A Generic Cognitively Motivated Web-Environment to Help People to Become Quickly Fluent in a New Language

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Abstract

To speak fluently is a complex skill. In order to help the learner to acquire it we propose an electronic version of an age old method: *pattern drills* (PD). While being highly regarded in the fifties, pattern drills have become unpopular since then. Despite certain shortcomings we do believe in the virtues of this approach, at least with regard to the memorization of basic structures and the acquisition of fluency, the skill to produce language at a 'normal' rate. Of course, the method has to be improved, and we will show here how this can be achieved. Unlike tapes or books, computers are open media, allowing for dynamic changes, taking users' performances and preferences into account. Our drill-tutor, a small web-application still in its prototype phase, allows for this. It is a free, electronic version of pattern drills, i.e. an exercise generator, open and adaptable to the users' ever changing needs.

1 Problem

To produce language spontaneously and at a normal rate is a challenging problem requiring the solution of several complex tasks: (a) content determination, (b) lexical choice, (c) morphological adjustments[1] and (d) articulation (Reiter & Dale, 2000; Fromkin, 1993; Levelt, 1993, 1989).

There are various reasons why language production is such a difficult process. For example, a speaker has to make quickly a great number of choices of various kind (conceptual, pragmatic, linguistic), leading to results which are highly unpredictable. Hence it is hard, if not impossible to make a causal analysis on the basis of correlations between an input and an output (a change of the former causing a change at the latter), as the relationship between the two may be unsystematic (no one-to-one mapping) and the result of the choices may show up not only at the final output, the only one accessible to our senses, but also at the intermediate stages (Zock, 1994, 1988). Figure-1 illustrates this for the input : `[help (Paul, Marie)]` which after multiple specifications at the intermediate steps yields: *Paul l'aide* (Paul helps her).

There are also time- and space-management problems. Speaking is basically a sequential process, component *b* relying on the results of component *a*. Hence, any hesitation in one component, say, lexical choice, may yield a delay of the next lower component (syntax or morphology). Also, the results of a higher component may need to be revised in the light of results coming from a lower component (retroaction). Correlated to the *time problem* (delay) there is also a *space problem*. Any symbol waiting for translation (say, the mapping of a concept into a word) needs to be stored,

[1] Not all of these components present the same level of difficulty. For example, morphology is hardly a problem for languages like Chinese or Japanese, while the production of the final output (spoken or written words) may be very demanding. It certainly is a challenge for Europeans learning Chinese, while the very same persons may have little problems with Italian, Spanish, or Japanese. Also, none of the European languages can compete with the logic of the Chinese lexicon, which make it particularly suitable for look-up (Zock et Schwab, 2010) and the learning of words, be it only for those describing objects.

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taxing short-term memory, a very scarce resource.

If speaking in one's mother tongue is already a daunting task, to do so in a foreign language can be overwhelming (Bock, 1995). Language production is a skill (Levelt, 1975; de Keyser, 2007a) whose *elements* (words, rules, etc.) and *order* (staging; what is to be processed when) have to be learned, and this is hard work, requiring a lot of practice in various situations.

