SKILL THEORY AND LANGUAGE TEACHING

W. J. M. Levelt

Nijmegen University

1. A third way

If one would ask me as a regular, though not systematic reader in applied linguistics to mention a major theoretical issue in this field of study, I would choose for the controversy about "behavioristic" audiolingual learning versus "mentalistic" cognitive code learning. This dichotomy is apparent in many theoretical papers, and starting point of various research programs.

At the basis of these two approaches to language teaching are two philosophies about complex human behavior. The one philosophy says that complex behavior, like simple behavior, can only be described and explained in terms of overt stimuli (S's) and responses (R's), and that learning consists of strengthening or weakening of associations between S's and R's through contingencies, reinforcements, and punishments. At this place one usually refers to American behaviorists, especially to B. F. Skinner. The other philosophy is based on the conception that complex behavior is caused by complex mental operations which derive from knowledge structures, especially knowledge of rules. This system of knowledge is based on innate capacities, which are further developed by the active creation and testing of hypotheses in a rich environment. Here one usually refers to N. Chomsky.

As a psychologist, I am always slightly surprised by the persistence of this seemingly obligatory theme. It has long been obvious that generalization of Skinnerian principles to complex behavior is either impossible, or results in clumsy and useless theory. It has been equally clear, however, that knowledge cannot explain performance (see Carroll 1971), without recourse to additional principles of learning and behavior organization. Such a theory has not been developed in the framework of cognitive code learning.

Surprising is that a major body of knowledge about complex human behavior and its acquisition is mostly ignored, sometimes mentioned, but hardly ever seriously studied in connection with second language learning. What I mean is the originally mainly British, but nowadays worldwide tradition of "human performance theory," the study of skills and attentional processes. Some

classics in this field are Welford (1968), Broadbent (1958, 1971), Miller, Galanter and Pribram (1960), and Bilodeau's anthology (1966). Important recent publications are Kahneman (1973), and Kantowitz (1974).

One excuse for this state of affairs may be that researchers in the area of human performance theory have not given much attention to complex language behavior. Notable exceptions, however, are Miller et al. (1960), and Herriot (1970).

The present paper is intended to sketch a rough, and admittedly very incomplete outline of attention and skill theory as far as it seems relevant to problems of second language acquisition. It may hopefully contribute to bridging the large gap between applied linguists and skill theorists. I am convinced that this bridge allows for a third and better way of approaching the psychology of language learning.

The next section (2) contains a general discussion of some aspects of skill and attention theory which seem to be useful for the analysis of the use and acquisition of language. In section 3 we will apply some of these insights to an analysis of errors and failures in second language performance. The final paragraph (4) contains some didactical applications of error analysis.

2. Attention and the structure of skill

The execution of any complex task requires attention, or mental effort. The supply of attention is not unlimited. A very demanding task may surpass our momentary capacity, which in turn may lead to error, or even complete failure. Psychological evaluation of a second language learner's performance requires analysis of the intricate relations between the structure of his skill, and the factors which determine the allocation of mental effort during speaking, listening, reading, or writing. I will, therefore, first discuss some aspects of effort allocation which seem directly relevant to the situation of a second language learner. In a subsequent paragraph I will try to relate these to the hierarchical structure of language skill.

2.1. The allocation of effort

A task is complex if it requires the execution of a variety of operations in accurate temporal integration. Language behavior is certainly complex in this sense, as will be discussed in 2.2. Each of the activities involved in the completion of a task requires some mental effort, dependent on the nature of the activity. Translating a 10-word sentence into the target language requires much more effort than simply repeating this translation

if it is prompted, though the output is the same in both cases. During translation some highly loading operations have to be performed, since translation requires the keeping in short term memory (STM) of the original sentence, as well as of partial results of word and sentence scheme retrieval operations. Quick decay of information in STM in its turn necessitates additional rehearsal operations, etc. Each of these activities requires mental effort.

To understand a learner's behavior, we must know (i) what factors determine the total amount of capacity available for the task, and (ii) what are the rules for allocating attention to different aspects of the task. Of course, there is the more preliminary question as to what makes a task more or less demanding. We return to that point in 2.2, since the demand of a task is co-determined by the skillfulness of the subject.

