Universal Grammar in Second Language Acquisition

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In his article, Meisel targets one of the central questions in the research on second language (L2) acquisition: why is it that the acquisition of a second language differs from first language (L1) acquisition when this second language acquisition takes place after a certain critical age? Meisel sets out to answer this question by referring to maturational changes in the developing brain that affect both, UG and the processing mechanisms necessary for acquiring a grammar on the basis of input data. In this comment, I will build up on Meisel's suggestion that a relationship between developmental neuroscience and the study of language acquisition should be established. Specifically, I want to suggest that the growing spezialisation of the brain towards L1 during L1 acquisition is the central factor that causes problems in L2 acquisition.

To attribute the differences between second and first language acquisition to differences in the availability of UG to language learners is an obvious move in the quest to explain L1 and L2 divergences. But what is UG? In fact, the answers to this question can be quite diverse (cf. e.g. Hauser et al. 2002, Wunderlich 2007).

According to the framework of Principles and Parameters (Chomsky 1981), UG consists of a set of principles universal to all languages. Some of these principles, so-called parameters, allow for a choice between limited options – ideally two. The variation between the languages of the world is restricted to the different settings languages can choose with respect to these parameters. During language acquisition parameters have to be fixed to the values expressed in the language acquired. By doing so, the child develops an I-language, an individual, internal grammatical representation of the language s/he acquires (IG L1). This I-language contains the universally valid principles and the fixed parameters valid for the specific language that is acquired. Hence, during language acquisition, UG is replaced by an internal grammar IG L1 which guides language performance and is accessed when an individual produces, comprehends, or judges the grammaticality of speech utterances.

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A possible move in explaining the differences between L1 and L2 learners is to assume that UG is no longer accessible to L2 learners (e.g. Clahsen & Muysken 1986). This, however, seems too strong an assumption. IG L1, the concrete specification of UG for the L1, guides the language behaviour of the individual speaker. And indeed, strong transfer effects in L2 acquisition exemplify that L2 learners – at least initially – apply their IG L1 to process language data from the L2. This is probably most obvious when we compare how a L2 is acquired by speakers with a typologically close L1 as opposed to speakers with a L1 that is typologically more different. Consider as an example the acquisition of German V2 placement. In German the finite verb is placed in the second structural position in main clauses (V2). A number of studies have provided concurrent evidence that V2 is notoriously difficult for L2 learners of a non-V2 language such as English, Turkish, or Korean (cf. e.g. Vainikka & Young-Scholten 1994, Beck 1998). However, V2 placement does not pose any problems for L2 learners of another V2 language such as Swedish (Bohnacker 2006) or Dutch. Bohnacker (2006) could show that Swedish learners of German had mastered V2 in German after only four months of exposure, whereas other aspects of German that differed from the Swedish L1 (here OV order in VP) had not yet been acquired at that time. Similarly, in a student project at the University of Ghent where the acquisition of German by Dutch speakers was investigated, we observed error-free V2 placement, although learners had a rather limited experience with German (i. e. 45 min. a week for about 30 weeks). The contrast between the effortlessness L2 learners of V2 languages (Dutch, Swedish) exhibit with German V2 and the marked difficulties L2 learners of non-V2 languages such as English, Turkish, or Korean show with respect to German V2 clearly highlights that transfer from L1 to L2 takes place in L2 acquisition. UG as mediated by the internal grammar of L1, thus, plays a central role in L2 acquisition.

The next step in L2-acquisition research, consequently, was to weaken the claim that UG is no longer accessible to L2 learners by suggesting that only parameter values not expressed in the L1 are inaccessible for L2 learners. Under this view, the learner addresses the L2 with her/his L1-IG. Parameter specifications that deviate from the L1 specification are, however, no longer accessible and pose serious problems to the learner. This suggestion captures the above-mentioned differences in the acquisition of German V2. Dutch or Swedish speakers have set the relevant parameter to V2 for their L1. Since German has the same parameter setting, no problem arises for Dutch/Swedish L2 learners of German with respect to the V2 placement of finite verbs. L2 learners of non-V2 languages, in contrast, attack German with a different setting of this parameter and, hence, experience problems with German V2, since the

V2 parameter is no longer available to resetting. Recall, however, that according to the Principles and Parameters approach typological differences between languages are based on different parameter settings. Hence, it seems questionable whether an interesting limitation has been achieved by claiming that only UG parameters are inaccessible to L2 learners. It is parameter values that distinguish one language from another, and it is different parameter settings that are difficult for L2 learners. In a nutshell, then, the theory simply states that L2 learners display problems with those aspects of L2 which differ from L1.