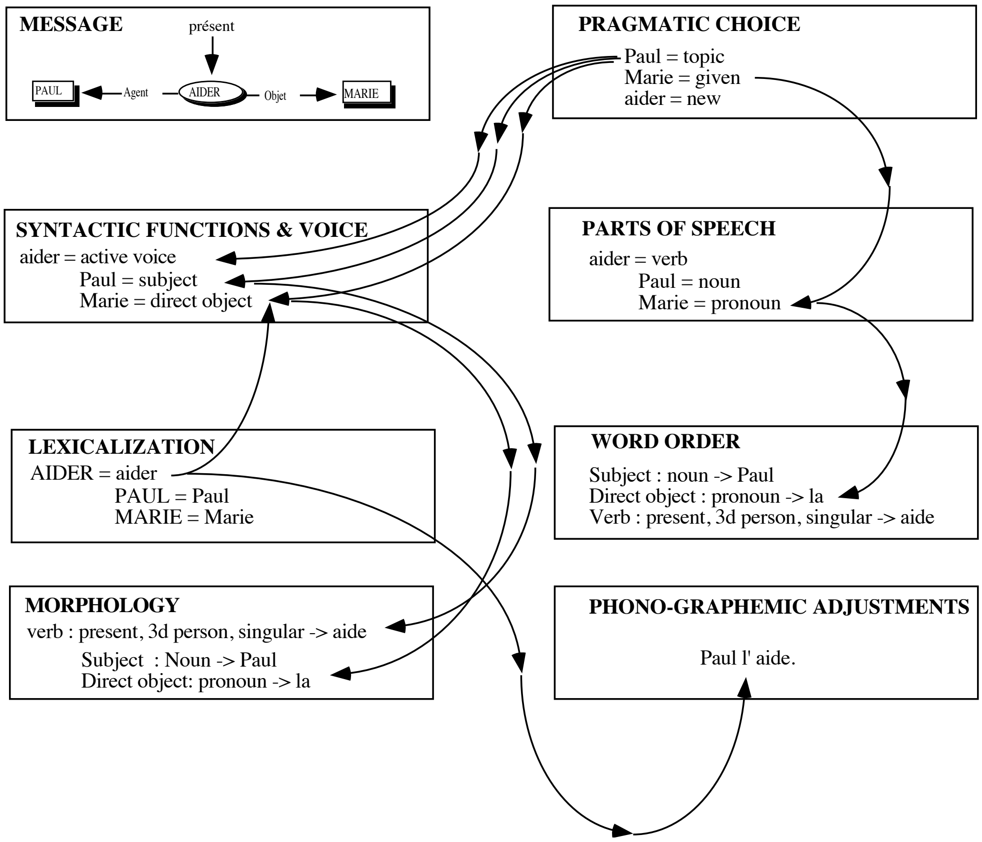

Figure 1 : Language production as a glass box, revealing the multiple dependencies and interactions at various levels.

2 Our model or approach : patterns, rules or both?

As you will see, we will take a hybrid approach. If spontaneous language production is such a complex process the question arises whether it can be made feasible, and if so, how. This is precisely the point we will try to address in this paper, be it only briefly. We would like to stress though, that we deal here only with the survival level (go shopping, ask for information, ...)

To illustrate our approach let us recast it into one of the major frameworks used for language production, the Reiter & Dale model (Reiter & Dale, 2000). Hence we will take on board some of their terminology like macro/micro-level, conceptual input, lexicalization, morphology, etc.

However, before proceeding and present our approach, we would like to emphasize another point. Going through the steps depicted in Figure-1 and applying all the rules implied by natural language generators is highly unrealistic for people trying to learn a foreign language. There are various good reasons to doubt:

- *memory*: people do not have in their mind all the knowledge described by linguists, neither can they hold all the required information in their working memory (Baddeley, 1970);
- *attention*: people can focus only on a small set of items at a time;
- *time*: speech, i.e. the conception of a message and its translation into language is extremely fast. Speakers do not have the time to perform all the computations, i.e. search and apply the needed rules.

Linguists describe languages in terms of rules, but people hardly ever learn such descriptions, leave alone apply all of them, at least not at the initial stages of acquiring a new language. What people do learn though are *patterns* complying with these rules. Of course, people do use rules, but in conjunction with patterns.

Patterns can be seen as frozen instances of a given step in the derivational process. They can also be abstracted at any level of the process. They can be of any sort, hybrid, mixing semantic and syntactic information. Patterns are global structures, which can be built dynamically by applying a set of rules, moreover, they can also be stored as ready made sentence plans or templates in which case they behave somehow like words: they can be retrieved at once, sparing us the trouble to have to go through the cumbersome process of structure creation. Obviously, access, i.e. pattern retrieval, is much faster than the computation of its corresponding structure. There are simply too many steps involved. This is probably the reason why so many people use them for language (learners, interpreters, journalists, etc.) or other tasks (music, programming, chess playing, etc.) without even being aware of it (Nagao, 1984).

Of course, there is a price to be paid : patterns need to be accessed (see below) and they may need to be accommodated. In other words, patterns have qualities, but also certain shortcomings: they are rigid and tax memory. Imagine someone abstracting a pattern for every morphological variation. Take for example the following two sentences: 'I've attended PACLIC 2012 in Bali' *vs.* 'I'll attend PACLIC 2013 in Taipei'. They basically instantiate the same pattern [(I've attended/ I'll attend <conference name> <place> <time>)]). In other words, it does not make sense in this case to abstract two patterns, since the two are so much alike. It would be much more reasonable to have one general pattern for the global structure and a set parameters, i.e. rules for local adjustments, like agreement, tense, etc.

