SECOND LANGUAGE ACQUISITION: THE PROCEDURAL SKILL HYPOTHESIS

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1. The objective of this paper

The main line of argument pursued in this paper is the following: the task of acquiring a second language is based on the acquisition of the *procedural skills* needed for the processing of the language. In this paper, I will present results from on-line experiments in L2 processing to support the above procedural skills hypothesis.

The key objective of this paper is to demonstrate that procedural routines, once automated, are similar in native speakers and non-native speakers. This similarity assumption derives logically from the processing-based continuity assumption (cf. Pienemann 1998) according to which the basic components of language processing do not change during acquisition and over age, except if they are damaged – as in aphasia, specific language disorders, dyslexia, etc. If empirical evidence can be supplied to show that NSs and skilled NNSs process specific linguistic structures in a similar manner and that unskilled NNSs do not, then the key thesis of viewing SLA as the acquisition of procedural linguistic skills will be supported.

2. On-line experiments in SLA research

The crucial feature of on-line experiments is that they measure language processing *in vitro*. In the field of SLA this type of experiments is a relatively new methodological approach. In his 1987 book "Theories of second language learning", McLaughlin (1987) was able to survey the literature relating to on-line experiments on automatisation within the space of four pages. The substantive research mentioned there are Dornic's (1979) study of language processing

speed in bilinguals, Lehtonen and Sajavaara's (1983) study of response time by NS and NNS in grammaticality judgement tests and Hulstijn and Hulstijn's (1984) experiments on learner performance under different test conditions. The other studies are unpublished student manuscripts. McLaughlin (1987) uses these studies to provide evidence for one of his key assumptions on SLA, namely that SLA is based on the automatisation of language processing skills.

Bley-Vroman and Masterson (1989) advocate the use of on-line experiments as an enrichment of the range of experimental data available to SLA researchers. These authors introduced the particular technique of sentence matching experiments into the field of SLA. During the past seven years this technique has proven very productive in SLA research. Below I will report on its adapted use in the present study.

In the context of SLA research, sentence matching experiments were used by Masterson (1993), Eubank (1993) and Clahsen and Hong (1995). All of these studies were modelled on the experimental design developed by Freedman and Forster (1985) with precursors in Forster (1979) and Freedman (1982). This design is based on the effect of information encoding on processing speed. For instance, it was found that informants can decide more quickly whether pairs of stimuli are identical if the stimuli are words (e.g., HOUSE/HOUSE) than if the stimuli are non-words (e.g., HSEUO/HSEUO) even though the words and the non-words consist of the same number of characters (e.g., Chambers – Forster 1975). The reason for this effect is that words are encoded as single units while non-words are encoded as strings of characters.

Below I will return to the psychological and theoretical status of the assumptions underlying the sentence matching task. Let us first review the SLA studies which utilised this technique.

The general set-up used in these studies is basically the same: two sentences appear on a computer screen separated by a very short interval; the informant has to decide as quickly as possible if the sentences are identical or not. The test sentences may be grammatical or ungrammatical. In studies with native speakers (Freedman – Forster 1985) it was found that the identity of the sentences can be determined faster with grammatical test sentences. Freedman and Forster interpret this as a grammaticality effect in the matching of sentences in the same way as a "real-word effect" was found in the matching of words. This "grammaticality effect" was utilised in the SLA studies to be summarised here.

Eubank's (1993) study is designed as an empirical test of Clahsen's (1984) strategies which were advanced as an explanation of L2 acquisition sequences. It came at a time when Clahsen's approach to SLA was being questioned, particularly by scholars who support the view that both, L1 and L2 learners, have access to UG (cf. for instance, White 1991 and several other papers in Eubank

1991). For those scholars who think that access to UG is limited for L2 learners, Clahsen's approach forms an alternative explanation which constituted an important component of the "fundamental difference approach" (Bley-Vroman 1990; Meisel 1991; Clahsen – Muysken 1986).

Eubank takes the logical step to test Clahsen's strategies in the context for which they were designed, namely the real-time processing of learner language. Eubank infers the following predictions from Clahsen's strategies:

> Clahsen's Initialisation/Finalisation Strategy (IFS) in particular predicts that uninverted, ADV-SVO sentences will exact less cost in terms of processing than inverted, ADV-VSO sentences, even though inverted sentences are grammatical in the target language and uninverted sentences are ungrammatical (Eubank 1993: 253).

