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LETTER FROM THE EDITORS

Dear Readers,

In the course of this year it has become clear that after ten years of VIEWS it is time for some changes. It took us a while to figure out exactly what we were going to do, so here are both numbers for 2002 rolled into a combined issue 11(1&2). Before presenting you the con-

tents of this issue we would like to explain "what's new"- and what will remain the same.

In principle we want to continue publishing two numbers every year but our main channel will be the internet from now on. Our subscribers will be notified when a new issue of VIEWS is published and can then turn to our homepage to view, download, print..... and err read, all this at:

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So much for the packaging and now for the content. If the history of the English language has been one cornerstone of VIEWS over the years, our interest in its acquisition and use as a second or foreign language has been another. The current issue is, in fact, solely concerned with this second area of interest. Christiane Dalton-Puffer presents an outline of a larger research project where she is looking into the language ecology of mainstream classrooms where EFL is used as the medium of learning for school subjects like biology or history. These CLIL (Content and Language Integrated Learning) classrooms are widely seen as a promising way of enhancing the learning opportunities of EFL learners in schools all over Europe. The study will pursue the question of what kind of language environment such classrooms are and what one can expect to learn in them. In the second contribution, Susanne Reiterer continues her research story from the 8(2) issue of VIEWS. Her research in the neurophysiology of second language processing contrasts language-specialists with mainstream EFL learners. Back in 1999, she posed the questions – now she can give the answers. As with all good research, Reiterer does not only give answers, but asks a number of new questions. You know how it is... The third study presented in this issue focuses on one area of second language learning, on the acquisition of vocabulary. Angelika Rieder presents a comprehensive cognitive model of vocabulary acquisition, lexical knowledge and lexical learning developed in conjunction with her experimental study of lexical acquisition during reading tasks.

We hope you enjoy reading VIEWS as much as we enjoy its making. We are looking forward to hearing from YOU.

the editors

Content and language integrated learning in Austrian classrooms: applied linguistics takes a look

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As the department which is the home of VIEWS is progressively recognising its position as the largest organisational unit in Austria which trains English teachers, more research and development efforts are being turned into that direction. This contribution outlines a new research project in this area in order to invite comment and interaction. The structure of this contribution is as follows: section one raises those general questions which represent the underlying rationale, sections 2 and 3 provide the most important aspects of theoretical and disciplinary background. This is followed in section 4 by a more detailed presentation of the research questions and of the research methods used (section 5). The conclusion describes the anticipated results.

1. Introduction: purpose and aims of the project

Considering the fact that over the last ten years there has been a continuous growth in the use of English as a medium of instruction in Austrian (and indeed European) mainstream schools, there has been little accompanying research and next to none directed at the development of underlying theory. This has also been noted by several observers (Abuja 1999, Trentini 2000, Peter 1999, Hallett 1999, Lamsfuß-Schenk and Wolff 1999). As an initial illustration of this lack in explicit theorising which characterises English-medium instruction in Austria (and elsewhere), we can refer to the terminological difficulty that we meet once we try to place it within the context of an international debate on second and foreign language learning. Locally, the most current term used to refer to situations where English is used as a medium of instruction to teach history, geography, business studies etc. is *Englisch als Arbeitssprache* (EaA;¹ *English as a working language*). Taken liter-

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¹ The abbreviation *EaA* is also repeatedly used in this article.

ally, this implies that the foreign language, which is considered to have been learned somewhere else (presumably during English lessons), is quite simply used to teach and learn subject content. Next to nothing is said about further language learning objectives.² Recently, *English across the Curriculum (EaC)* has also come into use, and I suspect it was introduced by individuals who believe that language objectives (in both L1 and L2) are indeed part of the entire curriculum, that is, also in the so-called content-subjects. (However, these efforts have made no impact at the curriculum-level.) Another term used in the international discussion to characterise such learning environments is *content-based foreign language learning* or *content and language integrated learning (CLIL)*, both of which put a strong focus on the language learning aspects of this undertaking.

For this and other reasons it seemed timely for applied linguistics to take on the challenge and try to forge a connection between the local conditions and the theoretical debate going on internationally. The project presented here understands itself as a contribution into this direction. However, there is very little information about what the “local conditions” actually look like that would go beyond the anecdotal. Two main areas of theoretical and empirical concern have, therefore, been identified. These are the characteristics of classroom discourse on the one hand, and the implicit language learning theories guiding the actions of teachers on the other. In somewhat more detail:

1. What are the main characteristics of classroom discourse in such English-medium classrooms and how do they relate to current theories of language acquisition and learning? What is the instructional relevance of the fact that some teachers are also trained language teachers while others are not?

Research emanating from Canadian immersion programmes has shown repeatedly that significant amounts of factual content can be learned through the medium of an L2 but the results regarding ultimate linguistic and communicative competence in the L2 have been more differentiated (e.g. Swain 1996). Especially a bilingual or immersion programme which operates in an otherwise monolingual environment carries a considerable linguistic-instructional burden (cf. Baetens Beardsmore 1996, Swain&Lapkin 1982, Cummins &Swain 1986) and this is the situation of English-medium instruction in Austria. The study therefore aims at examining classroom discourse

² Let me be up-front: my contention is that language learning objectives are necessarily there even if they are not explicitly formulated. Or else what would be the point in having German-speaking teachers and German (L1 and L2)-speaking students talk together in English.

from the perspective of current theories on second language acquisition which underline the role of output and interaction alongside the generally recognised significance of comprehensible input. The aim in this exercise is to identify instructional arrangements which are particularly conducive to language learning, or indeed those which are not.

2. What are the (language) learning theories underlying English-medium instruction in Austrian mainstream schools? What are the beliefs, convictions, theories and personal knowledge regarding content-based EFL on part of the acting stakeholders and how do these beliefs translate into instructional and classroom behaviour ?

While the importance of teacher cognition is fairly well-established in educational research at large, (e.g. Elbaz 1983, Pajares 1992) an emergent interest in teacher cognition in applied linguistics has only recently translated into a number of empirical studies (e.g. Golombek 1998, Borg 1999). From among the various stakeholders, the present study will focus on teachers, as they are the central agents in the shaping of day-to-day classroom realities.

The ultimate aim of this project thus is to develop a conceptually sound model of the language side of English-medium instruction that can serve as the basis for principled pedagogical decisions.

2. Some theoretical considerations

Looking at the history of education, we find that the fact of pupils learning educational content through a language other than their L1 is not at all extraordinary. Latin, for instance, was the language of instruction at all levels through much of European history. Indeed, in many parts of the world children are today receiving their education through the medium of a language which is not their first. In short, the fact, that whole educational careers through to tertiary level can be conducted in the language learned in infancy is not nearly as 'normal' and 'unmarked' as much of educational theory would make us believe.

Interestingly, even a good deal of the theorising on language acquisition over the last decades seems to have taken place largely unaware of its own historical situatedness in this respect and has displayed a strong *monolingual habitus* (cf. Gogolin 1994) as regards formal educational contexts. It is only relatively recently that demographic developments such as large-scale migration have begun to alter this. Here I am referring especially to the work emanating from research on immersion education in Canada and to the ESL-research taking place, above all, in the United States both of which have pro-

duced significant contributions to the development of language acquisition theory (see below).

Theories of second language acquisition and learning³

One way in which the theorising on second language acquisition can be usefully structured is by dividing the field into reception-based and production-based theories (e.g. Johnson 1995). An alternative organising principle would be to distinguish between input-output theories and interactive theories with interesting changes of categorisation especially regarding Swain's Output Hypothesis. As the former categorisation is less committed to defining interaction in a particular way, I will adopt it here. Additionally, it has to be mentioned that some neuro-biological, cognitive models of language acquisition offer overarching explanations which make the above categorisations pragmatic rather than substantial (e.g. Karpf 1990).

Probably the most widely known reception-based theory of language acquisition is Krashen's Monitor Model in which the concept of Comprehensible Input plays a central role (Krashen 1981, 1982, 1985). The basic idea of the model is that if the language learner is exposed to input which is comprehensible either because of the context in which it occurs or through intentional simplification (motherese, foreigner-talk), acquisition will occur, especially if the learning situation is characterised by positive emotions (Affective Filter). Comprehensible input will always be somewhat beyond the learner's current level of linguistic competence ("i"), thus providing a kind of added value ("i+1") in the shape of linguistic forms and functions which are just beyond the learners proficiency level. Krashen stresses that optimal comprehensible input is not grammatically sequenced but first and foremost focused on meaning. Provided there is also sufficient quantity of this kind of input, enough "i+1"-elements will naturally occur so that as long the input is also perceived as

³ In this article the terms *acquisition* and *learning* are used as quasi-synonyms. The classic distinction between them is roughly along the lines that *acquisition* is applied to non-instructed learning situations (i.e. first language or naturalistic second-language learning), whereas *learning* is thought to take place through instruction in formal educational contexts. Which of the two is to be applied to a situation in which a language (English) is to be learned in an instructional context but without (supposedly) explicit language instruction is a matter of theoretical, maybe even ideological convictions. There is extensive discussion and criticism of the distinction in the literature (cf. e.g. Widdowson 1990). As I am not convinced that a categorical distinction between the two can be drawn, I shall use them interchangeably.

meaningful and relevant by the learner, acquisition will automatically follow. Krashen does not deny the relevance of output, but sees it mainly as a means in which a language learner can secure more comprehensible input for herself.

Almost simultaneously, Long (1981, 1983, 1985) proposed a slightly different version of a reception-based theory. Long's Interaction Hypothesis emphasizes the importance of conversational adjustments which happen in two-way interaction for creating learner-adequate comprehensible input. It is claimed that such adjustments, resulting from the negotiation of meaning in personal interaction, maximize the opportunities for second language acquisition. Examples of such conversational adjustments would be models, recasts, expansions, or reformulations. An important difference to Krashen's conception of input and interaction seems to me to be the emphasis the Interaction Hypothesis framework puts on the problematic aspects of concrete interaction (i.e. the mistakes which cause misunderstanding or communication breakdown). The actual repair work done by way of conversational adjustments is seen as instrumental to the acquisition process (e.g. Gass, Mackey, Pica 1998: 301). This, however, requires that conversation-like interaction happen in the instructional context.

Both Krashen's and Long's models have been criticised for being interpretive rather than empirically based, but certainly Krashen's Monitor Model has proved highly influential and is the model most frequently referred to by teachers practising English-medium instruction in Austria. There is no doubt that it captures important and intuitively accessible features of the language acquisition process. Another important element was added to the theoretical repertoire by Swain's recognition that learners also need opportunities to produce output if they are to become fluent speakers and writers (Swain 1985, 1995). Studying immersion classrooms in Canada she found that "comprehensible output is, unfortunately, generally missing in typical classroom settings" (Swain 1985: 252) and claims that learners need to be "pushed" from semantic into syntactic processing mode by requiring them to encode comprehensible messages in order to propel their language learning. Only language production in the context of social interaction enables learners to try out their linguistic knowledge by testing hypotheses about the language and creating entrenchment of what they already know. So-called action-oriented (*handlungsorientierte*) approaches to language learning also come into the picture here (e.g. Krumm 1996) as does task-based learning.

Further elaborations of the production-based type of hypothesis concern the kinds of discourse learners are involved in as well as the roles which they are allowed to take. The Discourse Hypothesis (Givon 1979) holds that lan-

guage learners will acquire only those types of language found in the discourse types in which they tend to participate. Thus if a learner participates only in informal and unplanned discourse events s/he will learn only that type of language. Similarly, if a learner participates only in formal classroom discourse, this is the kind of language s/he will learn. Tarone and Swain (1995), for instance, found that immersion students in Canada were using their L2 for communication with adults in the school-context but not among each other because “they don’t teach us how to speak [French] that way”(1995:172). I believe that this is an important point to consider in the formulation of curricular aims as well as in the discussion of authenticity issues in the context of English-medium instruction in Austria. Finally, Ellis (1984) and Long (1983), in the Topicalisation Hypothesis, point out that situations where the learner is allowed to choose and control the topic of conversation are particularly facilitative of language learning. Summing up, I refer to R. Ellis (1990, 1999) who warns that to date there is no hard empirical evidence which would adequately describe exactly how topic selection, comprehensible input, comprehensible output etc. contribute to second language learning (see also N. Ellis and Laporte 1997) Even so, the use of the various models and hypotheses reviewed lies in their making explicit intuitively plausible aspects of the language acquisition process – a complex event which is defiant of attempts at monocausal explanation.

Classroom discourse

The analysis of educational talk was one of the first mainstays of the field of discourse analysis in linguistics. Sinclair and Coulthard’s (1975) identification of the Initiation-Response-Evaluation (IRE) unit has had a lasting effect on the view of classroom discourse the research community has taken. Lörcher (1983) first applied the framework to foreign language classrooms. Subsequent studies on the quantitative distribution of talk have tended to show overwhelmingly that it is the teachers who do most of the talking, even in classrooms with a strong learner focus (Cazden 1988; Mehan 1985, 1997; Chaudron 1988). This distribution of talk naturally has direct consequences on who nominates topics and how these topics are developed. Taken together these research results have led to the conviction (at least the publicised one) of many people, that teacher talk is somehow “not good” and stops the students from real learning. The fact that classrooms the world over continue to function like this, can however, not be put down to the mere collective un-

willingness of teachers to shut up and let the students get on with it. In fact, recently there has been a reappraisal of the IRE-sequence in terms of cognitive-interactive learning theory. Combining discourse-analytic and Vygotskian concepts, Jarvis and Robinson (1997) link Initiation-Response-Evaluation to the cognitive pattern of Focus-Build-Summarise (see also Wells 1993) in a very intriguing way.

3. Models of L2 instruction similar to EaA

French immersion in Canada

With 30 years of experience and an ongoing cycle of evaluation, research and development Canadian immersion education is probably one of the best documented educational programmes ever. Major contributions to language learning theory have also emerged in the process.

Generally, the hundreds of evaluations of different programmes across Canada (e.g. Cummins and Swain 1986, Swain & Lapkin 1982, 1986, Day & Shapson 1996) have shown consistent results on the question of academic achievement of immersion students: indeed, a significant amount of subject matter knowledge can be acquired through the L2 with immersion students tending to achieve the same results as L1-instructed control groups. A short differential view of this can be found in Swain (1996) who also states that “The findings concerning the learning of French were somewhat puzzling, however” (p.91).

Very briefly, these findings were that the receptive skills of early immersion students reach native-speaker level, and later-immersion students consistently surpass comparison groups who have received classic foreign language instruction (e.g. Lapkin et al. 1991). Productive skills, however, appear to be a different story. All immersion students fall short of their francophone peers with regard to writing skills. Their weaknesses mainly lie in grammatical and lexical competence rather than in the discourse aspects of writing. The weakest of the four skills areas is speaking, again with weaknesses concentrating on the grammatical and lexical rather than the discourse levels. It is this kind of research results which prompted Swain’s formulation of the Comprehensible Output Hypothesis (Swain 1985, 1995; Swain and Lapkin 1995).