Just like patterns, rules do have certain shortcomings. While they may account for the expressive power and all the regularities of a given language, they may prevent us from getting the job done in time, in particular if there are too many of them. This being so, we suggest to use a hybrid approach, resorting to each strategy when they are at their best, patterns for *global structures*, the syntactic layout, i.e. sentence frame, and rules for *local adjustments*. This combination gives us the best of both worlds, minimizing the use of computational resources (attention, memory), while maximizing the power (speed) and flexibility of output (possibly needed accommodations).

When people learn a new language, they build some kind of database composed of words, patterns and phrases. This memory (pattern-library) can consist of translation pairs, or, pairs of conceptual patterns and corresponding linguistic forms (sentences). One can also think of conceptual patterns as a pivot, mediating between translations of languages.

There is one problem though with this kind of approach. As the number of patterns grows, grows the problem of accessing them. This is where indexing plays a role. Patterns can be indexed from various points of view: *semantically* (thematically, i.e. by domain), via their components (words), *syntactically*, etc. While we index our patterns pragmatically, i.e. in terms of communicative goals (function that the pattern is to fulfill), we allow their access also via other means: navigation in a goal hierarchy.

To see how our model relates to the generation model mentioned earlier, we try to recast it in those terms. The tool we are building can be used as a translation aid, as an exercise generator (our concern in this paper), or as a tool to extend the current database (this is work for the future).

In the first case it would function in the following way: given some user input (sentence), the system tries to find the corresponding translation, which is trivial if the translation is stored in the DB.[2]

In the second case, the assumption is that the user knows the goal s/he'd like to achieve. Hence, the dialogue goes as follows (see table-1, next page). Given some goal (step-1), the system presents a list of patterns from which the user must choose (step-2), and instantiate then the pattern's variables with lexical items (step-3) and morphological values (step-4, or the steps A-D in figure 2 here below). Note, that some of these choices could be considered as optional, as they are performed by the system. This is typically the case in traditional pattern drills, where the user has no choice soever concerning the input, the words to use, ...

Note also, that the *conceptual input* (see table-

[2] If the goal is the extension of the database by finding similar sentences in a corpus, i.e. sentences built on the same pattern, the problem will be harder. The program must infer or abstract the input's underlying pattern and find a corresponding sentence in the target language. This sentence can be either the translation of the input or a somehow similar sentence extracted automatically from the corpus. This is clearly work for the future. The main part of this paper deals with the *exercise generator*.

1) is distributed over three layers: at a global level (macro-level) the speaker chooses the pattern via a *goal* by providing incrementally *lexical values* (for the pattern's variables) and *morphological parameters* (number, tense) to refine gradually the initially underspecified message. This kind of distribution has several advantages. Information is requested only when relevant and needed. There is better control in terms of access, storage and processing load. Obviously, this approach is better than storing a pattern for every morphological variant. Last, but not least, this method is faster for conveying a message than navigating through a huge *lexical* or *conceptual ontology*, as suggested elsewhere (Zock,1991; Power et al., 1998; or Zock et al. 2009).

task	input	output
MACRO-LEVEL	1) choice of *goal*	set of sentence frames 1 <OBJECT$_1$> is more <ATTRIBUT> than <OBJECT$_2$> 2 <OBJECT$_2$> is less <ATTRIBUT> than <OBJECT$_1$>
	2) choice of *sentence frame*	<OBJECT-$_1$> is more <ATTRIBUT> than <OBJECT$_2$>
MICRO-LEVEL	3) choice of *lexical value*	lexically specified structure *Cigar* is more *expensive* than *perfume*.
	4) morphological parameter	morphologically specified structure <OBJECT$_1$>: plural Fully specified conceptual, syntactic and morphological structure

Table 1: Conceptual input as a four-step process for the following output : "Cigars are more expensive than perfume"

3 Goal and scope

In order to reach the above mentioned goal, help people to acquire quickly the skill of speaking, we propose a very simple solution: the development of an open (i.e. customizable), generic, web-based environment. Put differently, we propose an electronic version of a well-known method called "pattern drill" (Chastaing, 1969). This method has been criticized for various reasons (see section 6). Despite this fact we do believe in its virtues provided that the method is adapted and properly used.

Obviously, in order to be able to perform ***automatically***, that is, without having to think about the various tasks mentioned, we must **exercise** them, as otherwise we will forget or be unable to integrate them into a well staged whole, a prerequisite for **fluency** (deKeyser, 2007).

