of the paper.

LEVELT'S MODEL OF SPEECH PRODUCTION

Several attempts have been made in the literature to set up a comprehensive model of speech processing, but the most widely used theoretical framework in L2 production research is Levelt's (1989, 1993, 1995) model originally developed for monolingual communication (for a schematic representation, see Figure 1). Levelt argues that speech production is modular; that is, it can be described through the functioning of a number of processing components that are relatively autonomous in the system. Five principal components are distinguished: the *conceptualizer*, the *formulator*, the *articulator*, the *audition* (or, as later relabeled, the *acoustic-phonetic processor*), and the *speech comprehension system* (relabeled as the *parser*). There are also three knowledge stores: the *lexicon*, the *syllabary* (containing phonological information), and the store containing *discourse models* and *situational and encyclopedic knowledge*. Although Figure 1 and the new terminology may seem highly complex at first sight, the basic mechanisms of speech processing are conceptualized by Levelt in a fairly straightforward manner: People produce speech by first conceptualizing the message, then formulating its language representation (i.e., encoding it), and finally by articulating it. With regard to speech perception, speech is first perceived by an acoustic-phonetic processor, then it undergoes linguistic decoding in the speech comprehension system (i.e., the parser), and it is finally interpreted by a conceptualizing module. The unique feature of the model is

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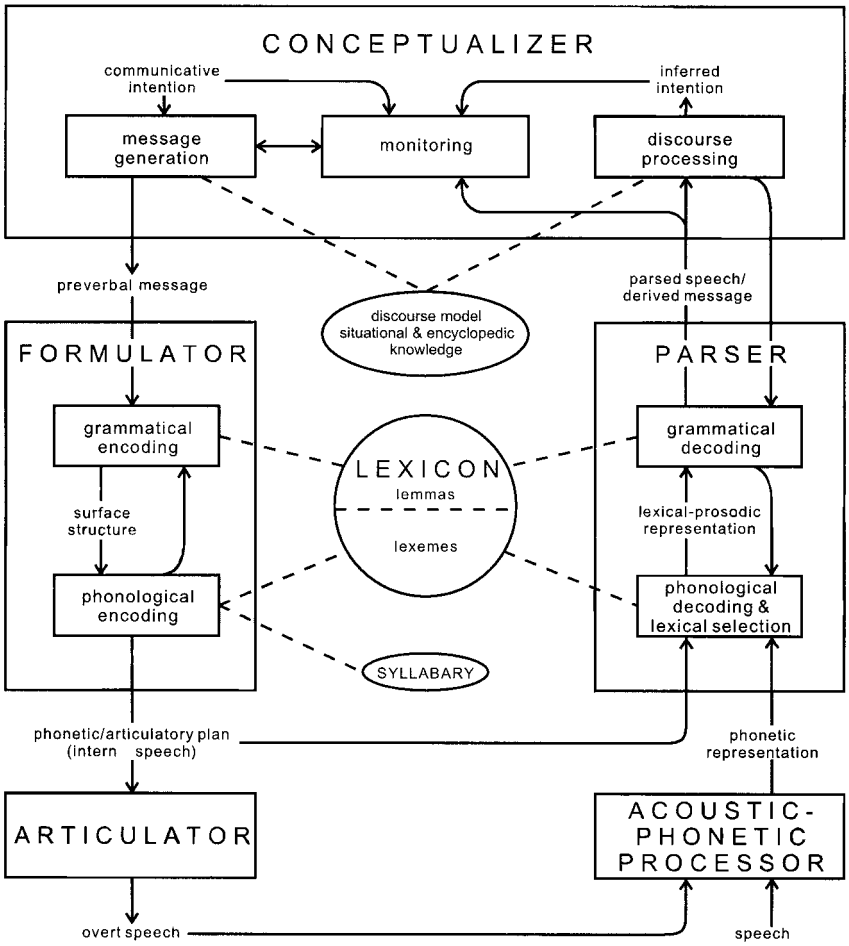


Figure 1. Levelt's schematic representation of the processing components involved in spoken language use (based on Levelt, 1993, p. 2. & 1995, p. 14; used with permission).

the integration of the two processes into one comprehensive system and its richness in details—for example, by precisely specifying the role of the lexicon and the procedures of monitoring in relation to the processing components, or by delineating explicit directional paths between the modules outlining their cooperation in producing their joint product, speech.

In Levelt's model, the processing components are specialists in the particular functions they are to execute; that is, they do not share processing functions. A component will start processing if, and only if, it has received its characteristic input. Levelt assumes that processing is incremental, which means that as soon as a preverbal chunk is passed on to the formulator, the conceptualizer starts working on the next chunk regardless of the fact that the

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previous chunk is still being processed. As a consequence, the articulation of an utterance can begin long before the speaker has completed the planning of the whole message. Thus, parallel processing is taking place as the different processing components work simultaneously, which is only possible because most of the actual processing, particularly the encoding phase, is fully automatic. As de Bot (1992) pointed out, the incremental, parallel, and automatized nature of processing needed to be assumed in order to account for the great speed of language production.

Figure 1 presents the blueprint of the language user, outlining the main processing components involved in generating speech. The first component, the conceptualizer, generates the message through (a) *macro-planning*, which involves the elaboration of the communicative intention down to the level of conceptual and propositional message content, resulting in macro-plans that Levelt (1989) called *speech-act intentions*, and (b) *micro-planning*, which shapes the semantic representations that are associated with the message content by assigning a particular information structure to the macro-plan, thereby finalizing it for expression, resulting in the *preverbal message*. As the name suggests, this preverbal message is not yet linguistic although it is linguistically accessible; that is, it contains all the necessary information to convert meaning into language.

The preverbal message is the output of the conceptualizer and, at the same time, the input of the next processing module, the formulator, which is the component in charge of selecting the lexical units and carrying out grammatical and phonological encoding. The formulator retrieves information from the speaker's mental *lexicon*, which in Levelt's model consists of *lexical entries*, each made up of (a) *lemmas* that specify the meaning and the syntax of the lexical entry and (b) *lexemes* that carry information on the morphophonological form of the lexical entry. In order for the preverbal message to be accessible to the formulator, it must contain lexicalizable *chunks*. It is not clear, however, whether this chunking is the result of micro-planning or is carried out by another processing module mediating between the conceptualizer and the formulator (cf. de Bot & Schreuder, 1993; Poulisse, 1993).

The primary procedure to take place in the formulator is *lemma activation*; the speaker retrieves the lemma whose meaning best matches the semantic information carried by the corresponding chunk of the preverbal message. Based on Bresnan's (1982) lexical theory of syntax, Levelt (1989) assumed that the selection of the lemma activates its syntax, which, in turn, triggers syntactic building procedures. Thus, Levelt considers semantic activation primary to form activation and sees the lexicon as a mediator between conceptualization and grammatical or phonological encoding—an assumption he calls the *lexical hypothesis*. Consequently, he attributes a central role to lemma retrieval in the speech process.

The output of grammatical encoding is the *surface structure*, which is "an ordered string of lemmas grouped in phrases and sub phrases" (Levelt, 1989, p. 11). This is further processed by the *phonological encoder*, which makes use

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of the phonological information of the lexical item contained in the lexicon, resulting in the *phonetic* or *articulatory plan* (or "internal speech"). This is, then, transformed into overt speech by the *articulator*, drawing on the repertoire of articulatory gestures stored in the *syllabary*.

Levelt's model also accounts for *monitoring* in speech production. The *monitor* is located in the conceptualizer but receives information from the separate *speech comprehension system* (or *parser*), which, in turn, is connected to the mental lexicon. In order to avoid the necessity of duplicating knowledge, Levelt assumes that the same lexicon is used for both production and perception, and the same speech comprehension system is used both for attending to one's own speech and for checking other speakers' utterances (via the acoustic-phonetic processing module). Furthermore, the interpretation of the perceived messages is carried out by the same conceptualizing module as the one in charge of generating one's own messages. This uniformity of the underlying processing modules justifies the inclusion of self-correction and meaning-negotiation mechanisms in a coherent, psycholinguistically motivated discussion of L2 problem management.

In Levelt's system of speech processing, there are three monitor loops (i.e., direct feedback channels leading back to the monitor) for inspecting the outcome of the production processes. The first loop involves the comparison of the preverbal message with the original intentions of the speaker before being sent to the formulator. The second loop concerns the monitoring of the phonetic plan (i.e., internal speech) before articulation, which is also called *covert monitoring* (see also Postma & Kolk 1992, 1993; Postma, Kolk, & Povel, 1990). Finally, the generated utterance is also checked after articulation, which constitutes the final, external loop of monitoring, involving the acoustic-phonetic processor. Upon perceiving an error or inappropriate item in the output in any of these three loops of control, the monitor issues an alarm signal, which, in turn, triggers the production mechanism for a second time. If a mere lapse has occurred in the speech encoding process, the same preverbal plan is reissued and processed in the hope of an error-free output. If there is a mismatch between the preverbal plan and the speaker's original intention, or if the speaker perceives that the originally issued message is itself inappropriate or inadequate, a new message is generated in the conceptualizer and encoded in the formulator.

