

## Errors aren't failures: on the need of *INFORMED* error analysis for efficient language instruction

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### 1. Abstract

Der schulische Erwerb einer Zweitsprache ist ein langwieriger Annäherungsprozess an ein bekanntlich nicht völlig zu erreichendes Ziel. Der Weg führt unvermeidlich durch Stadien, die sich vom angepeilten Ziel stets unterscheiden. Diese Stadien („*Lernsequenzen*“) lassen sich anhand ihres jeweils charakteristischen Abweichungsprofils („*Fehler*“) identifizieren. Das jeweilige Fehlerprofil ist das Diagnoseinstrument für die Bestimmung der jeweiligen Lernphase. Da L2-Erwerb aus neuro-kognitiven Gründen (siehe „*sensible Perioden*“) eine Phasenabfolge aufweist und (im Unterschied zum L1-Erwerb) *phasenspezifisch gezielt* instruktionsbedürftig ist, müssten Lehrer/innen zu kompetenten Diagnostiker/innen ausgebildet sein, um mit evidenzbasierten effizienten Maßnahmen effektive Lernfortschritte bewirken zu können.

Die derzeitige Ausbildungssituation ist in einem entscheidenden Punkt mangelhaft. Benötigte Kompetenzen werden nicht vermittelt, obwohl einschlägige Forschungsergebnisse in großem Umfang in den letzten vier Jahrzehnten - außerhalb der „*Lehrerfächer*“ - erarbeitet worden sind. Grund dafür ist nicht zuletzt die zu kleine Parzellierung und zu große Traditionsverhaftetheit der (Sprachen)lehrausbildung im deutschsprachigen Raum. Argumente dafür, wie diese tatsächlich noxische Situation zu vermeiden ist, bilden den zweiten Fokus des Beitrags.

### 2. Introduction – The situation of the learner

This is a paper on ‘*informed* error analysis’, *not* on ‘error analysis’ familiar from the seventies (see Corder 1974, 1981). In language acquisition, an error is a symptom of a given stage of the learners’ attained procedural knowledge of the given language. In most cases, the learner is not even aware of a particular error. Typically, learners do not know it better nor would they be able to correct deviances. For the language teacher, these deviances are the essential feedback, both on the learners’ progress as well as on her/his own success as teacher and therefore (s)he must be enabled to interpret the feedback qualities properly. However, error analysis is dependent on a thorough understanding of the conditions of second language acquisition on the one hand, and on the other hand, the teacher must be analytically competent in the grammar systems involved, namely that of the L2s (= second languages<sup>2</sup>) and of L1 (= mother tongue). This is the essence of *informed* error analysis. Its focus crucially is not on errors, but on what they are symptoms of.

L2 acquisition compared to L1 acquisition is ‘handicapped’ language acquisition. Beyond the sensitive ages (see Meisel 2011: 222), the L2-acquisition processes become an arduous task. It is an underestimated fact that the neuro-cognitively determined best time windows for ‘ab-

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<sup>1</sup> The paper has benefitted from peer reviewing and the author is grateful to two anonymous reviewers for criticisms and suggestions. Thanks to Greg Dogil for drawing my attention to the work of T.Hensch. Remaining shortcomings are to be blamed on the author, of course. During the time as professor of Germanic Linguistics at the University of Stuttgart (1987-1996), he was engaged in teacher education (*Staatexamen Germanistik*).

<sup>2</sup> Interference from L3 or L4 may be as intense as that from L1 on L2. This has already been suggested by the findings of Dewaele (1998) and Williams & Hammarberg (1998).

sorbing' a language in the child's truly easygoing way of native language acquisition are closing before our schools start language instructions. Typically, pupils in German speaking areas are confronted with their first serious foreign language lessons at the age of 10. However, the easy paths of second language acquisition in the nearly native style disappear around 8 to 9 years of age, as a consequence of the neuro-cognitive development of the brain.<sup>3</sup> From then on, the acquisition of any L2 language differs significantly from the L1 acquisition of the same language, both in terms of ease, progress and ultimately attainable level.

In L1 acquisition, all you need is natural input, that is, people to talk to. This is not sufficient anymore for a successful L2 acquisition, contrary to popular but empirically unsubstantiated beliefs motivating so-called 'communicative' language schooling. Effective L2 acquisition depends on *specific* guidance. In L1 acquisition, within few years, typically in the time span between 2,5 and 6 years of age, approximately 96%<sup>4</sup> of all children master the highly complex task of grammar acquisition spontaneously and effectively. They unconsciously identify and internalize the system of rules (viz. the grammar) that determines the complex patterns of expressions in the given language.

