From Item-learning to Category-learning:
A Learning Process of Procedural Knowledge of Language

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Abstract

It is argued in this article that procedural knowledge of a second language as the goal of learning is best learned through the learning of exemplars of language use as instances of connecting meaning with form. Two recent theories, ACT-R theory of cognitive skill learning by Anderson (1993) and Usage-Based Model of language acquisition by Tomasello (2003), are cited to show the importance of exemplar learning in second language learning. In discussing the role of exemplars in second language learning, a distinction is made between item-learning and category-learning. Item-learning refers to the learning of particular expressions item by item as exemplars which show how intended meanings are encoded onto forms or how the procedures connecting them are executed. Category-learning is defined as the learning of abstract rules that govern a set of different expressions of the same construction. It is stressed that category-learning occurs at all levels of language and at various stages of learning. It is also claimed that category-learning provides the source from which a whole system of grammar of an interlanguage is formed. Finally it is concluded that the learning of exemplars constitutes the most essential part of second language learning.

1. What Underlies Communicative Competence?

Most of the people concerned with second language learning and teaching would agree that the goal of learning is to develop communicative competence in the target language. It is also generally accepted that communicative competence is composed of several components. Bachman (1990), for example, proposes the following four components: grammatical knowledge, sociolinguistic knowledge, functional knowledge, and textual knowledge. Thus, it is argued that second language learning consists of learning the grammatical, sociolinguistic, functional, and textual knowledge of the language.

It should be recognized, however, that a grammatical component of communicative competence underlies all the other components. This means that in order to show evidence of
having the knowledge of each of these components, that knowledge must be actually realized onto some kind of linguistic form. This necessarily means that grammatical knowledge is required in this process of linguistic realization. Some examples may be in order here. Sociolinguistic knowledge of the appropriateness of an utterance is actualized by employing a particular structure appropriate to the situation, e.g., *May I borrow your pen for a while, sir?* vs. *Give me your pen for a while*. That is to say, sociolinguistic knowledge must be linguistically realized. It is also the case with functional knowledge and textual knowledge. Speakers’ intentions are encoded in their corresponding linguistic forms, and cohesion and coherence are also realized as utterances with their respective forms.

It can be safely stated, therefore, that to learn a second language is to learn the grammatical knowledge of the language. It is the basic knowledge necessary for realizing the sociolinguistic, functional, and textual knowledge of the language or communicative competence of the language.

### 2. Grammatical Knowledge as Procedural Knowledge

Grammatical knowledge necessary for realizing communicative competence must be distinguished from the kind of conscious and explicit knowledge of grammar second language learners may have. Grammatical knowledge underlying communicative competence is “procedural” in contrast to “declarative” (Anderson 1993) and “implicit” in opposition to “explicit” (Ellis 2003). It is procedural in that it is directly responsible for the internal processing during comprehension and production of language. It is implicit because its function in the process is unavailable for conscious attention.

Another way to look at the function of procedural knowledge of language is to ask what it does in the process of language use. In the process of producing language, meaning is encoded onto form, and in the process of comprehension, form is decoded into meaning. Procedural knowledge is, therefore, responsible for connecting meaning with form and form with meaning: linguistic realization of meaning in production and semantic restoration from form in comprehension.

The most important characteristic of procedural knowledge of language is in its dynamism. It is the kind of knowledge that works actively in leading the processes of encoding and decoding. It is not static at all like a descriptive pedagogical grammar written on paper.

### 3. Where is Procedural Knowledge of Language for Learners?

Procedural knowledge of language as the target of learning is not easy for learners to access. This is because it only works in the actual process of language use and it exists as such.
Moreover, it works only in connection with meaning. Learners cannot, therefore, access it by recourse to some description of the process, nor can they access it devoid of meaning. They can only access it by actually experiencing the meaning-form connections. This is especially the case with spoken language since it requires on-line processing of language.

It is pointless, therefore, to try to explain the formal features of the target constructions relying on pedagogical grammar and then to encourage learners to practice employing them in various activities as is usually done in the PPP approach. Pedagogical grammar only describes the formal features at the end result of the process of meaning-form connections; it does not constitute the kind of procedural knowledge which is directly employed in the process. It is surely not the case that learners develop procedural knowledge by practicing employing the conscious knowledge of grammar they may have by receiving formal instruction. It is necessary for learners to directly experience meaning-form connections in order to develop procedural knowledge of the target language.