L2 MODELS OF SPEECH PRODUCTION

The speech of L2 speakers is different from that of monolinguals in at least three main ways (cf. de Bot, 1992). First, L2 speakers tend to speak more slowly and hesitantly than L1 speakers do (Möhle, 1984; Pawley & Syder, 1983; Towell et al., 1996; Wiese, 1984). The reason for this is that, whereas L1 speech processing is largely automatic both in the formulator and the articulator, and can as a result run parallel, L2 speech processing requires attention both in the grammatical and phonological encoding phases, and therefore part of the output can only be processed serially. Second, L2 speakers' knowl-

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edge of the target language is rarely complete: they often lack the language competence necessary to express their intended message in the form originally planned. Third, the L1 often influences the L2 verbalization process either by means of transfer (e.g., Færch & Kasper, 1986; Kellerman, 1979; Kellerman & Sharwood Smith, 1986; Selinker, 1972) or by intentional code switches (e.g., Færch & Kasper, 1983; Poulisse & Bongaerts, 1994).

A principal issue in L2 speech production concerns the organization of the *bilingual lexicon*, which has received distinguished attention recently (for a comprehensive review of this question, see Schreuder & Weltens, 1993). Most researchers (e.g., de Bot, 1992; Poulisse, 1993; Poulisse & Bongaerts, 1994) accept the "Subset Hypothesis" (Paradis, 1987, quoted by de Bot, 1992), which, as its name suggests, assumes that L2 words form a subset of the total inventory of words stored in the lexicon (which also contains the L1 words). The key question regarding this hypothesis is how the corresponding L1 and L2 words are mentally related. De Bot (1992) and Poulisse and Bongaerts (1994) assumed that the conceptualizer was partly language-specific, and thus the preverbal message—in addition to conceptual information—also contained a *language-specifying* feature. This, according to de Bot (1992), activates a separate language-specific formulating module for each language, which then selects lexical items from one common lexicon.

Poulisse and Bongaerts (1994) used a connectionist model for explaining the use of L1 in L2 speech. They postulated that, besides having semantic and syntactic tags, the lemmas were also labeled with a language tag and lemma activation would take place only if all the features of the preverbal message, including the feature [+LANGUAGE], matched those of the lemma. The specification for language by the language tag makes it possible to explain both intentional and unintentional switches to L1 occurring by the simple exchange of the language tag.

Another important issue in L2 speech production models concerns the interaction of the syntactic, morphological, and phonological processes in L1 and L2. As was stated earlier, in Levelt's model the syntax of an utterance is largely determined by the syntactic information carried by the lemmas. This view assumes multiple linking; that is, there is interaction both between the corresponding lemmas and between the syntactic information they carry in the two languages. In case of nonproficient L2 speakers, L2 lemmas may be connected with the syntactic information of their L1 cognates, either because the speaker has not yet acquired the syntactic features of the L2 lemma or because of erroneous activation of the syntactic labels of the L1 cognate. Without this type of linking, we could not adequately explain the frequently observed phenomenon of L1-L2 interference, neither the fact that speakers with very little L2 knowledge can still formulate utterances in the L2 (de Bot, 1992).

In sum, L2 models of speech production differ from monolingual ones both qualitatively and quantitatively. For L2 speakers, depending on their level of proficiency, some formulation and articulation processes are consciously attended to (i.e., nonautomatic) and are therefore (at least in certain aspects)

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Table 1. Main components of the framework of problem-solving mechanisms in L2 use

Problem type	Relevant phase of speech production	Problem-solving mechanisms
Resource deficit	Planning and encoding the preverbal message	Lexical problem-solving mechanisms Grammatical problem-solving mechanisms Phonological problem-solving mechanisms
Processing time pressure	Planning and encoding the preverbal message	Stalling mechanisms
Perceived deficiency in one's own language output	Monitoring the phonetic plan and the articulated speech	Self-corrections Check questions
Perceived deficiency in the interlocutor's performance	Post-articulatory monitoring	Meaning-negotiation mechanisms

serial, slowing down language processing. The conceptualizer is assumed to select the language of the message and forward this information in the preverbal plan to the formulator, which in turn draws on the common lexicon of L1 and L2 words. There is interaction both between the lemmas and the syntactic information they carry in the two languages. From the formulator, then, the speech plans proceed to the articulator, which makes use of a common set of L1 and L2 sounds (or more precisely, syllable programs) and pitch patterns (de Bot, 1992) stored in the syllabary. This means that beginning L2 speakers might employ L1 syllable programs and pitch patterns for articulating L2 words, and with the development of their level of proficiency, they may gradually acquire the norms for L2 sounds.

OUTLINE OF A FRAMEWORK FOR PROBLEM-SOLVING MECHANISMS IN L2 USE

By incorporating the special features of L2 speech production into Levelt's model, we can outline a comprehensive framework of problem-solving mechanisms in L2 use, focusing on how the management of the four primary problem areas in focus (resource deficits, processing time pressure, deficiencies in own-output, deficiencies in other-performance) is related to the various phases of speech processing. Table 1 summarizes our framework by presenting each problem area, the speech processing phase in Levelt's model it is associated with, and the main types of mechanisms that can be called into action to deal with the problem. In the following, we will first provide a concise description of the four levels of problem management and, in subsequent sections, discuss the components in more detail.

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As Table 1 shows, the first problem area, *resource deficit* (which is a product of L2 speakers' deficient L2 competence), is associated with three problem-solving processes in the planning and encoding of the preverbal message: (a) *lexical problem-solving mechanisms* handle the frequent inability to retrieve the appropriate L2 lemma that corresponds to the concepts specified in the preverbal plan; (b) *grammatical problem-solving mechanisms* deal with the insufficient knowledge of the grammatical form and the argument structure of the lemma, as well as the word-ordering rules of the L2 (Kempen & Hoenkamp, 1987; Levelt, 1989); and (c) *phonological and articulatory problem-solving mechanisms* help overcome difficulties in the phonological encoding and articulatory phases caused by the lack of phonological knowledge of a word or connected speech.

The second main problem area, *processing time pressure*, is related to the fact that L2 speech processing is (at least partially) serial and, therefore, requires more attentional resources and processing time than speech production in L1 (for a review, see Schmidt, 1992). In order to gain time and devote additional attention to processing, L2 speakers can employ various *stalling mechanisms* both when planning the message and encoding the preverbal plan.

After the message has been encoded, the process of monitoring might reveal *deficiencies in one's own language output*, which will result in *self-initiated self-correction* or *self-repair*. We argue that self-repairs can be triggered by three different phenomena: a lapse in the encoding process, the generation of an inappropriate or inadequate message, and incomplete knowledge of the L2 system. As an alternative to immediate self-repair, the speaker may first check with the interlocutor whether a repair is indeed necessary by asking *check questions*.

Finally, because the speech comprehension system (i.e., parser) also constitutes an integral part of Levelt's comprehensive speech processing model, *other-performance-related problems*, involving meaning-negotiation mechanisms, comprise the fourth main level of our framework.

In discussing the different layers of problem management, we try to classify the actual problem-solving devices identified by earlier research (for a summary, see Dörnyei & Scott, 1997, and Tables 2–5) according to the psycholinguistic processes that underlie them. After covering the four problem sources, we will provide a summary of a number of unresolved issues in the model, highlighting possible future research directions.

PROBLEM-SOLVING MECHANISMS RELATED TO L2 RESOURCE DEFICITS

The most extensively researched area of L2 problem-solving behavior has been the study of *communication strategies* (for reviews, see Bialystok, 1990; Dörnyei & Scott, 1997; Poulisse, 1994), which have been defined by Poulisse (1995) in accordance with Levelt's model as "the expression of an alternative

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speech plan when the original plan proved to be unencodable" (p. 5). Although communication strategies have also been defined in the literature in several broader ways (see Dörnyei & Scott, 1997), according to this conception, they are seen as problem-solving mechanisms employed when resource deficits hinder the planning and encoding of the preverbal plan. Communication strategies have been analyzed most thoroughly with respect to lexical referential communication, where the main obstacle to the encoding process is insufficient L2 lexical knowledge (e.g., Kellerman, 1991; Poulisse, 1993; Yule, 1997). From a psycholinguistic perspective, this emphasis on lexis is well-founded (cf. the central role of lemma retrieval in Levelt's speech processing model), and, accordingly, lexical problem-solving mechanisms will receive the largest share of treatment in our discussion of L2 problem management. The encoding process, however, does not involve only lexical retrieval, and similarly to Tarone, Cohen, and Dumas (1976), we briefly extend the analysis of problem management to difficulties experienced in the grammatical and phonological phases of encoding.

Lexical Problem-Solving Mechanisms

According to Levelt (1989), speech formulation processes are lexically driven—that is, "grammatical and phonological encoding are mediated by lexical entries" (p. 181). This would imply that a great proportion of the problems speakers encounter during speech production is lexis-related, which has indeed been found to be the case in past research on communication strategies (cf. Kellerman, 1991, and also in the analysis of our own data, see note 1).