Other observations of relevance to the study of CLIL classroom discourse concern language input, grammar and vocabulary instruction, feedback and error correction. Longitudinal studies of immersion programmes have shown that the initial theoretical position of the ‘language bath’ (cf. Krashen’s com-

prehensible input) had to be revised in the sense that input received in a classroom setting will necessarily be functionally restricted in many ways. This is particularly serious when the main source of input is the classroom. This has led to increasing demands for a more stringent formulation of the programme's dual goals together with the development of a language curriculum (e.g. Lyster 1990, Snow et al 1989). In the 1990s numerous experimental and qualitative studies have sought to ascertain whether explicit grammar and vocabulary instruction can be shown to have beneficial effects on the language development of immersion students (e.g. Day and Shapson 1991).

Among the several models of immersion education which have been developed, it is late immersion which *EaA* can make reference to most directly, though the share of *EaA* lessons tends to stay way below the 80-50% of late-immersion. The teachers in immersion programmes are either native speakers of French, English or both (58%:34%:3% in one survey, Day&Shapson 1996). The majority have received their academic training in French, as well as immersion-specific teacher training. This highlights divergences in teacher profiles as well as in the sociolinguistic aims of the two instructional models: in Canada the aim is native-like competence in order to enable immersion students to communicate with their francophone compatriots on equal terms. In Austria there is no such resident English-speaking target group. Accordingly, deliberations regarding models and norms waver between native models and the recognition that students are most likely to use English as a *lingua franca* with other non-native speakers in later life (cf. Seidlhofer 2000, Peter 1999).

Content-and Language Integrated Learning (CLIL)

Part of the Language across the Curriculum (LAC) movement, CLIL has developed in the United States as an answer to the pressures on all levels of the education system to integrate non-native speaking students into the mainstream curriculum in ways which economise on time and resources. The field is sufficiently consolidated to have produced numerous reports on and evaluations of individual programmes, research on linguistic, pedagogical and sociocultural aspects, contributions to language learning theory (especially the interaction-based approaches, see above), well-documented curriculum and materials development projects (e.g. Chamot and O'Malley 1986; Short 1993, 1994) and even textbooks (e.g. Brinton, Snow, Wesche 1989, 1995; Rosenthal 1996). Given this, it is very tempting to turn to the CLIL literature for immediate solutions to perceived *EaA*-questions, also because the underlying phi-

losophy of the two educational models seems to be very much in line: both aim at offering “learners necessary conditions for second language learning by exposing them to meaningful language in use” (Brinton, Snow, Wesche 1989, viii). However, a number of factors speak against looking for quick solutions in these quarters. All of them ultimately lie in the different socio-linguistic context not all of whose ramifications can be pursued in this project outline: most importantly, CLIL in the U.S. takes place in a *second* and not a *foreign* language environment, that is the language to be learned is also present in the environment outside school or university so that the overall input learners receive, and the output which they produce is not limited to what is done in the classroom. Because CLIL-learners are being prepared to join the mainstream of the education system, it is easier to define the language and communication requirements which CLIL instruction needs to prepare them for. The form and sequence of language presentation is dictated by content material but there is also a language curriculum (Brinton, Snow, Wesche 1989, vii). In the *EaA* context, the students are already part of the educational mainstream, in effect it is one of the declared aims of *EaA* to prepare them for using the school-subject “English” outside, in the “real world” for “real communication” (e.g. Burda 2000). However, the ‘real world’ (of which, I would claim, school is definitely part) consists of a myriad different communication needs and events so that it is extremely difficult to define concrete linguistic and communicative aims for *EaA*. This may be somewhat better in directly vocationally oriented school subjects but the difference is only in degree not in kind. It is hoped that the results of the present study will help systematic reflection in this respect on the way.

Foreign-language CLIL⁴

There is only a handful of studies which deal with content and language integrated learning in a properly foreign-language context. Musumeci (1996) investigates geography-through-Italian classes in a post-secondary setting, trying to identify which features of classroom discourse make the input comprehensible, meaningful and rich, and focusing particularly on the issue of meaning negotiation. Her results show that the classrooms she investigates are not characterised by an overly great amount of meaning negotiation, even though the programme has a clearly defined, properly dual content and lan-

⁴ An overview of the relevant research scene in Germany has been excluded from this contribution but can be requested from the author.

guage objective (1996: 289). With regard to *EaA*, on the other hand, a clear formulation of its objective(s) is still a desideratum (though, I feel, an increasingly urgent one).

Duff (1995, 1996, 1997) reports on an ethnographic study of English-Hungarian classrooms in Hungary, this being the educational context in the literature which most closely resembles the situation of *EaA* in Austria. Duff's study focuses very strongly on the fact that different discourse and even educational cultures may be transported via the language which is used as the medium of instruction, thus pointing out the intercultural dimension of such instructional settings. While this intercultural migration of values may have been particularly pointed in the Hungary of the early nineties, this is also an aspect of *EaA* which should not be neglected. It has been pointed out repeatedly by *EaA* practitioners with reference to the use of British or American teaching materials (e.g. Trentini 2000, Sitte 1998, and others by personal communication).

The greatest number of publications making direct reference to English-medium instruction in Austria has so far emerged from the "Projektgruppe Englisch als Arbeitssprache" based at the ministry of education-led *Zentrum für Schulentwicklung III* in the shape of reports on the situation of *EaA* in Austrian schools as well as guidelines regarding organisational and didactic decisions (extent of *EaA*-use; curriculum analysis, materials development, role of native speakers, teacher development needs in Abuja 1993, Abuja and Heindler 1996, Abuja 1998, 1999 and *EaA*-Servicehefte). This is complemented by quantitative surveys on attitudes towards *EaA* among school administrators (Östreicher and Grogger 1997) and secondary-school students (Wallner 1999), and the situation in one Austrian province (Zeller 2000). Several perceptive action research reports covering a variety of content subjects have emerged from a course run by *Interuniversitäres Institut für Interdisziplinäre Forschung und Fortbildung (Klagenfurt)*, (e.g. Staudner 1999ab). Several M.A. and Ph.D. theses have dealt with the teaching of geography through the medium of English (Felberbauer 1996, Peter 1999, Trentini 2000), most probably caused by the fact that geography is by far the most widely taught *EaA* subject. The authors are more strongly concerned with what English can contribute to the curricular and didactic aims of the subject geography rather than how a geography learning environment can contribute to the learning of English. To varying extents all the publications referred to in this section express the tension between the professed view of *EaA* as a "fixen Bestandteil des modernen Fremdsprachenunterrichts" (Heindler 1998:

8 in Abuja ed. 1998), that is a way to improve foreign language competence, and a perceived threat to the content-subject.

On the whole, however, research into the use of English as a medium of instruction in Austria has been based on educational models for which I will use the shorthand “bilingual schools” (by which I mean that the extent of English use is such that they cannot be regarded part of the Austrian educational mainstream). Research on the bilingual schools has been predominantly outcome-oriented, i.e. oriented towards determining results of language learning and acquisition on part of the pupils. Griessler (1998) compared the morpho-syntactic and lexical competence of LISA (Linz) and non-LISA pupils through the analysis of a story-telling task. Eder (1998) made a similar comparison of the bilingual and non-bilingual groups at the relevant Gymnasium in Klagenfurt, using a battery of reception and production tests. Expectations that pupils from the bilingual streams would know more English than their mainstream peers were of course fulfilled. As a next step in this line of research it would probably be necessary to measure the achievement of the bilingual-stream students against some outside standard.

A large-scale longitudinal research project led by A. Peltzer-Karpf (e.g. Peltzer-Karpf & Zangl 1997, Zangl & Peltzer-Karpf 1998) was conducted at the Vienna VBS primary school. The project is based on a neuro-biologically founded model of language acquisition (as formulated in Karpf 1990). The central assumption of this kind of cognitive model is that language acquisition no matter whether first, second or third proceeds via neuronal self-organisation. Differences across acquisition contexts can be observed in speed and intensity by which the process advances, but the preference for certain kinds of input-data remains constant. The model thus accommodates both a psycholinguistic-individual and a sociolinguistic-pragmatic dimension since language acquisition happens through the individual’s interaction with the environment as provider of the input which triggers neuronal self-organisation. The research project accordingly included the observation of classroom interaction as well as psycholinguistic tests. However, in the published reports the emphasis is on the psycholinguistic aspects, reporting on the lexical, morphological and syntactic development of the children’s English competence over the years. Framed in a more strongly sociolinguistic context, Hüttner (1997) examined code-switching behaviour at the same school.

4. Research questions and hypotheses

The main empirical and theoretical concerns of the project were mentioned in the introduction. In this section I will give a more detailed account of the actual research questions pursued, as well as some of the working hypotheses connected with them. The research questions are grouped around three focal areas:

Patterns in classroom interaction

One of the main arguments brought forward in favour of English-medium instruction is that using English for the learning of history, geography etc. rather than for learning English itself prepares pupils for using the language in the world outside school. This, however, is not an actually established fact, but an assumption. In fact, pre-vocational contexts are notoriously problematic with regard to determining future language needs of students (which is not to say that this ought not to be attempted). It might therefore be a workable alternative to first examine what happens in the classroom, that is to say, patterns of participation and the language functions and forms needed and used within them. This might also be useful for developing teaching goals for *EaA* teaching (cf. Cazden 1995).

- What are the participation patterns in *EaA* classroom discourse? What are the global characteristics of the linguistic exchanges in the classroom: who speaks, how much, when, about what?
- To what extent are pupils required to produce “comprehensible output”? Can “comprehensible output” be defined independently of the situational context? For instance: do one-word responses to display questions count as comprehensible output? They are certainly comprehensible within the universe of classroom discourse.
- To what extent do teachers and pupils negotiate meaning in secondary *EaA* instructional situations? What does that negotiation look like?
- How is failure to comprehend signalled (is it?) and how are messages modified? Who signals, who modifies (cf. Musumeci 1996)
- What do teachers (and pupils) perceive as “authentic communication”?

Language teaching strategies

It is a persistent myth about first language acquisition that it proceeds entirely without instruction and correction. This is wrong on two grounds: caregivers also act as language teachers, and first-language literacy is predominantly the product of instruction and plenty of correction. That is to say that even in pre-

school, oral language acquisition things are not quite as undirected as it may appear, although it is probably possible to acquire basic oral skills in a first language without instructional intervention on part of the interlocutors. However, first language acquisition research has shown that children of parents who use plenty of language teaching strategies are consistently more advanced than children of parents who do not (Döpke 1993, Clark 1977, Moerk 1985). Thus, *EaA*-classroom discourse needs to be examined along the following lines:

- Is there evidence of language teaching strategies in oral teacher language? What is the incidence and function of e.g. expansions, paraphrases, echoes, models, recasts, expansions, reformulations or responses?
- How does this relate to corrective behaviour?
- If referential questions (as opposed to display questions) facilitate language learning through ‘real communication’, in how far does this relativise the supposed disadvantage of language lessons vis a vis content lessons? With the teacher firmly in the role of the subject expert, especially transmission-based designs of content-pedagogy are certainly not conducive to two-way communication.

Implicit theories (Alltagstheorien)

Internal conceptualisations about how languages are learned are certainly of importance in English-medium instruction as they inform how instructional events are designed and/or perceived by the participants.

- My working hypothesis in this respect assumes that because there is a delay and a kind of sedimentation in the spread of scientific innovation into textbooks, the knowledge base of practitioners and hence their actions informed by it, will often refer to older theoretical models. Additionally I assume personal experience to be an even stronger shaping force on implicit theories than knowledge of scientific theories. Being the key agents in the instructional event, teachers are at the centre of interest in this respect.
- I assume that the implicit theories which guide teacher’s actions are based on certain conceptualisations and beliefs about language learning as well as communication. The following are taken to be beliefs which play a significant role in shaping teachers’ actions:
 - input is the key to successful and effortless language learning (L1-analogy)
 - there is no instruction and correction in first language acquisition
 - classroom discourse is not “real” discourse
 - communication is transmission of information
 - in content classrooms there is more real communication than in language classrooms

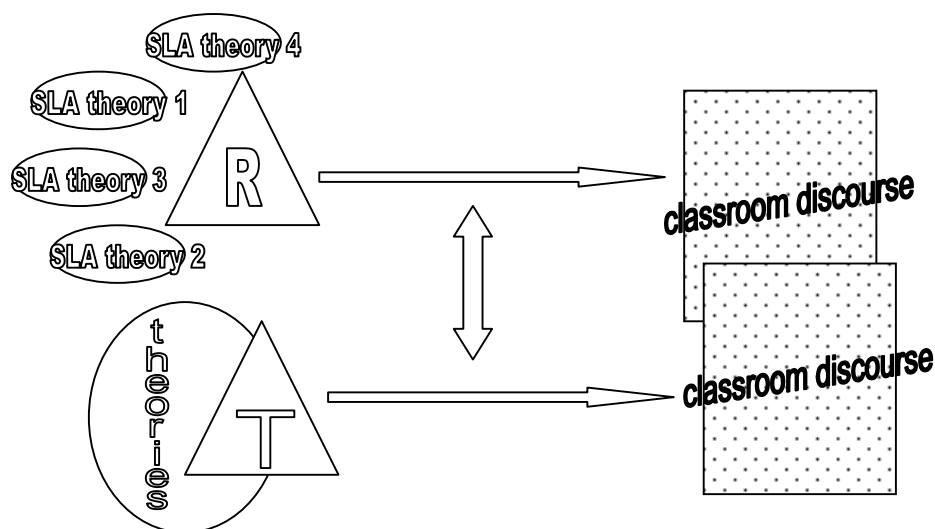
5. Methodological considerations

With the usual transdisciplinary delay, language acquisition studies began to discover qualitative research for its purposes just over ten years ago (Watson-Gegeo 1988). Surveys about research methods in SLA started to include chapters on “qualitative” or “ethnographic” approaches (Johnson 1992, Nunan 1992) and since the *TESOL Quarterly* 29-3 (1995) special issue, qualitative research on the acquisition of second and foreign languages has certainly come of age. This is shown by the share such studies now occupy in the pages of some leading journals of the field (*TESOL Quarterly*, *Applied Linguistics*). The reason for the attractiveness of qualitative research methods is easy to see. As the relationship between exposure/instruction and acquisition/learning is extremely complex and not linear, this means that experimental approaches by their very nature can only ever provide enlightenment on single pieces of a complex jigsaw. Additionally, transfer from experimental set-ups to classroom situations brings into play a considerable number of additional factors.