Ad (i). Kahneman (1973), who is mainly responsible for this mental effort theory, shows convincingly that capacity is limited, but not constant. In fact, it varies with the level of arousal of the subject: except for very high levels of arousal, capacity increases with arousal. In its turn, the main determinant of arousal is the complexity of the task. This leads to the interesting conclusion that more capacity comes available for difficulty tasks than for easy tasks. It should be clear that this is outside the subject's voluntary control. It is, for instance, impossible to spend as much effort on repeating a sentence as on translating a sentence. The task itself releases a certain amount of effort to be used. The subject's freedom is in accepting the task, as well as in starting or stopping his activity. But during execution it is the task that controls the total amount of capacity, as well as the momentary allocation of effort to the various partial activities (see Ad (ii)).

That capacity is task-controlled does not mean, however, that there is also SUFFICIENT capacity for each task. This may be the case for easy tasks, such as repeating a simple sentence, But for more and more complex tasks the increasing capacity does not keep pace with the task demands, so that there is less and less spare capacity available. At a certain task complexity a point will be reached where all capacity is consumed during performance. Beyond this point the supply of effort is insufficient to guarantee error-free performance.

One way to increase the task demands is to speed up performance, for instance by instruction to the subject. A foreign language student will have to invest much more effort in a speeded reading task than in slow or normal reading. In this way, or similar manners (see 4.2) it is nearly always possible to increase the task demands so much that the student's capacity is surpassed.

This, then, leads to erroneous performance. Much study has been made in human performance theory of this so-called "speed-accuracy trade-off." As we shall see, this phenomenon can be used in order to analyze the structure of a student's second language skill.

Arousal level, and therefore capacity, is not exclusively determined by the demands of a task. One effective increaser of arousal level is "knowledge of results." If the student receives direct feedback about his performance his arousal level, and therefore capacity is momentarily increased. This effect of feedback is probably due to the fact that information about one's own performance leads to a better evaluation of task demands, so that no underestimation occurs. Correction of errors is one form of feedback which is capacity-enhancing. Much less effective are incentives. It seems that reward and punishment (pay-off) have rather little impact on available attentional capacity.

If arousal surpasses a certain (high) level, available capacity no longer increases, but diminishes (the so-called Yerkes-Dodson law). There are different possible explanations for this finding, which are not of interest here, but it is a fact that both extreme task demands as well as extraneous stress-inducing factors can increase the student's level of arousal so much that his capacity decreases, leading to deterioration of performance.

Ad (ii). With respect to the more detailed structure of allocating effort to the different operations which constitute complex performance, Kahneman mentions various controlling factors. Most important for the moment-to-moment allocation of effort is feedback from the on-going process itself. Thus, there is not only a general effect of task complexity on arousal level, but also near instantaneous monitoring of capacity on the basis of momentary evaluation of task demands. Psychologists have developed means for measuring these quick fluctuations of effort during the performance of mental tasks.

There are also other factors which affect the momentary allocation of effort, such as the novelty of stimulation. They will not be discussed here.

2.2. The structure of skill

If a person is able to execute a complex task well, he is said to have skill. Skill in second language is characterized by the relatively error-free and smooth speaking and understanding (respectively writing and reading) of the target language. In order to understand the structure and acquisition of skill, one has to understand the structure of the task (i.e. of speaking, writing, etc.).

One of the most general features of complex tasks is their HIERARCHICAL STRUCTURE. This means that the task consists of sub-tasks, sub-sub-tasks, etc. The idea is that execution of one part of the task requires the completion of various smaller operations in accurate temporal integration. Each of these operations may in its turn require a set of still more elementary operations, etc. Speaking is an excellent example of hierarchical task structure. There is the first order goal to express a certain intention. In order to realize this, one has to do various things, such as for instance deciding on topic and new comment to be made, and selecting a certain syntactic schema. In its turn, the realization of this schema requires sub-activities like formulating successive phrases which can express different parts of the intention. Within these phrases word-retrieval operations have to be executed until the phrase is completed. But each word in its turn has to be realized phonetically by the activation of articulatory patterns, etc. After completion of lower level tasks control must be returned to higher levels, consequent selection of the next phrase, and so on. In short, the hierarchical nature of complex tasks requires the existence of PLANS (Miller et al 1960) or PROGRAMS for their execution.