After the sensitive age periods<sup>5</sup> (whose accumulation amounts to critical periods) of L1-like acquisition (1 to 3,5 to 7 years of age; Meisel 2011:246), language acquisition loses its unprompted quality. The process of acquisition becomes qualitatively different. From then on, the age of the learner does not matter much anymore. Beyond the sensitive ages, the acquisition of another language will be equally cumbersome, compared to a child's ease of acquiring the very same language.

What this indicates is an essential difference in the acquisition process. This difference tends to be overlooked in debates on language instruction strategies. Children will accomplish language acquisition without any instruction *within* the sensitive periods. Being an active and integrated member of a community that uses the respective language(s) is fully sufficient. Language learners *beyond the sensitive ages* are typically at a loss. Their process of acquisition resembles more that of impaired L1 acquisition, with parallels, for instance, to the highly impaired acquisition by children suffering from specific language impairment (SLI). Merely being exposed to language use is not sufficient any more for successful acquisition. At the neuro-linguistic level, inhibitory networks (that stabilize inter alia L1) impede the acquisition of L2.

Recent findings in brain research produced experimental support. The existence of an inhibitory threshold was demonstrated by using gene disruption technology in mice to prevent the rise in

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<sup>3</sup> Synaptic pruning and ongoing myelination (see Casey et als. 2005:105) are major sources of brain organization and consolidation during childhood. These processes are operative at different times in different areas of the brain. This accounts for the time windows (aka *sensitive periods*) for the acquisition of particular capacities.

<sup>4</sup> Approximately 3-5% suffer from language acquisition impairments (SLI = specific language impairment), in the absence of impairments of any of their nonverbal cognitive capacities. Arguably, they lack the *specific* support that a human brain typically provides for acquiring and organizing the complex system of principles, that is, the grammar system of a language.

<sup>5</sup> A *critical period* is the time when environmental input is required for the proper development of a particular brain circuit. If the circuit is left unstimulated, the brain function served by that circuit will be permanently compromised. A *sensitive period*, less stringent than a critical period, is the time when environmental experiences have the greatest impact on brain circuitry (Hensch & Bilimoria 2012:2)

GABA levels, the main inhibitory neurotransmitter of the central nervous system (Hensch et al. 1998, Fagioni & Hensch 2000). Bardin (2012) is already optimistic enough to predict the advent of substances for ‘unlocking’ the brain. For the time being we still need effective teaching. This is confirmed by another finding (Maya-Vetencourt 2013): Cortical plasticity can be triggered not only by pharmacological treatments but also in a non-invasive style by strategies based on the enhancement of environmental stimulation levels characterized by enhanced task-specific sensory-motor activity and social stimulation. In our case, the task is language acquisition and enhancement of the linguistic environment. This requires a specifically trained teacher, however.

It is typical of unguided or ill guided second language acquisition that the process gets stuck sooner or later. This is called *fossilization*.<sup>6</sup> In principle, it affects all levels of the linguistic system that are procedurally controlled. It is mainly a result of a particular lack of linguistic awareness. Typically, the L2 speaker is systemically unaware of deviant pronunciations, has persistent difficulties controlling the morpho-syntax, and sticks to deviant syntactic patterns. His or her aberrant L2 characteristics enter the chronic phase.

L1 learners, on the other hand, uniformly (except for the 3-5% mentioned in fn. 3) pass the finish line; L2 learners, however, typically do not. The major challenge for language teaching is specific support for efficient L2 acquisition. ‘Specific’ is the crucial term. It is not the quantity that matters, it is specificity and timing. A teacher must be able to determine what is effective for a given learner in the given stage of learning the language. It is very easy to frustrate language learners with inefficient instruction, and it is very hard to provide a language student with the really helpful quantity of useful input. This ability is what characterizes the efficient teacher and separates her/him from many of the colleagues that merely strain pupils and subsequently blame them for being so extremely unreceptive.

## 2.2 The situation of the teacher

The language teacher is in a situation comparable to that of a physician, although most teachers are presumably unaware of this. Their task is to provide adequate means for someone to exit a given state and arrive at a preferred one. A physician first seeks the appropriate *diagnosis* and then decides on the proper *evidence-based therapy*. Eventually (s)he *evaluates* the success of his/her interventions. Trial and error should be a last resort strategy only, as an unreliable and unprofessional strategy. An essential component in this process is communication since all necessary decisions are dependent on the patient’s feedback, and the patient wants feedback from the doctor, too.

Analogously, a language teacher ought to be a specialist in the diagnosis and supportive ‘therapy’ in the learner’s language acquisition process. Surely, it would not be enough to tell learners what they have accomplished and what not. Analogously, a patient would not have to accept a physician’s diagnosis like “*Sorry, you are lacking the capacity appropriate for your age. Therefore, I have to grade you as failed on this medical test. Try harder or you will miss the target of your age class.*” This is a ‘no go’ in each profession.