I think there is a growing realisation that a strict juxtaposition of experimental and quantitative vs. classroom-based and qualitative research is ultimately sterile. But there still seems to me to exist a tendency to equate classroom-based research with qualitative research somewhat too hastily. An equation which is unjustified if it is based on a confusion of typical research methods (e.g. ethnography, participant observation etc.) with underlying theoretical positions (ethnomethodology, constructivism, etc.).⁵ The project presented here does have an overall qualitative design in that it examines more than one perspective on the object. The following diagram seeks to illustrate this.

⁵ This in itself would make an interesting topic in the history and sociology of science. On related issues see Flick (1995: 16-21).

Diagram 1. Illustration of dual perspective in the research design
(T = teacher; R = researcher)



The object (English-medium classroom discourse) is viewed by the researcher (R) from a vantage point outside the field itself, a vantage point characterised by an array of scientific theories concerning L2-acquisition and learning. The same object is also viewed by the teacher (T) who is at the same time a participant of the field requiring ongoing decisions and actions from her or him. These actions are themselves informed by implicit and explicit theories on part of the teacher. Of course, the field is also viewed by several other stakeholders (students, administrators, school authorities, parents) but these are being excluded for the time being. The ultimate aim of this research should be to forge a connection and an exchange between these separate perspectives.

In pursuing the research questions laid out in section 4 and in order to maintain a dual, if not multiple perspective, the following research methods are being applied and the following kinds of data are being collected and analysed.

Classroom data

In examining the global event “English” in the *EaA* classroom we need to distinguish between the written and the spoken medium. Written language usually serves as input (textbook, teacher-generated materials) and is relatively easy to access. However, it is in the nature of instruction that it is an

interactive event where learners interact with the material, with each other and with the teacher(s). The spoken language thus plays a significant role.

Globally, classroom talk falls into three categories: a) organisational, procedural talk which often creates social demands requiring physical action; b) instructional, informative talk, which is usually perceived as the ‘content’ part of the lesson and c) personal, expressive talk (cf. Ernst 1994). Each of these types of talk has its own structural characteristics in every classroom and across classrooms. Linguistic lesson analysis (e.g. Wilkinson and Silliman 1990) will therefore proceed on the levels of topic development, social demands, quality and quantity of talk (source and communicative function). Particular attention will be paid to the negotiation of meaning and language teaching strategies.

It is hoped that a corpus-based analysis of *EaA* classroom interaction will yield a better picture of the foreign language demands which *EaA* puts on both teachers and students. Classroom interaction data are collected by way of non-participant observation (fieldnotes) as well as by the taping and subsequent transcription of representative lessons. The data-collection is currently in progress and aims at putting on record four lessons by 10 teachers representing different schools and content subjects.

Interviews

Narrative interviews are conducted with the teachers who agree to take part in the study, ideally before the onset of classroom observation. These interviews aim at finding out about the personal language learning history of the respective teachers, their beliefs and convictions about how languages are learned, and about the motivations and attitudes which informed their decision to use English as medium of instruction. It is assumed that personal experience strongly co-determines the way in which the knowledge-base acquired in the course of professional training is shaped and used in professional practice. Analytical methods for interview data are well documented in the literature (Schmidt, Rosenthal, Mayring, Böhm all in Flick/Kardoff/Steinke 2000, Goetz&LeCompte 1984, Spradley 1979)

Written documents

There are several classes of written data which are also highly relevant in the pursuit of the research questions formulated above. The classroom-related written materials are teaching materials (as mentioned above) and writings produced by the students - if applicable. It will be one of the purposes of the

study to gain a clearer impression of how much written language production is part of *EaA* teaching. An entirely different class of written data are formed by official and semi-official publications related to the *EaA* model: legal texts, ministerial decrees, other documents issued by the education authorities, curricula for training courses, publications on the part of the *EaA* project group, lesson plans. These are interesting primarily with regard to the question of how the aims of English-medium instruction are formulated and on what theoretical grounding these appear to stand. It is not expected that underlying theoretical assumptions will necessarily be stated explicitly. Interpretive methods like thematic coding will therefore be applied. There is ample documentation of these methods in the literature within the qualitative paradigm (e.g. Flick/Kardoff/Steinke 2000, Strauss & Corbin 1990, Mayring 1997)

6. Conclusion: some anticipated results

The anticipated results of the present project are relevant to at least four areas of the discipline. Firstly, the project will provide a *broad empirical basis* regarding language and interaction in English medium classrooms in a non-English-speaking European country. It will produce insights in the kinds of discourse which are typical of such classrooms and the kinds of linguistic forms and functions which characterise them. In conversation with current theories of language acquisition it is hoped that this will produce a realistic picture on the kind of language learning which is likely to happen in typical *EaA* classrooms. It may well turn out that in the *EaA* classroom students learn classroom communication in English on a particular school subject, but not so much ‘general’ communicative competence (cf. e.g. Widdowson 1998 on authenticity). Second, the study will make a contribution to the *development of theory*. The formulation of an explicit theoretical model of *EaA* instruction will draw significantly on language acquisition theory, an area much under-represented in *EaA* research up to the present. Thirdly, the study is *methodologically innovative* in its qualitative design through the triangulation of different kinds of data on the one hand, and the combination of the insider-perspective of stakeholders on the one hand and the researcher’s outside perspective on the other. Finally, the results of the study have considerable *practical relevance*. The following table summarises the anticipated outcomes:

Table 1. Anticipated outcomes

<i>scholarly</i>	<i>practical</i>
<ul style="list-style-type: none"> ▪ link SLA theory to local conditions – focus on the classroom ▪ gain insight into discourse forms and strategies typical of EaC ▪ insight into teacher cognition and conceptualisation re. language learning and classroom behaviour ▪ progress towards an understanding of classroom discourse which also takes account of its constructive and genre constitutive aspects (not as “deficient conversation”) ▪ formulation of a theoretically explicit model of EaC 	<ul style="list-style-type: none"> ▪ identify strategies that might serve as “best practice” models ▪ consolidate the knowledge base regarding EaC in Austria ▪ basis for the development of teacher education curricula regarding EaC ▪ a clearer conceptualisation of the objectives and implications of EaC should help practitioners in their day-to-day decisions ▪ improve communication between researchers and practitioners

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The neurocognition of second language acquisition: The influence of proficiency level on cortical brain activation patterns

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A neurophysiological EEG imaging study was conducted to elucidate differences in neuronal network recruitment between linguistically more proficient language students and less proficient non-language students during foreign language TV-processing.

The main questions treated by this study are the following: do differences of proficiency level in speaking and understanding a second language have a neuro-biological manifestation, for example, in the form of different “brain routes” or special activity patterns. If so, this could be seen as a neuronal alteration in response to different learning conditions. If this difference in level of L2 competence does cause a distinction, to what degree and form do these two groups of “more“ or “less“ proficient language learners differ in terms of their brain activity patterns and what could this mean for the second language learning process. It is shown that different cognitive or neuro-biological language processing strategies can be made visible by a brain imaging tool like the EEG.

1. Theory

1.1. Right / Left Hemisphere and Bilingualism

In experimental neurolinguistics the role of the right hemisphere in language processing has been discussed extensively over the last decades. Especially such language-related aspects as intonation (emotional prosody), pragmatics, semantics and non-verbal communication (gesticulation and facial expressions) have been proposed to be primarily processed by the right hemisphere. (Van Lancker, 1997). Moreover, the right hemisphere has been assumed to play a key role at the beginning of the language acquisition process, when someone is beginning to learn a second language. It has been assumed that the right (non language-dominant) hemisphere “helps” the left hemisphere in so

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far as it adopts a holistic strategy to make the language learning process easier in its initial stages. The initial stages are the first years of the acquisitional process, when a learner is not yet experienced enough to develop grammatical “automatisms” in the second language (left hemisphere) and thus resorts to imagery and holistic thinking to tackle the acquisitional problems.

According to Obler (1981) and Galloway & Krashen (1980), the initial stages of adult second language acquisition recapitulate children’s right-to-left hemispheric shift in relative hemispheric dominance during L1 acquisition. This is in line with the assumption of Paradis (1994), who states that monolingual children have to rely on right hemisphere-based pragmatic processing during their first years of language acquisition, in order to derive an interpretation for utterances in that language for which the required automatic linguistic competence has not yet been fully internalized.

Obler’s model is referred to as the Stage Hypothesis in Second Language Acquisition research. According to this model, the right hemisphere’s relative dominant functioning, during the initial confrontation with novel stimuli such as in the case of foreign orthography and semantics, would be advantageous (Gordon & Carmon, 1976; and Hardyck, 1980). For example, the right hemisphere would have a preeminence over the left hemisphere in the processing of foreign tonal patterns and intonation as well as emotional tone (Galloway, 1982). Obler’s model implies increased involvement of the left-hemisphere during later stages of the learning process, when a sophisticated level of grammatical accuracy has been gained. This may occur when a basic vocabulary of novel words must be arranged in particular word order sequences according to foreign grammatical rules. Even though not a hemispheric theory per se, it suggests that learning styles and strategies may change after initial exposure to information which may be different from later, more grammatical strategies. If Obler’s model is correct, one would expect to see greater right-hemisphere activation during the early stages of adult second language acquisition, e.g. in the first years of learning (if instruction is not very intense). This predominance ought to decline during later stages, when the person’s grammatical knowledge increases. Moreover, left-hemisphere activation for the same time and skill progression would either increase or remain the same. This is the case since students in foreign language classes engage left-hemisphere processes during language learning activities (Conesa et al., 1999). Finally, a corollary of Obler’s model is a relationship between the time of exposure / increased experience in a second language acquisitional setting and greater left-hemisphere involvement. Conversely, one would expect right-

hemisphere dominance to be associated with limited experience in the second language.

→ From this derives hypothesis 1 of the present study: The non-language students should show more activity in the right hemisphere because of their lower language proficiency level.

1.2. Cortical Efficiency

The second theoretical assumption of this study relies on the neuropsychological concept of cortical efficiency. The basic idea of this concept is that individual differences between persons with high versus low performance (either because of high or low aptitude or due to more or less training) can be indicated by the localization and the amount of brain activity. Persons of good and poor performance are thus expected to differ in their recruitment of neuronal networks or circuits.

The concept of neuronal efficiency was introduced by J. Ertl (1969) assuming that higher ability in a cognitive task is associated with more efficient neuronal processing of this task. Several functional neuroimaging studies (e.g. EEG) have tried to verify this assumption later. This very basic concept of efficient versus inefficient neuronal “wiring” can be taken as an underlying theory which can be investigated with various methods and efficiency can be seen in the light of various physiological parameters.

By measuring glucose metabolism, the concept was reintroduced and investigated extensively by the group around the American psychologist Richard Haier. Haier et al. started out by investigating the relationship between intelligence and brain glucose metabolism with the help of PET (Positron Emission Tomography). In several studies (Haier et al., 1988; Haier et al., 1992; Haier et al., 1995) they could show a negative correlation between intelligence measures and glucose consumption. More intelligent persons consumed “less energy” (meaning decreased glucose-consumption) than less intelligent persons. The brain scans during the intelligence tests indicated that higher metabolic rates (more activity) were associated with lower intelligence scores and lower metabolic rates with higher intelligence scores. The authors interpreted the results as an expression of higher cortical efficiency in performance groups with higher intelligence scores and vice versa. **“Smarter brains burn less glucose”** became the famous slogan that comprises the idea behind the concept of cortical efficiency in one sentence in PET terminology. Less activity of more intelligent and more effective brains is measured by the consumption of less glucose and this may in turn “reflect greater increases in

automatic processing in the high-ability subjects after practice, which would result in fewer extraneous brain areas being used for the task, and thus result in a greater decrease in Glucose Metabolic Rate (GMR). Haier *et al.* see these results as consistent with the “efficiency hypothesis” (Haier *et al.* 1992). Similar findings were reported by Parks *et al.* (1988), who found that verbal fluency scores were negatively correlated with brain metabolism.

It is conceivable that subjects who found the verbal fluency task to be difficult, exerted a greater degree of effort so that they evidenced the greatest amount of activation. Similarly, it is possible that those with greater verbal fluency used more efficient strategies in their cognitive operations so that little effort needed to be expended. (Parks *et al.*, 1988 ; p.572)

However, not only aptitude, ability or general intelligence in problem solving strategies was measured here. There is the aspect of training and task-evoked effort in skill acquisition (e.g. playing the piano, doing mental rotation tasks). This was also interpreted as consistent with the efficiency theory and resulted in better performance after practice but lower metabolic rate. The overall pattern of inverse correlations between decrease in glucose metabolic rate following learning and higher intelligence scores, suggests that high-ability subjects may have the most gains in automatic processing. This increased automatic processing in high-ability subjects after practice would result in fewer extraneous brain areas being used for the task. This efficiency may derive from the disuse of many brain areas irrelevant for good task performance as well as the more focused use of specific task-relevant areas. Since language acquisition (with subsequent language use) can be seen as a skill which can be automatized and made more efficient by practice and, moreover, as a skill that could most efficiently and quickly be automatized in high-ability persons (language talents) – the theory of cortical efficiency could also apply to language acquisition.

→ This leads us to the formulation of hypothesis 2: The NON-Language students should show more overall brain activity, they should activate more distinct brain areas than the more experienced and perhaps at the same time more language-talented English students, because they need more brain circuits to solve the same, but for them more difficult language tasks. The English students, on the other hand should have developed a more efficient strategy and thus use less brain tissue.

2. Method and Data Analysis

2.1. The EEG

The EEG (Electroencephalogram) measures the electrical activity of networks or large circuits of brain cells (pyramidal cells) in the outer layers of the cortex (for an overview about the EEG see H. Petsche, 1998; Reiterer, 1999).

Activated nerve-cells of the brain generate electric signals, the so-called action-potentials of postsynaptic electro-chemical processes. In the standard procedure 19 metal electrodes are glued to the scalp according to an internationally fixed positioning system (the so-called “10/20-system”) and thus the oscillatory activity of the cortex (“brain waves”) is recorded. During registration, oscillations are amplified, filtered, digitized, inspected for disturbing artifacts and analysed further.

2.2. Method of Analysis

This section gives some background information about experimental possibilities in EEG research. There are basically three distinct ways in which the raw data of the recorded EEG can be further analysed: Firstly, by measuring “ERPs” (event-related potentials, high time-resolution in the millisecond-range), secondly, DC-EEG (slow potentials – low time-resolution, high space resolution) and thirdly by employing COHERENCE ANALYSIS, a spectral-analytical method, that takes into consideration the frequency characteristics of the spontaneous EEG activity of all electrode positions and by comparing the similarity of the signal characteristics (amplitude, wave shape) and establishes correlations between several cortical areas. This method can trace cooperative processes in the cortex which occur in a certain time interval, possible from the millisecond to the minute-range. The third method (Coherence Analysis) was used in this study.