Creation of such plans or programs consumes large amounts of effort. Planning a subtask means retrieving from memory the necessary information (about present and desired state, about rules for achieving the desired result, etc). During this planning, partial results of earlier operations may have to be kept in STM in order to stay available for successful execution of later operations. For instance, in many languages the person of the verb will be dependent on the person of the subject noun phrase. If the foreign language speaker has to spend effort on planning the structure of a relative clause to the subject noun, he has to keep in memory the person of the head of the noun phrase during the whole planning and execution of the relative clause program. One of the most important characteristics of skill is that the creation of plans during performance is reduced to a bare minimum. The skillful performer has these plans available in long term memory (LTM). This is especially the case for lower level plans, such as articulatory patterns for words, phrase structures, intonation patterns and so on. Plans which have become part of the more permanent cognitive outfit of a person, are said to be automated. The acquisition of skill consists essentially of automation of low level plans or units of activity. Initially the execution of such a unit of activity requires the allocation of a large amount of mental effort, since it has to be designed anew (like constructing an actual negative sentence in French from knowledge of the rules of negation). Repeated performance of the activity, however, leads

to the availability of ready made plans in LTM for such activities. It is then possible for the activity to run off without much attention. It should be noted that automation-through-repetition does not mean that the resulting partial activity is rigid. It is the plan or program which is available in permanent memory, not a cliché for the activity itself. Plans have goal states, procedures for reaching the goal state from any initial state, and tests for evaluating if the goal state has been, or will be reached. In each situation, therefore, the activity may be different although it is controlled by the same plan. Moreover automated programs call their own sub-programs which may or may not be automated, and whose choice may depend on earlier decisions in the master plan. So, for instance, the choice of a particular lexical entry during the execution of an automated phrase building activity may depend on the choice of particular words in an earlier phrase, on a particular topic of discussion, etc. In this way the particular lexical decision may even require substantial attention. This may explain the frequent occurrence of substantial speech pauses before the utterance of content words (Goldman-Eisler 1970). Nevertheless construction of the phrase itself can be fully automated. Thus, even automated plans are flexible entities, which allow for integrated execution of very divergent complex tasks. This observation has some importance for skill training. Though an essential objective of training is automation of lower-level programs, it would be wrong to conclude that this should be done exclusively by frequent repetition of one and the same activity. It is PLANS that should be trained, not "terminal" activities. Training of a particular phrase structure plan, for instance, is not much helped by frequent rehearsal of a particular phrase. The disadvantage of such a procedure is that the plan hierarchy is collapsed: with the phrase a particular choice of words and sub-phrases is also stored in memory. Adequate storage, however, would mean that the phrase plan is stored in memory with CALLS for lexical items or syntactic sub-programs, not with the items themselves. Therefore, training should consist of frequent use of the particular phrase structure, in varied lexical settings. A similar approach should be taken in the other direction. An important feature of an automated plan is its potential to be called by higher-level plans. Training of the plan, therefore, requires integration of the class of activities in varied task settings. The classical issue in skill theory about part versus whole learning turns around this integration aspect. The general finding of empirical studies is that during learning of a skill the units of activity have to be chosen as large as possible, however on the condition that the rate of errors stays low. This means that allowance is made for maximal integration of sub-programs without risking the automation of erroneous patterns.

The result of automation is that less and less effort is to be spent on lower-level patterns of action, so that more and more capacity is left for the higher level decisions. In speech, for instance, attention should be mainly directed to planning the topic of discussion. This is mostly conceptual, not linguistic activity. These decisions are relatively slow as compared to the speed of the lower level decisions and activities. Decisions which require attentional effort will normally take as much as 200 msec. Therefore, lower levels of activity such as phoneme-selection cannot be performed by conscious control since they require much higher rates.