Learning should be made simple and possible in a reasonably short time. Our goal is to help the learner reach the level of fluency needed to express his/her basic needs: ask for information, answer a question, solve a concrete problem, etc. by using language. In other words, our scope is the **survival level**.

4 Method

To achieve our goal, we suggest to build a *template-based sentence generator*. Patterns or templates are abstractions over concrete linguistic instances, i.e. sentences (I prefer beer to wine => < SPEAKER> prefer < DRINK$_1$> to < DRINK$_2$>). Patterns are linked to *communicative goals*, for example, 'comparison', the speaker's starting point (see table 2, next page). Our approach is based on the following assumptions :

Resource limitations: given the limitations of our brain (space and time), speakers cannot afford to perform very complex operations, especially not during learning;

Decomposition: speaking being a complex process, we have to decompose it, allowing the speaker to focus selectively on a limited number of issues: *meaning*, *form*, or *sound*. Since people can focus only on few items at the same time, it makes sense to put them into a situation, where they can rely upon a set of ready-made building blocks (the 'constants' of the pattern), computing only part(s) of the whole structure (the values of the patterns' variables).

Open-endedness: different people have *different needs*. This being so, we propose to build an *open system*, allowing the user to tailor the tool to fit his or her needs.

Contextualization: words are not learned in isolation, they are learned in the context of a sentence pattern, which may form even larger structures (scripts, discourse patterns).

Grounding: words and sentence structures are linguistic resources used to achieve specific communicative goals. By indexing our patterns in terms of goals and by presenting words in the context of sentence patterns, we achieve this kind of communicative grounding (pragmatic competency). The student learns when to use what specific resource.

	goal	*associated pattern*	*example of instantiated pattern*
1°	Identity (name)	My name is <NAME>, <FIRST NAME> <LAST NAME>.	My name is *Bond*, *James Bond*.
2°	Presentation (full name)	This is <FIRST NAME> <LAST NAME> also called the <SUR-NAME>.	This is *Bjorn Borg*, also called the *iceberg*.
3°	Origin (country)	I am from <COUNTRY> and you?	I am from *Portugal*, and you?
4°	Q-A : preference	Q : What do you like better <DRINK$_1$><DRINK$_2$>. A : I prefer <DRINK$_1$> to <DRINK$_2$>.	Q : What do you like better, *tea* or *coffee*? A : I prefer *tea* to *coffee*.
5°	Q-A : comparison	Q : Which city is bigger, <PLACE$_1$> or <PLACE$_2$> ? A : <PLACE$_1$> is bigger than <PLACE$_2$>.	Q : Which city is bigger, *Tainan* or *Taipei* ? A : *Taipei* is bigger than *Tainan*.

Table 2 : Patterns indexed in terms of goals

The **need of practice**: words have to be memorized, so do syntactic structures. Speaking is fast and various component tasks have to be carried out quasi-simultaneously. Hence we need to automate some of them (conversion meaning => form => sound). All these operations require practice (de Keyser, 2007), as without it we may not only forget, but also be unable to integrate the components into a well staged whole and to deliver the result in time.

Holism: rather than assembling words into sentences we instantiate patterns. Instead of proceeding word by word, the learner operates on larger chunks, sentence patterns. In doing so, we buy what is needed next to knowledge, *space* (intentional resources) and *time*.

5 Discussion

While there are many good teaching methods, there is at least one point where nearly all of them (books, tapes) fall short: due to the media constraints they are closed. In consequence, everything has to be anticipated, which implies that all students have to take the same route, in spite of the diversity of their ever changing needs. This is a pitfall we try to avoid in our sentence and exercise generator, an open, customizable, web-based tool designed for novices studying foreign languages. The generator's **inputs** are *communicative goals* and *conceptual information*, the **output** is text (i.e. written form) or synthesized speech.

To summarize, we propose the building of an exercise generator to help people to develop basic communication skills in a foreign language (in our case the Chinese). The goal is to assist the *memorization* of words and the acquisition of fundamental sentence patterns to become sufficiently *fluent* in the new language to participate in a simple conversation.

6 Building and using the resource

There are two aspects to be considered: *building* the resource and *using* it.

To **build the resource** (construction phase), we index a list of fundamental sentence *patterns* with *goals* from which the learner will choose during the exercice phase (Table 2). Since different people have different needs we keep the system open so that the user can customize it according to his needs. In other words, the user can change certain parameters:

- the link between *patterns* and *goals*;
- the *names* of the *goals* (if s/he doesn't like our metalanguage);
- the *words* with which s/he'd like to instantiate a given pattern;
- the *number of times* s/he'd like to work on

a given pattern;

- the *time delay* between a stimulus (question) and a response (answer);
- etc.