Poulisse (1993) assumed that lexical communication strategies were carried out within Levelt's framework as follows: Having planned the message in the conceptualizer, the speaker issues the preverbal plan. The formulator, however, is unable to retrieve the lemma corresponding to the specific chunk of the preverbal plan, so the speech production process comes to a halt and an alarm signal is sent to the monitor, which feeds this information back to the conceptualizer. After some modifications are made in the speech plan, the conceptualizer issues a new preverbal plan, which the formulator either manages to process or, upon experiencing another problem, sets the above mechanism in motion again.

Poulisse (1993) argued that speakers could resort to one of two main options in case of difficulties in lexical retrieval. They can (a) abandon or change the original speech plan or (b) keep the macro-plan unchanged and modify the preverbal message only. These two options are analogous to the dichotomy of *reduction* and *achievement behaviors* postulated by Færch and Kasper (1983), and both processes can be further broken down to different types of solutions (for a list of the various mechanisms with definitions, examples, and retrospective comments, see Table 2).

The first main option the speaker has (i.e., when the intended message, or macro-plan, is reformulated) can be executed in three different ways: (a) the

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Table 2. Problem-solving mechanisms (PSM) related to L2 resource deficit

Class and type of PSM	Description	Examples and retrospective comments
Lexical PSM		
Content reduction		
Message abandonment	Leaving a message unfinished because of some language difficulty.	*that is a flat . . . in a house . . .* [Retrospective comment:] Speaker: *First I wanted to explain 'housing estate' . . . and in the end I couldn't explain it.* Interviewer: *Why?* S: *The words were missing.*
Message reduction	Reducing the message by avoiding certain language structures or topics considered problematic languagewise or by leaving out some intended elements for a lack of linguistic resources.	*he is responsible . . . for the . . . for the cleanness of the house and er . . . he locks the door . . . at night and opens it . . . in the morning* [Retrospective comment:] *I couldn't say what I wanted in English, that he was responsible for the running of the house so that things would go smoothly and so on.*
Message replacement	Substituting the original message with a new one because of not feeling capable of executing it.	*you can . . . stay here until . . . midnight or . . . how do you want.* [Retrospective comment:] *Here I wanted to say that until 'dawn' or 'morning' and I found the word but I did not like it, and I had to say something so I said this.*
Substitution		
Code switching	Including L1 or L3 words with L1 or L3 pronunciation in L2 speech; this may involve stretches of discourse ranging from single words to whole chunks and even complete turns.	[Retrospective comment after saying "ferrum":] *I immediately remembered chemistry classes. I knew we used the sign "Fe" which is "ferrum" in Latin and that an English speaker uses a word like that too. He might understand something of it. But I couldn't remember "iron" at all.*
Approximation	Using a single alternative lexical item, such as a superordinate or a related term, that shares semantic features with the target word or structure.	*and er . . . takes the apple in its mouth* [Retrospective comment:] *Here I couldn't remember 'beak.'*

(*continued*)

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Table 2. Continued

Class and type of PSM	Description	Examples and retrospective comments
Use of all-purpose words	Extending a general, "empty" lexical item to contexts where specific words are lacking.	The overuse of *thing, stuff, make, do,* as well as words like *thingie, what-do-you-call-it*; e.g., *I can't can't work until you repair my . . . thing.*
Complete omission	Leaving a gap when not knowing a word and carrying on as if it had been said.	*then . . . er . . . the sun is is . . . hm sun is . . . and the Mickey Mouse . . .* [Retrospective comment:] *I didn't know what 'shine' was.*
Substitution plus		
Foreignizing	Using a L1 or L3 word by adjusting it to L2 phonology (i.e., with a L2 pronunciation) or morphology.	*my guest from the . . . minister-ium* [with an English pronunciation].
Grammatical word coinage	Creating a nonexisting L2 word by applying a supposed L2 rule to an existing L2 word.	[Retrospective comment after using *dejunktion* and *unjunktion* for "street clearing":] *I think I approached it in a very scientific way: from 'junk' I formed a noun and I tried to add the negative prefix "de-"; to "unjunk" is to 'clear the junk' and "unjunktion" is 'street clearing.'*
Literal translation	Translating literally a lexical item, an idiom, a compound word, or a structure from L1 or L3 to L2.	[Retrospective comment after saying "snowman":] *I don't really know the English expression, so this is actually the literal translation of the Hungarian word, and the hesitation must be due to the fact that I am not sure that this is how to say it but there isn't anything better.*
Macro reconceptualization		
Restructuring	Abandoning the execution of a verbal plan because of language difficulties, leaving the utterance unfinished and communicating the intended message according to an alternative plan.	*She has to care about the house, to care about the garbage, and to care about the . . . or to clean the house.* [Retrospective comment:] *Here I wanted to say 'cleanness' but I couldn't remember it.*

(*continued*)

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Table 2. Continued

Class and type of PSM	Description	Examples and retrospective comments
Micro reconceptualization		
Circumlocution	Exemplifying, illustrating, or describing the properties of the target object or action.	[Retrospective comment:] *Well, here for instance, if I had known how to say 'melt', then I would have said that. But I didn't know this and that's why I said "it becomes water."*
Semantic word coinage	Creating a nonexisting L2 word by compounding words.	*snowsculpture* for 'snowman'
Appeals for help		
Direct appeal for help	Turning to the interlocutor for assistance by asking an explicit question concerning a gap in one's L2 knowledge.	*it's a kind of old clock so when it strucks er . . . I don't know, one, two, or three o'clock then a bird is coming out. What's the name?*
Indirect appeal for help	Trying to elicit help from the interlocutor indirectly by expressing lack of a needed L2 item either verbally or nonverbally.	*I don't know the name . . .* [rising intonation, pause, eye contact]
Grammatical PSM		
Grammatical substitution	Changing certain grammatical specifications of the lemma through transfer or overgeneralization.	*and this mouse put a bowl to the table.*
Grammatical reduction	Using simplified grammar in the belief that the interlocutor will be able to reconstruct the grammatical meaning from the context.	*When she er come back again* [Retrospective comment:] *I'm always in doubt what tense to use and then I decided that I'd stick to the present tense because that's the easiest.*
Phonological and Articulatory PSM		
Phonological retrieval		
Tip-of-the-tongue phenomenon	In an attempt to retrieve and articulate a lexical item, saying a series of incomplete or wrong forms or structures before reaching the optimal form.	*it's some kind of er . . . co . . . cop . . . copper*

(*continued*)

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Table 2. Continued

Class and type of PSM	Description	Examples and retrospective comments
Phonological and articulatory substitution		
Use of similar-sounding words	Compensating for a lexical item whose form the speaker is unsure of with a word (either existing or nonexisting) that sounds more or less like the target item.	[In the following example, the question intonation indicates that the speaker was aware that she said only the approximate form:] Speaker: . . . *snowman smelt? or* . . . Interlocutor: *Melt.*
Phonological and articulatory reduction		
Mumbling	Swallowing or muttering inaudibly a word (or part of a word) whose correct form the speaker is uncertain about.	*And uh well Mickey Mouse looks surprise or sort of XXX* [the 'sort of' marker indicates that the unintelligible part is not just a mere recording failure but a strategy].

Note. Retrospection examples have been translated from Hungarian (see note 1). Words enclosed in single quotes in the examples were originally spoken in Hungarian, whereas those in double quotes were spoken in English during the retrospection.

intended message can be given up as a whole, resulting in the avoidance strategy called *message abandonment*; (b) parts of the intended communicative content can be either deleted (*message reduction*); or (c) parts may be replaced with other components (*message replacement*) (cf. also Færch & Kasper, 1983; Tarone, 1977; Váradi, 1980). These processes can be seen as "problem solving" only in a limited sense: their application does not actually solve the original problem but rather helps the speaker get over the problem situation and thus avoid a complete communication breakdown.

The second option available to the speaker when experiencing difficulties in encoding the message due to lexical deficits is to keep the macro-plan of the intended message unaltered and reformulate only the preverbal plan by means of *lexical problem-solving mechanisms* to compensate for the L2 deficiency. Poulisse (1993) asserted that three main psycholinguistic processes could underlie lexical compensatory strategies (her term for lexical problem-solving mechanisms). First, in the search of a new lemma, one or more conceptual specifications set in the preverbal message might be changed or omitted and thus the original lexical item can be substituted by an alternative one; this Poulisse calls a *substitution strategy*. Second, in addition to the modification of the conceptual specifications of the lemma, the speaker may also apply L1 or L2 morphological and phonological encoding processes, resulting in a *substitution plus strategy*. The third process is termed *reconceptualization*

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strategy because it involves the alteration of more than one chunk of the preverbal message.

Although the three types of compensatory strategy postulated by Poulisse (1993) are associated with three distinct psycholinguistic processes, Kellerman and Bialystok (1997) pointed out that it was not always easy to classify the overt manifestations of these strategies according to Poulisse's categories. Therefore, in order to establish more straightforward correspondences between verbalized problem-solving devices and the underlying psycholinguistic processes, we suggest slightly modifying Poulisse's tripartite model and some definitions of the components.