A final characteristic feature of skill to be mentioned here is ANTICIPATION. The existence of a plan or program means that patterns of activity are readied ahead of time in order to be executed at the right moment. This is called anticipation; it is also highly typical for skilled language behavior (cf. Oller 1974). Articulatory patterns in speech, for instance, are activated up to 1.5 sec. in advance. This appears from analysis of speech errors. They consist mostly of anticipations up to about 7 syllables (see Fromkin 1973, especially the contributions of Cohen and Nooteboom). In terms of attention, anticipation allows the subject smooth allocation of effort to future parts of the program.

3. The origins of failure

In this paragraph we intend to apply the insights about effort and skill to an analysis of errors during second language performance. There are at least six possible causes for erroneous performance of complex tasks.

3.1. Insufficiency of relevant information

One of the most obvious reasons for failure is that the subject simply does not know how to complete the task. It is a triviality that a native English student of Spanish who has never heard that the Spanish word for *hot* is *caliente* will fail at any task where he is expected to use this Spanish word. It is this aspect of language learning, the acquisition of knowledge, which has been stressed by the cognitive code learning movement. It has especially been emphasized that much relevant information consists of rules: phonetic, syntactic, semantic and pragmatic rules. The language student must acquire insight in these rules in order to attain any real skill in the new language. Whether this insight should be explicit or implicit has been a topic of much discussion. Here we want to look at such knowledge from the point of view of the just discussed theory of skill. We have seen that task execution is guided by a hierarchical system of plans and programs. A plan should either be created, or retrieved from long term memory. In the first case, the ingredients

for construction of the plan may again come from LTM. The learner may, for instance, have studied particular rules of grammar which he is now able to formulate explicitly, and which he can use to set up a particular sentence frame. We have seen, however, that the creation of a new plan requires much attention. The availability of explicit knowledge of rules, therefore, is not a sufficient condition for errorless performance: if too much effort is required for the creation of the plan, failure will result in spite of available knowledge. Furthermore, the existence of explicit knowledge is also not a necessary condition for errorless performance. If the execution of a task is based on available plans in LTM, the internal structure of these plans may not be formulisable by the subject. As we have seen, such plans may have been acquired by performing the activity in varied circumstances, not by explicit teaching of rules. Nevertheless, if the plan is available, the subject has the disposal of the relevant information.

3.2. Interference

A major source of error in second language use is interference. In terms of skill structure, interference occurs if at some instance during execution of a task the wrong program is called. There are two clearly distinct cases:

(i) the misplaced program is nevertheless part of the skill hierarchy, or

(ii) the program is part of a different, but compatible skill.

Ad (i). The best example, again, is speech errors in the mother tongue. If a subject intends to say *cedars of Lebanon*, but in fact produces *cedars of Lemadon*, he has used the nasalization program for producing /n/ at the earlier moment where /b/ should have been produced. The result is nasalization of /b/, i.e. production of /m/ (see Fromkin 1973). Nasalization is clearly part of the subject's mother tongue skill. There is interference if the program is called at the wrong moment. In second language learning such interference is quite frequent. The acquisition of English pluralization, for instance, involves automation of -/s/, -/z/, or -/iz/ affixing patterns. At the same time different schema's have to be learned for particular cases (*mouse-mice*). If during performance a pluralization program is called at a certain instant, all or some of the schema's may be activated in memory. Even if the subject knows very well that the plural form of *mouse* is *mice*, the other schema may be released earlier (having a lower threshold), and *mouses* pops out. These errors are called INTRALINGUISTIC ERRORS. They may or may not be due to lack

of knowledge (the student may simply not have any special program for *mice* in his LTM); the didactical approach should be different in the two cases (see section 4).

Ad (ii). The erroneous program may be part of another, compatible skill. This is also very frequent case during second language learning: mother tongue programs are often used in foreign language performance, but one can also observe the "borrowing" of programs from another foreign language which the student happens to know.