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<sup>6</sup> There are different notions of *fossilization* by different scholars, as e.g. *learning plateau*, *backsliding*, *stabilized errors*, *de-acceleration of the learning process*, *systematic use of erroneous forms*, *cessation of learning*, or *persistent difficulties*. For Selinker and Lamendella (1978), fossilization is the permanent cessation of *interlanguage* before the learner has attained target language norms at all levels of linguistic structure.

A language teacher must be able to identify the *cause* of the trouble that shows in symptoms (that is ‘errors’) in order to determine what an effective ‘therapy’ could be. And how does a teacher find out what has to be done? First, teachers must be experts for identifying syndromes, just like physicians, and next they must be able to professionally ‘examine’ their ‘clients’, in order to identify the particular needs. A teacher ought to be equipped with a set of reliable ‘therapeutic’ measures, with a strong emphasis on ‘evidence-based’. Finally, the teacher must be able and willing to evaluate the success of the chosen means. On top of it, the enterprise must be framed in a continuous process of feedback between teacher and pupil(s), crucially in *both* directions, that is, from teacher to pupils and even more so from pupils to teacher, as clearly emphasized by Hattie (2009:12, 174-76): “*The most powerful single influence enhancing achievement is feedback.*”

Currently, teacher education in Austria or Germany does not provide teachers with the required competences listed above at all.<sup>7</sup> Traditionally, a forthcoming language teacher mainly receives training in the language (s)he is supposed to teach, that is, the teacher’s *own* L2 abilities are schooled. It is an (outdated) tradition, too, at least at Austrian universities, that the relative majority of the curriculum for language teachers is devoted to the occupation with the literary works in the given language and with contemporary literary theorizing, although its usefulness for the classroom work (except maybe for teaching of L1) is neither evident nor proven.

The third traditional component of the curriculum is schooling in pedagogics and didactics. Becoming acquainted with varieties of teaching strategies or techniques of classroom management is fine for a future teacher, but not sufficient. The diverse field of education science does not cover the specifics of learning *languages* as a basic area of the professional knowledge for language teaching. This is neither a research field of education studies nor an established research area of the departments that take care of language teacher education. It is a research field that has developed in the past fifty years outside the teacher education departments. It is the domain of language acquisition research in combination with psycho- and neuro-linguistics of language acquisition as a field of cognitive science.

In German-speaking areas, unlike the English-speaking countries, this field has not been generally recognized yet as an essential partner in the academic education of language teachers. A substantive amount of relevant results from more than four decades of basic research is still awaiting the attention it deserves for language teacher education. Roth (2011:25) puts it unmistakably: “*Without any ifs or buts, pedagogics and didactics must integrate established insights from psychology and neurobiology into their teaching and learning concepts.*”<sup>8</sup> For language teaching, this evidently includes psycho- and neuro-linguistics.

<sup>7</sup> This statement rests on the results of a random sample of ‘Studienpläne’ for teachers of English (HU-Berlin, Marburg, Mainz, LMU Munich, Vienna, Salzburg). Course requirements for *neuro-psychology of learning, psycholinguistics of L2, L2 acquisition of English by learners with L1 German, German-English comparative analytics, sequence-based error analysis*, to name some of the essentials, are either completely missing (Mainz, München LMU, Wien) or they are condensed in a two-heours course (HU-Berlin, Marburg). Interestingly, the qualification profile defined by the Dept.of English in Vienna lists all the requirement but does not offer the corresponding courses: [http://anglistik.univie.ac.at/fileadmin/user\\_upload/dep\\_anglist/StudienServiceStelle/Studien/Mtbl\\_2010\\_2011\\_128-1.pdf](http://anglistik.univie.ac.at/fileadmin/user_upload/dep_anglist/StudienServiceStelle/Studien/Mtbl_2010_2011_128-1.pdf)

<sup>8</sup> Original version: „Pädagogik und Didaktik müssen ohne Wenn und Aber gesicherte Erkenntnisse der Psychologie und Neurobiologie über „Lehren und Lernen“ aufnehmen und in ihre Konzepte einbringen.“

What is indispensable<sup>9</sup> for the language teachers' curricula is the very subject area that is necessary for empowering the future teachers for becoming competent facilitators of language acquisition. It is the area of language acquisition as a *domain-specific* cognitive process in the domain of *procedural* cognitive capacities. Procedural learning is different from all other areas of *declarative* learning processes. Pedagogics, when it focuses research on school agendas, is primarily focusing more on teaching than on learning, and when it focuses on learning, it focuses on *declarative* learning since this is the learning activity that is characteristic of all school subjects except languages (and sports).