Eubank empirically tests this hypothesis using German sentence matching tasks in which he measures the informants' response time which is taken as a measure of "processing cost". The (adult) informants are NSs of German and NSs of English.

The results of Eubank's experiments do not support the hypotheses inferred from the IFS strategy: The NNS informants (with English as NS) respond more quickly to grammatically correct stimuli (Adv-VSX) than to the IFS-supported (ungrammatical) stimuli (Adv-SVX). The NS informants (German NSs), on the other hand, do not show any differential response time for the two types of stimuli.

If the SM task at hand is sensitive to alternating verb positions, then the lack of any differential effect in NS shows that the IFS strategy cannot be taken as a general characteristic of on-line processing. On the other hand, the differential effect found in NNS is the opposite of Eubank's prediction. Eubank's study therefore casts some doubt on the validity of the IFS strategy.

The more constructive finding that emerges from Eubank's study is the observation that "... we discovered in the course of our work that the NSs and the NNSs appear to process stimulus sentences in different ways in the SM task" (Eubank 1993: 279), a conclusion that nevertheless supports the fundamental difference hypothesis.

On the other hand, Eubank's conclusion about processing differences is in opposition to the procedural skill hypothesis which is being examined in this paper. Below I will display empirical evidence in support of the procedural skill hypothesis. In Pienemann (1998) I have demonstrated that the procedural skill hypothesis is nevertheless compatible with the view that L1 and L2 acquisition are different.

Clahsen and Hong (1995) utilise the differential effects in NNS sentence matching tasks in a different way. They argue that the limited access to UG

by NNSs can be demonstrated with grammaticality effects in NSs and NNSs. In particular, they argue that one would expect grammaticality effects for *all* domains of a given UG parameter if the learner has access to UG and no such uniformity in grammaticality effects if the learner has only limited access to UG. In particular, Clahsen and Hong (1995) test Vainikka and Young-Scholten's (1994) claim that the acquisition of subject-verb agreement and non-pro drop occur simultaneously in adult SLA. Vainikka and Young-Scholten's (1994) claim is made in support of the full-access-to-UG position, and the two grammatical phenomena under discussion are linked by one parameter.

At this point the reader will notice that Clahsen and Hong (1995) use the sentence matching technique not to study language processing, but linguistic knowledge. I will return to this point below.

Clahsen and Hong (1995) test their hypotheses with Korean speakers of German and German NSs. Korean was chosen as L1 because it does not have the syntactic property of subject-verb agreement and it is a topic-prominent language which allows empty subjects and objects. In other words, Korean learners of GSL were chosen to avoid any possible influence of L1 transfer in the experiments. The two sets of informants were tested on grammaticality effects for the two grammatical phenomena, null subjects and subject-verb agreement, in SM tasks.

The results show clearly that grammaticality effects are present for all NSs on both grammatical phenomena. In contrast, NNSs showed a more heterogeneous behaviour. In order to understand Clahsen and Hong's argument one has to consider the following of their basic assumptions: given that grammaticality effects exist with the structures in question for NSs and some NNSs, the absence of such effects in individual NNSs can be interpreted as indicating the non-acquisition of the corresponding structure. This assumption enables Clahsen and Hong to analyse which of their NNS informants have acquired the two rules simultaneously and which have acquired them separately. It turns out that the ratio is 18:13 in favour of the separate acquisition of the rules in question. In other words, unlike in L1 acquisition, the two rules are not always acquired simultaneously by NNSs. This finding is taken as strong evidence against the assumption that adult L2 learners have full access to UG.

3. Reflection: the focus on processing

I mentioned above that Clahsen and Hong use sentence matching experiments as a means of accessing linguistic knowledge. This assumption is stated explicitly in Clahsen and Hong (1995: 70):

> Bley-Vroman and Masterson (1989), Eubank (1993) and Masterson (1993) were the first to apply the SM technique to study L2 acquisition. Their idea was that if the SM task provides a measure of structural representations in native speakers, then the SM task could also be used for measuring grammaticality/ ungrammaticality in L2 learners (Clahsen – Hong 1995: 70).

In fact, the use of SM experiments as a measure of structural representations is quite in line with Freedman and Forster's (1985) reasoning. Clahsen and Hong summarise Freedman and Forster's (1985) reasoning as follows:

> The idea behind this [SM] experiment is that the presence of structure ... in the stimuli facilitates the same/different decision. In general, a subject's RT to a particular sentence pair can be taken to be a function of its grammaticality: grammatical sentences can be matched faster than ungrammatical ones. Therefore, performance in SM tasks provides a way of determining the availability of structural representations (Clahsen – Hong 1995: 69).