The frequency ranges (delta, theta, alpha, beta) are then closely inspected, one after the other. If the underlying cortical areas of two electrodes oscillate within the same frequency range at a given point in time, (e.g. task=2 minutes of watching TV in English) then these two parts of the brain are said to cooperate for performing this task. It is this cooperation of two different areas of the brain which is expressed by a coherence value (a kind of correlation coefficient). If coherence is high between the EEG-signals of two electrodes positioned on the scalp, there is an increased functional interplay, meaning increased activity between the neuronal assemblies generating those signals. If

coherence is low, the functional interplay between the involved areas is low. Coherence ranges from 0 – 1 and is expressed by a coherence-coefficient which is converted into a statistical value and presented as a line on the brain maps. (For the mathematical descriptions and technical aspects of coherence analysis see Rappelsberger 1977, 1988, 1993).

3. Study Design

3.1. Subjects

There were two groups under investigation. A group of English students and a group of non-English (and non-language) students. The two groups of students, who volunteered to participate in the study, consisted of 38 (19 persons each group) right-handed, female students of 24 years of age in the mean (ranging from 20 to 30 years, standard-deviation: 2,5 years; median: 23,6 years) whose mother-tongue was German. Thus, handedness, sex, mother-tongue, field of study, place of study and age - were the controlled variables.

The two groups participating in the study can be described as follows:

Group 1: The English students. The first group was the one of the “experts” for English as a foreign language. The participants were studying or had studied for a degree in English Language and Literature at the University of Vienna. Those who were still studying were at an already advanced level (2. Studienabschnitt). They were assumed to be good language learners with regard to English as a second language, having a profound knowledge of the English language and good comprehension skills, because English is not only the subject but also the medium of their studies. The average amount of time they had spent abroad in an English-speaking country was 10 months.










Group 2: Non-English students. The control group was the “lay-persons”-group. They were students of various disciplines, except language studies. Persons of this group studied medicine, psychology, biology, business and mathematics. They all had basic or moderate knowledge of English because they learned English at school and had to do an English exam to pass their A-levels, but their level of proficiency was intermediate compared to that of the English-students. They certainly lacked particular language comprehension skills which the language students had acquired during the course of their studies. The most important criterion in this group was the condition that the students had not developed their English-skills any further in a decisive way since their school-leaving examinations and that they described themselves as not being especially interested in or talented for English. The mean amount of time spent abroad in an English-speaking country was 5 weeks in this group.

According to the theoretical model described in 1.1., this group functions as the group whose foreign language automatic linguistic competence has not yet been fully internalized because of lack of training and exposure time. A group of even lower proficiency level (absolute beginners) have deliberately not been taken as subjects, because of psycho-experimental problems with the stimulus material. If absolute beginners had been used, they would have understood very little of the presented texts and therefore probably have stopped watching the videos and initiated distracting thought journeys.

3.2. Stimulus Material

The subjects were seated on a comfortable relax-armchair in a small acoustically screened, dimly-lit experimental room where they had to watch / listen to various video sequences of TV / Radio reports, features, discussions or interviews while their EEG was recorded. Nine different video sequences of TV news were presented by a single male speaker (close-up focus) in randomised order and in 3 conditions: as a normal TV scene (visual + acoustic), as a pure acoustic presentation and as a pure visual presentation. Control conditions (base line tasks) were also inserted randomly. The base-line task was looking into a grey flickering picture while trying to think as little as possible. The duration of a typical task as well as control-item was approximately 2 minutes. The whole EEG-recording session took 3 hours in total for each student.

Figure 1. The stimulus material

British English:	American English:	Austrian German:
 <p><u>John Cleese</u> „How to irritate people” (visual + acoustic)</p>	 <p><u>Senator Baker:</u> About the Clinton case (visual+acoustic)</p>	 <p>Fritz Verzetnitsch About a tax reform (visual+acoustic)</p>
 <p><u>BBC-Radio-Speaker</u> about South Africa (only acoustic)</p>	 <p><u>American Radio Speaker</u> about Bacteria (scient.) (only acoustic)</p>	 <p>Ö1-Radio speaker about the Vienna Stock Exchange (only acoustic)</p>
 <p><u>Chris de Burgh</u> TV-interview (only visual)</p>	 <p><u>CNN-Speaker</u> In front of White House (only visual)</p>	 <p>Prof. Johannes Huber In „Zur Sache“ (only visual)</p>

To substantiate the group differences in linguistic abilities and as behavioural measure of validation, after each sequence the students were asked compre-

hension questions. The questions reflected the different proficiency levels of the two groups in understanding the English texts. As expected, the non-English students understood only approximately 50 % of the English contributions, whereas the English students understood the texts nearly perfectly. But, strangely enough, when it came to understanding and reporting the German texts, the non-English students also scored slightly worse than their English studying colleagues! This is a marked detail which will be interesting for the interpretation of the EEG results. As examples of the TV reports listened to by the participants, three of the items are provided in the appendix with their subsequent comprehension questions: 1. John Cleese, 2. About South Africa, 3. Chris de Burgh.

3.3. Reasons for choosing the stimulus material

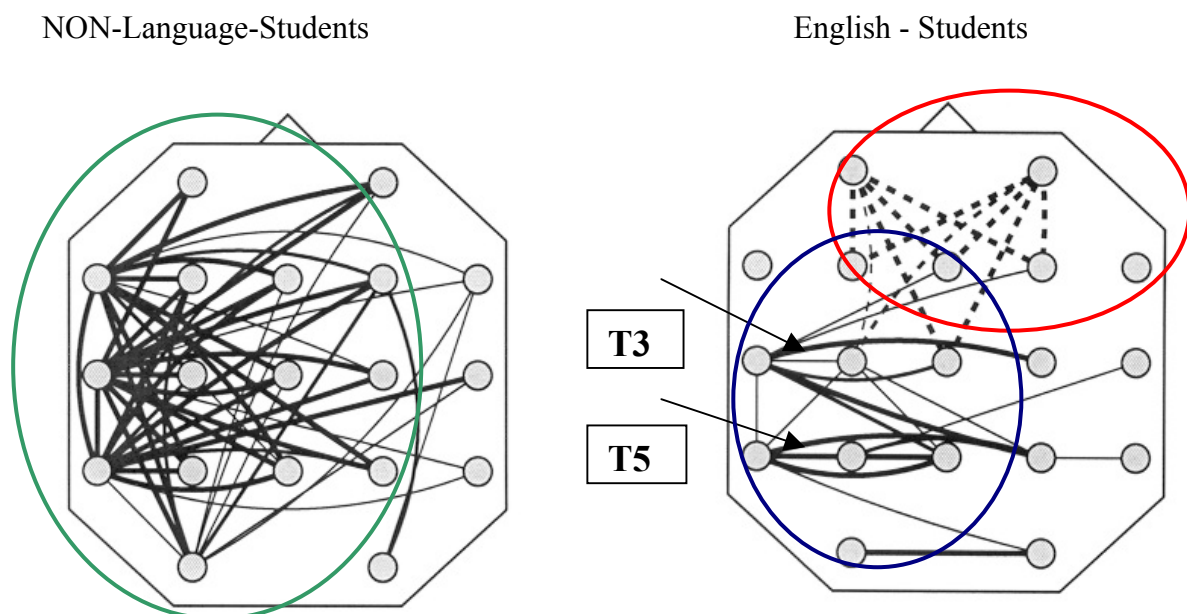
The presentation of language stimuli as multi-modal parts of real spoken speech where the speakers can be seen articulating and gesticulating, was chosen to imitate a natural and frequent communicative situation of every-day life. The most important criterion for presenting the foreign language stimulus material in video form was, that it captures the naturalness of a communicative situation which closely resembles a form of spoken linguistic reality: you sit or stand in front of a person and listen to what he is saying while at the same time you are watching his gestures and facial expressions, observing the whole person with his idiosyncratic movements, voice and looks that accompany the act of speaking – which is, in short, the whole pragmatic act itself. It is precisely this pragmatic aspect, capturing the social meaning of a linguistic output within its situational and contextual embeddedness, which is so scarcely investigated with neuropsychological methods. The intention behind this is to investigate the mental processing of language as it occurs in context, and not language as isolated sentences or words. The cerebral organisation of language on the word- and sentence level has been investigated extensively with PET, fMRI and ERP studies and voices have been raised that more research should be carried out on the processing of coherent language on the discourse-level, where phonetic, grammatical, semantic and pragmatic aspects of language have to be integrated. This could shed new light on the questions concerning the cerebral and neuronal organization of language phenomena. Due to methodological restrictions, ease of implementation, fear of the inability to interpret complex “full language” stimulus material and simply interest in other aspects of language processing, there are large numbers of investigations in the field of cognitive neuroscience which are based on the single-

word-presentation or isolated-sentence-presentation paradigm, but there are hardly any neurolinguistic studies which investigate language in its full context – that is to say – with a stimulus-item that contains components of all levels of linguistic organization (syntax, morphology, semantics, lexicon, phonetics (including word and sentence prosody, and pragmatics). Other brain imaging studies with the focus on bilingualism that make use of such language input - investigating short story processing - are using PET or fMRI as method of analysis (compare Perani 1996, 1998; Dehaene 1997). To date there have only been two EEG studies conducted in this manner, investigating mental interpreting (compare Petsche, 1998).

4. Results

This diagram provides a visual summary and reflects the essence of the main results. For the purpose of this paper the results for the visual items are not discussed. (For details see Reiterer, 2002.):

Figure 2. Summary of brain activation results for the two groups of subjects



HOW TO INTERPRET THESE BRAIN MAPS:

Solid lines – Increase in coherence

The solid lines presented on the brain maps connecting the single electrode positions mean an increase in coherence as compared to a base-line activity (task minus base-line). Coherence is defined as cooperative activity between cortical areas which cooperate during a certain task. Therefore, an increase in coherence means more connected activity and more cooperation during a certain task.

No lines - No coherence

The missing lines indicate no or almost no cooperative activity between two or more brain areas.

Broken Lines - Decrease in coherence

If there is a decrease in coherence or cooperative activity, as compared to the base-line condition (i.e. more cooperative activity in the baseline than in the task), then it is indicated as a broken line on the brain maps. And this third kind of activity is a very special one, because its interpretation is still an unresolved issue as will be explained later in the text.

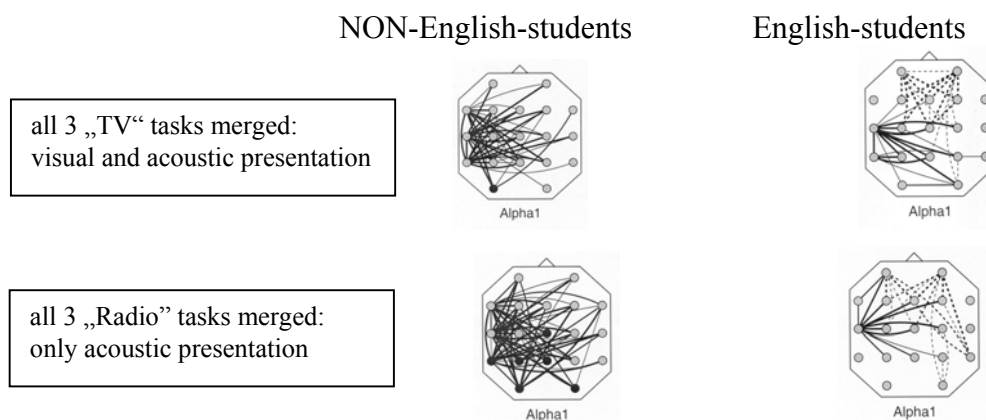
T3 and T5

are the labels of electrode positions – the T stands for temporal lobe (the lobe above the ear). The temporal lobe is one of the four lobes (the others are: occipital, frontal, parietal) and “houses” the primary acoustic cortex.

4.1. Ad hypothesis 1 (Right / Left Lateralization)

Do the non-language students show more right hemisphere involvement, because they use a more holistic language strategy?

Figure 3. Intergroup comparison of lateralisation



Alpha1: only the Alpha 1 frequency band (8-10 Hz, classical Alpha) was analysed in detail, because it reflected the most pronounced results.

The answer is no! There is no statistically significant difference which regards the use of the right hemisphere alone. Extensive right-hemispheric activity could neither be attested in the predicted group of the non-English-students, nor in the group of the English-students. The focus of activation during the language tasks was in the Left hemisphere in both groups! There was no significant difference between the groups concerning the place of activation. In other words, the right hemisphere was not more involved during the tasks

than the left hemisphere within the group of the non-English students, as the hypothesis would have predicted. As a result, hypothesis 1 was rejected.

Only the extent of the activation was markedly different between the two groups (see hypothesis 2). The core centers of activation lay in the left hemisphere for both groups with the following refinements:

The **English students'** activity was restricted to certain regions of the left temporal lobe (above the ears) where the center for language understanding is located (the so-called **Wernicke center**; see in figure 2: T3, T5 - most active electrodes - see the small circle on the left side in right brain map in Figure 2. The non-English students' activity extended almost to an intricate network (see big circle in the left brain map in Figure 2, which involves almost the entire left hemisphere and also some parts of the right. When regarding the right hemisphere alone, no significant group differences come to light.

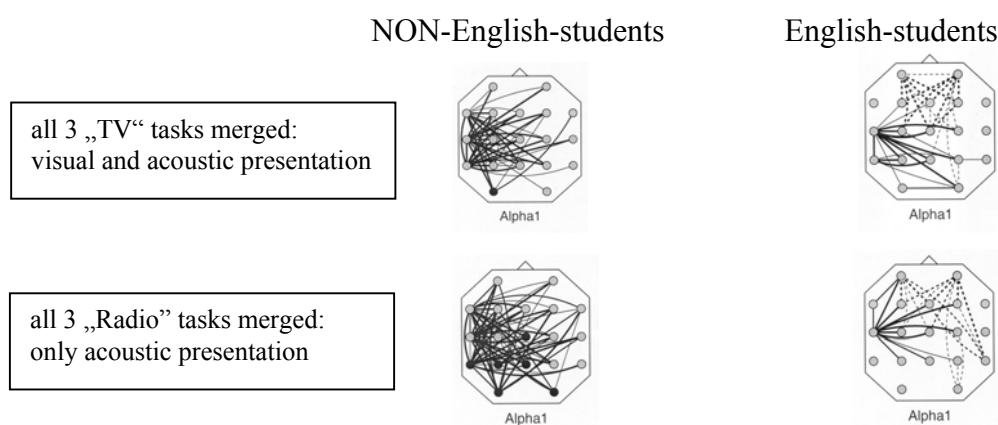
The right hemisphere is presumably involved in the language tasks as well in both groups, but probably only to a minor extent, so that it plays only a marginal role in these tasks.