To **use** the **resource:** having chosen the *goal*, the system will display the according pattern(s). If there is more than one, then the learner will choose among them the one s/he wants to learn, communicating the system the specific words s/he would like the pattern to be instantiated with (see Figures 2-3).

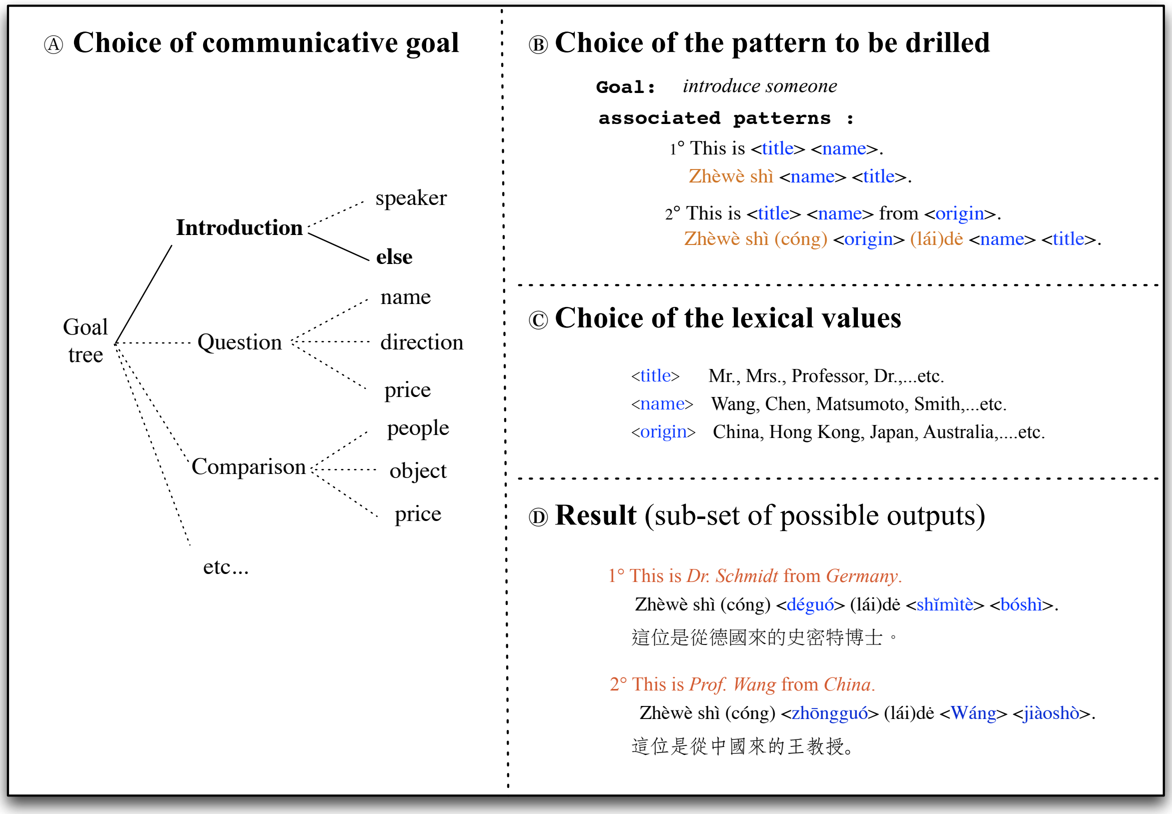

Fig. 2 : Communication Flow

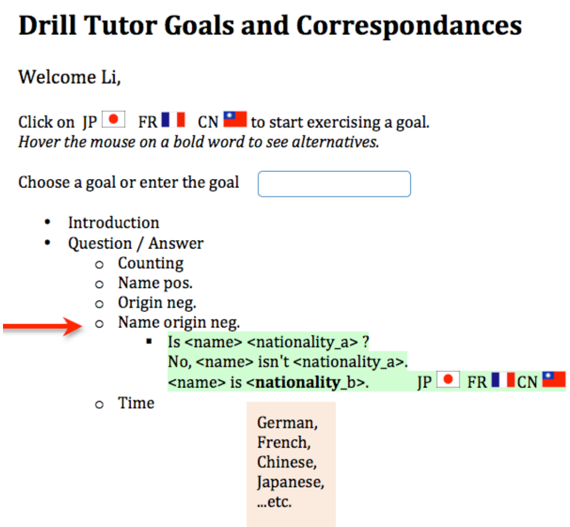

Fig. 3 : Lexical choice

The system has now all it needs to produce sentences of a specific kind/class (pattern) taking the user's preferences (chosen words) into account. Yet, before doing so it will invite the learner to try by herself[3]. Once this is done, he can compare his results with the system's outputs. By seeing which pattern achieves which discourse goal and by being able to produce the required form he can now compare his/her outputs with those of the system. Hence s/he learns not only to express himself in a foreign language, but also, and more importantly, how to achieve quickly a specific communicative goal.

7 A short note concerning the criticism against pattern drills

After having been very popular for many years, pattern drills and repetition which they rely upon have been discredited by linguists, —see Chomsky's violent criticism (Chomsky, 1959) of

[3] Note that in this particular case the output is subvocal, as unlike in the case of the language laboratory we cannot record it and written output would be too time-consuming.

Skinner's book *Verbal Behavior,*— by psychologists (Levelt, 1970, Herriot, 1971; Leont'ev, 1974; Krashen, 1981) and pedagogues (Rivers, 1964, 1972; Spolsky, 1966; Chastain, 1969; Savignon, 1983; Stevens, 1989, Wong and vanPatten, 2003).

While we partially agree with these criticisms with respect to the *creative aspects* of language production, we do not share them at all when *habit formation* or the *acquisition of automatisms* are the learning goal Actually, it seems that we are not the only ones to hold this view, see for example: deKeyser (2007a, 2007b, 2001), Fitts, (1964), Garrod & Pickering (2007), Gatbonton & Segalowitz (2005, 1988), Guillaume (1973), Hulstijn (2001), Segalowitz (2007, 2003, 2000), Segalowitz and Hulstijn (2005), to name just those.

At least partial automatization of the process is necessary to become fluent in speaking. Automatisms are the speakers' means to buy time, allowing them to focus on another, possibly more demanding component, for example, the next conceptual fragment, i.e. message, to be uttered. Put differently, in order to achieve the skill of fluent speaking, that is, fast conversion of ideas into sounds (Zock, 1997), we do believe that well-staged repetitions of stimulus-response patterns in a clear communicative setting, together with feedback are a valuable learning method. Of course, they are not the whole story. Interestingly enough, patterns have been rehabilitated by well-known linguists like Goldberg (1998) and by Ray Jackendoff (1993) one of Chomsky's most brilliant students.