Freedman and Forster (1985: 117) did indeed show that "... the matching task is sensitive to degrees of grammaticality ...". This was found by comparing response times in the matching of sentence pairs which were based on word scrambles, phrase structure scrambles and grammatical sentences. In other words, "degrees of grammaticality" refers to the rough contrast between word scrambles, phrase structure scrambles and grammatical sentences that was set up for the experiments, and it did not refer, as one might perhaps assume, to the minute nuances in acceptability which native speakers can detect in somewhat unusual sentences.

Freedman and Forster (1985) found grammaticality effects in some SM tasks but not in others, especially not in sentences with WH-extraction from NP-complements. They argue that this is so because the SM technique is sensitive only to grammaticality effects that are created early in the derivation process.

One crucial point emerges from this brief discussion, namely the fact that Freedman and Forster's reasoning about SM experiments as a measure of structural representations is closely linked to a definition of the *derivational process* in transformational grammar with its different levels of representation which have since been fundamentally revised. It is therefore not at all obvious that SM experiments can validly be seen to relate to structural representations as defined in theories of grammar with an architecture that is different from that of multi-level transformational grammars. In other words, SM tasks can by no means be taken as a general-purpose measure of linguistic representation. In this context it is relevant to note that Crain and Fodor (1987) argue that SM tasks are not sensitive to the derivational process but to the correctability of the test sentences.

The fact remains that SM tasks first of all measure performance, namely the speed with which certain linguistic computations can be executed. These computations are the very procedures which are specified in a procedural per-

formance grammar which utilises the linguistic knowledge encapsulated in a competence grammar (cf. Kaplan – Bresnan 1982). In other words, the response times recorded in SM tasks are firstly a measure of the speed with which linguistic procedures are executed. It may then be possible to argue in a second step that such procedures are nevertheless linked to linguistic rules of a competence grammar and that one can therefore make inferences about such rules and the knowledge they represent. However, such a case has not yet been made.

Taking a step back from sentence matching experiments, one can see that the grammaticality effect found in sentence matching tasks is the specialised appearance of the more general phenomenon of the effect of encoding on recall tasks. As George Miller (1956) showed in his classic paper "The magic number seven; plus or minus two", the immediate memory span is determined not by the total number of items recalled, but by the number of items grouped together. Such groupings, or "chunking", can be achieved through rhythm, semantic cues or other means (cf. Kintsch 1970; Baddeley 1990).

The type of "chunking" that occurs in free recall tasks is usually determined by the skill of the subjects to form useful groups. However, if the task involves the difference between clusters of information which are grouped together in the subjects' cognitive system as opposed to clusters of information for which no ready-made schemata exist, then the existing schemata serve as the "natural" chunking principles. This is true in tasks based on hearing and seeing as well as in the recall of language. In other words, the "grammaticality effect" found in sentence matching tasks is brought about by the structuring of the stimuli on the basis of procedural skills that form the component parts of the language processor. If the procedural skill is absent, no grammaticality effect will appear.

The objective of my own study of response times in SM tasks is to test the "procedural skill hypothesis" according to which the ability to process specific linguistic structures is acquired gradually and the nature of the individual skill is the same in NS and NNS. In other words, I will apply the performance measure obtained from SM tasks to the notion of "linguistic procedures".

It is at this point that some of the assumptions inherent in the study by Eubank (1993) diverge from some of the key assumptions made in this paper. One of these concerns the notion of "processing difficulty" which surface in statements such as the following:

> We can now make the following prediction ...: for L2 learners of German, utterances of the form Adv-SVX (i.e., uninverted) are *easier to process* [emphasis added] than utterances of the form Adv-VSX (i.e., inverted) ... (Eubank 1993: 257).

Eubank tests, quite logically, Clahsen's (1984) notion of "processing difficulty" in relation to the effect of processing strategies. However, it has been known since Slobin (1966) and Goldman-Eisler (1968) that reaction times do not correlate with syntactic complexity. The reason for this lack of correlation between different measures of linguistic complexity and reaction times can be understood from within Levelt's (1989) theory according to which linguistic skills are integrated into parallel distributed routines which can all be executed at optimal times. This gain in processing time, irrespective of syntactic complexity, is one of the main features of parallel distributed linguistic routines. This also explains why ungrammatical structures and non-words usually require an increased response time in NSs (Levelt 1989; Bock 1978). In such cases there are no ready-made routines available. This applies to syntactic patterns as much as to word access.