From the skills point of view, the first thing to be noticed is that such interference is the negative side of an otherwise highly productive mechanism. The mechanism can be called "transfer of training," and allows the organism to use automated patterns of activity in new tasks where conditions of performance and circumstances may be widely different: proficiency on the scooter may transfer to bicycle riding, skill in flute playing is helpful in learning to play the recorder, writing skill is easily transferred to blackboard-writing though very different musculature is involved, etc. It is due to this productive mechanism that it is easier to learn a compatible language than a very unrelated language. From laboratory experiments it is clear that learning a new skill which is compatible with an existing skill, is quicker than learning an incompatible skill. More exactly, the difference is not so much in the RATE of learning, but in the initial level of performance. The starting proficiency for a compatible activity is relatively high, and this initial advantage is maintained throughout learning.

Interference is the negative side of this mechanism. In trying to perform the new task, the subject may not only transfer programs that are useful in the new skill, but also programs which have no place in the new behavior. If two languages are highly compatible it may be so advantageous to use mother tongue programs that in general these programs are kept at a rather high level of activation in LTM. The result is that the chance of erroneously activating such programs is also increased, which becomes apparent in a high rate of so-called INTERLINGUISTIC ERRORS. In view of this effect, it is not impossible that there exists an optimal level of compatibility between languages, which is neither unrelatedness, nor strong similarity.

Just as for intralinguistic errors, interlinguistic errors may or may not be due to lack of knowledge. If the correct pattern is simply not available in LTM interlinguistic errors are quite likely to occur in case of compatible languages.

One final remark on interlinguistic errors: A typical type of interference seems to be some form of "chaining," like for the

German student of English who in a London café requests *Can I become a cup of coffee?* (see for more intricate forms of chaining Kaper 1974). Apparently, a particular semantic intention activates some mother-tongue word in memory. The articulation program for the word, however, is not executed, but in its turn the program activates a similar articulation program in the lexicon of the target language (*bekommen → become*). This mechanism is not at all well-understood. Of course, it indicates that mother tongue programs are used to mediate between semantic intentions and the choice of foreign language patterns. We will return to this observation in discussing didactical consequences of interference (section 4).

3.3. Insufficient automation

As we have discussed, the result of automation is that sub-programs become available as such in LTM. Another way of stating this is that the decision units in short term memory become larger, which amounts to reducing the number of decisions to be taken per time unit. In view of the essentially slow operation of STM this is a necessary condition for errorless execution of speedy complex tasks. A major cause of errors in second language performance is insufficiency of automation. Lower level programs have still to be assembled during execution of the task, which will require so much attentional effort that it may temporarily exceed the subject's total capacity so that failure results.

It should be noticed, however, that insufficiency of automation does not NECESSARILY result in failure. It all depends on the relation between momentary task demands and available capacity. A non-automated pattern may require much effort, but if other aspects of the task are very easy, the total attentional capacity may not be surpassed, and an accurate performance results. Such a situation is especially possible if no instructional or intrinsic speed requirements are made. In view of the earlier mentioned speed-accuracy trade-off, the subject may slow down so much, that he can allocate sufficient effort per time unit in order to effectively complete a non-automated pattern of behavior. We will return to this in section 4.

3.4. Insufficient supply of capacity

Even well-automated behavior can break down if supply of capacity is truncated. There are two rather different situations in which this may occur. Capacity is an increasing function of arousal, but for high arousal levels capacity diminishes again (Yerkes-Dodson law). This means that capacity supply can be insufficient due to either too little or too much arousal.

Too little arousal may result during states of fatigue or under the influence of certain drugs. The relation between fatigue and arousal is, however, not a direct one. As we have discussed earlier, arousal level varies with task demands. This is also true in states of fatigue. But in order for the task demands to have this effect, the subject must EVALUATE the task demands. It is this evaluation mechanism which suffers from fatigue or drugs. The result is a continuous underestimation of the task requirements, and as a consequence underarousal and insufficient capacity. This means that it is not NECESSARY for a tired person to make many errors: he can be helped in evaluating the task demands by giving him frequent feedback about his performance. Under such conditions, normal levels of performance may result (Wilkinson 1963).