8 Conclusion

We have started the paper by stressing the fact that speaking is difficult. We have tried then to show that the acquisition of this skill could be made feasible by blending an old theory and new technology. While the current prototype is fairly small (15 goals, a dozen of patterns and 300 words, in four languages), this should not be taken as a decisive argument against the potential usefulness of our approach. Our focus was not on scope but on generality. We wanted to see how difficult it would be to use the very same approach for typologically different languages. We were pleasantly surprised to see that even adding Chinese after having tried the system for French and Japanese, was quite simple.

In sum, the number of patterns and the size of the vocabulary is not really our major concern at this stage, the focus being on the implementation of an editor designed for building, modifying and using a database. The database can easily be extended. Note also that our system is not only an exercise generator, but also a language generator, simple as it may be. In sum, our drill tutor has several features that set it apart from traditional pattern drills, user-controlled input being just one of them.

To conclude, we do believe in the virtuosity of our approach : the system is open and customizable (concerning input, linguistic knowledge, processing preferences, interface, etc.). It is generic and it can be built and extended quite easily, by allowing to add various plug-ins : synthesized speech, automatic creation of patterns or automatic building of a pattern library. Obviously, the ultimate judge of the qualities of the system is the user, but since we are still in the development phase, this has to be left for the future.

Obviously, pattern drills are not a panacea. They can even be harmful it not used properly (parroting, mindless repetition), but used in the right way, that is, at the right moment, with the right goals and at the right proportion, they can do wonders. Just like a tennis player might want to go back to the court and train his basic strokes, a language learner may feel the need to drill resisting patterns. Whoever has tried to become skillful in a language fundamentally different from his own can't but agree with deKeyser's (2001) words when he writes: "Without automatization no amount of knowledge will ever translate into the levels of skill required for real life use".

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