Poulisse cited *code switching* and *approximation* as the two primary examples of substitution strategies. With regard to code switching, she argued that the intentional use of an L1 lexical item in L2 speech involved merely resetting the parameter of the language tag attached to the lexical chunk in the preverbal message. Thus, instead of the specification [+L2], the speaker will choose the parameter [+L1]. This process is similar to the one underlying approximation, where one or more features of the lexical chunk are either deleted (e.g., if speakers cannot retrieve the word corresponding to the concept CARNATION, they will choose to remove certain specifications and reduce the notion to FLOWER) or substituted (as in co-hyponyms); in some rare cases even extra features might be added to the lexical chunk (resulting in a subordinate term, such as *pines* instead of *conifers*). Some researchers in the past have indeed kept various types of approximation separate (e.g., Yarmohammadi & Seif, 1992), but from a psycholinguistic point of view, Poulisse's substitution category subsumes these variations.

Besides approximation and code switching, substitution processes underlie a third problem-solving device as well—the use of *all-purpose-words*. In these, so many features of the preverbal chunk are removed that only a general specification such as [OBJECT] (e.g., *thing*, *thingie*) or [CAUSE TO HAPPEN] (e.g., *make*, *do*) remains, and the interlocutor uses contextual clues to reconstruct the intended meaning. In fact, going one step further, the speaker may also resort to *complete omission*; that is, might leave the slot for the problem item completely empty trusting that the help of contextual support will enable the interlocutor to decode the message, similarly to a cloze-test item (thus, even though complete omission involves certain reduction behavior, it is distinctly different from the message-reduction strategies discussed earlier because the latter entail the reduction of the originally intended message, whereas these mechanisms do not alter the original speech plan). The inclusion of complete omission into a speech production model is admittedly equivocal because it does not involve actual speech, and its categorization under substitution strategies is also contestable. Yet, we have decided to mention it here because it raises an interesting point: The fact that complete omission is embedded in a well-formed utterance indicates that the preverbal concept has been grammatically encoded to a certain extent, which would mean, following Levelt's lexical hypothesis, that some (perhaps limited) de-

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gree of lemma retrieval has taken place. It is noteworthy that all the instances of omission in our corpus occurred in clause-ending positions; thus, we may speculate that in certain well-defined syntactic positions the speaker may find it sufficient to substitute the specifications of the preverbal concept by a very broad syntactic category. We should also note that although complete omission does exist (see Table 2), we have found it to be rather rare. However, it is more common if it is accompanied by *mime*,[2] whereby the speaker also substitutes the omitted word with body movements.

Among substitution plus strategies, which involve modifying one or more features of the lexical chunk plus employing L1 or L2 morphological or phonological encoding procedures, Poulisse (1993) listed *foreignizing* and *grammatical word coinage*. An interesting question is whether *literal translation* can be subsumed under this category. Literal translation is a process in which the speaker first substitutes the [+L2] language tag of the preverbal chunk by [+L1] and, when the L1 lexical entry (which is usually a compound word or an idiomatic collocation) has become available, considers its components separately and retrieves the corresponding L2 lemmas one by one, thereby creating a new (often incorrect) L2 lexical entry not previously stored in the mental lexicon. Thus, in applying literal translation, a substitution process is followed not so much by morphological or phonological encoding but rather by lexical encoding. Although literal translation, foreignizing, and word coinage are obviously not produced by exactly the same psycholinguistic processes, all three involve an initial substitution process and subsequent construction process leading to the creation of a new lexical entry, so we would at this stage categorize literal translation under substitution plus strategies by extending the "plus" component to include lexical encoding.

In Poulisse's (1993) framework, *reconceptualization* strategies involve the modification of more than one single chunk of the preverbal message. Poulisse listed *circumlocution*, *semantic word coinage*, and mime as examples of reconceptualization. In the case of circumlocution, the speaker encodes the conceptual features of the intended lexical item separately, thus changing the whole of the preverbal chunk. In the case of semantic word coinage, two lexical items are selected and combined into one word (e.g., a *suit carrier* for "suitbag"). The third device, mime, posits a problematic case (see note 2).

Kellerman and Bialystok (1997) argued that Poulisse's tripartite model "does not seem to be able to draw a clear distinction between Substitution and Reconceptualization strategies" (p. 45)—for example, in cases of definition-like structures (e.g., *stuff to kill flies*) and strategy tokens that exemplify superordinate categories by lists of category members (e.g., *tables, beds, chairs, and cupboards* for FURNITURE). It is indeed questionable how many lexical chunks are involved in the verbalization of these examples. One solution to the conceptual ambiguity may be to tie reconceptualizing strategies more closely to the original concept of "reconceptualization" rather than to the number of changes involved. The two problematic examples quoted by Kellerman and Bialystok (1997) are clearly distinct from substitution strategies: they

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involve more than the mere retrieval of lexical items of less conceptual accuracy (which is what happens during substitution-based processes) because they entail the *analysis* and *decomposition* of the preverbal chunk in order to be able to express it through a *combination* of lexical items. This series of analysis, decomposition, and recombination can be summarized by the concept of reconceptualization, which then makes up the core feature of the corresponding strategy type.

If we accept that the process of reconceptualization (analysis-decomposition-recombination) is the primary defining criterion for reconceptualization strategies, we can logically distinguish *micro reconceptualization*, which involves reconceptualizing one preverbal chunk (as is the case in circumlocution and semantic word coinage), and *macro reconceptualization*, which involves the modification of more than one single chunk in the preverbal message. The advantage of this would be that *restructuring*, a communication strategy often mentioned in the literature (e.g., Færch & Kasper, 1983), could be placed in the framework as an example of macro reconceptualization because, by resorting to it, the speaker seeks an alternative manner of expressing the intended message. In *On Mickey's face we can see the . . . so he's he's wondering*, for example, the speaker cannot retrieve the lemma for "surprise" or "bewilderment" in the L2 and thus decides to completely reformulate the preverbal plan for the utterance in order to be able to express the message with the available resources.

In sum, lexical problem-solving mechanisms are considered to be attempts by the speaker to overcome problems in lemma retrieval. Following Poulisse (1993), we can classify them as substitution strategies, which involve changing one or more features of the lexical chunk; substitution plus strategies, which entail a combination of a substitution strategy and further phonological, morphological, or lexical encoding; micro reconceptualization strategies, which involve the decomposition of the lexical concept of the preverbal chunk into components that will then be retrieved separately; and macro reconceptualization strategies, where more than one lexical chunk of the preverbal message is modified.

Finally, we feel that the discussion of lexical problem-solving mechanisms would not be complete without looking at the highly problematic case of *direct* or *indirect appeals for help*. These interactional strategies are widely used by L2 speakers to compensate for lexical resource deficits and have, therefore, been included in a number of taxonomies of communication strategies, including Tarone's (1977) and Færch and Kasper's (1983). On the other hand, they are hard to straightforwardly accommodate within Levelt's model of speech production, partly because it is not the speaker but the interlocutor who solves the problem. Yet, as N. Poulisse (personal communication, May 13, 1997) pointed out, in asking for help the speaker often has to give some cue about the word he or she needs assistance with, and this cue, in turn, often involves strategic language use; in fact, the main difference between indirect and direct appeals seems to be that the latter do not include any lexical cues

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but merely the acknowledgement of the need for assistance. Thus, we may regard appeals for help as problem-solving devices that utilize the interlocutor's rather than the speaker's own speech production system in retrieving a lemma by providing some verbal stimulus (a question or an explicit "don't know" phrase possibly accompanied by a strategic lexical cue) to initiate the process.

Grammatical Problem-Solving Mechanisms

Grammatical encoding is a continuation of the lexical retrieval process. This is the point when the *grammatical form* of the lemma (information about the diacritic parameters of the lemma such as person, number, tense, gender, etc.) and the *argument structure* (determining what place the lemma can occupy in the sentence and what obligatory and optional complements it can take) are accessed and encoded, and also the point when the lemmas are ordered in a phrase. Problems in grammatical encoding can arise at three different points of the encoding process: (a) when the lemmas activated by the preverbal message are inspected for optional and obligatory complements, specifiers, and diacritic values; (b) when the complements, specifiers, and diacritic parameters are handled; and (c) when the order of the processed materials is established. Insufficient knowledge of the grammatical form and the argument structure of the lemmas can prevent the message from being encoded in the way it was originally planned, and in such cases, the speaker needs to resort to certain problem-solving mechanisms.

Problem-solving mechanisms triggered by deficiencies in grammatical knowledge can be of several types. Because, according to Levelt (1989), grammatical information is stored by the lemmas, one way of getting around grammatical problems is by simply not activating the lemma associated with the problem issue but calling into action some lexical problem-solving mechanism instead. There are, however, two *grammatical problem-solving mechanisms*, specifically related to grammatically motivated communication difficulties (see Table 2). First, we can conceive *grammatical substitution mechanisms*, which involve changing certain features of the lemma either in terms of its grammatical form or argument structure. Such processes can be employed when the L2 speaker lacks the knowledge of a lemma's syntactic environment to process the complements, specifiers, or diacritic values or to order the lemmas properly. In order to cope with this problem, the speaker can draw on the corresponding L1 or L3 subroutines and rules or the argument structure of a similar or synonymous L2 lemma (overgeneralization). These cases are very similar to subsidiary transfer described by Færch and Kasper (1986) and can either be in subsidiary or focal attention.