Very high levels of arousal are also detrimental to capacity. These high levels may be caused by intrinsic factors, extrinsic factors, or both. By intrinsic factors is meant very high task demands. If a very complex task is to be performed under high time pressure, arousal may increase so much that capacity drops. Extrinsic arousal - increasing factors can be of various sorts: anxiety, examination stress, arousal increasing drugs such as amphetamins, etc. Some of these factors should be taken into consideration in the evaluation of errors during second language performance.

3.5. Dispersion of attention

Even if there is sufficient supply of attentional capacity, errors may result when the subject channels part of his capacity into other activities. In fact, one way to measure the task demands of a particular activity is to introduce the subject to simultaneously perform a second task, like tapping in a regular fashion (Michon 1966). The quality of this secondary performance is an inverse measure of the mental load induced by the main task. Speaking or writing a foreign language (and even the mother tongue) may deteriorate if the subject is simultaneously giving attention to another activity. This may be completely internal (like trying to decide which friend to take on vacation), or it may be external (such as trying to not only write in the foreign language, but to also deliver a nice piece of calligraphy). It is probably one of the oldest and most misused explanations of failure in classroom situations to say that a student does not adopt the right task set, and is meanwhile doing other things than he should.

3.6. Rewarding effects of failure

A final cause of errors to be mentioned here is that failure may be useful. In certain countries, or under certain conditions, it can be advantageous to be recognized as a foreigner: one is given special treatment, etc. One's speech is the most

immediate and effective indicator of alienship, except when there is perfect mastery of the foreign language. These positive effects of accent and of using queer turns of phrase have been discussed by Diller (1971). In terms of skill: the subject simply does not adopt the task set to produce perfect second language. This may already work during acquisition with the result that no full automation is reached.

This enumeration of causes for failure is certainly not complete. What they have in common is that they can be understood in terms of modern attention and skill theory. In the next section some possible didactical consequences or uses of these insights will be discussed.

4. Some applications in language teaching

4.1. The goals of language teaching

It is well known in applied linguistics that a student's errors can be used to assess aspects of his skill (see especially Corder 1971). How such assessments can be made useful for the teaching process is a different matter. It is not only dependent on the type of teaching setting (language laboratory, classroom, individual teaching), but also on the aims that are pursued in the teaching program. In the following we will limit to learning settings where there is a possibility of frequent interaction between teacher and student. With respect to aims it will suffice to notice the following points.

(i) There is hardly any language learning situation where the ultimate goal is full mastery of the foreign language by the student (cf. Jespersen 1904). In general, more restricted aims are set, such as limited conversational ability plus fluency in reading, or administrative correspondence ability, etc. For any language teaching programme these aims should be made as explicit as possible.

(ii) Didactical consequences of skill assessment depend on the aims of the teaching programme. If it is the aim to attain correct writing without fluent speaking, for instance, the meaning of speech errors is limited: only if they signal lack of knowledge it is important to give additional instruction, since lack of knowledge will in the same way affect writing. However, if it is only lack of automation, the same error is not likely to appear in writing, and can probably be ignored.

4.2. Assessment by spontaneous and induced errors

As has been discussed extensively in section 3, the occurrence of errors may be indicative of lack of skill. It should be wrong,

however, to conclude that errorless performance indicates the presence of skill. In applied linguistics there is much consciousness of the first state of affairs. Especially Corder's work (1967, 1971, 1973) has led to new interest in the analysis of spontaneous errors in second language learning. By now there exists a substantial bibliography on error analysis (see, for instance, Ollson 1972, Nickel 1972).

Much less attention has been given to the second point. In the teaching situation errorless performance as such is no guarantee that the goal situation has been reached. It is wrong to make that tacit assumption, and no special didactical conclusions can be drawn from error-free performance, except that the student apparently has the disposal of the necessary information to complete the task. The reason for this lies in the attentional structure of complex task performance. If there is sufficient informantion available to perform the task, errors result in case the task demands exceed available capacity. As we have seen, one of the major characteristics of skill is automation of lower level activities so that attention is kept available for the slow high level decisions (such as selecting topics of discussion, making particular lexical choices, etc). But if low level activities are not fully automated, perfect performance may nevertheless result if there is sufficient spare capacity left to control a low level activity by attention.

