Language acquisition as cognitive processing

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INTRODUCTION

The foremost goal of researchers of second language acquisition has been to find the optimal sequence in which structures should be presented to learners in order to facilitate the acquisition, given that ease of processing and memorizing of linguistic material depends on simplicity of input (cf. Krashen 1985, Pienemann 1989). This has caused a search for universal orders of acquisition. Such an approach takes for granted that language acquisition consists of a gradual accumulation of more or less correctly acquired rules and that we only have one processing mode available, namely conscious, analytic processing. However, language is of such a high complexity that it is impossible to acquire as separate rules without creating systems, and complex systems cannot be created analytically just by selecting and adding structures and rules. These circumstances are probably the reason for a constant emergence of new approaches, which, however, have not succeeded in solving the numerous problems in language learning research. Such accounts underestimate the brain’s ability to adapt itself to data; the brain always finds the most economical way. Therefore a more comprehensive, cognitive account has to be employed for the explanation of the language acquisition process, that can be utilized for more efficient instruction.

I would like to show in this paper that it is the right choice of the processing mode that determines the speed of progress in language acquisition rather than the sequence of presentation of structures, especially when complex structures are concerned, and that this choice is made by the brain unless prohibited. We have different processing methods despite, and just because of, the limitedness of our cognitive capacity. That allows our short-term memory to maintain only a few (seven plus-minus two) items for a few seconds, but this is the potential available for analytic processing with attention. We also have the option of taking a holistic perspective with growing complexity, whereby no accurate analysis is made and only salient features get attention (Glass & Holyoak 1986). Furthermore, our brain tends to create systems, which demand no attention. Further advantages of systems will be seen in the following. It will be shown that the brain is able to make the right choice of processing.

In the following, a description of the study is followed by a presentation of the results to illustrate the high relevance of processing
modes. Additional evidence for the importance of the processing mode is provided by an account of a different learner type and the acquisition of morphology. The results will be discussed and referred to the most significant topics of research.

1. THE STUDY
The learners included in the study\(^1\) were eleven German school children of age 11-14 at the beginning of the data collection; they were in their second to fifth year of English education. Half of them attended partial immersion classes, in which they were taught other subjects, such as geography, in English; the other half attended regular English classes. The results referred to in this paper are based on the production of two girls, Stephanie and Manuela, who were age 13 and in the third year of English at the beginning of the data collection. Stephanie attended a regular English class in Berlin, while Manuela took part in an immersion program and had more exposure to English. Furthermore, I will report on a less successful course of acquisition by a younger learner, whose processing mode differed from those of the other two.

Data collection took place every second or third month, so that the sessions for each child totaled ten in a period of two and a half years. The material used was either memory-based or visual stimuli, mostly in narrative form, in order to find out whether the source of information and the complexity of situation influenced the choice of structures. Among the memory-based tasks were films, such as "Some Like It Hot", which the learners told after having seen them, or stories, which they read first and then told without support: visual material consisted of picture stories, such as Donald Duck, and also of single pictures. Furthermore, the same data produced by six native speakers of the same age were compared to those of the learners, since the analysis of data did not consist of compilation of errors and correct structures but of functional analyses of structures used by the learners. Even missing structures were registered.

The approach was cognitive-functional and therefore included the investigation of the relation between linguistic and cognitive structures as well as processes behind these. A large number of structures were investigated in terms of the most important textual dimensions, coherence and grounding\(^2\), which have a cognitive foundation. Although these seem to be opposite forces in established languages in that coherence is involved

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1 This paper presents only an excerpt of the comprehensive study (Pishwa 1998).
2 "Grounding" is used here the way most linguists employ it, namely to refer to degrees of relevance in text, foreground and background information (Tomlin 1987). Psychologists use this for creating a setting or a mental space.
with textual connectedness, and grounding with differentiation of textual parts, they proved to be intertwined with each other in the developing language, so that both qualities are promoted by one single structure.