Language learning is fundamentally different from learning chemistry, geography, or history, to name just a few subject areas of declarative learning in school. Language learning is procedural learning (see Morgan-Short and Ullman 2011). Even if you knew everything about English declaratively this would not enable you to use English in real life situations. These two kinds of learning processes are entirely different and so are the neuro-cognitive systems that support these learning processes. Since they are different, there is no uniform ensemble of teaching approaches that works jointly for the two areas, contrary to beliefs in general education theory in cases where learning is misperceived as a homogenous totality of general purpose learning activities, that is, declarative learning.

The language teacher must be an expert in language *acquisition*. For geography or chemistry, you do not need to be an expert for the *acquisition* of geographical versus chemical knowledge.<sup>10</sup> The learning process in these areas is just a domain-general process of declarative learning. A teaching technique that proves useful and effective for geography can easily be transferred to teaching physics or history. It is merely the particular substance matter that would differ, not the process of learning. But it is unlikely that it works for language learning.

### 3. Elements of informed EA - Learning sequences and sequence-dependent errors

This section of the paper deals with the central aspect mentioned above, namely the *diagnostics* of the progress of acquiring a language as a basis for teaching decisions. This is the domain of informed error analysis. An ultimately successful teacher would need to know precisely 'where' his students are at any time in the apparent maze of the language system they struggle to acquire. The difficulty is that the learners will be scattered over different 'locations' of the learning sequence for the particular language. An age-based school class is never homogenous. So the teacher will always have to devise a multi-level strategy. He needs to be able to identify at least the lower and the upper threshold of the group.

A most valuable inspection window is the continuous observation of 'error'-patterns. Actually, 'error' is an unsuitable term for most of the deviances the teacher will observe. The learner does not 'err'. (S)he simply does not know how to do it otherwise (viz. correctly). Moreover, this concept invites a depreciative connotation. To put it simply, if you commit an error or a

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<sup>9</sup> One of the reviewers justly remarked that this statement is not evidence-based. This is correct. You cannot study the present outcome of presently inexistent qualifications. Analogy helps. In ski jumping, for instance, successful trainers have to understand and apply a lot about biomechanics and motor learning expertise. Language teachers should understand a lot of classroom-relevant details of the cognitive processes of learning and using a language. They generally don't, I fear, since they do not receive any of the necessary training.

<sup>10</sup> Interestingly and contrary to widely held beliefs in teacher training, there is no positive correlation between the subject matter knowledge of the teacher and the success of learners in the subject area (Hattie 2009:109, 113f.).

mistake you do something wrong and you feel bad. In exercise books, errors and mistakes are marked in red to signal the stop sign. “Stop committing mistakes; the sooner the better!”

Most errors or mistakes in language learning are not genuine errors or mistakes. If they were, this would indicate that learners could avoid them if they only would try to. Typically, this is impossible for the learner at the given stage. The particular error patterns are symptoms of the level attained while approaching the system of language you are targeting. As symptoms, they are the most valuable source of information, both for the teacher as well as for the learner, but only if the teacher knows how to deal with them. This is the topic of this section.

The term ‘error analysis’ (EA) has become popular more than forty years ago, promoted by Corder in his work (1974,1981). EA was propagated as a principal means of conducting research in L2 acquisition. Its popularity was short-lived, though (see Ellis and Barkhuizen 2005, ch. 3). Its shortcoming is its exclusive focus on descriptions and taxonomies of errors. Taxonomies like ‘omission’, ‘misinformation’, ‘regularization’ etc. are insignificant by themselves. What has been underestimated is the fact that errors are merely *symptomatic*. They are not the primary objects of interest. The error is not the target. It merely is a symptom. The primary object is the correct identification of the *temporary stage* of the learners’ L2 know-how that becomes partially accessible via the analysis of the error patterns.

The analysis of error patterns needs to be part of a more comprehensive analysis. The full picture consists of the identification of the trouble zones relative to the already mastered parts of the L2 system. One aspect is the structure of *deviant* utterances; another equally important aspect is the *avoidance* phenomenon, that is, the identification of structures that are *avoided* in order to sidestep difficulties that might trigger incorrect utterances (see Schachter 1974). At a given stage, some learners may appear to be more advanced than they are if one merely looks at the quantity of errors they produce. These learners may be successful in avoiding problem areas and their shortcomings would show only under controlled testing. Counting would not be informative. In other words, pupils with a higher number of errors might be more advanced than pupils with a lower number. It is the kind of error patterns that matters. There are good and bad errors. ‘Bad’ errors are those that are setbacks on levels that had been passed already. Good errors are those that go together with a step ahead towards the next level. Each level provokes typical errors

Let me re-introduce once more the analogy with diseases. The way in which EA had been conceptualized is analogous to collecting and classifying a lot of symptoms *without* relating them to particular diseases. In medical reality, as we all know, the main concern is not collecting and fighting symptoms. The symptoms merely help identifying the disease, and the disease is the target of treatment, sometimes even with temporary aggravation of the symptoms.