In order to check, therefore, whether the intended skills are really present, it is necessary to look at the student's performance under less optimal attentional conditions. The most effective way to realize this is to have the student work under time pressure. In that case more decisions have to be taken per time unit, so that less capacity is available for each of them. From the resulting pattern of errors one can infer which parts of the skill are not yet fully automated. It then depends on the goals of teaching, whether any or all of these sub-skills require further training. Apart from time pressure, one can also use other means to limit available capacity. A rather natural method might be to construct tasks where the high level decisions require much effort. One can have the student converse in the foreign language about very difficult matters (such as problems in mathematics), so that little spare capacity is left for lower level decisions; again, errors will indicate the weak points in automation. Finally, there is the classical situation of stress: the examination. Sometimes high levels of arousal are induced during examination, with a resulting drop of available capacity (Yerkes-Dodson law). Nevertheless, this is the least effective way to assess the subject's skill. The arousal increasing effect of exams may as well have positive effects on the subject's available capacity. This is very much dependent on the personality structure of the student. Some students nicely attain a medium level of arousal which brings them at the top of their attentional capacity: they will perform better than any time before; and this in spite of possible lacks of automation.

4.3. Evaluation of errors and some didactical consequences

In section 3 some causes of error have been discussed. It can be useful to find out the cause of a particular error, whether spontaneous or induced. We will now discuss some tests which can be applied to determine the origin of a particular error, and look at possible didactical conclusions.

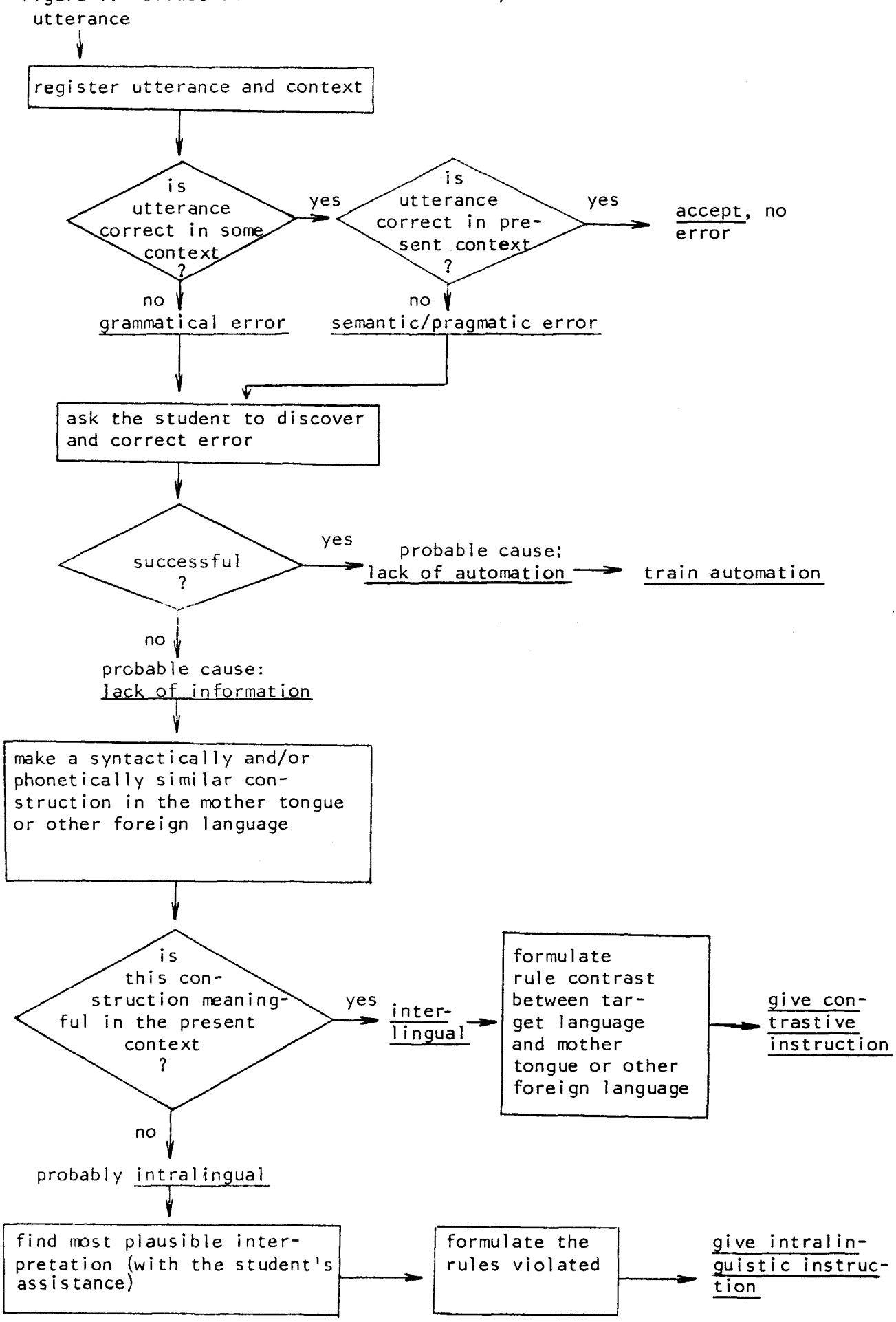
We will limit, however, to only some of the possibilities mentioned in section 3. Special attention will go to errors caused by lack of information, interference, and lack of automation. We will assume that there has been no lack of attention on the part of the student's skill. Also, we do not consider the possibility that the making of errors is rewarding.