The structures, of which only a few are presented in this paper, were analyzed in terms of coherence and grounding and related to their underlying cognitive structures in order to determine the processes that steered the production. By "underlying cognitive structures" I mean organized knowledge, i.e. schémas stored in semantic memory and shared by all members of a community. Such knowledge structures, categories and schémas, are assumed to consist of hierarchical networks with nodes and their connections. While the nodes contain bits of information, their connections stand for relations between them. Certain nodes are more important than others as is the case with abstract nodes that the brain creates unconsciously. This can be applied to the well-known restaurant script, which is a rigid schema with little variation: The single steps, or nodes, are: "hanging the coat", "seating", "receiving the menu and making a choice", "ordering" and so on. They are connected to each other chronologically. These steps are connected to each other also by means of the two higher-level nodes, the goal of visiting the restaurant (eating) and its successful outcome. While the goal evokes expectations, the stored outcome confirms these. An outcome that deviates from the stored variety is more interesting than the goal itself and therefore a point worth telling. In the restaurant script this would be the case if a visitor left a restaurant without having eaten. Goal and outcome are the most salient nodes and the last ones to be lost from memory since they contain the main structure of the schema. This explains why increase in the degree of abstractness of an event implies increase in holistic processing and the reverse: the more abstract cognitive structures become, the wider their scope becomes and the fewer details they contain (Markman 1999).

Apart from text-forming structures, the most frequently investigated area of English, inflectional morphology, was included in the study to be compared with more complex structures. This will be commented on after the presentation of the main findings since its acquisition seemed to take a different path from that of syntactic structures used for text structuring.

2. RESULTS
The 10 data collections clearly divided into two separate phases: in the first phase (occasions 1-5), the learner language was the result of holistic processing, and the structures investigated formed a coherent system. In the second phase (6-10), this system had been restructured abruptly after sufficient exposure to English, which enabled a more accurate analysis of
structures. I will describe some of the features characteristic of the two phases in the following.

3. THE HOLISTIC PHASE
While conscious attention is directed to the acquisition of the lexicon and simpler morphological rules, such as the plural of nouns, text formation, which requires complex syntactic structures, is achieved by using holistically analyzed, invented functors. These symbolize only salient events and items, among which we find the abstract nodes, goal and outcome, in memory-based tasks as well as perceptually salient events in visually based tasks. I would like to illustrate this first in the verbalization of memory-based tasks, which consisted of stories with a gist stored in the abstract nodes. The learners verbalized these two elements explicitly, leaving out details in narratives and descriptions. The protagonist’s goal is symbolized by want and a surprising outcome by but. Example (1) illustrates the use of these functors.

(1) Achja, he want to phone, but there are three phone (I: boxes) phone boxes. The first in the first phone box there is a man yet and the second is damaged and the third is damaged too. Then if the man was gone away, he he want to phoned to to Norwich but he hasn’t got enough money. (Stephanie 2³)

The example contains goals at various levels. The highest goal is to make a phone call. The anticipated difficulty is marked by but right at the beginning. This is followed by more details. When the last opportunity is opened up in that a man leaves the only usable phone boot, the headmaster finds out that he hasn’t got money; this is again marked by want-but. Since goal and outcome are connected to most other nodes, their verbalization creates global coherence and renders mention of details unnecessary. As they are salient as well, they contribute to the focusing of the protagonist’s goal and its outcome.

The following examples compare Stephanie’s behavior with that of a native:

(2) He (=Donald Duck) ties the rope at his car and on the tree and the two crawals (=squirrels) want to protect themselves so they run up the tree and try to durchbeissen (‘bite through’) the rope. (Stephanie 5)

(3) And he’s about to pull the whole tree down and the squirrels are very very scared. So they run down the tree and they bite and they bite the rope apart. (Robert, native speaker)

³ The figure refers to the data collection session so that „2“ in the example means the second session out of 10.
While Stephanie uses *want* to create coherence by verbalizing the goal, the native simply uses an adjective which describes the mental state of the squirrels to serve as a motivation for the following actions. Modal verbs and negation are used to specify the surprising outcome in addition to or instead of *but*, as example (4) shows.

(4) On the next day the parents knock (‘lock’) him in the room so he *can’t collect* stones, *but* he decides to to (Interviewer: leave his bread) to leave Ms bread on the way. Then *but* when their parents leave the children in the woods the birds eat the bread so they *can’t find* the way back to the house of their parents, and they run in the wood away. (Stephanie 3)

In (4), the negative outcomes are expressed by means of *can’t*. In the second pan we find an additional *but*. Example (5) contrasts this behavior to that of natives.