How can learners experience form-meaning connections then? It is probably possible only through learning concrete instances or exemplars of language use. This is because instances or exemplars embody the process of connecting meaning and form. It is, therefore, expected that learners can experience the process of meaning-form connections through learning exemplars and thus can find the mechanisms connecting them. Thus, exemplars provide learners with opportunities for the learning of procedural knowledge of the target language.

Some examples might be appropriate here to show the role exemplars can play in the learning of meaning-form connections or procedural knowledge of the target language. The plural form of baby is babies and likewise cities is the plural form of city in written English. By experiencing babies and cities one by one, learners can learn the connection between the form and its plural meaning respectively. The experience can be productive and receptive. It is productive if learners actually produce them, and receptive when they understand the meanings of these forms. In either case, it is an active process of experiencing connections between meaning and form.

The pedagogical rule stipulating “When the noun ends with a consonant plus ‘y’, change ‘y’ to ‘ie’ and add an ‘s’ at the end to make the plural form of the noun” describes the process of the connection with an emphasis being put on the form. Although learners may learn this pedagogical rule consciously, it is not only difficult but also implausible that learners employ it in realizing plural forms of this type. In contrast, when learners experience babies and cities item by item as instances of connecting the meaning with the form, everything stipulated in the pedagogical rule is involved in the process of experiencing the connection.

Another example is at the syntactic level. The hunter was killed by the bear is a passive sentence expressing a particular passive meaning. If learners learn the sentence as an instance of the passive voice and experience connecting the meaning with the sentence form either in
production or comprehension, they actually experience all the processes which are described by the corresponding pedagogical grammar as follows:

1. Addition of BE ... EN (i.e., the auxiliary verb BE plus the passive participle) in he passive sentences.
2. Inversion of the nouns signifying the agent and the theme with respect to subject and object position in the sentence.
3. Although pronominal agents are fairly rare in the passive, when they do occur, the case of the pronoun changes from subject to object (or vice versa if the theme is a pronoun).
4. Insertion of the preposition by before the demoted agent in the passive version.

(Celce-Murcia & Larsen-Freeman 1983: 223)

It should be noted that these pedagogical rules only describe the internal processes of connecting the passive meaning with the passive form. It is not the case, therefore, that these rules are applied when producing and comprehending passive sentences. This is especially the case in speaking and listening. The fact is that when learners experience passive sentences as instances of connecting the meaning with the form, the experience automatically entails all the processes and they can actually experience them in process.

To summarize: To learn procedural knowledge of the target language is to experience it through exemplars; it is not learned efficiently by practicing applying pedagogical rules. This is simply because procedural knowledge works in the actual process of connecting meaning with form, and it is accessible and therefore learnable by experiencing it as such.

4. Role of Exemplars in the Learning of Procedural Knowledge of Language

The crucial role exemplars play in the learning of procedural knowledge has been pointed out by at least two recent theories explaining the development of cognitive skills and language acquisition respectively: ACT-R theory by Anderson (1993) and Usage-Based theory of language acquisition by Tomasello (2003).

ACT-R theory has been proposed in response to the criticism against ACT* theory concerning the status of declarative knowledge. ACT* theory, the former version of ACT-R theory, claims that all procedural knowledge starts initially as declarative knowledge in its literal sense, that is, verbally reportable. It has been pointed out that this explanation of the development of procedural knowledge does not apply to language learning, especially so in first language acquisition. It is clearly not the case that young children initially have verbally reportable knowledge of their first language. In response to the criticism, Anderson (1993) admits that there are instances of declarative knowledge that cannot be verbally communicated. Thus, concerning the origins of declarative knowledge, the emphasis has been
shifted from “declarative memory for instruction,” which is reportable, to “declarative memory for examples of how the procedures should be executed,” which may not be reportable.