Thus, the left / right hemisphere model does not explain the results so adequately as does the second theoretical model of "cortical efficiency".

4.2. Ad hypothesis 2 (Cortical Efficiency)

Do the experienced English-students adopt a more efficient strategy and therefore have less cortical effort – reflected by less overall brain activity ?

Figure 4. Cortical efficiency over all audio and visual tasks



The tentative answer is, yes. Systematic (meaning in all 9 tasks) and statistically significant differences could be obtained for the extent and distribution of the activity patterns and for the coherence increases and decreases (focal versus diffuse activation).

The **non-English students** had many coherence increases, which sometimes spanned the entire cortex, but in most of the cases the core activity lay in the left hemisphere. (See also the mapping overview below, Figure 6.)

In contrast to that, within the group of the **English Students**, the following picture emerges: **1.** accentuated **frontal decreases** in coherence (broken lines – see small frontal circle in the right brain-map in Figure 2 and **2.** only selectively focused connections over the **language areas of the left hemisphere** (left-sided circle in right brain-map in Figure 2) could be found, which points to a selective activation of the Wernicke-region, localizable under the electrode positions T3, T5. The Cortical Efficiency hypothesis was accepted.

4.3. Activation of the prefrontal cortex

One of the most marked results of the present study was the difference between the two groups with regard to prefrontal cortex activation. Only the English students showed decrease in coherence over the prefrontal areas.

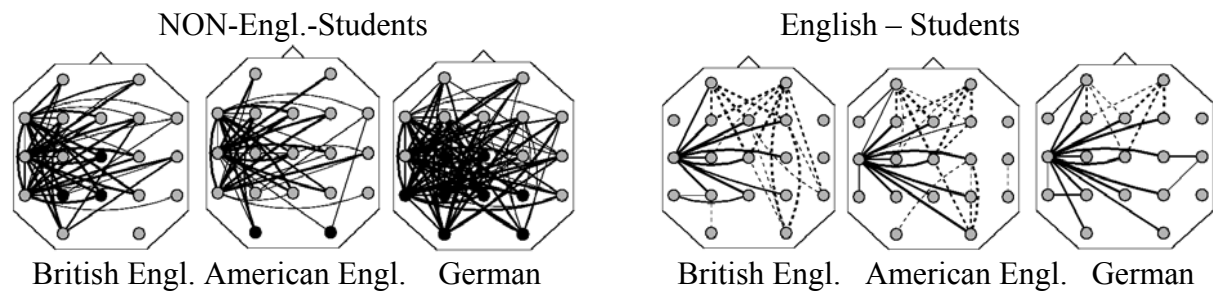
The decreases in coherence (less cooperation during task than during baseline – the broken lines in the brain maps) don't mean „less activity“, but could either mean 1) more focused activity in yet smaller areas of the frontal cortex (isolated activity in many small regions, because no stable connections between areas have yet been established) or 2) a shift of the activity towards more subcortical structures (deeper) brain structures.

4.4. No difference between the languages

As far as one can detect from visual inspection of the mapping data alone, there is no notable difference between the items presented in British English, American English or even German, although the German items - paradoxically enough - show even more pronounced coherence increases, a result and at the same time question, which remains unresolved, at least by this study.

Figure 5. Overall intergroup comparison

For each language, the two language items with audible speech input were averaged



5. Discussion

The frontal cortex is now known to be a very important wiring place for a wide range of cognitive demands, amongst which working memory plays the most prominent role. But a wide range of other aspects of cognition have also been attributed to the frontal cortex. Data from human neuroimaging and monkey electrophysiology are used to provide information on how the prefrontal cortex is functionally specialized. The data show that the prefrontal cortex is activated by increasing demands in a wide variety of cognitive domains, including perception, response selection, working memory, problem solving, executive control, verbal episodic memory, auditory discrimination, semantic processing of words and focused attention, amongst others (Duncan, 2001). In summary one can say that many current views of prefrontal function reflect that its tasks are in the first place specific cognitive control functions and secondly, maintenance and organization of working memory.

Related to the above mentioned control functions is, set switching and inhibition of inappropriate behaviour. An interesting and for this study highly relevant finding is the prefrontal function of strategy selection.

That the frontal cortex plays a major role in the processing of tasks where general human intelligence is needed, or even that the frontal cortex is the seat of human intelligence, is a longstanding view, that has often been discussed (see also Haier, 1992) and currently again is a hotly debated issue (Neubauer et al., in press).

If the English students show more activity in the prefrontal cortex, does that mean that they have better access to their working memory, attention, strategy control, or even to their faculty of intelligence ?

According to interpretation 1) (see 4.3.) the extensive decrease in coherence over the frontal cortex in the group of the English students could stem

from a very specific involvement of the prefrontal areas. If this is true, it would mean that the group of English students did something with their fore-brain that the others, the non-language students, did not. This something, could mean that they activated their prefrontal areas in a very specific way, which could reflect a higher involvement of the prefrontal cortex, to achieve the following goals: a better use of 1) working memory, of 2) verbal episodic memory, 3) selective attention, 4) executive control mechanisms, 5) semantic processing of words, 6) auditory discrimination, and 7) selection of the right strategy. It could mean that the English students have developed better strategies of understanding or decomposing language, because they have a better command of their working memory, attentional and control mechanisms, semantic processing of words and the other above mentioned mechanisms. Alternatively, they might possess a more intelligent strategy to tackle the language tasks, which in turn is an achievement of their efficient use and selective employment of the prefrontal areas, due to intensive practice, better knowledge of language structures or simply a more automatized skill in listening comprehension. In the non-English students instead, these prefrontal areas are not involved in this way, because their focus is not set so much on attention, memory and control-related demands, for their primary task is to cope with the text as a whole – not trying or not even knowing how to elicit and remember the fine-structure of the message that is presented to them (i.e. single difficult words or sentence structures).

If the English students show more coherence decrease over the prefrontal areas, does that mean they have more subcortical activity and thus access to highly automatized language skills ?

According to the interpretation that a decrease in coherence means more activation in subcortical regions of the brain, higher activation in prefrontal areas could stem from subcortical structures like the thalamus, which results in the focal activation of prefrontal areas, still measurable by the EEG on the scalp.

Crosson et al. (Crosson & Nadeau 1998) investigated the role of subcortical structures in linguistic processes and concluded that the thalamus plays a direct supportive role in language processing by being a selective engagement mechanism that increases the efficiency of structures needed to process language in such a way that appropriate lexical choices are more reliably differentiated from semantically related but inaccurate alternatives – thus being a control mechanism. In an fMRI study investigating lexical-semantic working memory, they found areas of increased activation, which were the thalamus

and the caudate nucleus (Crosson & Nadeau 1997, 1998). PET studies have also been used to study thalamic activity in cognitive tasks requiring attention (Buchsbaum, 1990). These studies indicate that the thalamus plays a significant role in language and an important supporting role in cognitive processes.

A further point that can be made in connection with subcortical language processing, is that of automaticity and skill learning. It is known that the more automatic and subconscious a process is, the more it is processed in deeper structures of the brain (like breathing is mainly a domain of the arousal system that is located in the midbrain, or brain stem; basic functions of posture and movements, also movements related to speaking, are a function of the cerebellum that is also part of the brain stem). If the more experienced language students show more subcortical activity than the inexperienced language learners, this could mean that they process language in a different and more automatic way, a way that uses the subconscious and so-called “low route” in the brain. As Fabbro (2001) summarizes:

When a second language is learned formally and mainly used at school, it apparently tends to be more widely represented in the cerebral cortex than the first language, whereas if it is acquired informally, as usually happens with the first language, it is more likely to involve subcortical structures (basal ganglia and cerebellum).

These are amongst the most important structures that contribute to any practised skill learning where motor control and movement plays a role, also if it is partly a cognitive skill, like, language and speech. The cerebellum still has a number of yet poorly understood functions, but is known to be involved in the regulation of movement. Patients with damage to the cerebellum can still move, but the movements become more erratic and less controlled. The cerebellum is also involved in the ‘automatic response’ that is experienced when a new skill has been learnt. For example, when learning to play a piece on the piano, at first the cerebral cortex is required to control the fingers, but upon learning, the cerebellum takes over. There is also growing evidence that the cerebellum (together with motor cortex) participates in imagined, mental movement and silent speech. Based on their PET studies, Petersen *et al.* (1989) suggest that the cerebellum is indicative of fundamental processes in automatic speech. Also Bellugi *et al.* (1990) have suggested a role for the cerebellum in automatic speech. People with lesions of the left frontal lobe but preserved cerebellum may suffer loss of propositional speech, yet retain relative amounts of other utterances, like nursery rhymes, songs, the alphabet or multiplication tables. Other evidence comes from genetic disorders. Children with William’s syndrome have an atrophic cerebrum, but preserved cerebellum, and are conspicuous for their precocious “cocktail conversation”

– socially responsive, fluent, correct in language content and appropriate to context, it is nevertheless peculiarly devoid of propositional content.

On the background of this neuroscientific (both patholinguistic and experimental neurolinguistic) evidence, second language acquisition could be seen as skill acquisition which is, when automatized by practice, gradually more subserved by deeper brain areas with the effect of more automatic and effortless access to skill knowledge resulting in profound “native-speaker-like” proficiency.

6. Conclusion

Studying a second language could finally result in a better understanding of the first language as well and make you a better listener to language in general. The linguistic refinement one acquires by intensive foreign language study makes one a better listener to one’s mother tongue – as a kind of feedback on the first language!

An interesting finding of this study was that both groups showed the same differences in brain activity - also when processing the German videos. The differences in the brain maps between the two groups were very similar for all nine stimulus items. Each group showed a stable and distinct pattern of activity regardless of the language of input, whether it was British English, American English or German.

There were no indications for distinct places of processing for the different languages (foreign and native) as predicted by the storage hypothesis (Paradis, 1995). All three languages/varieties of the investigation yielded similar results in terms of the place of processing. The distinctions within the study lay more in the differences between the groups in terms of strategies, but not in “storage” differences for different languages.

The last aspect, strategy selection, which is also attributed to the functions of the prefrontal cortex is especially interesting in the context of these results, because the advanced language students certainly use a different strategy, which enables them to understand and process the language stimuli more efficiently. The behavioural results (comprehension questions) also consolidated the differences in understanding between the two groups. Roughly speaking, the English students were 2 times better in understanding the English and American video sequences than the other students, but they could also reproduce the German texts slightly better, although German is the mother-tongue of all students and there should not have been any differences in comprehension and memorizing.

In the context of this study the term “linguistic or language processing strategy” is seen against the background of neurobiological theories of learning, memory and language processing. Unfortunately there has not yet been developed a unifying neurobiological theory that brings all aspects of human learning and cognitive behaviour under one theoretical concept, because the field is so-to-say “under construction”. The neurobiological perspective, which views learning and cognition as adaptations of motor and brain systems, contrasts with the more passive view of learning as purely mental activity maintained in psychology and cognitive science so far, although within cognitive and behavioural neuroscience, comprising neuropsychology and neurobiology and large parts of cognitive science, the understanding of cognition (comprising learning strategies) is more and more directed towards an integrated view of learning as an integrative process of brain, mind and body that consists of aspects of implicit, subconscious, emotional, procedural and automatic as well as explicit, conscious, mental, declarative and cognitively controlled features, which cannot easily be taken apart, because their functioning depends on their very interrelatedness. (see also Schumann, 1994, 1992).

Thus, language decoding strategies are cognitive, neuronal representations of behaviours, thoughts, actions and consequences of action that guide behaviour toward a goal (e.g. understanding a text). For the purposes of this discussion, strategies may be broadly defined as neuronal and cognitive operations or procedures performed by a language learner to achieve the goal of comprehension. Comprehension strategies may be both: conscious and controlled, and, unconscious and automatic, and they serve to direct the various components of the listening process towards an efficient understanding of a given text.

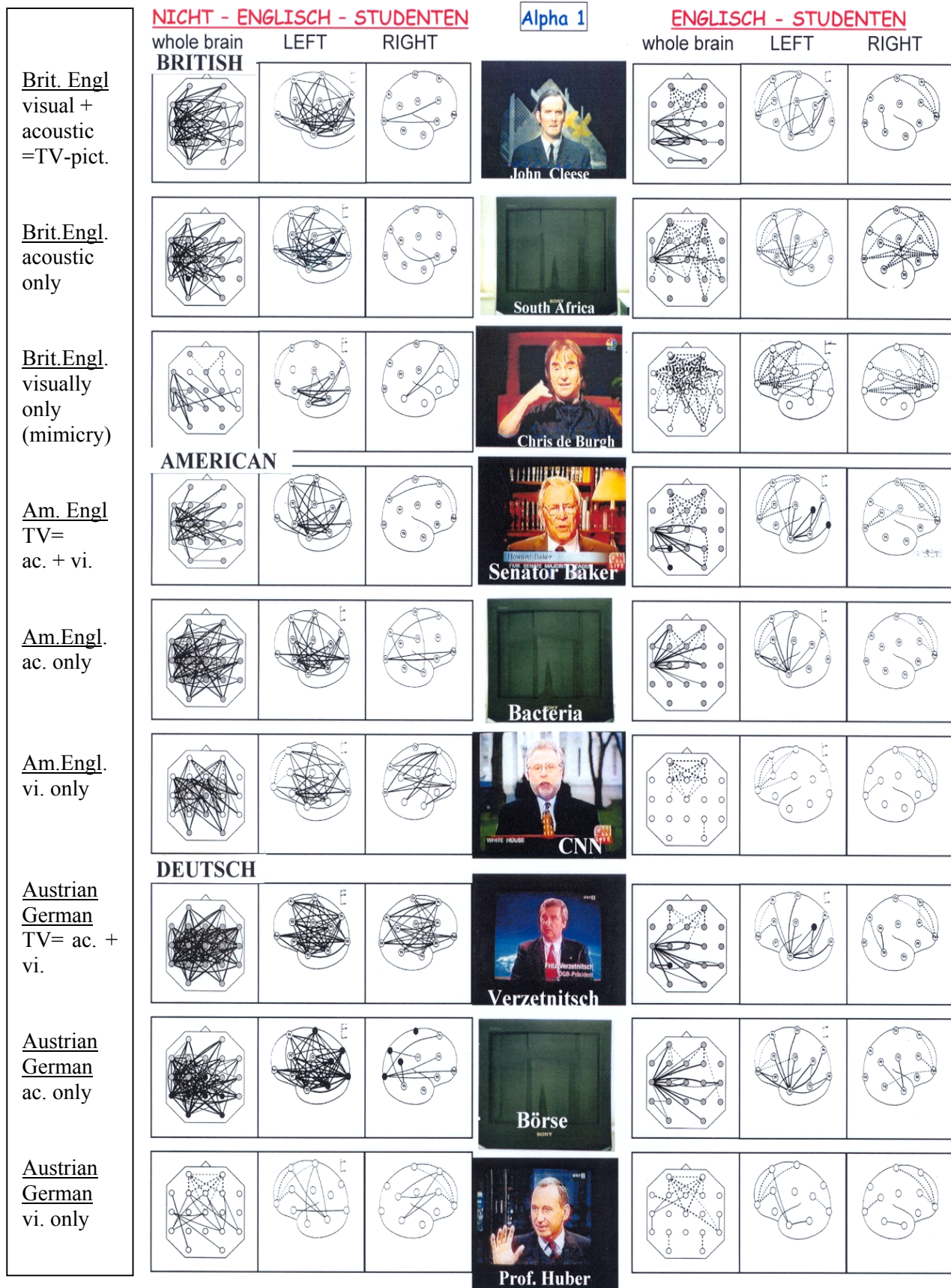
Considering these results, one conclusion could be that it was not only the foreign language comprehension ability that has been measured, but more likely, the strategy selected to firstly understand and secondly memorize “text” in general. If it had only been foreign language comprehension there should have been no differences between the groups for the German texts and the two groups should have understood the German texts to the same degree.