(5) But this time the son had no time to collect stones, so he brought with him some bread and along the trail he sprinkled bread crumbs along the trail. ... and when they went outside all the bread was gone because the birds had come and eaten it so they were totally lost. (Robert)

While the learner mentions the failure twice (*can’t find the way, they run in the wood away*), the native simply states *they were totally lost* preceded by *but* at the beginning of the text. The comparison makes clear that both modal verbs, mostly *can*, and the negation highlight the expected but not realized outcome. Because of this function, *but* is used with a higher frequency than among native speakers: so are modal verbs, occasionally over 20% of all finite verbs. While modals are deontic or epistemic in native speech, they appear to have a function bound to expectations in early learner language. *Can* is focused in learner language in this phase, whereas natives and advanced learners use it mostly in background information (see analytic phase). Negation exhibits the same frequency as with natives; it is its usage that differs: Whereas native speakers use negation mostly in background information, in learner language negation appears in the foreground, preferably in focused parts, as shown in the above examples. The learners do not provide much background information at the beginning.

In picture stories, in which the narrator is not under the same pressure to create coherence and clarity as in memory-based tasks, it is single highly kinetic or outstanding events that are highlighted. Events, such as jumping or yelling, are salient in the perceptual field of a viewer. The structure used to mark this is the progressive, the function of which is reanalyzed to mark
perceptual salience without considering the semantic features of the verb. Example (6) illustrates its usage.

(6) ... give him a hit and the boy cries is crying very loud and he ran he's running to his mother. The mother is coming to the father and asked him asked why he why he hit and why he did that. ... The other grandparents col/are coming and they shout and they are shouting too. Ehm now all the * all the * people are shouting are shouting and ehm suddenly the mother was is crying and .... Suddenly the boy is shooting with the water gun again ehm in his father's eyes. (Manuela 1)

While cry, run, and come appear in the progressive, ask does not; also hit in the subordinate clause carries a simple past tense. This device is not restricted to visual tasks but is also occasionally used in memory-based tasks. Despite this, it is used less frequently by learners than by natives. The progressive is well suited for focusing because of its salient form. Furthermore, this function is iconic in that a "larger" content is symbolized by more linguistic material. The progressive is reported to carry a similar function in spoken American English (Couper-Kuhlen 1995).

To summarize: The learners process structures required for text construction holistically because of the accumulated complexity brought about by both the speech situations and the small inventories' of linguistic devices. Holistic processing implies that markers for cognitively and perceptually salient information develop without being linguistically analyzed. The function of these markers is extended to cover a wide scope of the goal and outcome nodes, which provide the most important information of a schema and create global coherence, whereas perceptually salient information strongly varies with the kinesis of the events. The invented functors structure texts also by focusing the most relevant textual parts, while background or subsidiary information is hardly provided since the linguistic system in this phase offers only few, simple syntactic structures. The structures form an unconsciously created prelinguistic system, which reflects cognitive contents and ability very closely. It leaves capacity for the acquisition of the lexicon and simpler morphological rules, since it does not "cost" anything due to holistic processing and yet remains flexible enough to be restructured. The benefit of the broad functions is apparent in narratives: A large number of grammatical elements are rendered redundant, since the speaker has simplified various verbalization tasks in order to cope with the high complexity involved in language learning.

4. THE ANALYTIC PHASE
Accumulated exposure to English causes not only the expansion of the lexicon but also semantic and syntactic analyses of structures and rules; new
rules emerge as well. This brings about an abrupt restructuring of the holistic system on occasion six and results in a high degree of syntactisization, which promotes automatization of structures and thus enables the speaker to provide detailed information at all textual levels. Hence we can claim that the new linguistic system is a product of analytic processing. It no longer reflects the underlying cognitive structures as clearly, as will be seen in the following. Accordingly, salience is no longer verbalized explicitly.

The broad functions of the structures are narrowed in their scope and provide local instead of global coherence. They tend to appear increasingly in background information, since they lose their function for salience. Examples (7-10) illustrate the new functions.