This brief reference to Levelt's model of language production highlights the reason why I assume reaction time experiments with linguistic stimuli to measure the execution of automatised linguistic routines. Processability Theory implies that the acquisition of grammatical structures entails the automatisation of the underlying routines. For instance, when SV-agreement is acquired, one can assume that the learner has acquired the routine that processes SV-agreement. It can now be predicted for this learner that the availability of this routine releases processing procedures in sentences with SV-agreement. Therefore the learner will display response times more like those of NSs.

In other words, Processability Theory predicts a gradual transition from NNS behaviour to NS behaviour. This is in stark contrast with the assumptions underlying Eubank's study. By comparing response times between NNSs and NSs he set his experiment up to test categorial differences in the processing of language between these two types of speakers. Therefore his conclusion that "... the NSs and the NNSs appear to process stimulus sentences in different ways ..." (Eubank 1993: 279) is biased by the experimental design. Given also that he presents the response times of his informants as group mean scores one will always find a difference between NSs and NNSs as long as the NNS group contains a sufficient number of informants without the requisite skills.

This opens up an interesting perspective in comparing the procedural skill hypothesis with Eubank's "processing difference hypothesis". Confirmatory results for the procedural skill hypothesis can nevertheless confirm the "processing difference hypothesis" as long as the sample includes a sufficient number of learners who have not yet acquired the necessary skill. These learners would bring the group mean score down which would then be different from that of the NNS.

A test of the procedural skill hypothesis therefore requires a different experimental design from that in Eubank's study. Since this hypothesis predicts that NNSs who have acquired a given L2 processing skill will perform in a

manner similar to NSs in relation to this skill, one needs to base the experiments on three groups of informants:

(1) NNSs with the given L2 skill
(2) NNSs without the given L2 skill
(3) NSs (who will naturally have the given L2 skill)

This set-up will allow us to compare each of the three groups with the other groups, and it will be possible to establish if the following predictions are correct:

- Groups (1) and (3) perform in a similar way;
- Group (2) will perform unlike groups (1) and (3);
- Grammaticality effects will show only in groups (1) and (3).

Interestingly, Eubank (1993: 256) asks the crucial question: "... what happens to strategies like the IFS after rule acquisition?" However, he does not produce his own answer and sticks with his interpretation of Clahsen's (1984) work. While Processability Theory does not utilise strategies, the spirit of the answer to Eubank's question within the processability framework would be the following: the processing "shortcut" used by the learner before the acquisition of the necessary processing procedure will be replaced by the procedure itself. This is, in effect, the procedural skill hypothesis.

Clahsen and Hong (1995) are aware of the difference between NNSs with the targeted grammatical rule and those without it. They state:

> We expect the same facilitating effect [as in NSs, MP] for those L2 learners who acquired agreement and the correct properties of null subjects in German. On the other hand, those L2 learners who have not yet acquired these two properties of German should not produce significant SM differences between grammatical and ungrammatical results (Clahsen – Hong 1995: 76).

This brief quotation reveals a number of significant underlying assumptions. At a conceptual level, Clahsen and Hong assume that the same grammatical properties may develop in L2 learners as the ones that are present in L1 learners. While Clahsen and Hong refer to grammatical knowledge rather than processing routines, this assumption is similar to the procedural skill hypothesis in that features of the L1 speaker are seen to develop piecemeal in the L2 learner.

At a methodological level, Clahsen and Hong assume that the absence of grammaticality effects in the L2 informants demonstrate that the corresponding grammatical properties have not developed. While I agree with this assumption I believe that its validity has to be demonstrated empirically. In fact, this assumption overlaps substantially with the procedural skill hypothesis, for which empirical support will be presented below.

4. Experimental design

The above discussion of the experimental design of Eubank's, and Clahsen and Hong's experiments predicates the experimental design of my own study which is aimed at testing the procedural skill hypothesis. For this study, three groups of informants were included as discussed above:

(1) NNSs with the given L2 skill
(2) NNSs without the given L2 skill
(3) NSs (who will naturally have the given L2 skill).

The particular skill to be tested was German subject-verb agreement which is also one of the structures included in Clahsen and Hong (1995). All materials were taken from the Clahsen and Hong study which demonstrated grammaticality effects with these materials in NSs and NNSs.