In his article, Meisel adopts a recent suggestion by Tsimpli & Mastropavlou (2007) according to which only parameter settings referring to uninterpretable syntactic features are inaccessible to L2 learners. This is an interesting limitation of the inaccessibility account to UG, since it predicts that parameters related to interpretable syntactic features should not pose any problems in L2 acquisition, even in those cases where L1 and L2 display different parameter settings.[1] Meisel suggests that the inaccessibility of uninterpretable features to L2 learners is caused by maturational changes during brain development. This suggestion implies that uninterpretable and interpretable syntactic features are represented differently in the mind/brain, since the former but not the latter are affected by these assumed developmental changes. One prediction deriving from Meisel's proposal is the following: if interpretable and uninterpretable features are differently represented in the brain, we should find language disorders caused by brain lesions or alterations in brain development that selectively affect uninterpretable features with interpretable features spared or that vice versa selectively affect interpretable features leaving uninterpretable features unimpaired. Indeed, it has been suggested that language disorders such as Specific Language Impairment (SLI) or agrammatic Broca's aphasia are due to deficits that selectively affect one type of feature, but not the other. Clahsen et al. (1997), for instance, have proposed that SLI is due to a deficit affecting the uninterpretable phi-features of verbs, whereas interpretable tense features are not affected in this language impairment. A reverse deficit affecting interpretable tense features but sparing uninterpretable phi-features has been sug-

1. This account makes the right predictions concerning the acquisition of V2 in L2 learners. Movement of the finite verb to C is caused by an uninterpretable feature in C that has to be checked during derivation. Since this uninterpretable feature is inaccessible for L2 learners and the corresponding parameter cannot be reset, learners from non-V2 languages should experience severe problems in the acquisition of V2 − as they do. The account, however, does not seem to be compatible with the data on the acquisition of French gender markings presented in Meisel's article: the GENDER feature on nouns is an interpretable feature, it should not present any difficulties to German L2 learners of French, contrary to the observations reported.

gested for agrammatic Broca's aphasia (Wenzlaff & Clahsen 2004). Note, however, that the language deficits in SLI and agrammatic aphasia are not as selective as suggested above. Whereas Clahsen et al. (1997) state that only agreement but not tense inflection is impaired in SLI, a number of studies have found tense inflection to be severely affected in children with SLI (e.g. Rice & Wexler 1996, van der Lely & Ullman 2001). Conversely, deficits with agreement inflection are typically observed in English-speaking Broca's aphasics (e.g. Goodglass et al. 1993, Faroqi-Shah & Thompson 2004), contrary to the claim of Wenzlaff & Clahsen. At present, thus, there is no convincing evidence to support the claim that the deficits observed in language disorders such as SLI and agrammatism are selective to specific types of features. More research making use of a variety of neurolinguistic methods will be needed to investigate the issue of a distinct neural representation of uninterpretable and interpretable features.

Rather than pursuing this suggestion any further, I want to advocate a different definition of UG which takes serious the close relationship between linguistics and the neurosciences that is called for by Meisel. In a recent article, Dieter Wunderlich (2007) proposes the following definition of UG which directly relates to the neurosciences:

> As is well-known by now, all linguistic activities are processed in certain areas of the brain, and they are based on a certain memorized inventory. UG, then, more precisely, is a description of the (genetically transferred) information for the brain of how it has to process chunks of memorized linguistic input. (Wunderlich 2007: 148)

According to Wunderlich's definition, UG consists of the genetically-specified capacity of specific brain areas to deal with language data; UG is a "human-specific learning algorithm towards language" (Wunderlich 2007: 147) that is implemented in the brain. According to this view, the distinction Meisel draws between representational knowledge, i. e. UG, and discovery and processing mechanisms necessary to attain this knowledge is rendered invalid. UG is the genetically shaped pre-wiring of the brain that determines how specific brain areas process primary language data. Given this definition of UG, the maturational effects in brain development, alluded to by Meisel, can be understood as a functional adaptation and shaping of the processing mechanisms and their neural substrate in order to optimally and efficiently process and represent the incoming L1 data.[2] The IG that develops through the interaction of UG

2. The incoming L1 data, or intake, changes considerably during L1 acquisition as more and more language units (phones, phonemes, words etc.) are segmented in the speech stream and categorized, specified, and stored in the mental lexicon.

and primary language data can, then, be conceived of as a higher-level description of the processing mechanisms that are adapted and optimized to deal with L1 data.