(7) Her bottle fell on the floor when she danced and one of the man told that it was his bottle and in the night she wanted to thank him. And later they wanted to celebrate a bit and then one came and she brought another bottle of alcohol and waked up the others and suddenly all the girls were awake and they all came and they wanted to have a party. (Manuela 9)

(8) He was very angry because he was Supergoof and he had to save lives but he wasn't there to dry clothes (Manuela 9)

(9) And there he told her that he could never fall in love again because his first love had died in an accident (Stephanie 9)

(10) A man can't get married with a man. (Stephanie 9)

Want does not appear in a focused position any longer since it refers to local goals and motivation, as in example (7). Motivation is a subjective feature, which could not be found in the holistic phase. It marks events that events have already taken place. In example (7), all the events preceded by want take place and do not just remain intentions. But is no longer used in advance to mark a total failure; its function is rather that of a local adversative, as in (8), without a focusing function. Examples (9) and (10) show that modal auxiliaries and the negation increasingly appear in background information just like with natives and no longer highlight failed expectations. It is apparent that these functors have undergone a thorough semantic analysis resulting in more accurate, grammatical functions.

The progressive is also (re)analyzed semantically. The first new function is simultaneity, which bridges salience with duration since simultaneity implies some kind of duration. The next step is to mark duration of all kind by means of the progressive without any restriction, such as habituality (11) and states (12); these are excluded by a further analysis from this category and yield sentences like (13).

(11) They see that she drinks some alcohol and she says "Oh yes. Sweet Sue she she knows that T m drinking alcohol and she doesn't want me to drink." (Stephanie 9)
(12) And Sugar is very interested in him because he is looking like a millionaire. (Stephanie 9)
(13) Then another woman noticed that they are talking with to each other, and she thinks that is a party, and so she wakes up the other women (Stephanie 10)

The thorough analysis of linguistic devices enables the introduction of further refined syntactic structures, such as the infinitive (14-17), the extended form (18-19), and would instead of want to mark irrealis (20-21). These structures, which were incompatible with the holistically oriented first phase, appear abruptly and simultaneously. Since some of these structures are not possible in German, they must have been acquired independently of it and therefore cannot be transferred from there. They introduce a new perspective into learner language in that some of them can be used subjectively (Stein 1995, Traugott 1989), as the speaker's evaluations of the situation in the examples below. Syntactically, they simplify sentence structure with regard to its length and create local coherence.

(14) He wants the beautiful wolf to kiss him. (Stephanie 7)
(15) The king ... didn't want the man to marry his daughter... (Manuela 8)
(16) He was very happy to know who he was. (Manuela 8)
(17) She doesn't know what to do with the clothes. (Stephanie 10)

The extended form appears in this phase as well and serves purposes similar to the infinitive: local coherence and the speaker's evaluation and hence subjective perspective, as examples (18) and (19). Previously this kind of sentences contained a subordinate clause and was considerably clumsier.

(18) She's lucky about getting the three pigs. (Stephanie 7)
(19) They apologize for being so tough. (Stephanie 8)

Would is used to mark irrealis in this phase and appears in background information. In certain contexts, it replaces want in this function. The following examples illustrate its use (see also (22)).

(20) And that would have been the chance to get into the Guinness Book, and they both are very sad...(Stephanie 9)
(21) I only play in this orchestra for fun, I wouldn't have to if I don't want to if I didn't want to. (Stephanie 10)

A further linguistic structure introduced in this phase is cleft sentences (22-23) which focus nominal elements. This is noteworthy since the learners focused only verbs in the first, holistic phase. This feature is common with pidgins and créoles, which develop focusing structures for verbs as well
(Holm 1988). But it is rare in standard language due to the fixed topic-focus structure of clauses, whereby the verb phrase is automatically focused in the unmarked case. Focusing of nominal elements involves a more detailed analysis than focusing of verbs since it is a feature of hearer-orientedness which implies more complex processing than mere description of events. Thereby the speaker highlights a single non-presupposed element of a clause and pertains to information structure, while focusing of verbs is based on a perceptual and holistic perspective, whereby the viewer marks events that he judges to be salient in a specific way. Finally, (24) shows that preposition stranding and the omission of a relative pronoun are also introduced despite the fact that they are entirely new grammatical features for German learners.