The second mechanism frequently applied is *grammatical reduction*, whereby the speaker uses intentionally simplified grammar hoping that the interlocutor will be able to reconstruct the grammatical meaning from the context. Anecdotal evidence and our own experience suggest that a variety of this

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strategy is very common in languages such as Russian or German, in which speakers often swallow or completely omit the diacritic markers of adjectives and verbs.

Phonological and Articulatory Problem-Solving Mechanisms

Once the L2 speaker has succeeded in retrieving the appropriate lemma and has completed the grammatical processing phase, the surface structure needs to be encoded phonologically and articulated. As Tarone, Cohen, and Dumas (1976) pointed out, these processing phases might also posit potential problems to the L2 speakers, and the retrieval of the lexeme (i.e., the morphophonological form) of a particular lexical entry can be hampered for some reason. L2 speakers might experience problems in all the three major phases of phonological encoding (see Levelt, 1989, 1993): (a) They might encounter difficulties upon generating the metrical frames, which consist of phonological words; (b) adding the segmental information, the specifications of the phonemes, and inserting them into the frames can also pose a problem if the L2 speaker has not acquired the lexeme of the given word appropriately; and (c) problems can arise when the speaker maps "the syllabified and metrically specified phonological strings onto phonetic or articulatory programs" (Levelt, 1993, p. 5).

Similarly to grammatical problems, when phonological or articulatory difficulties occur, speakers can resort to lexical problem-solving mechanisms to avoid using the word(s) they cannot verbalize. Additionally, although very little research has been done on this aspect of L2 problem management, we can also conceive of certain phonological and articulatory problem-solving mechanisms. One mechanism often documented in the literature is *phonological retrieval*, whereby the speaker attempts to retrieve a lexeme for which only incomplete phonological information (e.g., some phonemes, usually the initial ones, or the metrical structure) is available; in this case the speaker experiences a "tip of the tongue" phenomenon (for discussion, see de Bot, 1996; Levelt, 1989) and encodes or articulates several versions of the item so that by running the alternatives through the acoustic-phonetic and speech comprehension modules he or she can test them and select the best version.

As an analogy to lexical and grammatical substitution, we may also conceptualize *phonological or articulatory substitution*, which allows the speaker to encode and articulate the problematic lexical item by substituting certain phonological features (via inter- or intralingual transfer). It is an interesting question whether the use of *similar-sounding words* is a subtype of this mechanism: this device is applied when the speaker finds a lemma that matches the preverbal chunk but cannot retrieve the accompanying lexeme fully and, therefore, utters a string of sounds that bears some resemblance to the original item and that is hoped to help the listener make the association with the target word. In this case, therefore, the word is substituted by an underspecified phonological representation. Levelt (1995) argued that a lexeme's phono-

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logical information was of two kinds—the word's meter (or accent pattern) and the word's segments of morphemes—and, as he has found, the "phonological segments are not fixated in their position, but have to be inserted in the right metrical slot as we speak" (p. 19). Similar-sounding words, then, can be seen as metrically similar versions of the original lexemes in which one or more phonological segments have been replaced.

Finally, we can also conceive of *phonological reduction* mechanisms. A more extreme version of the use of a similar-sounding word is a mechanism Dörnyei and Scott (1997) labeled as *mumbling*, whereby a deliberately non-understandable word is uttered in the slot of the problematic lexical item within the utterance, and the listener is expected to guess the missing item from the context (as in a white-noise test). We believe that mumbling is also a metrically similar version of the originally intended lexeme, but it differs from similar sounding words in that the problematic phonetic segments are not properly substituted but are rather swallowed.

PROBLEM-SOLVING MECHANISMS RELATED TO TIME PRESSURE

Because L2 speech production for L2 speakers is less automatic than speech processing in the L1, at certain phases of language production the encoding processes can only proceed serially. This results in delayed production, and as a consequence, retrieval may take "more time than the production system will allow" (de Bot, 1992, p. 14). As well, L2 speakers are usually aware that in order to be able to remain in the conversation they need to observe certain temporal organizational principles, particularly (in the case of English, for example) the need to avoid lengthy silences, which can terminate the conversation or deter the interlocutor; in Hatch's (1978) words, learners must do their best to use "whatever fillers they can to show the Native Speaker that they really are trying" (p. 434). Instances of needing more processing time than would be naturally available in conversation occur in four phases of speech processing: (a) during macro- and micro-planning, when the content and the form of the message are generated; (b) while the preverbal plan is processed to generate the articulated message; (c) in the monitoring phase; and (d) during the comprehension of the interlocutor's speech (cf. van Hest, 1996).

When speakers perceive that language production (i.e., conceptualization, formulation, and articulation) will take more time than what the production system or the communicative situation allows, they have three options: (a) They may resort to message reduction or message abandonment to avoid extreme hesitations caused by planning and processing; (b) they may employ other resource-deficit-related strategies, because the application of an alternative encoding mechanism may prove to be faster than the encoding of the original preverbal plan; or (c) in order to keep the communication channel open and provide more time and attentional resources, speakers can apply various *stalling mechanisms* (see Table 3). The three options are not mutually

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Table 3. Problem-solving mechanisms (PSM) related to processing time pressure

Class and type of PSM	Description	Examples and retrospective comments
Pauses		
Nonlexicalized pauses		
Unfilled pauses	Remaining silent while thinking.	
Umming and erring	Using nonlexicalized filled pauses (*er, uh, mhm*).	[Retrospective comment:] Interviewer: *Why were you 'erring' here?* Speaker: *I didn't know what to say . . . I was thinking about how to phrase it.*
Sound lengthening (drawling)	Lengthening a sound in hesitation.	[Retrospective comment:] *when I said "I'm" I lengthened the 'm' to gain time to think. This is the same as if I said "uh."* And the same participant later: Interviewer: *When you said "look," you stressed the "k" at the end*. Speaker: *Unfortunately, I didn't have an "m" here and I couldn't lengthen it, that was how I gained time*. I: *And what were you thinking about?* S: *What to put after it.*
		[An extreme version of this strategy is when the speaker slows down a whole word, as evidenced by this retrospective comment:] *I was thinking of what I would say after finishing the sentence. For example, here I tried consciously to say "snowman" slowly because I was already thinking about how to say "it takes place in winter time."*
Lexicalized pauses		
Fillers	Using filling words or gambits to fill pauses, to stall, and to gain time in order to keep the communication channel open and maintain discourse at times of difficulty.	Filling words or short phrases such as *well; you know; actually; okay; how can I say that; this is rather difficult to explain;* E.g., *Uhm, it's interesting because the hall . . . is er . . . forty person.*

(*continued*)

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Table 3. Continued

Class and type of PSM	Description	Examples and retrospective comments
Fillers (*cont'd*)		[Retrospective comment:] *Here I was still thinking over what I was going to say and I said "it's interesting," I have no idea why I said it, it did not mean anything in this context.*
Repetitions		
Self-repetition	Repeating a word or a string of words immediately after they were said.	[Retrospective comment:] Interviewer: *[Why did you say] if you . . . if you . . . ?* Speaker: *I probably wanted to gain some time because I couldn't continue immediately.*
Other-repetition	Repeating something the interlocutor said to gain time.	Interviewer: *Do you know whether you have rubber washer at home?* Speaker: *Rubber, rubber washer . . . er* [Retrospective comment:] I: *Why did you repeat "rubber washer"?* S: *What can "rubber" mean . . . I was thinking hard about it.*

Note. Retrospection examples have been translated from Hungarian (see note 1). Words enclosed in single quotes in the examples were originally spoken in Hungarian, whereas those in double quotes were spoken in English during the retrospection.

exclusive; the first two options also require some cognitive attendance, although less than the encoding of the original difficult preverbal plan, and can therefore also be accompanied by stalling mechanisms.

Time-gaining mechanisms can surface in two major types of realization, *pauses* (cf. van Hest, 1996) and *repetitions*. Pauses may involve (a) *unfilled* or *nonlexicalized filled pauses* (e.g., silence or "umming and erring"), which require no additional processing but are inadequate in maintaining the appearance of fluency as they result in hesitant and disjointed speech; (b) *lengthening a sound* or *drawling* while thinking ahead, which is a more elaborate variation of nonlexicalized filled pauses, effective in holding the floor; and (c) *lexicalized pauses*, which involve the use of various filling words or more complex prefabricated chunks (cf. Pawley & Syder, 1983; Raupach, 1984; Towel et al., 1996). Based on Newell and Rosenbloom's (Newell, 1990; Newell & Rosenbloom, 1981; Rosenbloom & Newell, 1987) general chunking theory, prefabricated chunks are assumed to be stored as one unit in the lexicon and retrieved as a block. In order for them to serve as time-gaining devices, they need to be fully automatized so that their encoding does not require attention and thus their use frees the speaker's attentional resources (cf. Schmidt, 1992).