That the development of the brain is affected by the environment is common knowledge in developmental cognitive neuroscience. Processes such as synaptogenesis (i. e. the building of synapses to pass along information between neurons) and synaptic pruning (i. e. the selective elimination of synapses not activated by appropriate coordinated signals) by which the brain wires itself to optimally deal with sensory input are dependent on stimulation from the environment, i. e. from external or internally generated experience (cf. e.g. Couperus & Nelson 2006). These processes take some time in post-natal development and synaptic pruning might well continue until mid-adolescence in brain areas related to higher cortical functions (cf. Couperus & Nelson 2006). Our knowledge on the development of language related brain areas is still very limited, since such knowledge can only come from post-mortem investigations, and I am not aware of findings that point to specific processes in brain development at age four, which according to Meisel marks the transition from L1 acquisition to child L2 acquisition. However, Meisel is right to suggest that the comparative investigation of L1 and child L2 learners could direct research on brain development to take the specific period of time into view that is correlated with the closing window of opportunity in language acquisition. Research in neuroscience that scrutinizes on particular age ranges singled out by linguistic research on language acquisition could, indeed, offer a fascinating opportunity to relate changes in brain development to developmental changes in the capacity to acquire language, thereby providing an important piece of knowledge on the neural basis of the human language capacity.

Evidence that processing mechanisms are adapted and optimized to deal with primary language data has come from investigations on the development of auditory perceptual abilities of infants during their first year of life. Research has shown that babies' perceptual capacities are shaped by the language input they receive during the first year. Whereas the ability to perceive native phonemic contrasts increases during the first year, the ability to discriminate phonemic contrasts that are not used in the native language declines during this same period of time. This homing in on native phonemic contrasts serves a purpose: it is correlated with the ability to recognize and segment words from the speech signal. Thus, it has been shown that the better the child's abilities to discriminate native phonemic contrasts and to neglect non-native ones, the more advanced are her language skills (cf. Conboy et al. 2008 for overview). These findings exemplify that it is the fine-tuning of cognitive processes which ensures a fast and effective processing of the language data available in the input.

Once a brain is shaped and attuned to optimally represent and process the primary language data available, it will necessarily run into problems when confronted with the task to deal with language data that are differing from these data in critical respects. Thus, children and adults might not be able to discriminate phonemic contrasts in a L2 (e.g. a contrast between a retroflex or dental /t/) if these distinct L2 phonemes are perceptually assimilated to the same phoneme (/t/) in their L1 (e.g. Best et al. 1988).[3]

When the brain specialized and optimized for processing L1 data is faced with critically different language data from a L2, a restructuring has to take place that allows for learning the L2. In the course of L2 acquisition processing mechanisms have to be established that will deal with those aspects of L2 data that critically differ from L1 data. It seems reasonable to assume that the same basic mechanisms of segmentation, comparison, identity and difference detection, structural decomposition, categorization, generalization and storage that are put to use in L1 acquisition also guide L2 acquisition. The observation that native-like L2 acquisition is not regularly achieved, however, suggests that the processing mechanisms established during L2 acquisition do not operate as effectively as their L1 counterparts. Hemodynamic studies of brain activation patterns correlated with L1 vs. L2 language processing support this assumption. A common finding of such studies is that cortex areas active in L1 language processing display increased activation for comparable language tasks in the L2. In a recent article, Indefrey (2006) suggests that the neural organization of one of these areas, the left inferior frontal gyrus, is optimized for native language processing, specifically for the processing of L1 syllabification patterns, and that the stronger activation of this area in L2 reflects a less efficient organization of the neurons involved in processing different patterns in the L2 data.