For this limited situation a rather straightforward testing schema can be set up, which derives much from Corder's error analyzing algorithm (Corder 1971). It is represented in Figure 1.

The input is the student's utterance (either spoken or written), and it is decided whether it is acceptable in the target language. If so, it is furthermore checked whether it makes sense in the context of use (*Can I become a cup of coffee?* is correct, but not appropriate). If also pragmatically correct, the utterance is accepted as correct. In the other two cases (grammatical and/or pragmatic errors), the first test is whether the student himself is able to correct the error. This self-correction test is essential for determining "lack of information" - causes of error. If the student is able to correct the error he does have the appropriate implicit or explicit knowledge, and the cause of error is most likely lack of automation. It is irrelevant here whether the error is a case of interference or not. If automation is complete interference hardly occurs. This, then, is the first didactical consequence: if the goals of the teaching programme require automation of this part of the skill, further training of the pattern is required; i.e. it should be used frequently in various contexts.

If the student is unable to correct the error, the conclusion must be that there is a lack of information. The main task now is to determine whether the error is inter- or intra-linguistic. One way to check this (but it is not 100% fail-proof!) is to make a word-to-word translation into the mother tongue (or to another foreign language which the student has knowledge of). If the obtained string makes sense in the given context, the error has most likely been interlingual. Another check should be to replace certain words by phonetically similar words in the mother tongue (*become → bekommen*), and to see whether such a translation makes sense in the context. If so, the error is also probably interlingual.

Figure 1. Didactical schema for error analysis



For interlingual errors it is important to make explicit the difference between the two languages in the concerning respect, and to explain this difference to the student. This is called contrastive teaching, and it is required here. (This does not mean that I am a proponent of contrastive teaching in general. The disadvantage of a more general contrastive approach in foreign language teaching is that the student is facilitated to make the erroneous association (*bekommen - become*), an association which he might otherwise not have made. By systematically drawing his attention to such cases one may increase the chance of his making the "chaining" response which was described in 3.2. as a special case of interference. Contrastive teaching should only be practiced in case the subject has made the error, i.e. has already laid the misleading association himself). Of course, this contrastive teaching should be followed up by automation training.

If the error cannot be labelled interlingual, it is most likely intralingual. One should then try to discover which schema has been followed by the student instead of the correct one (e.g. weak pluralization in the case of *mouses*). The student himself may know this. At any rate, the student should be informed about the correct pattern, and the pattern should be automated by further training.

The schema has no pretension to be either complete or foolproof. But it is hopefully useful in some cases.

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