The second main type of stalling mechanisms, repetitions, can involve (a) *own-repetition*, which has the same function as lexicalized pauses, because by retrieving a recently processed string of words as one unit from short-term

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memory, the speaker does not use any attentional resources; and (b) *other-repetition*, whereby part of the interlocutor's utterance is repeated by retrieving it from the speech comprehension system as one unit, which again does not require much conscious encoding capacity.

Finally, we would like to note that stalling mechanisms are not L2-specific but are also used by L1 speakers for both problematic and unproblematic processing. However, their role may be more prominent in L2 use as the encoding processes of L2 speakers are less automatized and therefore require more time than L1 speech processing.

PROBLEM-SOLVING MECHANISMS RELATED TO PERCEIVED DEFICIENCIES IN ONE'S OWN LANGUAGE OUTPUT

Once the L2 speaker has completed macro- and micro-planning and has subsequently managed lexical, grammatical, and phonological processing, the monitor inspects the language output both before articulation (prearticulatory monitoring) and after articulation (postarticulatory monitoring) via the parser (Levelt, 1983, 1989; Postma & Kolk, 1992, 1993; Postma, Kolk, & Povel, 1990). When a problem is experienced, a signal is sent to the conceptualizer, the encoding process is stopped, and another preverbal plan is issued (Levelt, 1989), which can take the form of either overt or covert repair. Problem-solving mechanisms related to deficiencies in one's own language output have usually been termed *self-correction* or *self-repair*.

We suggest that four main types of psycholinguistic mechanisms underlie self-repair in L2 (see Table 4). The first three, *error repair*, *appropriacy repair*, and *different-repair*, are the main components of Levelt's (1983, 1989) taxonomy of L1 self-corrections; to these we would add a fourth type that is typical of L2 production, *rephrasing repair*.

In the course of an *error repair*, an accidental lapse in speech processing is corrected. Such lapses can occur at any phase of the production process—that is, during lemma retrieval, grammatical and phonological encoding, and articulation. When the monitor perceives this type of problem, it sends an alarm signal to the conceptualizer, which reissues the same preverbal plan without any modification to remedy the erroneous production (Levelt, 1989). Most researchers studying L2 repair from a psycholinguistic perspective (for reviews, see Kormos, 1997; van Hest, 1996; van Hest, Poulisse, & Bongaerts, in press) have followed Levelt's (1983) further classification of error repairs into subgroups according to the nature of the reparandum (e.g., lexical or semantic repair if the corrected item is a word, or grammatical—morphological or syntactic—repair if it is a grammatical structure). We should note, however, that it is questionable to what extent such taxonomies reflect the nature of the underlying psychological processes. As a viable alternative, it may be possible to set up a classification of error repairs by grouping them on the basis of the phase of speech processing the lapse occurs in (cf. van Hest, 1996).

Unlike error repair, the next two categories of self-repair phenomena in-

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Table 4. Problem-solving mechanisms (PSM) related to own-output problems

Class and type of PSM	Description	Examples and retrospective comments
Self-Correction		
Error repair	Making self-initiated corrections of accidental lapses in one's own speech.	*you have to . . . er rent it er . . . for . . . 35 . . . person . . . uhm it's max . . . minimum, minimum yes* [Retrospective comment:] Interviewer: *Here you started saying "maximum" and what happened then?* Speaker: *I realized that I was not using the right word. It's not "maximum," but "minimum," because it is a room for 40 people*.
Appropriacy repair	Correcting inappropriate or inadequate information in one's own speech.	*This I . . . I said that this a quite er big room er* [Retrospective comment:] Interviewer: *Here you started saying "this" and then you added some more information*. Speaker: *Yes, because I remembered some earlier information that it is quite a big room and this is why we would like there to be 35 of you and I was trying to refer back to this.*
Different-repair	Changing the original speech plan by encoding different information.	*to have a private room . . . you . . . need to have at least 35 people or a . . . at least you have to pay for . . . 35 people*. [Retrospective comment:] . . . *the thing was that if there are not 35 people but they still want to come and if they have a lot of money, then they should come*.
Rephrasing repair	Repeating the slightly modified version of a word or phrase (by adding something or using paraphrase) because of uncertainty about its correctness.	*we will er reflect er to you in another letter we will answer you* [Retrospective comment:] Interviewer: *Here you replaced "reflect" with "answer."* Speaker: *What happened here was that I was not sure whether "reflect" really meant "answer;" I knew what "reflect" meant but I did not know whether you can use it in writing as well, that is whether it means the same in writing as in speech that you "reflect on something."*

(*continued*)

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Table 4. Continued

Class and type of PSM	Description	Examples and retrospective comments
Asking Check Questions		
Comprehension checks	Asking questions to check that the interlocutor can follow you.	*And have you got the rubber washer? Do you know what the rubber washer is?*
Own-accuracy checks	Checking that what you said was correct by asking a concrete question or repeating a word with a question intonation.	*it's red copper . . . i . . . is it?*

Note. Retrospection examples have been translated from Hungarian (see note 1). Words enclosed in single quotes in the examples were originally spoken in Hungarian, whereas those in double quotes were spoken in English during the retrospection.

volve a modification of the preverbal plan during the course of modification (Levelt, 1983). Appropriacy repairs occur when the speaker realizes that he or she has provided inadequate or inappropriate information in the utterance and repairs it. When applying different-repair, the speaker decides to encode information that is different from what he or she is currently formulating (i.e., changes the original speech plan). The psycholinguistic processes involved in these two types of repair are similar in that they involve a complete or partial reformulation of both the macro-plan and the preverbal plan.

Rephrasing repair also involves a revision of the preverbal plan but differs from appropriacy and different-repairs in that it does not affect the macro-plan. It is also different from error repair because it is not triggered by a recognized lapse in encoding but is the result of the speaker's uncertainty about the correctness of the utterance stemming from limited L2 competence. In order to ensure that the conversational partner understands the intended message, the speaker overinsures it by repeated verbalization through slightly modifying the preverbal plan.

Although repair mechanisms are the most common immediate responses to the monitor's perception of a questionable item in one's own performance, they are not the only problem-solving mechanisms available to the speaker. Rather than immediately initiating some repair mechanism, it is also possible to first elicit feedback from the interlocutor regarding the problem area by asking check questions such as *comprehension checks* and *own-accuracy checks*. Based on the responses to these, the speaker can then decide whether a repair mechanism is warranted. Thus, check questions can be seen as pre-repair mechanisms.

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PROBLEM-SOLVING MECHANISMS RELATED TO PERCEIVED DEFICIENCIES IN THE INTERLOCUTOR'S PERFORMANCE

As pointed out earlier, Levelt's model of speech production includes the speech comprehension system as a major component related to the monitoring process. This makes it possible to integrate into our framework other-performance-related problem-solving mechanisms—that is, meaning-negotiation mechanisms triggered by perceived problems in the interlocutor's rather than in one's own speech (see Table 5). These mechanisms are different from the ones discussed earlier in that they involve reactions to problems encountered with regard to the interlocutor's speech, and therefore meaning-negotiation devices are related not only to speech production but also to speech perception processes. In Levelt's theory, however, considerably more attention is paid to the generation than to the perception of speech; yet we feel that the study of meaning-negotiation mechanisms has been such a prominent area in L2 research on problem management that these interactional processes should be at least briefly covered within this summary.

According to Varonis and Gass's (1985) model, meaning-negotiation exchanges are made up of *indicators*, which signal that an utterance or part of an utterance—termed as the *trigger*—is the source of a non-understanding, *responses* elicited by the indicator, and *comprehension checks* (discussed earlier), which can occur at any stage of a conversation. There are several reasons for L2 speakers to initiate meaning-negotiation mechanisms, the most obvious being that the speaker simply cannot hear what the interlocutor has said and therefore *asks for repetition*. In a speech comprehension framework, this means that the listener encounters a problem of acoustic-phonetic analysis (Levelt, 1993). A second reason may be that although the trigger is clearly understood, it is perceived to contain a mistake. As Schegloff et al. (1977) pointed out, this does not necessarily result in other-correction; however, if correction occurs, it can be described as a process whereby the monitor signals that an error has been encountered in the speech of the other party, and subsequently *other-repair* is initiated in the same way as self-repair (Levelt, 1989).