(22) And they lied because they said that the wind would damage the house, but /I was their them who did this. (Stephanie 6)

(23) And he thought somebody wanted to break in his house, but it was Donald who wants to sing. (Manuela 7)

(24) She wanted to make her house the nicest house in the whole area 0 she lived in. (Manuela 6)

The data show, in contrast with most other studies, that a large number of changes take place simultaneously; practically, the whole system is restructured. The holistic functors undergo a radical change through semantic and syntactic analyses. This leads to a restriction of the function among the global functors and makes new structures necessary to fill the gaps. The syntacticization that takes place with this change causes their detachment from cognitive structures featured in the first phase. This process also adds the subjective perspective to language, which belongs to the realm of psychology.

The analytic phase is characterized by a high stability of structures, reached through their fixing to linguistic functions: single cognitive nodes are no longer verbalized, though the holistic system remains looming in the background (see below). A further consequence is that various stimuli do not cause entirely different verbalization. The syntacticization brought about by the changes increases redundancy and enables automatization; holistically analyzed structures that reflect cognitive nodes are too flexible to serve as a basis for a linguistic system. Textually the change contributes to local coherence and verbalization of background information, which enables the description of how something happened instead of what happened, which we find in the holistic phase.

5. SUMMARY OF THE DEVELOPMENT
The analysis shows that the choice of processes is adapted to contextual complexity. Due to the limitedness of our cognitive processing, we are able
to learn a language holistically step by step as a system, and not in separate pieces adding one rule to another of type a + b + c: We start out with the lexicon and a few other linguistic devices, such as rules and functors, which have to serve multiple functions to cover a whole range of communicative needs. Therefore, they are strongly generalized at the beginning and form a well-organized system, which is later restructured as a whole. System-boundedness means that linguistic devices interact with each other and must be flexible and adapted to each other in order to create a system; rigid rules are not economical because it takes too much effort to change them. After sufficient exposure to the target language, the learners are able to restructure into a native-like system by increasing differentiations in every area simultaneously. Despite a large expansion, the grammar in the analytic phase still forms a coherent system.

6. A DIFFERENT ROUTE OF LEARNING
Initial adoption of a holistic view has a profound consequence for the rest of learning. The importance of this strategy becomes evident when we review the efforts of a learner who, at the beginning, chose a different point of view. The youngest learner chose at the outset an analytic style, perhaps something like the view of a native speaker. In particular, she regarded English as a variant of German, but with different vocabulary and other peculiarities, and she attempted to learn by analogy. Thus, she did not expand the function of want and but, neither did she use modals and negation differently from native speakers nor depend excessively on other global structures. Instead, she focused only on detail, like seeking a suffix to distinguish females (e.g., friend versus friend-ess as with prince versus princess). Seemingly, her analytic vantage could not be replaced, as the following example from her speech production in session 10 illustrates.

A: I carry the was. Suddenly came Donald and * sing. Eh but eh when he
   sing the was and the
I: mirror
A: mirror are broken. The maestro was very angrily and run in his house. In *
   it was
I: das heißt pond (schreibt an die Tafel)
A: and the maestro stand on the pond and look to the fish and said "Oh that
   Ruhe
I: peace
A: peace! Oh that good peace". Suddenly Donald look over the wall and sing
   Figaro. The cat and all other animals are ne erschreckt
I: shocked
A: are shocked and the man the man spring vor the shock in the pond. But Donald sing again. The man run in his house and ehm ja trocknet sich die Haare ab (German: dries his hair). Suddenly Donald came with a ladde* on a window where the man is and sing again. The man is was heißt empört?
(A: the learner. I: the interviewer, * a longish pause)

If we consider that the time of this recording corresponds to the time of the reanalysis of the grammatical system among the two other learners we can conclude that this learner is lagging far behind. Fortunately all the other learners, even the ones not presented here, were rather of the successful type: They made a rapid progress while overgeneralizing the global functors.