In language learning, we do not treat diseases, of course. However, in both instances we deal with *systemic* properties. The symptoms are characteristic of a particular state of the learner’s L2 system. This is the target of the interventions. The correct identification is essential for

deciding the correct treatment of the patients on the one hand and the L2 learners on the other hand. Unfortunately, there are no pills for curing a learner's deviant L2 system.<sup>11</sup>

For the sake of concreteness, let me illustrate the preceding considerations. Let's assume a beginner of English as L2 wants to formulate an utterance that conveys the message expressed by a German clause like (3).

(3) Sagte er gestern etwas Neues?

Depending on the proficiency level of the class, a teacher will encounter a variety of deficient attempts, some of which are listed under (4). The asterisk sign marks deviant utterances. Italics mark the 'offensive' parts.

- (4)
- a. Did he tell anything new yesterday?
  - b. \**Said* he yesterday *something* new?
  - c. \*Did he say *yesterday* anything new
  - d. \*Did he *yesterday* say anything new (given that he *always* tells something new)
  - e. ?Did he say *something* new yesterday?
  - f. ?*Has* he *said* anything new yesterday?

If this was part of a written test, the pupils would be returned their corrected versions, full of red marks. They would briefly glance at the grading and then, depending on the quantity of red marks, close their exercise books with more or less discontent. In this moment, all they realize is that they failed again to a greater or lesser extent. For quite a few, this merely adds to a growing dislike. It goes without further explanation that hardly anybody enjoys being confronted with one's shortcomings.

For the learning process, these are critical situations whose positive potential must not be wasted. The learners deserve two general messages, not just one overly detailed negatively biased one. They first need feedback and positive affirmation on what they have already accomplished. Next, and importantly, they need information about what are the specific *areas* (not the *details*) of future attention in order to make further progress. Eventually, the teachers must analyze the results of testing in order to update their own records on the teaching progress they made by evaluating the effects of their teaching efforts on the learners.

One thing should be clear. It does not help to simply tell the pupils what they did wrong and what is correct. Most of their deviant productions are not mistakes resulting from negligence. The errors show what kind of competence is still missing and the teacher must be able to identify it. Curing single symptoms would not help. The learners must be enabled to accomplish the next higher level. This will cure the given symptom and prevent all other symptoms of the same kind. In order to explicate this, we need to go into some detail:

As for the deviant variants in (4), there are at least *four* different areas of grammatical know-how involved. First, English is exceptional with regard to the *positioning* of the *finite* verbs. Auxiliaries and modals are 'mobile', main verbs are not (4b). 'Mobile' means that finite auxiliaries and modals have to be fronted to the position preceding negation or to the clause initial position, as in interrogative constructions. Main verbs, however, always stay in place. So,

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<sup>11</sup> But pharmacological means for partial re-accessing levels of brain plasticity similar to sensitive periods by weakening hormone-triggered inhibitory neural mechanisms are currently under research (see Bardin 2012).

in obligatory fronting contexts (negation, interrogative), English is exceptional. In these contexts, it employs a dummy auxiliary, namely ‘do’. Cross-linguistically, this is a highly exceptional trait of English, but teachers are not aware of this and its consequences for acquisition.

*Second*, English is a typical case of a ‘VO’ language, that is, a language in which the verb precedes its objects.<sup>12</sup> In this type of language, adverbials are not allowed to intervene between the verb and its object (4c). In addition, only a subset of adverbials may immediately precede the verb (4d). This condition is completely absent in OV languages like German. Adverbs are serialized ‘freely’ in this language type. So, learners tend to overgeneralize.

Third in English (4e), ‘some’ is to be distinguished from ‘any’, since ‘some’ presupposes the existence but any does not, as in: *How many times did you observe anyone/someone telephoning while driving?* In German, a single element is used in each of the two contexts. Learners have difficulties in differentiating the contexts for *some* and *any*, and disregard the latter.<sup>13</sup>

*Fourth*, a restriction of the tense system is involved. English requires distinguishing clearly between the contexts for past and for present perfect tense (4f). In German, however, especially in spoken varieties in the Southern areas, past and perfect tense are treated as exchangeable, with perfect tense being favored.

Typically, pupils receive the corrected versions as the main feedback information. These details are completely uninformative, however. It is the teacher’s task to guide the pupil to the appropriate next step. Unfortunately, most teachers are at a loss in these situations since they have not been equipped with the necessary professional competences. They have not been trained in identifying the relevant systematic differences between German and English as L2. As native speakers of German, they are completely unaware of the *systematic* characteristics of German. Next, they have not been equipped with an evidence-based roadmap of the L2 acquisition of English (‘learning sequences’). Finally, they are unable to do informed error analysis since this presupposes the other two competences. In sum, they are unable to proceed professionally. This lack of professional competence is not the teacher’s fault, of course. It is a severe shortcoming of current teacher education (see Haider 2010 for details).