This might be an indication that it was not only comprehension as such, which was measured, but a special language processing and memorizing strategy which was adopted by the English language students - because of their “fine-tuned” linguistic training - to listen to, differentiate, understand and reproduce the texts efficiently. It is this “fine-grained” training in a foreign language and linguistics, which may have influenced and shaped their

language uptake capacity in such a way that their attention was focused on a detailed but quick and efficient decomposition of the text they were presented with. This different strategy may also have a “neuronal correlate” and therefore be traceable by electro-physiological means of investigation – like in this case by EEG-coherence analysis.

Thus, strategy selection or better automatic listening comprehension skills are most likely the factors that brought about the group-differences in the activation of the prefrontal cortex.

Figure 6. Summary of results & overview: the 9 tasks and corresponding brain maps:



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Appendix

1. **Tapescript JOHN CLEESE: How to irritate people** (British English: „TV“ = acoustic + visual presentation)

Extract 1

We're going to take a look at how to irritate people - at life.

We can't of course hope to be comprehensive. So just look on this as a refresher course; a few hints on how to help people to become more neurotic. Now, if you want to irritate people purely for pleasure, one fundamental rule must be observed. Never push them too far.

If you don't go too far they will explode into anger, shouting, stamping, becoming abusive and so forth, which releases all the tensions and frustrations which we have carefully built up. And we don't want to do that, do we ?

With a little skill and tact we can keep those very same tensions bottled up inside them for weeks, months, who knows ? Eventually you may induce a nervous break-down or, better still, actual damage to the brain cells. So, to avoid this explosion of anger, whatever you are doing to irritate someone, should seem to be unintentional. And the great masters of this art are parents.

Extract 2

You see it isn't inefficiency itself that is so irritating. It's the refusal to admit inefficiency. Mr. Graham Chapman recently had trouble with his telephone. He explained to the telephone supervisor that over a period of six weeks his telephone had been out of order about four days in each week, despite at least five visits from the telephone engineers.

She explained that the trouble was, quote, "There are too many people on this island !" Presumably the plans for an improved telephone service include deportation of selected subscribers - or even this, " Hi, I've come to improve the telephone service !"

We get the same sort of treatment from banks. The bankmanager himself irritates people by writing to them immediately they owe the bank forward. I advise you if you've had this trouble in the past, but are now in credit, to write to your own bankmanager pointing out that he owes you money and would he please drop in and have a word with you about it. The banks themselves they're all in business of making money, so when they get hold of yours they make it as difficult as possible for you to get any of it back. For this end they open just after you arrive at work and close two hours before you leave. And should you sacrifice your lunch-hour to join the angry queue in the street outside, don't blame the single cashier on duty for the slowness of the service. After all, the cleverer cashiers are out at lunch !

In this way banking hours have been carefully tailored to the needs of two classes of persons: the unemployed and bankrobbers.

Actually, the increase in the number of bankrobbers in Britain is not as horrifying as it sounds. It is now known that over 70 % of them are only frustrated customers trying to get at their money. Yes, banks are maddeningly greedy !

But, to some of the more eccentric professions money isn't everything.

We all know what actors are after.

- End -

Ad 1: Comprehension questions

- 1) What is the aim of this course John Cleese speaks about in the beginning ?
- 2) Which were the difficulties Mr. Graham Chapman had with his telephone ?
(describe the scene).
- 3) What could solve or improve the English telephone problem ?
- 4) Explain the scene where the man is shooting with a gun !
- 5) How exactly do the British banks manage to irritate people ?
- 6) Which two groups of people are the British bank opening hours tailored on ?
- 7) What is the cause for the enormous increase of the number of bankrobbers in Britain ?

Additional Questions

- 1) According to your personal impression, how do You feel You have understood the text?
best 12345 worst
- 2) Did You like the speaker or not ? How much sympathy did You feel for him?
best 12345 worst
- 3) How interesting was this video-sequence for Your personal taste ? most 12345 least
- 4) How demanding was the task for You ? (in terms of concentration)
not very 12345 very much
- 5) How much attention did you pay to the sequence ? (attentiveness, alertness)
not much 12345 very much

2. Tapescript: South Africa (British English: acoustic presentation only)

BBC – Radio Report

South Africa looks pretty much as it did a decade ago. The whites still have the wealth, the blacks still suffer the poverty. Nowhere is this more evident than in Cape Town. The magnificent contours of Table Mountain that so enthrall the tourists mean something else to those who live in its shadow. It is a great granite barrier dividing black from white, continuing privilege from desperate grinding hopelessness. The white people still live on the sunlit north side where the mountain slopes down to the sea in gentle pleasing gradients.

On the other side on the dry and barren plains of the interior the blacks and coloured still live in the isolation and poverty that apartheid designed for them. When Nelson Mandela bears out a public life and hands the leadership of the country over to his deputy Thabo Mbeki later this year, there will be less talk of reconciliation and much more of black empowerment. When I lived in South Africa during the Mandela-years the talk was all of rainbows and the miracles that so inspired the whole world. Is the miracle safe in Thabo Mbeki's hands ? It is the question that frightens so many whites.

Look, leave Nelson Mandela out of this“, the satirist Peter Deragase has one of his characters say. “Nelson Mandela is all that stands between us Whites and the refugee-camps“. The line is supposed to raise a laugh but it seldom does among his predominantly white audiences. It is too close to home for them. It reawakens the paranoia that fuelled apartheid, the fear that the menacing, appalling, dark and frightening continent to the north will get them in the end. It is what the Afrikaners used to call: “the *swarache war* – the black danger“. And it is still part of the white South African mind set. In Cape Town “*Hrute Kerk*“ – a group of worshippers in the dutch-reformed church, the church that once provided scriptural justification for white supremacy and which has this year for the first time publicly apologized for apartheid, describing it as a sin, are struggling to come to terms with the new reality. They are trying desperately not to be afraid.

I would feel a lot safer“, one woman told me, “if you could show me a single black government anywhere in Africa that has been successful“.

There are many reasons why South Africa is not like the rest of the continent and many reasons to believe that it will not follow the same dismal path that led so much of the continent to ruin. The task of the new generation is to rescue the miracle from the twin threats of deepening poverty and violent crime. It is terrifying to live in South Africa.

Those who can leave are doing so in ever growing numbers. They are taking the skills the country needs with them. It is painfully evident to most employers that skilled jobs vacated by educated whites heading overseas cannot be filled by blacks because of the skills-gap bequeathed by apartheid, a system in which black people were deliberately undereducated. It is almost impossible to say so without being denounced as racist.

Ad 2: Comprehension questions

- 1) What is the situation in Cape Town ? How do the Blacks and the Whites live ?
- 2) Who is Thabo Mbeki ?
- 3) What are the Whites afraid of ?
- 4) *Hrute Kerk* - a group of worshippers in the Dutch-reformed Church: What did they confess or admit this year for the first time ?
- 5) Does the speaker say that South Africa is similar and comparable to the rest of the African states ?
- 6) Why is it terrifying to live in South Africa ?
- 7) What does the speaker say about the job situation in South Africa ?

Ad 2: Additional questions

- 1) According to your personal impression, how do You feel You have understood the text ?
best 12345 worst
- 2) Did You like the speaker or not ? How much sympathy did You feel for him?
best 12345 worst
- 3) How interesting was this video-sequence for Your personal taste ? most 12345 least
- 4) How demanding was the task for You ? (in terms of concentration)
not very 12345 very much
- 5) How much attention did you pay to the sequence ? (attentiveness, alertness)
not much 12345 very much

3. TV-Interview: Chris de Burgh (British English, visual presentation only)

Questions on the visual item

- 1) What did you concentrate on during the presentation of this item ? What caught your special attention ?
- 2) What did you think of during this sequence ?
- 3) What could the speaker have said according to your judgement of lip-reading ?
- 4) Do you think that he had a rather clear pronunciation or not ? yes 12345 no
- 5) According to your personal impression, how do You feel You have understood the text ? best 12345 worst
- 6) Did You like the speaker or not ? How much sympathy did You feel for him?
very much 12345 none at all
- 7) How interesting was this video-sequence for Your personal taste?
most 12345 least
- 8) How demanding was the task for You ? (in terms of concentration)
not very 12345 very much
- 9) How much attention did you pay to the sequence ? (attentiveness, alertness)
not much 12345 very much

A cognitive view of incidental vocabulary acquisition: From text meaning to word meaning?

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1. Introduction

It is generally accepted that a considerable percentage of the L2 vocabulary of learners is acquired incidentally, i.e. as a 'by-product' of reading (Nagy, Anderson & Hermann 1985, Nation & Coady 1988, Nation 2001). The author's personal interest in this subject, however, was rather triggered by the observation that many words that learners encounter in a text are in fact *not* acquired – for instance because they are not attended to during the reading process, because the meaning cannot be inferred or because the word simply does not remain in the learners' memory after reading. This observation gave rise to the following basic questions: What principles and guidelines characterize the process of (re)constructing the meaning of unknown words within the text comprehension process? What factors determine the effort a learner makes to determine the meaning of an unknown word in a text, and what factors are responsible for the degree to which the contextual meaning can be determined? Furthermore, how does this meaning construction process influence the subsequent acquisition of these new lexemes?

Although research on vocabulary acquisition in general, and on incidental vocabulary acquisition in particular, has increased considerably over the past years, researchers appear to be concentrating on specific aspects of this phenomenon rather than adopting a comprehensive view of the processes involved. Aspects which form the focus for research activities include e.g. the resources and procedures applied in meaning inference (Haastrup 1991, van Parreren & Shouten-van Parreren 1981), the influence of reading task and learner factors (Hulstijn 1993, Grace 1999), or the effect of dictionary or glossing support (Hulstijn et al. 1996, Knight 1994, Krantz 1990, Roby 1999). Consequently, hardly any answers to the above questions can be found in these studies.

The shortcomings of the current research situation appear to be situated on three levels. Firstly, the selective and quantitative attitude of most studies tends to lead to results which do not grasp the qualitative nature of the acquisition process. Due to the varying conditions and research questions, these studies can rarely be compared or integrated into a comprehensive perspective. Secondly, the dimension of the text comprehension process appears to be totally neglected in most current studies, so that no distinction is made between the text meaning level and the word meaning level within the comprehension process. Thirdly, the process of inferring the meaning of an unknown word in a text is frequently equated with the actual acquisition of these words.

This paper is written from a complementary perspective and discusses the main dimensions of incidental vocabulary acquisition from a global, cognitive viewpoint. One goal will involve sketching a combined model which integrates the process of inferring word meaning into the overall text comprehension process. Another focus will be on the non-trivial step from text meaning to word meaning which the learner has to take in order to build up new vocabulary knowledge. The theoretical observations presented here formed the basis for a range of empirical case studies carried out with German learners of English, who were given text passages with the target words occurring in specific contextual constellations, and asked to think aloud during their reading tasks. Unfortunately it is not possible to provide a detailed description of these studies in this paper; however, selected results will be integrated where appropriate.¹

2. The text comprehension process: Mental modelling

In earlier research approaches to text comprehension the interest tended to be on the *product* of the reading process; the interest of modern research, in turn, has shifted to the *process* of reading. Moreover, in modern research approaches, text comprehension is not seen as a passive process of decoding, but rather as an active construction process on the part of the reader (Meutsch 1987). The reader is seen as building a mental representation of the textual meaning based on information contained in the text and on the activation of complementary knowledge resources (van Dijk & Kintsch 1983, Johnson-Laird 1983).

The process of actively constructing textual meaning can be outlined in the following way: the reader processes the text, uses her language knowledge

¹ For a detailed discussion cf. Rieder 2002.

for retrieving the propositions mediated by the words and sentences and thus builds a propositional basis of the text meaning. This basis in itself will be incomplete, however, as much of the information required for text comprehension will not be contained in the text explicitly. The reader thus has to activate complementary knowledge resources such as world knowledge in order to supplement this propositional basis by means of explicatures and implicatures (Blakemore 1992) in order to build a coherent representation of the situation described by the text. This process of retrieval and supplementation can be illustrated by the following example:

- (1) The animal ran towards him with lowered horns. Peter quickly climbed over the fence.

The reader of sentence (1) will typically interpret the lexeme animal as bull and will probably conclude that Peter leaves a pasture over a fence because he is afraid of the approaching bull, and not that he climbs into the pasture. The information for this specific interpretation, however, is not contained in the text and is solely based on the activation of relevant world knowledge (Schwarz 2000).

Parallel to this interaction of two levels of knowledge resources, text comprehension seems so be characterized by two complementary processes: on the one hand, the reader retrieves and updates the propositional basis by means of *bottom-up processes* based on her language knowledge. On the other hand, she complements this bottom-up analysis through *top-down processes*, i.e. associations and predictions based on additional knowledge resources and on the information already processed (Brown & Yule 1983: 234).

Thus, the reader constructs and updates her mental model of the textual meaning by means of these interacting bottom-up and top-down processes throughout the reading process. In this process, the existing model at a certain stage of reading forms the basis for the interpretation of newly read information and is in turn continually tested and updated by this new information (Rickheit & Habel 1995). Furthermore, the interpretation on the part of the reader is always characterized by a search for coherence. The reader will always try to interpret new information in a way that is consistent with her current mental model. Discontinuities in the textual basis are thus bridged in order to maintain textual coherence, and the resources activated for bridging these discontinuities are always applied with a focus on textual coherence (Beaugrande & Dressler 1981: 108).