It may also happen that the speaker does not understand, misunderstands, or only partially understands the speech of the interlocutor (Aston, 1986; Gass & Varonis, 1985). One reason for this can be that the L2 speaker has not acquired the words, idioms, or grammatical structures the conversational partner is using. Other reasons for perception problems, according to Levelt's (1993) theory, can be the following: (a) L2 listeners may not be able to segment the input into words; (b) they may fail to perceive the difference between certain nonredundant distinctive features of the word; (c) problems may also arise when the speaker tries to match the sensory input with a lexical entry and cannot access the corresponding lemma with its semantic and syntactic specifications; (d) the speaker might also experience problems in the grammatical decoding phase and might fail to assemble certain phrases or

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Table 5. Problem-solving mechanisms (PSM) related to other-performance problems

Class and type of PSM	Description	Examples and retrospective comments
Meaning Negotiation		
Asking for repetition	Requesting repetition when not hearing or understanding something properly.	*Pardon? What?*
Asking for clarification	Requesting explanation of an unfamiliar meaning structure.	*What do you mean?, You saw what?, The what?, What is it, I beg your pardon, what is it?* Also question repeats, that is, echoing a word or a structure with a question intonation.
Expressing non-understanding	Expressing that one did not understand something properly either verbally or nonverbally.	Interlocutor: *What is the diameter of the pipe?* Speaker: *The diameter?* I: *The diameter.* S: *I don't know this thing.* I: *How wide is the pipe?* Also, puzzled facial expressions, frowns and various types of mime and gestures.
Asking for confirmation	Requesting confirmation that one heard or understood something correctly.	Repeating the trigger in a question repeat or asking a full question, such as *You said . . . ?, You mean . . . ?, Do you mean . . . ?*
Interpretive summary	Extended paraphrase of the interlocutor's message to check that the speaker has understood correctly.	*So you have you have some problem with the pipe in the sink . . .*
Guessing	Guessing is similar to a confirmation request but the latter implies a greater degree of certainty regarding the key word, whereas guessing involves real indecision.	*Oh. It is then not the washing machine. Is it a sink?*
Other-repair	Correcting something in the interlocutor's speech.	Speaker: *. . . because our tip went wrong.* Interlocutor: *Tip?* S: *Tip!* I: *Oh, tip.* S: *Tip. Okay . . . er . . . so in the kitchen from er . . . where the water is fluent.* I: *Oh, you mean the tap.* S: *Tap, tap . . .*

(*continued*)

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Table 5. Continued

Class and type of PSM	Description	Examples and retrospective comments
Feigning understanding	Making an attempt to carry on the conversation in spite of not understanding something by pretending to understand.	Interlocutor: *Do you have the rubber washer?* Speaker: *The rubber washer? . . . No I don't.* [Retrospective comment:] *I didn't know the meaning of the word, and finally I managed to say I had no such thing.*

Note. Retrospection examples have been translated from Hungarian (see note 1). Words enclosed in single quotes in the examples were originally spoken in Hungarian, whereas those in double quotes were spoken in English during the retrospection.

clauses due to insufficient lemma information or L2 rule knowledge; and (e) serious problems may arise at the level of discourse processing: As Kasper (in press) points out, L2 speakers are frequently unable to interpret indirect speech acts or infer conversational implicature. In all these cases they might *express non-understanding* or *ask for clarification* or *repetition*. In case of partial understanding or uncertainty about understanding, the speaker can also *ask for confirmation*, provide an *interpretive summary*, or make an attempt at *guessing* the intended meaning of the unknown item.

Negotiation of meaning might also be required if the utterance of the interlocutor contradicts the expectations of the speaker concerning what will be said in the given situation—that is, when the two parties do not share the same frames or scenarios (for review, see Brown & Yule, 1983) applicable in the particular discourse context. In this case, the same troubleshooting mechanisms might be employed as with misunderstanding or partial understanding.

Finally, instead of indicating the trigger and thereby eliciting a response, the speaker might also decide to *feign understanding* and carry on the discourse, relying at the same time on his or her knowledge of the discourse context and using inferencing mechanisms to guess the intention of the interlocutor. Thus, feigning understanding can be seen as a zero-negotiation mechanism.

SOME UNRESOLVED ISSUES AND FUTURE RESEARCH DIRECTIONS

The coverage of the various issues in this paper has been admittedly uneven in depth. Apart from our varying degree of familiarity with certain areas, this is also due to the often rather preliminary stage of research into different aspects of speech production and the sparse amount of research on L2 production. Except for Poulisse's (1993, 1995) work, the psycholinguistic approach to L2 problem management is, to a large extent, still uncharted terri-

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tory and therefore it may be useful to summarize some unresolved issues and highlight certain potentially fruitful research directions.

Lexical Encoding

Levelt (1989) pointed out that for the time being hardly anything is known about the psychology of *lexical encoding* (i.e., word production), and therefore the emphasis of the discussion in both Levelt's model and in our treatment of lexical problem management is on problems in *retrieving* stored lexical items rather than creating new ones. However, there has been an increase of research on L1 lexical encoding appearing in psychological journals since 1989, and a recent line of research on L2 word production (e.g., de Bot & Schreuder, 1993, and other studies in Schreuder & Weltens, 1993) is hoped to shed more light on the "plus" aspect of substitution plus strategies and on the decomposition and compounding processes that underlie reconceptualization strategies.

Formulaic Language Knowledge

A second underdeveloped area, partly related to the above point, is the issue of the storage and retrieval of formulaic language knowledge (collocations, idiomatic expressions, conventionalized routines, lexical phrases, etc.; for recent summaries, see Ellis, 1996; Kasper, 1995; Nattinger & DeCarrico, 1992; Weinert, 1995). To date, very few studies have analyzed formulaic chunks from a psycholinguistic perspective, and therefore, we do not know whether the problems occurring in their retrieval and encoding are analogous to the problems experienced in the retrieval or encoding of less complex lexical items. In Levelt's model, completely fixed formulaic phrases (such as "polywords" and "institutionalized expressions" in Nattinger and DeCarrico's taxonomy) would be stored as single lexical entries in the lexicon, which is in accordance with Pawley and Syder's (1983) claim that, similarly to lexical items, prefabricated units also have their syntactic specifications (tense, number, optional complements, etc.). However, Nattinger and DeCarrico also draw attention to the fact that many formulaic phrases (such as "phrasal constraints" and "sentence builders" in their taxonomy) are not completely fixed in form and idiomatic meaning but rather contain a combination of fixed components and slots for more or less freely variable constituents. One problem type, then, that is definitely unique to idiomatic strings, especially to partly variable ones, is their partial or incorrect retrieval.

According to an alternative view by Zernick and Dyer (1987, cited by Kasper, 1995), prefabricated patterns are stored in parallel in two ways: (a) as unanalyzed chunks, or as proper lexical entries; and (b) as broken down into their individual components, with the components stored as individual units (which type of storage is compatible with Stemberger's (1985) model of the structure of the mental lexicon, as he also proposes that inflected lexical

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items like *wanted* are both stored as one unit and as *want* + *ed*). This conception raises the question of how the different interrelated entries are linked and what kind of lemma specifications are responsible for determining the level of compoundness during their retrieval.

Grammatical Encoding

With regard to grammatical encoding, the main question to answer is how much of the grammatical information is contained by the lemmas and how much of it is stored by independent means. If we look at the schematic representation of Levelt's model in Figure 1, one key concept of linguistic analysis is striking in its absence—*grammatical knowledge*—even though it needs little justification that some grammar rules are not tied to (and thus not stored by) specific lexical items. Although Levelt (1989) assumes that what has been traditionally called "grammatical procedural knowledge" is stored in the different phrase-processing modules (i.e., subroutines that handle Ss, NPs, VPs, etc.), it is not clear where this procedural knowledge is stored in the model. As N. Poulisse (personal communication, May 13, 1997) points out, it may be reasonable to make a distinction between problems arising from insufficient rule knowledge and insufficient lemma-based grammatical knowledge, and, we may add, between the mechanisms used to deal with the two types.

Phonological and Articulatory Encoding

It needs still to be established how conscious certain phonological or articulatory substitution and reduction processes are. Difficulties concerning stress patterns, for example, are often handled intentionally, whereas the production of particular sounds appears to be more automatic. Even the well-documented phenomenon of phonological retrieval may be a largely automatized process (i.e., it is doubtful whether the repeated articulation of a word is based on a series of conscious once-again decisions).

Automatization

Although it is generally accepted that one major difference between L1 and L2 speech production concerns the extent to which subprocesses are automatized, we would need to know more about how this automatization takes place from a psycholinguistic perspective. The question of fluency has been addressed in psychology using a number of different paradigms (for a review, see Schmidt, 1992), but as Poulisse (in press a) concludes, there is not enough empirical evidence yet with regards to which of the recent psychological theories of learning and automatization can account most extensively for second language acquisition. In a pioneering study, Towell et al. (1996) made an important attempt to relate Anderson's (1983) ACT* theory to Levelt's (1989)

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model of speech production, and based on the quantitative and qualitative analysis of the development of fluency in advanced learners of French, they placed proceduralization within the formulating module. Further research along this line is required to examine how certain production subprocesses slow down in disfluent speech (particularly in L2 use) and how stalling mechanisms can compensate for the delayed production. This latter question is likely to have a close connection to the understanding of the relationship between fluency and formulaic language use.

Speech Perception Strategies

A shortcoming of our treatment of L2 problem management, pointed out before, concerns the lack of a more detailed discussion of speech perception strategies in contrast to speech production mechanisms, which stems from a similar imbalance in Levelt's theory. This was also reflected in our somewhat sketchy account of meaning-negotiation mechanisms. Additionally, our discussion of grammatical and phonological or articulatory problem-solving strategies was also brief relative to lexical issues, which reflects the same tendency in the communication strategy literature.