#### 4. The situation of the language learning task – procedural, not declarative.

Language acquisition is fundamentally different (see Ullman 2005, Morgan-Short & Ullmann 2011) from content-oriented areas of learning. It is *not* the acquisition of a body of declarative knowledge; it is the acquisition of a particular, procedurally encoded *know-how* for performing a particular complex *activity*. In the case of language learning, there is no body of

<sup>12</sup> English is VO, German is OV, as the following expressions exemplify:

- i. [tell the truth], [tell the audience the truth]
- ii. [die Wahrheit sagen], [dem Publikum die Wahrheit sagen]

German, like all the Germanic languages except English, fronts the finite verb in main clauses. This masks the original positioning of the verb at the clause final position in clauses without auxiliaries.

<sup>13</sup> If the English teacher had a training in comparative syntax (German-English), (s)he would be in the comfortable position to show the learners a rule of the thumb: The contexts for ‘any’ in English are the very contexts in which ‘je’ or ‘jemals’ is licit in German, since both items (i.e. *any* and *je*) are *negative-polarity* items.

- |  |   |   |
|--|---|---|
| a. Nobody saw <i>any</i> daffodils there     | – | Keiner hat da <i>je</i> Narzissen gesehen |
| b. *Everybody saw <i>any</i> daffodils there | – | *Jeder hat da <i>je</i> Narzissen gesehen |
| c. Did you see <i>any</i> daffodils there?   | – | Hast du da <i>je</i> Narzissen gesehen?   |



knowledge the learner could learn by heart and reproduce. The ‘proof of the pudding’ is the ability of adeptly using the language in production and reception.

Procedural learning is a much more challenging process than declarative learning. Coaching successful procedural learning is by far more demanding than teaching declarative contents. A first and major obstacle is the *rigidity* of the learning process, in contrast to the plasticity in declarative learning. Declarative learning is *order-free*. Our brain is principally able to ‘digest’ declarative contents like our stomach digests food, namely in any incoming order.

Procedural learning is rigid. It is stage-dependent and it must be steadied by continuously exercising it. We are unable to advance a higher level of mastering a complex procedural capacity before we have mastered the preceding stage which this level is dependent on. This is a well-known fact and it is established in other fields of procedural learning, like in motor learning as in sports or in learning to master a musical instrument. In language teaching, however, teachers cannot know these sequences since teachers are not instructed this way.

Let me give an example: Language teachers often complain about the low degree of sustainability of their teaching efforts. A given specific trait of a language is specially exercised and repeated for a lengthy period in preparation for a written test (‘Schularbeit’). In the test, quite a few pupils seem to master it satisfactorily. A few weeks later, however, even these pupils seem to have completely ‘forgotten’ what they had been exposed to and they proceed as if they had been absent at the lessons preceding the test. In retrospect, these lessons appear to have been a waste of time and efforts, obviously. What was the problem?

In many of these cases, the cause of the disaster is the incapability of identifying the stage-dependent elements of the learning task that the teacher expected the pupils to be able to master. Every time a text book presents a new task that is ill-scheduled in terms of the phase-dependent cognitive road map, the pupils will be unable to transfer it into their procedural repertoire. They will do their best and memorize what they are able to memorize, that is, they try to grasp it declaratively. If at a given stage they are unable to integrate what they memorized into their procedural repertoire, it does not matter how often it is explained to them or exercised, simply because it is premature for them. You are unable to genuinely exercise an activity that you are unable to perform properly at your given stage of expertise. Entrenching by exercising means that first of all, you perform the activity properly and second, cycles of exercising the activity contribute to turn the activity into a habit. Exercising without access to the supporting cognitive routines of the activity will have no long-lasting positive effect.

As a consequence of inappropriate timing, procedural acquisition fails. The alternative attempt, viz. declarative learning of abstract patterns, is short lived, however. This is at the very source of the teachers’ complaints. What they (and the text book authors, even more so, of course) would desperately need is an evidence-based road-map of the stage-progressions in the procedural learning of a given language in terms of the details of language structures.

Whenever you bother pupils ‘counter-stage-wise’ you will be punished by their brains that are structurally unable to cope with the task. They will not be able to integrate the new information structure properly and the teaching efforts will disappear into thin air very soon afterwards. As a teacher you would need to know what the appropriate moment for the next step is within the sequence of learning stages and what the next step will consist of in terms of lan-

guage routines to be put on the class room agenda next. In other words, the specifics of ‘learning sequences’ must be part of the teacher’s professional competence. Here is an illustration.

Scandinavian languages like Danish or Swedish share with German the very same abstract build-up of a declarative clause, that is, the inflected verbs follows a freely selectable item. This is a property common for all Germanic languages (except English).