While not denying the development of procedural knowledge form declarative knowledge in the traditional sense, ACT-R theory states that “a major avenue for the acquisition of procedural knowledge” is to start learning from exemplars that are used analogically for solving new tasks, and to compile production rules or procedural knowledge that are summarized through the analogy process (Anderson & Fincham 1994). It should be emphasized that exemplars in the theory are conceptualized as instances of “how the procedures should be executed.” It also should be stressed that production rules or procedural knowledge is formed through abstracting general rules common to exemplars of the same class by analogy.

Usage-Based theory of language acquisition basically contends that language structures emerge from experiencing actual language use rather than from some innate properties of the mind. And the theory claims that “children begin with item-specific and construction-specific learning” and that “children construct their abstract linguistic representations out of their item-based constructions using general cognitive, social-cognitive, and learning skills” (Tomasello 2003).

According to Usage-Based theory, an item to be learned is a concrete expression on its own and at the same time it is an exemplar of an abstract construction or constructions to be formed later. For example, I dunno is an expression with a single coherent meaning and children may learn it as a fixed expression expressing the meaning on the one hand. On the other, with the learning of other similar expressions, children may break down this expression into its component parts with the result that don’t is abstracted out to be used in other expressions such as I don’t like it and I don’t want it.

In Usage-Based theory, frequency with which children hear or produce a linguistic construction plays an important role. Frequency is divided into two types: token frequency and type frequency. Token frequency is the number of the times children experience the same item. For example, if children hear or say Do you wanna this? five times, its token frequency is five. It is said that token frequency contributes to the entrenchment of the expression and to its fluency of delivery. Type frequency, in contrast, is the number of different items of the same construction children experience. For example, when children hear or say Gimme-that, Gimme-this, Givim-that, and Givim-this each one time, they have four types of frequency of the give-imperative construction. Type frequency contributes to the process of generalization or abstraction of constructions.

Both theories put an equal emphasis on the role of exemplars which are learned item by item in the process of learning. Exemplars form a kind of spring board for learning in two senses. First, to learn an exemplar is to experience how the relevant procedures in the form of
production rules are executed in ACT-R theory, and how a particular meaning is expressed with a particular form in Usage-Based theory. Token frequency of each exemplar strengthens the procedures and therefore the connection between the meaning and the form. Second, exemplars accumulated item-by-item constitute the source from which constructions or abstract rules are formed and summarized. Type frequency is responsible for the process of abstraction and summarization.

Although ACT-R theory is concerned with the development of cognitive skills in general and Usage-Based theory describes the process of first language acquisition, both of them can be said to have strong relevance to second language learning as well. This is because both of the theories explain the development of the kind of knowledge which is responsible for the actual process of language use or procedural knowledge of the target language which is the goal for second language learners.

In the sections to follow, it will be argued how exemplars play important rules in the development of second language knowledge in terms of the distinction between item-learning and category-learning.

5. Item-learning

Item-learning is usually contrasted with system-learning in second language learning. Ellis (1999), for example, defines item-learning as involving “the accumulation of linguistic forms, each of which is stored separately or, at best, with very weakly weighted connections with other items” and system-learning as entailing “the construction of abstract rules that govern a whole set of items and, also, of the establishment of interrelations between one abstract rule and another and, therefore, between one set of items and another.”

An important point in the distinction of item-learning and system-learning is their developmental relationship. As Ellis (1999) states, “item learning is developmentally prior to system learning and provides the raw material for the acquisition of grammar and the construction of a system.”

While admitting the general picture of second language learning in terms of the distinction between item-learning and system-learning and their developmental relationship, it may seem necessary to examine both concepts of item-learning and system-learning still further, because each of these contain separable stages of development (Yamaoka 2001).

Item-learning defined by Ellis (1999) is characterized by two features: the item-by-item nature of learning and the unanalyzed nature of learned items. It is, therefore, clear that item-learning in Ellis's definition refers to item-by-item-learning of whole unanalyzed chunks which are learned and used wholistically.