7. THE ACQUISITION OF MORPHOLOGY
The fact that morphological rules in English are relatively transparent and uniform may have been the reason for their acquisition being a frequent object of study (Ellis 1994). The results have been assumed to be representative for all kinds of linguistic structures. The present study shows, however, that this is not the case. In fact, morphology was acquired explicitly by means of analogy from the very beginning and was not part of the complex textual system that the learners created without any conscious analysis. The regular past tense of verbs and the plural of nouns are easy to memorize, and irregular forms have to be memorized in any case. Even the subject-verb agreement rule seems to be acquired at least partly analytically: the third person singular -s is first applied on verbs which are well established in the lexicon of the learner. Thus, the application of these rules is not connected to the text-creating structures examined in this paper.

However, a further study shows that no generalizations should be made: The acquisition of the German agreement rule by Swedish school children adapts itself to the whole linguistic development and is strongly system-dependent (Pishwa 1988, 1990). This derives from the high complexity of the non-transparent paradigm of German with four different forms in comparison with the English paradigm with two forms and the uniform Swedish paradigm with only one form. This suggests that the degree to which holistic processing is employed depends on the complexity of the structure and its relation to other structures.

8. DISCUSSION
Current theories are not able to explain the results of this study (Mitchell & Myles 1998). The crucial issues are a sudden emergence of syntax, the initial interaction of the prelinguistic system with knowledge structures, and the varying employment of processes in accord with the context. Without going
into a detailed discussion, I would like to comment on the treatment of these three issues in a few language acquisition theories. While a rapid growth of syntax is predicted in Universal Grammar, it denies an interdependence between cognitive and linguistic structures. Different processing methods are not considered, either. Cognitive theories of language acquisition would not be helpful since most of them are concerned with a number of psychological processes, such as salience, without indicating when the single processes are employed. Pienemann et al. (1988) establish a rigid order of acquisition for German word order, which, however, is not realized by Swedish learners of German (Pishwa MS); the order is based on the principle of salience, whereby a new salient feature is paid attention to and processed. Furthermore, none of the cognitive theories considers the relation of linguistic and cognitive structures, which proved to be an important factor in the present study, so that a close relation reflects a prelinguistic phase. The present study has shown that this is only true of certain areas. Also the ACT model (Anderson 1983) is bound with the same problem: Language acquisition is explained as an incremental process from declarative to procedural knowledge. This statement is probably valid for single structures; if the whole system is considered, a different picture emerges.

Functional theories are better compatible with our cognitive-functional approach despite their claim of a gradual development of learner language. Functionalists assume various levels in the acquisition, with the first phase being a pregrammatic or pragmatic phase, in which the share of syntax is almost non-existent (Givon 1979, 1995). This phase is followed by a grammatical mode, similar to the present study. The proponents of functionalism also argue that the object of investigation should consist of texts to enable discourse analyses to capture changing levels of linguistic means. This approach is, however, missing a link to cognitive processes and structures.

The question of the source of an abrupt emergence of syntax also remains. No single theory is able to explain it except for Universal Grammar, which does not acknowledge any relation between other cognitive structures and language. Clearly, this is a necessary requirement for an adequate explanation. The view in Cognitive Grammar which regards syntactic structures as an entrenchment of concepts, is the mere contrast of this. The reason for the dilemma probably lies in research methods, which limit the object of investigation to a few structures. Furthermore, the proportion of studies concentrating on the acquisition of morphological

4 Pidgins seem to maintain a close relationship between knowledge structures and language, for instance serial verbs, which reflect complex processes more accurately than do established languages (Sebba 1987).

5 ACT means Adaptive Control of Thought.
phenomena is surprisingly large; it has been shown in this paper that these
develop differently from syntactic structures in English.

9. CONCLUSION
It has become clear that language acquisition is a multifaceted phenomenon
and therefore requires multifaceted explanations; even "universal" orders of
acquisition are not always valid, and they do not explain much. The reason
for this is that the processing of new linguistic data does not differ from that
of data of other types; the brain is context-sensitive and flexible and finds the
most economical way of processing by creating systems wherever possible,
the benefit of which is the "low cost" and restructurability. The latter
property is important because the system created by the brain is only
prelinguistic and clumsy and has to be replaced by a more native-like
linguistic system. Where system creation is not profitable other processes are
employed. It seems then that the choice of the process is more important
than the order of the presentation of structures which does not aid language
acquisition if the data are processed in the wrong way. Therefore, the right
kind of processing should be encouraged in language instruction instead of
paying attention to errors, which are unavoidable elements of a cognitive
system.

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