- (1) a. Denne bog [*har* [Bo læst]] (Danish)  
b. Dieses Buch [*hat* [Bo gelesen]]

Nevertheless, learners do not take advantage of this general identity of patterns, as e.g. Håkansson et. als (2002) report. Instead of using the pattern that is familiar from their L1 (2a), Scandinavian learners are likely to produce a pattern that is ungrammatical both in their L1 and in German, namely (2b), instead of (2c). This is the very same pattern Turkish or English learners produce, too. This is the effect of the rigidity of the learning sequences mentioned above. (2b) reflects a step in the rigid learning sequence of German.

- (2) a. Här bor många studenter som cyklar (Swedish)  
hier leben viele Studenten die rad-fahren  
b. Hier viele Studenten leben die Rad fahren  
c. Hier leben viele Studenten die Rad fahren

In their earliest phase, learners start with a semantically geared “Subject-verb-object” pattern, followed by “Adverb-Subject-verb-object” followed by the phase when the learner eventually ‘understands’ that the first position in the German clause is accessible for any arbitrary single item, followed by the finite verb (cf. Pienemann 1989a,b).

The next and obvious question to ask is this. If obedience to ‘learning sequences’ is essential, why is the relevant knowledge not part of the schooling of language teachers? Why is it so that the education of language teachers still does without the essential empirical basis for monitoring the language acquisition of their learners? The psycholinguistic concept of ‘learning sequence’ and its language-specific implementations has not entered the respective language teacher departments. At universities, the relevant knowledge is typically produced outside the traditional academic teacher departments, but they do not bother insourcing it.

## 5. The situation of teacher education

In Austria (which is to a large extent representative of German speaking countries in general) teacher education has developed into a kind of closed-shop setting. It is the territory of academic disciplines that are confined in their traditions. The internal organization of most of the ‘philological’ departments has not changed principally for a century. The traditional canon partitions the subjects and personnel into research fields as literature (majority), language, and the history of the language as reflected in the literature plus some practical advice in ‘Fachdidaktik’. A department with a sufficient number of internationally acknowledged research positions in (second) language acquisition is still a rare exception. Research on language learning and the consequences for teaching is not institutionalized as a necessary part of the obligations of a language department involved in teacher education.

A second reason is the division of labor between language departments and the departments of educational science. In each camp, one of the two necessary competences for covering the

large white spots on the research agenda is missing. Consequently, the specific research area is orphaned and neglected or even not perceived at all. What are the two areas of competence?

One area of competence is the competence for designing, carrying out and evaluating broad-scale empirical teaching & learning research projects for arriving at an evidence-based body of knowledge as a basis for decisions on improving language teaching and teacher education. Language departments lack both the necessary background in empirical research methods (study design and statistics) for broad-scale research projects as well as a background in teacher-oriented research. Hence such projects are rare and small-scale only.

As for education science departments, the missing competence is the competence in linguistics and psycho-linguistics that is essential for (second) language teaching research. It is understandable that this is not part of the competence of a social science department. It is usually missing in psychology departments, too. Language acquisition research requires a strong background in linguistics since this is the discipline that provides insights into the details of the organization of the grammar systems at stake. If you do not know in detail how the knowledge system of a particular language is organized you will not be able to design and interpret a meaningful experiment that traces the acquisition of these systems and subsystems as a function of teaching and learning.

As a consequence, in education science, specifically language related issues are neglected or touched only superficially at best. Language acquisition research as basic research for decisions on language teaching is homeless within the traditional organization of teacher education. This situation urgently calls for change. Researchers who want to study the teacher-gearred acquisition of a complex system like a language have to be experts for that system at the same time.

What is the way out of this dilemma? It is time to give up the outdated and inefficient organization that obviously impedes urgently needed research. Language teacher education must become strictly evidence-based, based on up-to date reliable research provided by *research centers for language learning and teaching*. This kind of research cannot be accomplished in splendid isolation by the various language departments. A university that offers programs for school teacher education for languages has the obligation to provide the necessary research background. Productive research is dependent on an adequate infrastructure, though, that institutionalizes and facilitates the research obligations.

*Research centers for language learning and teaching* would combine the necessary competences, that is, (neuro-)psychology of learning, psycho- and neuro-linguistics of (L2) language acquisition, social aspects of learning and teaching, empirical and comparative research of language teaching. In other words, the scattered and therefore ineffective competences must be united in research units with a clear joint research obligation, focusing on school issues.

In the present situation, in the absence of anything conceivably better, people seem to be content with the current (low-level) performance in language teaching and learning. There are no broad-scale systematic attempts of finding out how language teaching could be improved. There is no systematic output control, neither in teacher education nor in school teaching.