It should be noted that there can be another type of item-learning. Learners can learn a particular expression as an exemplar showing how an intended meaning is encoded onto a
particular form or how the procedures connecting them are actually executed. It is one thing, for example, to learn the expression I'm hungry as an unanalyzed chunk; it is quite another to learn the same expression as an exemplar of connecting the meaning with the form. The former type of item-learning is rote-learning of whole expressions without structural analysis and the latter type is item-learning of exemplars with structural analysis. For the sake of convenience, hereafter in this article, the former type is called rote-learning and the latter item-learning.

This distinction between rote-learning and item-learning is especially relevant to second language learning. Most typically second language learners are at a stage of cognitive development at which they can benefit from formal instruction. By receiving formal instruction, they can have conscious understanding of the linguistic features of form. To have conscious awareness of the formal features is to be in a better position to experience the internal processing of connecting meaning with form. Importantly this is not to claim that such conscious knowledge is directly applied in the connecting process, but to claim that such knowledge can be an indirect help for second language learners to experience the internal process of connecting them. It is easier for learners to experience the internal process connecting meaning with form if they have conscious awareness of the formal features beforehand. It may be very difficult to experience meaning-form connections without knowledge of form. This is a weak interface position. Indirectly helped by formal knowledge, second language learners experience meaning-form connections through item-learning of exemplars and as a consequence of it, they learn procedural knowledge of the target language in the fashion of item-based learning.

System-learning defined by Ellis (1999) is also ambiguous. It refers to the construction of abstract rules that govern a whole set of items, and at the same time it also refers to the establishment of interrelations between one abstract rule and another. Two levels of abstraction are involved here. First, learners need to abstract rules that govern a set of different expressions of the same construction. For example, by learning exemplars such as I'm hungry, I'm sad, I'm happy item by item and accumulating similar exemplars, learners abstract rules that may be formalized as “I’m + Adj.” Second, learners need to establish interrelations between the rules (i.e., I’m + Adj.) with other abstract rules such as “We’re + Adj.” and “I + Full Verb,” and consequently to form an interlanguage system of the time.

Both of these two types of system-learning have the process of rule abstraction in common, but it might be appropriate to make a clear distinction between them: abstraction of rules concerning a particular construction type and abstraction at a higher level involving the establishment of interconnections of such rules as a whole system. Therefore, in this article, the former type of system-learning is named category-learning and the term of system-learning is reserved for the latter type.

In the next section, category-learning defined here as such is discussed further.
6. Category-learning

Category-learning occurs at all levels of language. As an example at the level of morphology, let's take plural forms of English nouns shown in Table 1.

Table 1 Category-learning of English noun plural forms

<table>
<thead>
<tr>
<th>Category</th>
<th>Exemplars</th>
<th>Descriptive rules</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>cats, maps, sticks</td>
<td>/s/ after voiceless consonants except /s, f, y/</td>
</tr>
<tr>
<td>2</td>
<td>boys, dogs, girls</td>
<td>/z/ after vowels and voiced consonants except /z, s, f/</td>
</tr>
<tr>
<td>3</td>
<td>cases, houses, bridges</td>
<td>/z/ after /s, z, f, y, z/</td>
</tr>
</tbody>
</table>

English plural forms of nouns in speech are divided into three different categories as shown in Table 1. By learning cats, maps, sticks and so on item by item as exemplars of connecting the meaning with the form respectively, learners experience the connecting process common to all these cases and consequently develop the procedural knowledge pertaining to Category 1, which is described as the descriptive rules shown in Table 1. This is the process of category-learning of the plural form applying to all the nouns belonging to Category 1. The same is true with Categories 2 and 3.

Learners need to attain abstraction each in these three different categories of plural noun forms in spoken English. Category-learning, therefore, constitutes the essential and foundational stage for system-learning to occur. It is clear that token frequency of item-learned individual exemplars contributes to their confirmation as exemplars, and type frequency is essential for category-learning.

Category-learning is needed at the syntactic level as well. Take expressions containing the be copular verb with personal pronoun subjects for example. Category-learning of the construction occurs at three stages at least. At Stage 1, category-learning or the formation of abstract rules occurs according to the different types of the subject as is shown in Table 2.