These ‘means to an end’-characteristics of reader strategies for bridging discontinuities in the textual meaning, however, have important implications

for incidental vocabulary acquisition. In the special case where an L2 learner comes across an unknown word in a text, her mental model of the textual meaning will exhibit a discontinuity with regard to this unknown word.² If, however, these strategies are only geared towards bridging discontinuities to such an extent that textual coherence is achieved, this means that the reader will only focus on unknown words if they lead to perceivable discontinuities in the mental model, i.e. if she considers them as sufficiently important for grasping the text meaning. And even if the learner invests effort in inferring the meaning of the new word, she will still be operating on the textual level, and only invest effort in filling the conceptual gap until her mental model is sufficiently coherent.

3. The meaning of words in a text: Text level and word level interacting

In the model sketched so far, the meaning of the words occurring in a text can be seen as an ‘atomic basis’ on which the reader builds her mental model of the textual meaning. But how can the nature of these elementary building blocks of meaning be characterized?

In the cognitive approach taken in this paper, lexical meaning is not seen as definable object but rather as a set of cognitive relations within a speaker of a language. In the context of incidental vocabulary acquisition, several types of word meaning appear to be relevant: One type of word meaning, i.e. *denotation*, is formed by the relation between a lexeme and the extralinguistic reality of the speaker (Lyons 1977:206). Lyons describes this relation as a connection between a lexeme and the things, persons etc. external to the language system. According to cognitive approaches, however, this type of meaning is situated wholly within the language knowledge of a speaker and is said to be stored in the form of concepts which pick out parts of the encyclopedic knowledge of a speaker (Jackendoff 1983: 27ff.). Apart from the connection between a lexeme and its denotational concept, the denotational knowledge of a speaker will also contain knowledge about the potential lexical environment of words, i.e. of the *collocational relations* between lexemes (Kohn 1992: 378).

² In this paper, it is assumed that L1 and L2 reading are basically characterized by the same processes (i.e. that L2 readers apply similar strategies as in an L1 reading task). L2-specific variations in the reading process are seen as a result of compensation strategies due to L2-specific lack of knowledge resources.

A complementary component of word meaning is constituted by the *sense relations* between words within the language, which comprise the hierarchical semantic relationships of super- and subordination (i.e. hyponymy: rose-flower), and of co-ordination (i.e. synonymy: truck-lorry; antonymy: big-small, cf. Lyons 1977). Next to these sense relations, *frame relations*³ also play a role at this level of word meaning. Frame relations are formed by assigning lexemes to so-called knowledge frames, in which common knowledge about stereotypical situations is stored. Frame knowledge is activated through the words in a text, and the activation of the relevant frame knowledge in the reader is in turn presupposed by the author of the text: if the author assumes that specific entities can be inferred by the reader due to the activated frames, these entities are not always explicitly mentioned in the text.

Although complementary types of word meaning can be characterized, an attempt to find clear semantic boundaries for the meaning of a word soon tends to meet with problems. As it seems, one of the basic characteristics of denotative concepts appears to be their variability. In the extreme case, a word will exhibit several different denotations in isolation (hyponymy, polysemy, cf. Lyons 1977). But even for lexemes which seem to have a unified denotation structure at first sight, the variation of the meaning from one context to another makes clear that the denotational meaning includes a range of different contextual specifications. The meaning of the word coffee in the following three example sentences will illustrate this point:

(2) He poured **coffee** into his cup.

(3) A pound of **coffee** costs £3.

(4) **Coffee** is grown in Brazil.

While sentence (2) refers to coffee as a drink, sentence (3) is directed towards the meaning aspect beans or powder. In sentence (4), in turn, coffee is seen as a plant or crop. These examples illustrate to what extent the recipient has to limit the denotational meaning potential of a word when specifying the contextual meaning of this word within a text. Furthermore, these observations also illustrate the basic difference between the concrete contextual meaning of a word and its abstract denotative meaning range. In the case where the reader knows the denotational word meaning, the process of determining the con-

³ The term 'frame' is used as a superordinate term for 'schemata', 'scripts' etc., for a discussion of the various terms see e.g. Beaugrande & Dressler 1981: 94f.

textual meaning variant can thus be pictured as a process of *disambiguation*, *selection* and *stretching*: In a first step, the reader has to *disambiguate* the denotational meaning range through the surrounding context (sense, frame or collocational relations, syntax, etc.) and through her top-down expectations. This process is then followed by *selecting* the contextually relevant meaning aspects, or by *stretching* the word's meaning range if the contextual variant is not directly contained in the activated denotational spectrum (as e.g. in the case of metaphorical language).

The above examples have illustrated the case in which the denotational word meaning is available to the reader. In the case where the reader encounters an unknown word in a text, however, she does not have any denotational knowledge available as a starting point. Thus she cannot activate a suitable conceptual structure and her mental model will remain blurred with respect to this unknown word meaning. Assuming that the reader's primary goal is text comprehension, the degree to which she will try to determine the meaning of this word will primarily depend on how central the word is for building up her mental model of the textual meaning successfully.⁴ If the contribution of the word to the textual meaning is too peripheral, the reader is likely to skip the word without paying attention to it; if her text comprehension, however, is impeded by this information deficit, she will try to fill the conceptual gap by using the clues given by the surrounding context or her background knowledge.

From the perspective of incidental vocabulary acquisition, an important aspect to keep in mind here is that the reader will usually stay on the textual level when trying to figure out the meaning of the unknown word. She will only attempt to bridge the gap in her mental model until sufficient continuity is ensured. This focus on the textual level implies that she will not automatically form a connection between a concept of the contextual meaning she has reconstructed and the form of the unknown word, and will thus not automatically acquire new word knowledge.

In the current literature on incidental vocabulary acquisition, however, the process of meaning specification and the actual acquisition of a word are mostly treated as if they were a single phenomenon. This can be exemplified by Carton's original definition of the term 'inferencing':

⁴ Apart from textual factors, situational factors or individual learner factors are of course also determining factors for the degree to which a learner will concentrate on a word. For a brief investigation of these dimensions see section 4.

Inferencing refers to a process of identifying unfamiliar stimuli. In foreign language learning inferencing is concerned with the acquisition of new morphemes and vocables in 'natural contexts'. (Carton 1971: 45)

The above definition implies that the process in which the reader reconstructs the contribution of the word meaning to the text meaning during the reading process is equated with the actual acquisition of new word meanings. However, this equation, which is still carried through from the use of the term by Carton to many modern research approaches, is an oversimplification. On the one hand, it leaves out important characteristics of this phenomenon, and on the other hand it leads to a representation of the acquisition process which is inaccurate on several levels. Firstly, it gives the impression that the process of deducing contextual word meaning is automatically situated on the lexeme level. As the model of text comprehension sketched above has shown, however, the reader is normally focussed on the text level while reconstructing the unknown conceptual structure. Secondly, the different nature of the cognitive processes involved in inferring word meaning (i.e. building up conceptual knowledge) on the one hand and in acquiring vocabulary knowledge (i.e. storing conceptual knowledge, storing the word form, combining conceptual knowledge and word form) is neglected by this equation. The following sections will therefore focus on important features of word meaning construction within the text comprehension process and the difference between meaning inference and vocabulary acquisition.

4. The specification of contextual word meaning: Constructing conceptual knowledge

Due to the reasons mentioned in section 3, the conventional term inferencing seems to be ill-suited for describing the process of specifying the meaning of an unknown word during reading. As an alternative, the terms *focus* and *enrichment* will be used here for describing the two complementary factors directing this process. On the one hand, the word's saliency in the text (as regards form or content), the individual interest of a learner in that word and her particular reading goal will determine the amount of effort she will invest in figuring out the meaning of an unknown word (i.e. the degree of *focus* on a word). On the other hand, the learner's strategies and the knowledge resources available to her through the text and through her background knowledge will determine the extent to which she is able to specify the unknown conceptual structure (i.e. the degree of *enrichment* of the concept).

If the learner's primary goal is text comprehension, we can assume that the attention she pays to unknown words in the text will be guided by a *comprehension focus*. She will therefore only invest effort if the gap in her mental model is big enough to give her a direct reason to invest energy in determining the missing conceptual structure. With this type of focus, however, the learner's primary attention is still on the word's contribution to the textual meaning, and we can not automatically assume that she will take the step from the text meaning to the word meaning level. Furthermore, due to the *economic effort calculation* which is always subordinated to the overall text comprehension goal, the learner will stop the inferring process as soon as the continuity of her mental model is ensured to a satisfying degree, so that the concept may not be sufficiently determined at the end. If, however, the learner is interested in finding out the meaning of an unknown word independent of her text comprehension goal (e.g. due to a particular interest in this word, or because of a general interest in vocabulary extension), we can speak of explicit *learning focus* on her part. Here, the conditions for the step from meaning inference to vocabulary acquisition are much better, as the learner's focus is on the word level from the start, and she will thus make *exhaustive use of the resources* available for meaning inference. The degree of attention given to word meaning specification is thus directed by textual factors (e.g. centrality of the word for the text meaning, recurrence of the word in the text, etc.), learner factors (e.g. individual interest, learning motivation, etc.) and situational factors (e.g. reading goal, time available).

In terms of the semantic *enrichment* of the unknown conceptual structure, the learner will also take the text meaning as a starting point for forming a hypothesis about the contextual word meaning. On the basis of her current mental model and of her activated frame knowledge, she will be able to specify the new concept to a certain extent, so that the missing conceptual structure will not leave a complete gap in her mental model. We can illustrate the enrichment process with the following example sentence:

(5) He was kept in a **dungeon** for 25 years.

If a learner comes across the unknown word dungeon in sentence (5) in a text where the 'crime'-frame has already been activated, she will be able to specify the denotational concept 'dungeon' to a certain extent due to the surrounding clues (he, kept in, for 25 years) as 'place where a person is detained for a long time'. Due to her world knowledge, she will probably delimit the concept as a rough equivalent to 'prison'. The fact that the meaning of dungeon will probably be specified as the best possible meaning candidate and

not just as any meaning that moderately fits the context (e.g. a general place-term like 'room' or 'house') can be based on the *assumption of optimal relevance* (cf. Sperber & Wilson 1995), which seems to guide learners on the discourse level as well as on the word level: A learner will always assume that a certain word in a text is used deliberately by the author because it achieves an optimal meaning contribution. More specifically, if a learner already knows the English word prison, she will assume that dungeon is not a synonym of prison but rather a hyponym, representing a special type of prison. This tendency that learners will typically rule out absolute synonymy with known L2 terms can be explained by the *principle of contrast*, which is a general principle of language acquisition and implies that different words in a language are generally assigned to different meanings (cf. Clark 1993). Based on these principles, the learner will therefore assume that the word dungeon carries a similar meaning as prison but not exactly the same meaning. Accordingly, her denotation hypothesis will probably be a slightly modified concept [PRISON + ?] with an empty slot concerning the exact specification of the hyponym.

The above example sentence has offered ample clues to the meaning of the target word dungeon. Generally, however, cases where sufficient clues can be found in the text are rare, and the case where texts offer insufficient or even misleading clues to the meaning of a word are by far more common. We must always keep in mind that words are used in texts to convey the text meaning, and that it is not in turn the purpose of texts to define the meaning of the words which are used.⁵ Therefore, clues to the meaning of unknown words will primarily be found as "side-products" in texts. In most cases, the potential of the text for enriching an unknown concept will be implicit and leave aspects of the contextual word meaning unspecified. As regards the enrichment potential of a text, however, it is important to keep in mind the active role of the learner, who has to flesh out the text meaning and the relevance of the meaning clues by means of her language and world knowledge. This implies that the learner's knowledge resources and strategies form another determinant for the success of the enrichment process. In how far the meaning of a word can be specified by the reader will thus depend on the balance between the necessary and the available resources in the text (i.e. clues) and in the learner (i.e. language knowledge, world knowledge).

⁵ There are of course also cases where a word meaning is explicitly defined in a text – an extreme example where a text indeed has the sole purpose of defining the meaning of a word would be the meaning explanation provided in a monolingual dictionary.

While the degree to which a learner is capable of specifying the word meaning is determined by the *enrichment conditions* outlined above, the degree to which she is in fact willing to concentrate on an unknown word during the reading process depends on the *focus conditions* with regard to this word. Like the enrichment conditions, the focus conditions are also influenced by textual and learner-specific factors. On the textual level, the focus potential will for instance depend on a word's contribution to the text meaning or on the word's recurrence in the text. On the learner level, variables to be taken into account include the learner's text comprehension demands, her subjective interest in a certain word or her general language learning attitude. In addition to these two levels, however, the specific reading situation constitutes a third factor affecting word focus. Here, circumstances such as the reading goal, the time available, or the expected knowledge application after reading form influencing variables. On the whole, then, the degree to which a learner is able and willing to determine the meaning of an unknown word in a text is a result of the three influencing dimensions text, learner and situation. The particular constellation of these three dimensions will determine both the degree to which a learner can successfully specify the contextual word meaning, and the effort she invests in figuring out this meaning.

At the end of the specification process, the learner's hypothesis of the contextual word meaning will thus be more or less specific due to two types of limiting factors: Either she will have stopped the process at the point where a sufficient specification for her mental model is reached (economic effort calculation) or at the point where she has used all resources available to her (exhaustive use of resources). As a result, the concept of the contextual meaning will be specified to a certain degree, and the learner will be more or less certain that her meaning hypothesis is correct. The reader will specify the word meaning on the basis of its contribution to the text meaning and will not automatically assume that this contextual contribution is representative for its denotational meaning. In how far this meaning hypothesis does in fact mirror an aspect of the denotational meaning or not, will primarily depend on the meaning clues within the text and the learner's exploitation and complementation work. This constellation will in turn also determine how certain a learner is about the accuracy of her hypothesis.

In terms of describing the structuring processes involved in building up new conceptual knowledge, current research on incidental vocabulary acquisition has little to offer. However, useful ideas can be found in constructivist approaches, which view comprehension and learning as an active and subjective construction process on the part of the learner (Wolff 1994). Here, cogni-

tive structuring processes such as forming or assigning new knowledge schemata, or reorganizing, abstracting and generalizing knowledge structures, are viewed as strategies which a learner applies in order to (re)construct her knowledge (Norman 1982). Following this view, the act of building up conceptual knowledge during the text comprehension process can be imagined as an active construction process on the part of the learner.