For the time being, we apparently have to be content with second-rate outcomes in teaching languages. It is bound to remain mediocre or worse due to the reasons sketched above. One of the major reasons is neglecting the need for providing future teachers with insights into the process of language learning that are indispensable for shaping efficient and effective processes of L2 acquisition in school. They need to find their place in the education of language teachers since these insights are relevant for the classroom situation.

### Summary

1. The academic education of language teachers must not any longer neglect the neuro-cognitively geared specifics of second language learning processes, as far as they are essential for teaching.
2. Future teachers must be *experts of language acquisition* rather than experts in a language who try to teach it. Any teaching effort that does not honor the neuro-cognitive boundaries of language acquisition processes is wasting the learner's as well as the teacher's energy.
3. Informed error analysis is a competence that is essential for successful language teaching. It combines linguistic expertise in the taught language, expertise in the L1 and L2-Ln and expertise in the learning sequences for the given language.

### Bibliography

- Bardin, Jon 2012. Unlocking the brain. *Nature* 487: 24-26.
- Casey BJ, Nim Tottenham, Conor Liston and Sarah Durston (2005). Imaging the developing brain: what have we learned about cognitive development? *Trends in Cognitive Sciences* 9: 104-110.
- Corder, S. Pit (1981). *Error analysis and interlanguage*. Oxford: Oxford University Press.
- Corder, S. Pit (1974). Error analysis. In J.Allen and S. Corder (eds.): *The Edinburgh Course in Applied linguistics. Vol.3: Techniques in applied linguistics*. Oxford: Oxford University Press.
- Dewaele, Jean-Marc (1998). Lexical inventions: French interlanguage as L2 versus L3. *Applied Linguistics* 19:471-90.
- Ellis, Rod & Gary Barkhuisen (2005). *Analysing learner language*. Oxford: Oxford University Press.
- Fagiolini, Michela, & Hensch, Takao K. (2000). Inhibitory threshold for critical-period activation in primary visual cortex. *Nature* 404(6774): 183–186.
- Haider, Hubert (2010). Mehr (Psycho-)Linguistik in die Ausbildung von Sprachenlehrer/innen! – eine Bring- und Holschuld. In: David Newby, Michaela Rückl, Barbara Hinger (Hg.): *Mehrsprachigkeit: Herausforderung für Wissenschaft und Unterricht*. Wien: Praesens Verlag. (p. 157-182)
- Håkansson, Gisela, Manfred Pienemann and Susan Sayehli (2002). Transfer and typological proximity in the context of second language processing. *Second Language Research* 18: 250-273.
- Hattie, John. (2009). *Visible Learning*. London: Routledge
- Hensch Takao K. and Bilimoria Parizad M. 2012. Re-opening windows: manipulating critical periods for brain development. *Cerebrum*: vol. August 2012 (Epub 2012, 29 Aug).
- Hensch,Takao, Fagiolini,Michela, Mataga,Nobuko, Stryker,Michael, Baekkeskov,Steinunn & Kash, Shera (1998). Local GABA circuit control of experience-dependent plasticity in developing visual cortex. *Science*, 282(5393): 1504–1508.
- Maya-Vetencourt, José Fernando. 2013. Activity-dependent NPAS4 expression and the regulation of gene programs underlying plasticity in the central nervous system. *Neural Plasticity*. vol. 2013, Article ID 683909.
- Meisel, Jürgen. (2011). *First and second language acquisition. Parallels and differences*. Cambridge: Cambridge University Press.

- Morgan-Short, Kara and Ullman, Michael T. (2011). The Neurocognition of second language. In A. Mackey & S. Gass (eds.), *Handbook of Second Language Acquisition*. London: Routledge. (p. 282-299).
- Pienemann, Manfred (1998a). *Language Processing and second language development*. Amsterdam: John Benjamins.
- Pienemann, Manfred (1998b). Developmental dynamics in L1 and L2 acquisition: Processability theory and generative entrenchment. *Bilingualism: Language and Cognition* 1: 1-20.
- Roth, Gerhard (2011). *Bildung braucht Persönlichkeit. Wie lernen gelingt*. Stuttgart: Klett-Cotta.
- Schachter, Jacqueline 1974. An Error in Error Analysis. *Language Learning* 24 (2): 205–214.
- Selinker, Larry and John T. Lamendella. 1978. Two perspectives on fossilization in interlanguage learning. *Interlanguage Studies Bulletin* 3: 2-3.
- Ullman, Michael T. (2005). A cognitive neuroscience perspective on second language acquisition: The declarative/procedural model. In Cristina Sanz (Ed.), *Mind and Context in Adult Second Language Acquisition: Methods, Theory, and Practice*. Washington, DC: Georgetown University Press. (p. 141-178).
- Williams, Sarah and Hammarberg, Björn (2005). Language switches in L3 production: Implications for a polyglot speaking model. In Björn Hammarberg ed. *Processes in Third Language Acquisition*. Edinburgh: Edinburgh University Press.