Table 2 Category-learning of the be copular construction: Stage 1

<table>
<thead>
<tr>
<th>Category</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exemplars</td>
<td>I'm young</td>
<td>You're tired</td>
<td>She's old</td>
<td>He's tall</td>
<td>We're rich</td>
<td>They're old</td>
</tr>
<tr>
<td></td>
<td>I'm sad</td>
<td>You're old</td>
<td>She's active</td>
<td>He's poor</td>
<td>• • •</td>
<td>• • •</td>
</tr>
<tr>
<td></td>
<td>I'm happy</td>
<td>You're rich</td>
<td>She's tired</td>
<td>He's smart</td>
<td>• • •</td>
<td>• • •</td>
</tr>
<tr>
<td>Abstract rules</td>
<td>I'm + Adj.</td>
<td>You're + Adj.</td>
<td>She's + Adj.</td>
<td>He's + Adj.</td>
<td>We're + Adj.</td>
<td>They're + Adj.</td>
</tr>
</tbody>
</table>
It is also important to notice that category-learning is required for the subject types other than I and you as well. By item-based learning of Mary, Yuki, the woman, the girl and others and accumulating them, learner can abstract "the third person singular female," and learn them as a category. This is exactly the same with "the third person singular male," "the first person plural," and "the third person plural."

At Stage 2, category-learning takes place with the abstraction of the concept of sentence subject and of the copular be as is shown in Figure 1.

**Figure 1** Category-learning of the *be* copular construction: Stage 2

\[
\begin{align*}
\text{I'm } &+ \text{ Adj.} \quad \text{You're } &+ \text{ Adj.} \quad \text{She's } &+ \text{ Adj.} \quad \text{He's } &+ \text{ Adj.} \quad \text{We're } &+ \text{ Adj.} \quad \text{They're } &+ \text{ Adj.} \\
\text{S } &+ \text{ be } &+ \text{ Adj.} \\
\end{align*}
\]

It might be interesting to find that the categorical rules learned at Stage 1 constitute the exemplars for the abstraction at this stage of category-learning, and, therefore, they assume the role of type frequency for abstraction at this stage.

At Stage 3 of category-learning of the *be* copular construction, the concept of complement is abstracted. That is to say, learners need to find that subject predicatives of the construction can be realized either by an adjective phrase or a noun phrase. (Note that another option of a prepositional phrase like in *He's in his room* is excluded from discussion here.) Category-learning at this stage requires prior category-learning of the construction types with a noun phrase at Stage 1 (i.e., I'm + NP, You're + NP, and so on) and at Stage 2 (i.e., S + be + NP). Category-learning at Stage 3 is shown in Figure 2.

**Figure 2** Category-learning of the *be* copular construction: Stage 3

\[
\begin{align*}
\text{S } &+ \text{ be } &+ \text{ Adj.} \\
\text{S } &+ \text{ be } &+ \text{ Complement} \\
\text{S } &+ \text{ be } &+ \text{ NP} \\
\end{align*}
\]

It is not without saying that type frequency is essential for category-learning. That is to say, different expressions belonging to the same category must be experienced for category-learning to take place.

Examination of the learning of plural forms of English nouns and the *be* copular construction described above may suffice to show how category-learning is needed at all levels of language and at various stages of learning before system-learning is carried out.
7. Conclusions

Procedural knowledge of the target language as the goal of learning is different from the kind of knowledge learners may have as the result of receiving formal instruction by way of pedagogical grammar. Since procedural knowledge exists in the actual process of language use and works for connecting meaning with form, it can only be accessed through directly experiencing the connecting process. This can be attained most effectively by learning exemplars as instances showing how meaning is connected with form or how the procedures connecting them are executed. Exemplars assume two roles: to confirm the connections of particular meanings with particular forms and to abstract common rules governing a set of similar exemplars. Item-learning defined here as the item-based learning of particular connections of meaning and form corresponds to the former role of exemplars. Token frequency is important for the role. Abstraction of rules is made with category-learning defined here as the learning of general and abstract rules that govern a set of different expressions of the same construction. Category-learning refers to the second role of exemplars. Abstract rules formed as the result of category-learning provide the raw material for making a whole system of an interlanguage grammar: system-learning.

It might be safe to conclude that there can be no other way to learn procedural knowledge of the target language than to learn exemplars with respect to both item-learning and category-learning.

References