The task of the subjects was to judge if two sentences that appeared on a computer screen with a short time interval (360 msc.) were identical or not. A computer program was used for the purpose of managing this experiment. This program was based on a Hypercard stack made available by Robert Bley-Vroman and Deborah Masterson. I modified this software in several areas, most significantly to include a reliable and finely tuned method of recording response times at intervals of 5 msecs.,[1] since the original program made use of the system clock which only achieves a resolution of one sixtieth of a second (= 17 msecs.) and, more importantly, is reported to be unreliable[2] for the purpose of accurate time recording within the given application.

The program recorded the subject's response time to each of the test items starting from the moment at which the second item first appeared on the screen. If no response was given within 5 seconds or an inappropriate key was pressed, a warning was given. The program also displayed the test items on the screen in a random order and in one of four random positions which were indicated by a visual clue before the second sentence appeared. This clue serves two functions:

> The first is to alert the participant that appearance of the pair sentence is imminent, encouraging a high level of attention; the second purpose is to force the participant to focus momentarily on a new image and, it is hoped, to "erase" the visual image of the priming sentence, forcing the participant to rely more heavily on representations other than the visual (Masterson 1993: 94-95).

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[1] The program itself can record time at a finer resolution. However, the computers used in the experiment introduce an error margin of 5 msec through variation in keyboard response.

[2] Cf. *Inside Mac* 6: 239; D. Goodman: *The Complete Hypercard 2.0 Handbook* p. 601. I would like to thank John Tucker for his programming assistance in this project.

The experiments were carried out at the Australian National University on a Macintosh computer. Each informant was tested individually in the presence of a trained test co-ordinator who was a NS of English and a near-native speaker of German. The test co-ordinator explained the test procedure and the computer controls. Each test taker was given the opportunity to learn to use the control keys for the responses "same" and "different" (marked with the colours red and blue on the key board and the control key (space bar) for "next item". They were also given unlimited time to respond to 10 training items and were tested for their average reaction time using 10 stimuli.

Each of the three groups of informants consisted of seven persons. In order to determine NNS group membership GSL interlanguage samples were collected from learners of German as a second language (ANU students of German). The samples were analysed according to stage of acquisition, and learners whose samples were able to be classified as below Agreement and above Agreement were assigned to the corresponding group of informants. In this way it was ensured that the learners' oral production was used as an independent measure of their processing skill. One would now expect that those learners who display evidence of not having acquired Agreement will not show grammaticality effects with test items based on Agreement.

The sentence matching experiments were carried out several days after the collection and analysis of the interlanguage samples. The whole sequence of experiments was completed within two days.

The materials used in this experiment are taken from the Clahsen and Hong (1995) study. It is therefore appropriate to quote the description of the relevant material by those authors:

> The main items of the experiment were grammatical and ungrammatical German sentences containing violations of subject-verb agreement and the null-subject property. The overall ratio of grammatical an ungrammatical items was set at 1:1. The experimental items are presented in Appendix 1.
>
> *a Agreement*: Three grammatical sentences were constructed for each possible combination of three grammatical persons in singular or plural, resulting in 18 items altogether. To minimise the effect of lexical idiosyncrasy, only regular high-frequency verbs of German were used (cf. Ruoff, 1981). In addition to that, the length of the sentences was controlled with respect to number of words and number of syllables: for each sentence, the number of words was either 6 or 7, and the number of syllables was 10 or 1. Ungrammatical sentences differed from their grammatical counterparts only in their verbal suffix, as illustrated by the following sentence pair:

8) a. Du flieg-st nach Korea am nächsten Sonntag
you fly-2nd sg. to Korea next Sunday

b. *Du flieg-t nach Korea am nächsten Sonntag
you fly-3rd sg to Korea on the next Sunday [sic].
(Clahsen – Hong 1995: 72)

For the purpose of the present study only items related to subject-verb agreement were selected. These were complemented by filler items as in Clahsen and Hong (1995):

> *c Filler items:* Two kinds of filler items were used to make sure that the subjects were in fact performing the task accurately: 1) nonmatching pairs in which one word of the second sentence was replaced with a different one of the same length (cf. 10); and 2) pairs of meaningless word strings consisting of 6/7 constituents (cf. 11). These filler items were not included in the data analysis:
>
> 10) Du schwimmst jeden Morgen in der Schwimmhalle
> Du schwimmst jeden Abend in der Schwimmhalle
> 'you swimm every morning/ evening in the swimming pool'
> 11) Zu Blume die kochen Auto deutsch
> 'to flower the cook car German'
>
> The overall ratio between matching and non-matching pairs was set at 3:1; ... i.e., in the agreement condition, 11 filler items were used ... (Clahsen – Hong 1995: 73).