In line with a constructivist approach, learner behaviour indeed seems to be characterized by strategic actions and assumptions. Among these, the assumption of optimal relevance (see above) appears to be a general strategy when contextual word meaning is specified. Generally, a learner will not be content with a meaning which matches the context reasonably well, but will tend to look for concepts which are optimally relevant for achieving contextual coherence. As to the role of available lexicalized concepts, learners tend to search their existing L1 vocabulary for equivalent denotational concepts initially rather than creating a new conceptual structure for the unknown word. This strategy ties in with Nemser's (1998: 113) observation that the learner's first goal in lexical acquisition is not to discover the meanings of unfamiliar L2 words but to match new labels with familiar meanings, and that she only moves from this "assimilation stage" to the "approximation stage" (i.e. the adaptation and construction of new concepts) if no matching L1 equivalents can be found. In contrast to this search for L1 equivalents, lexicalized L2-concepts which are known to the learner will probably be ruled out as candidates for the new word meanings. The origin of this strategy is the assumption of contrast, i.e. the fact that learners do not expect two different words in their L2 to denote absolute synonyms.

In addition to the assumptions outlined above, several other strategies were observed in the empirical case studies.⁶ One interesting strategic assumption concerned the expected default quality of the new concept in terms of its ambiguity. While the learners in the studies readily accepted homonymous/polysemous word meanings in their mother tongue, they tended to experience serious difficulties when confronted with homonymous target words which recurred with different meanings in a text passage. As the case study results suggest, learners initially tend to rule out the possibility of conceptual ambiguity when approaching an unknown conceptual structure, and try to construct a concept which is unambiguous and homogenous, even if contradictory meaning clues are provided. This observation shows that *the principle*

⁶ For a comprehensive description and discussion of the empirical case studies see Rieder 2002.

of conventionality (i.e. that word meanings are consistent and conventionalized, cf. Clark 1993) obviously constitutes a major guideline for learners when constructing new meaning concepts.

So far, the observations have concentrated on the learner's first encounter with an unknown word. Encountering a word only once, however, can rarely be expected to result in the acquisition of this word. On the one hand, the learner is very likely to forget a word she has focussed on incidentally only once, and on the other hand, the contextual meaning in one context will only offer very limited information on the denotational meaning range. After discussing the enrichment process when a completely unknown word is encountered, we will now investigate how a learner reacts when she encounters a word again for which she has already constructed a (partial) meaning hypothesis.

Initially, we would expect her to start out from her previous meaning hypothesis and assume that the meaning of the word is largely consistent in the different contexts of its occurrence. This assumption is in line with the pragmatic principle of conventionality, which learners generally follow when acquiring new lexemes. Accordingly, the initial meaning hypothesis will probably function as a basis, and the learner will then test its validity in the light of the new meaning clues. Depending on how far the new clues can be integrated into the existing meaning hypothesis, the initial hypothesis will be refined, specified or revised accordingly.

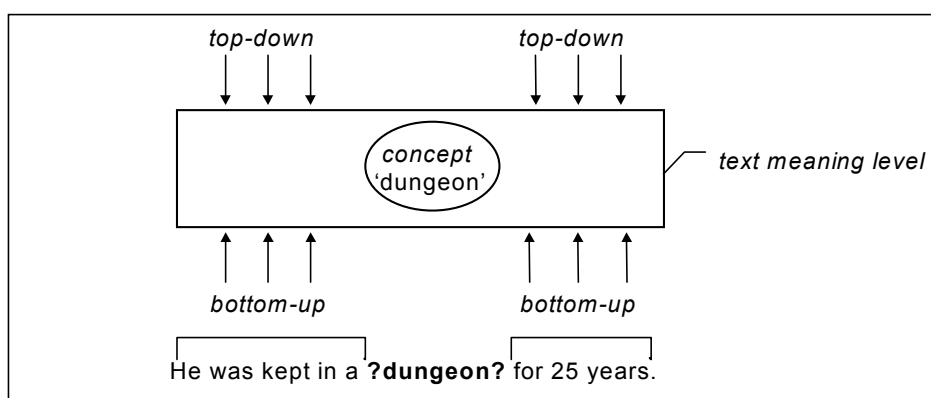
In the case where the new meaning aspects cannot be integrated into the original conceptual structure, the learner basically has three choices: she can either revise her old hypothesis on the basis of the new evidence, she can try to stick to the original meaning hypothesis as far as possible and try to extend it so that the new meaning aspects fit in, or she can choose to ignore the incompatible information. An interesting observation in the empirical studies concerned the fact that learners tended to stick to their meaning hypotheses about an unknown word once they had set them up, and tended to ignore contradictory clues as long as the new evidence was not completely incompatible. In some cases this strategy was so prominent that it even led to the construction of deviating mental models of the text meaning. These findings suggest that existing hypotheses form a powerful basis for further meaning specifications when a word is encountered again.

5. From meaning specification to vocabulary acquisition: Acquiring new words through reading

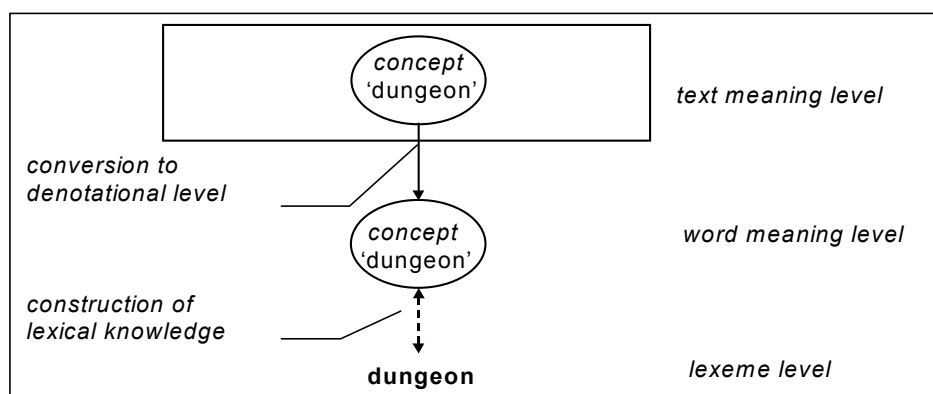
After having dealt with text comprehension and the specification of unknown word meaning within this process, we shall now turn our attention to the step from meaning specification to the actual acquisition of a new word. As already stressed, it is one important aspect of inferring contextual word meaning that the reader is usually on the text meaning level when specifying the unknown conceptual structure. Consequently, an active shift from the text to the word level is necessary on the reader's part in order to ensure that acquisition can take place, i.e. that she actively focuses on the word form, transfers the contextual meaning to the word meaning level and forms a mental connection between the word form and her meaning hypothesis. This shift will again be illustrated by means of example sentence (5) (see diagram 1):

Diagram 1. Steps in the construction of lexical knowledge during the *reading process*

Step 1: Specification of the concept on the text meaning level



Step 2: Shift from text meaning to word meaning



In a first step (step 1), the reader specifies the unknown concept of the word dungeon within her mental model of the text meaning. In order to construct lexical knowledge, however, she actively has to convert the contribution of the concept 'dungeon' to her mental model of the text meaning level onto the word meaning level and grasp the connection between this meaning hypothesis and the word form (step 2). From this cognitive perspective, it thus becomes clear that the path from word meaning inference to vocabulary acquisition is by no means as straightforward and automatic as many researchers suggest. As a precondition for the process of meaning inference to take place at all, a sufficient learner focus on the word has to be ensured; this degree of focus will also guide the degree to which the learner invests effort in the enrichment process, so that focus and enrichment are partly dependent on each other. And even if the learner focuses on a word and attempts to figure out its contextual meaning during the reading process, the conditions for incidental vocabulary acquisition are only positive if sufficient resources are provided by the text and by the learner, and if the learner focus is shifted from the text to the word level.

Putting the various strands together, three different processes appear to be relevant for ensuring that a new word in a text can be embedded in the learner's mental lexicon. Firstly, the specification of the contextual meaning on the text level through enrichment and focus; secondly, an abstraction from the contextual meaning contribution to the denotational level and the integration of this denotational knowledge into existing knowledge structures; and thirdly, the consolidation of the word form and of the connection between form and conceptual structure in the learner's mind:

❑ **Enrichment/Focus:**

text level: specification of contextual word meaning

❑ **Abstraction/Integration:**

shift from text level (contextual meaning) to word level (denotational meaning)

❑ **Consolidation/Association:**

word level: memorization of word form, link form-conceptual structure

Keeping a 'bird's-eye view' of incidental vocabulary acquisition, we always have to keep in mind that a single encounter of a word in a text can hardly be expected to lead to the acquisition of a new lexical item. In order to enhance the chances of acquiring a word, several instances of processing the same word in different contexts will be necessary, in which the learner can test her

first meaning hypothesis, elaborate the overall range of the denotative concept, and consolidate the word form and the link between form and conceptual structure.

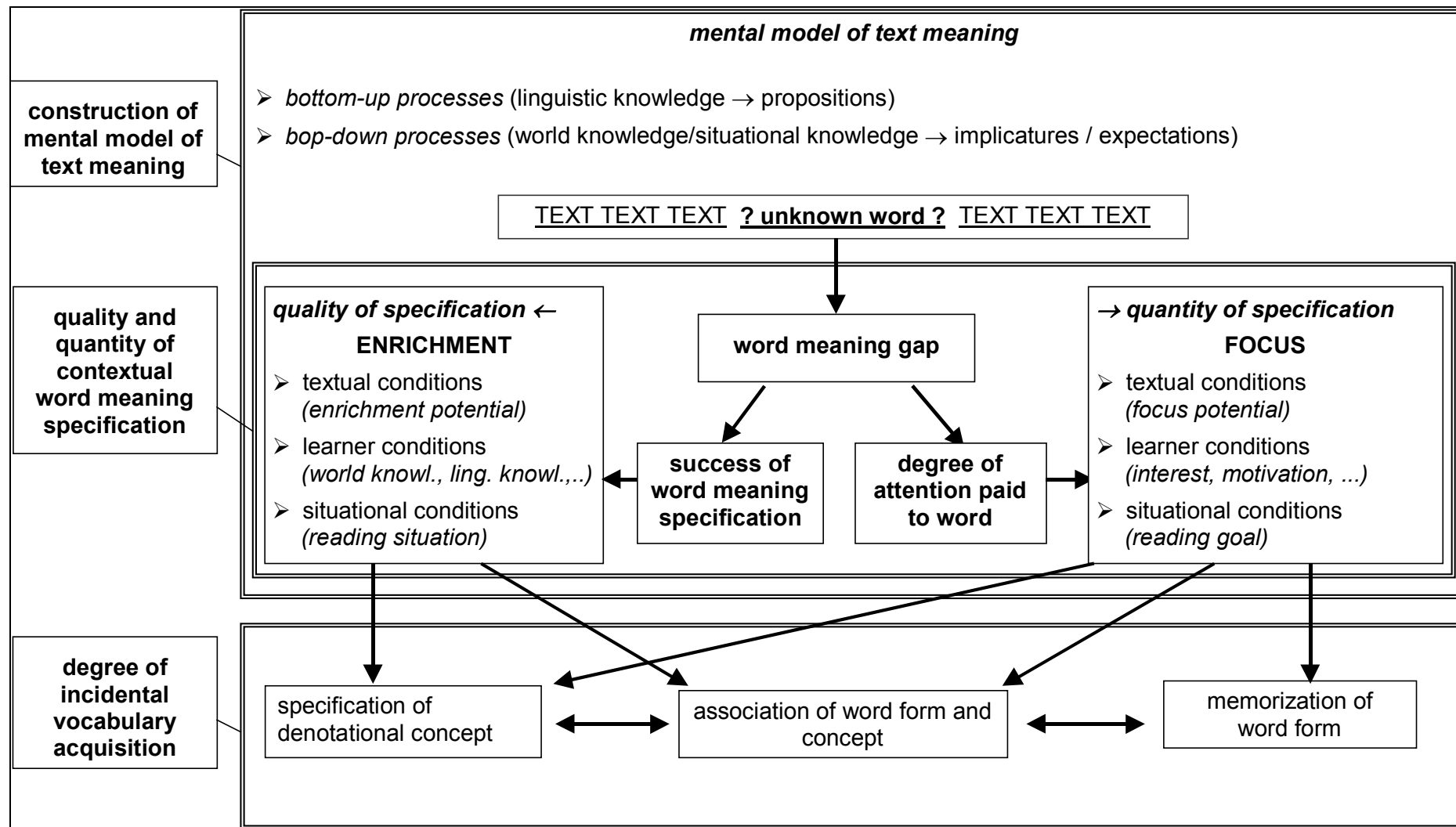
The process of abstracting the various contextual meanings to form the denotational meaning range of a word can be illustrated by comparing the denotational concept to a file-card box. Like in a file-card system, the different contextual word meaning contributions have to be abstracted into aspects of the denotational meaning (i.e. written on file-cards) and ordered into a common conceptual frame (i.e. the file-card box). Only within this framework do they result in the complex denotational concept. In order to lead to the acquisition of the new word, this new concept as well as the word form also have to be stored and linked in memory. All these processes require that the learner is repeatedly confronted with the word in order to ensure the elaboration and consolidation of lexical knowledge in the learner's mind.

As has been made clear by the theoretical and empirical observations above, incidental vocabulary acquisition involves a complex network of interacting processes and influencing factors. In an attempt to summarize the various dimensions, diagram 2 illustrates the interaction of the components involved in word meaning specification during the reading process, and of the implications for incidental vocabulary acquisition: Initially, the learner is confronted with an unknown word in the text, which will leave a conceptual gap in his mental model of the text meaning. The *quantity* of the meaning specification (i.e. the effort invested by the learner) will depend on the *focus* constellation, whereas the *quality* of the meaning specification (i.e. the degree of concept elaboration) will be limited by the *enrichment* constellation. Both the focus and enrichment conditions are influenced by specific textual, learner and situational factors. In terms of the effect on *vocabulary acquisition*, the degree of enrichment that has taken place will primarily affect the delimitation of the conceptual structure, while the degree and type of focus will influence the memorization of the word form as well as the abstraction from contextual to denotational meaning. Finally, both enrichment and focus will indirectly reflect on the association of word form and conceptual structure in the learner's mind; this association process, however, will only take place provided that the conceptual structure has been sufficiently specified and that the learner has taken the step from contextual to denotational meaning.

On the whole, then, the conditions for the incidental acquisition of an unknown word which a learner encounters in a text appear to be the result of two complementary determinants: the *availability* of the *resources* required for specifying the contextual meaning successfully, and the *necessity* for fo-

cusing on this particular word. The resources are made up of the textual clues on the one hand and the learner's language and world knowledge on the other, whereas the necessity for a meaning specification is determined by textual conditions (e.g. the word's centrality for the text meaning), learner conditions (e.g. text comprehension demand) and situational factors (e.g. reading goal). The specific constellation of the resource and necessity components will then determine the degree of incidental vocabulary acquisition. The crucial precondition for an acquisition process to take place, however, will always be the learner's attention to the word form and her active step from the text to the word level.

Diagram 2 Combined model of the factors influencing incidental vocabulary acquisition



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