Choice of Problem-Solving Mechanism

An area where future research can significantly elaborate on the discussion of problem management concerns the analysis of *why* the speaker, when coming to a processing difficulty, resorts to one particular mechanism and not to another that could potentially be used in the same problem situation. The selection of a particular mechanism is likely to be motivated by certain features of the preverbal chunk and the corresponding lexical entry that is being sought—for example, it is reasonable to assume that semantic word coinage is applied when the preverbal chunk lends itself to conceptual division, and literal translation occurs when there is an obvious L1 equivalent of a complex L2 lexical entry. Another important aspect of deciding which strategy to employ is the knowledge of the situation (e.g., the L1 of the interlocutor or the level of formality of the interaction) and the task demands (e.g., the required level of clarity; cf. Poulisse, 1997). Such situation-based choices are made in the conceptualizer, which is the only module connected to the situational knowledge store (see Figure 1). This, however, raises the issue of how the situation-level choices made in the conceptualizer and the language-level choices made in the formulator are coordinated.

Pragmatic Problems

Finally, let us return to the question of problem sources not covered by this article, a point already mentioned in the introduction. When using the target

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language, L2 speakers experience a great variety of problems—some are closely related to actual language processing difficulties, some are rooted in the handling of situational matters, and still some further problems concern identity issues associated with having to communicate within a sociocultural or ethnolinguistic context that is different from, and sometimes alien to, the one the speaker was born into (cf. Kasper, 1997; Rampton, 1997). The focus of this paper has been the analysis of problem management related primarily to language processing, which follows from the nature of the psycholinguistic approach we have adopted. With regard to the other end of the continuum, problems associated with L2 identity, we do not think that psycholinguistics can at the moment offer an appropriate framework for their analysis—such issues have been more meaningfully studied using a social psychological approach. The interesting question is the range of problems between the two poles—that is, *pragmatic difficulties*, which have been defined by Kasper (1997) as "communicative events which fall short of participants' actional (illocutionary and perlocutionary) and relational goals" (p. 346), and are experienced by learners with respect to, for example, levels of politeness, conversational implicature, or directness versus vagueness (for a summary, see Kasper, 1996a, 1996b). Such issues could and should, in principle, fall under the domain of speech production, and indeed Levelt (1989) conceptualizes a store for situational and encyclopedic knowledge in his model (see Figure 1).

Although we are aware of the significance of pragmatic difficulties and errors in L2 speech (cf. Bardovi-Harlig & Dörnyei, 1998), there are two main reasons why it is difficult to extend our current analysis onto this area. For one, Levelt's model lacks a sufficient pragmatic dimension, and although it acknowledges the significance of context-specific factors, it does not attempt a systematic analysis of these:

> There are, probably additional properties stored with an item. It may have particular pragmatic, stylistic, and affective features that make it fit one context of discourse better than another. . . . Whether such features should be considered as conceptual conditions on the item's use is a matter of much dispute; we will not go into it. (Levelt, 1989, p. 138)

Additionally, the area of pragmatics is multifaceted, and pragmatic problems are of diverse nature (e.g., violating Gricean maxims, failing to express the intended illocutionary force, or conveying the wrong degree of politeness), forming a less homogeneous set than the four problem sources mentioned earlier. Therefore, a comprehensive overview of how they can be handled at various stages of speech production is beyond the scope of this paper. Here we will outline only one basic challenge in providing a psycholinguistic account for pragmatic problems.

According to Thomas (1983), a basic type of pragmatic error ("pragmalinguistic failure") concerns the mapping of inappropriate pragmatic force onto (usually highly conventionalized) utterances—that is, attaching incorrect illocutionary specification to a lexical item either because of incorrect or insuffi-

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cient learning or because of some error in the sociopragmatic interpretation of the situational parameters. It is not clear at the moment, however, which processing module assigns specifications regarding illocutionary force to the message and what kind of mismatch causes pragmalinguistic errors. The problem is that illocutionary specifications do not appear to be absolute but rather situationally dependent (i.e., we cannot attach an absolute illocutionary value to a given phrase), and therefore, they should be regulated by the conceptualizer, which is the only processing module that has access to the situational knowledge store (see Figure 1). On the other hand, the conceptualizer does not have a direct link to the lexicon and cannot, therefore, directly map pragmatic force onto lexical items. Instead, following Levelt's theory, the conceptualizer needs to add some pragmatic tag to the preverbal chunk, which is then matched against some lemma specification. It is difficult to conceive, however, what these specifications are like because lemma-specifications are assumed to be constant (i.e., situation independent). One key task concerning the psycholinguistic representation of pragmatics will, therefore, be to define the nature of the pragmatic tags of the preverbal chunks and the lemma specifications that carry situationally relevant information and then to describe how the matching process (and mismatches, in particular) actually occurs.

CONCLUSION

The initial assumption of this paper was that problem management is a salient feature of L2 speech, occurring at various levels of the production process. We attempted to bring together the different mechanisms L2 speakers can employ when experiencing communication difficulty into an integrative model that enables us to establish links between different processes of L2 production that have so far been handled by different conceptual frameworks. In order to provide a coherent analysis of the wide range of relevant language devices, we applied a psycholinguistic approach, which connected problem-solving mechanisms to the consecutive stages of speech processing as described by Levelt (1989) and his followers adapting the model to L2 processing (most notably de Bot, 1992, 1996; de Bot & Schreuder, 1993; Poulisse, 1993, 1995; Poulisse & Bongaerts, 1994).

We proposed a four-level framework of problem management based on four broad classes of problem sources that may trigger problem-solving mechanisms (resource deficit, processing time pressure, perceived deficiencies in own-output, and perceived deficiencies in other-performance), and we attempted to relate the problem-solving language devices previously identified in the literature to the various stages of speech production. Following this, we summarized the most important gaps and untied threads in the model and in our approach, along with some potentially fruitful areas for further research.

In conclusion, we can say that although the study of L2 speech production has barely taken off the ground and, as de Bot (1992) concludes, the L2 production model "invokes at least as many questions as it answers" (p. 7), it is

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believed to have great potential for the further understanding of L2 acquisition and use. A psycholinguistic perspective can offer a new set of scientifically validated metaphors and terminology for researchers to use, as well as a new analytical framework to enrich interlanguage analysis. Within this line of research, the study of L2 problem management may have a special importance from both a theoretical and practical point of view. First, speech errors have traditionally been seen as exposures of the underlying formulating machinery (hence the interest in slips of the tongue and the like), and the study of problem-solving mechanisms can therefore be informative about the psycholinguistic processes underlying message planning, transfer, word construction, and monitoring in particular. Second, the study of L2 problem management can have important practical implications. L2 speakers spend a lot of time and effort struggling with language difficulties, yet L2 courses and course books do not generally prepare learners to cope with performance problems. The understanding of how L2 speakers can deal with the frequent communication problems they encounter may lead to designing activities and teaching materials that more effectively enhance fluency, coping skills, and communicative confidence in a second language. Additionally, an awareness of the nature of L2 processing problems and coping mechanisms may also enable language teachers to better understand their learners' idiosyncratic language difficulties and, consequently, to provide them with more effective help.

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NOTES

1. Although our paper provides more of a conceptual than an empirical analysis, our original research was data driven, and we illustrate the problem-solving mechanisms with examples and retrospective comments taken from a data-based study specifically conducted for the purpose of our investigation. The study was designed to elicit a wide range of problem-solving language devices from L2 speakers. The objective was to identify, with the help of the respondents, the language manifestations of all the problem-solving behaviors applied and then classify them according to the underlying psycholinguistic processes. Participants in the study were 44 Hungarian learners of English, ages 15–25, whose language proficiency ranged from intermediate to post-intermediate. They were asked to perform three different oral tasks: cartoon description, definition formulation, and guided role play.

An important element of the study was a retrospection phase, inspired by Poulisse, Bongaerts, and Kellerman (1987), who provided evidence supporting the usefulness of such a methodology in communication-strategy research. Participants were asked to listen to the recording of their own speech elicited by the tasks and answer questions about and make comments on the difficulties they experienced. In spite of the shortcomings of retrospection as a research method documented in the literature (i.e., retrospective data are incomplete and sometimes inaccurate; see for example Cook, 1993; DeKeyser, 1988; Poulisse et al., 1987), an impressive amount of retrospective data were accumulated: over 450 manifestations of problem management were discovered or confirmed through retrospection.

2. The analysis of mime as an independent mechanism is problematic. It is not a substitution-based mechanism. It involves more than just substituting a set of gestures for a word because it requires the analysis of the concept to be expressed in order for the speaker to be able to select the most appropriate gestures for encoding it. Yet, mime is not a reconceptualization strategy either because it involves only one preverbal chunk at a time and there do not seem to be any decomposition and recombination processes involved. In fact, the question of mime raises the more general issue of how body language or other nonverbal gestural codes can be made compatible with a sys-

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tem specifying the production of verbal messages. Without attempting a detailed analysis, we believe that these diverse types of production processes are similar to speech production up to the point of conceptualizing the preverbal message but are then processed by different formulators depending on the type of the communication code involved. If this is the case, however, then mime cannot be comprehensively discussed within a speech production framework.

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