The average response times are listed for every informant in Table 1 which therefore also lists all 21 informants. The age range of the informants was between 19 and 31 years with the exception of Kees who is 71 years old.

5. Results

As in Freedman and Forster (1985) and Clahsen and Hong (1995), only those matching items were included in the analysis to which a correct response was given. The results of the experiment are presented for the three groups that participated, namely seven native speakers of German, seven post-agreement non-native speakers of German and seven pre-agreement non-native speakers of German. Table 1 lists the mean response times for all 21 informants.

The mean correct same response time for ungrammatical items was 229 msecs longer for NSs and 215 msecs for Post-agreement NNSs. The corresponding figure for Pre-agreement NNSs is 9 msecs. All NS and all Post-agreement NNSs show shorter response times for grammatical items, while for Pre-agreement NNS this is not the case. The one-way ANOVA results show that the difference between response time for grammatical and ungrammatical items is significant only for the NS and the Post-agreement NNS, but not for the Pre-agreement NNS. Theses results support the hypothesis that skilled NNSs behave more like NSs than "un-skilled" NNSs in the particular linguistic skill they have acquired.

Table 1: Mean response times in milliseconds by informants

Target language: German
Structure: subject-verb agreement

Native speakers

	gram.	ungram.	reaction time	difference
Christian	1376	1470	289	+94
Gaby	1329	1624	432	+295
Walter	1356	1626	238	+270
Silke	1318	1677	257	+359
Winfried	1343	1416	191	+73
Lan	834	1055	285	+221
Günter	1382	1673	295	+291
Mean	**1277**	**1506**	**284**	**229**

Post agreement learners

	gram.	ungram.	reaction time	difference
Alex 08	1833	2254	276	+421
Neri 08	1290	1752	221	+462
Mel 08	1178	1349	287	+171
Julie 08	1596	1828	287	+232
Lena 08	1038	1149	286	+111
Stefanie	1833	1920	446	+87
Melanie	1330	1349	218	+19
Mean	**1443**	**1657**	**289**	**215**

Pre agreement learners

	gram.	ungram.	reaction time	difference
Dean	1999	2060	345	+61
Douglas	1921	1931	257	+10
Kees	3653	3597	493	–56
Jeremy	2054	2087	178	+33
Alex 2	2254	2260	282	+6
Guy	2331	2327	291	–4
Peter	2415	2427	283	+12
Mean	**2375**	**2384**	**304**	**8.86**

Table 2: Mean RTs for agreement

	Grammatical	Ungram.	ANOVA	Scheffe-F
Native speakers	1277	1506	F=31.734 (6,7)	$p \leq .0013$
Post-agreement	1443	1657	F=11.304 (6,7)	$p \leq .0152$
Pre-agreement	2375	2384	F= .428 (6,7)	$p \leq .5371$

*significant at 95%

In addition to the above comparison of reaction times within groups for the two conditions "Grammatical" and "Ungrammatical", an ANOVA analysis was carried out comparing the reaction time differences between the three groups of learners. The analysis supports the same trend: NSs and Post-agreement NNSs are similar, and Pre-agreement NNSs are different from the other two groups. A significant difference between groups ($F=7.697$ (2,18), $p \leq .0038$) was found. The significance levels according to the Scheffe F-test were as follows:

Comparison	Scheffe F-test
NS vs Post-Agreement	.026
NS vs Pre-Agreement	6.146*
PostAgr vs PreAgr	5.374*

*Significant at 95%

The rests of periments confirm the procedural skill hypothesis. It was possible to demonstrate that for the three groups

(1) Post Agreement NNSs
(2) Pre Agreement NNSs and
(3) NSs,

the following is true:

- Groups (1) and (3) perform in a similar way;
- Group (2) perform unlike groups (1) and (3);
- Grammaticality effects show only in groups (1) and (3).

In other words, the grammatical skill that produces subject-verb agreement develops in NNS in the same way as in NS, and there is no fundamental difference in language processing between NNS and NS as suggested by Eubank (1993). This is strong support for the procedural skill hypothesis.

I hasten to add that the procedural skill hypothesis does not imply that there is no difference between L1 and L2 acquisition. All it implies is that any such differences will be outside the domain of language processing. In Pienemann

(1998) I show that there are, in fact, fundamental differences and that those are to be found in the initial hypotheses of the learner and the developmental dynamics that follow from those hypotheses.

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