Decreases in brain plasticity are the central factor in accounting for a less efficient representation and processing of L2 data at the neural level. Once efficient processing mechanisms tailored to L1 data have been established in the brain (for instance via synaptic pruning in brain development), limitations in the plasticity of the brain structures subserving

3. Not every difference between L1 and L2 is to cause problems. For instance, children and adults are well able to discriminate phonemic contrasts not used in their L1 if the different phonemes are not part of their L1 phonemic inventory (e.g. Zulu clicks, Best et al. 1988), or if the different phonemes are perceptually assimilated to different phonemic categories in the L1. Which differences are critical respectively not critical has to be established by careful linguistic research.

these processing mechanisms might render it difficult or even impossible to sufficiently adapt these mechanisms to also deal with differing data. In this situation, different neural circuits than those involved in L1 processing might be allocated to process L2 data. While hemodynamic studies have shown that the larger brain areas involved in language processing do not differ between L1 and L2, studies employing the method of intraoperative electrical stimulation of the cortex have reported differences in brain organization for L1 and L2 in individual subjects. Intraoperative electrical stimulation allows to investigate the localization of language functions in very small areas of the cortex (of about 1mm in diameter) in an individual subject. Making use of this technique, Lucas et al. (2004) reported that in individual speakers brain areas necessary for object naming in L1 might differ from brain areas subserving object naming in L2. This observation suggests that within the larger brain regions involved in language processing different brain areas are allocated to deal with L2 structures – brain areas that might not be as effectively tailored to perform this task as comparable L1 circuits.

Meisel suggests that a less efficient representation and processing of L2 might also come about because L2 learners make use of different cues and employ different mechanisms in language acquisition – cues and mechanisms which are not as optimal as the ones employed in L1 acquisition. He provides data suggesting that child L2 learners of French differ from L1 learners in that they do not rely on formal properties of nouns to determine their gender, but learn the gender of nouns word for word. Evidence that L2 learners heavily rely on the memorization of language data comes from a recent study investigating the electrophysiological components that are correlated with the processing of French sentences containing correctly or incorrectly inflected verbs (e.g. *Tu adores/*adorez le français.*). Osterhout et al. (2006) observed an interesting difference between native speakers and beginning L2 learners of French. Whereas native speakers of French displayed a P600 that reflects detection of a rule violation when confronted with an incorrect verb form, beginning L2 learners of French reacted with a N400 component. The N400 is correlated with lexical-semantic processing and indicates here that the tested L2 learners stored a combination of pronoun and verb (or verb ending) and simply detected a novel combination in the ungrammatical sentences. The lack of a P600 in these beginning learners reflects that they have not yet generalized the rules of subject-verb agreement in French. In accordance with these observations is a recent proposal by Michael Ullman (2005) who suggests that L2 learners over-rely on the declarative knowledge system where words and other memorized language chunks are stored, but under-use the procedural system which contains the rules to generate composite structures such as sentences and complex words out of these stored elements. Ullman argues that the over-reliance on the declarative memory system is due to maturational changes in brain development (e.g. caused by increasing estrogen levels during childhood/adolescence) which result in an enhancement of the declarative memory system and a weakening of the procedural system. Indeed, it has been speculated that the limited memory capacities of young children are a driving factor in generalizing language rules (Locke 1997, Deacon 1998), since the decomposition of language structures into productively combinable constituents relieves the strain on memory capacities. An enhancement of the declarative memory system in brain development would conversely lead L2 learners to rely on storage of language constructions at the expense of decomposing structures and generalizing combinatorial operations. A different, less economical and, hence, less efficient organization of L2 results.

The uninterpretable-feature account to L2 acquisition suggested by Meisel and the suggestion sketched above differ widely with respect to the facets of L2 acquisition they take into scope. Whereas the former account restricts its focus to uninterpretable features not shared by L1 and L2, the latter suggestion takes a much broader view also encompassing aspects of L2 acquisition that lie outside the focus of syntax proper. All aspects of L2 which critically differ from L1, including uninterpretable features, should cause problems in acquisition, as they cannot be dealt with by the processing mechanisms specifically tailored to L1. In the endeavour to combine research on brain development and on language acquisition we should not take too narrow a focus, but we should consider the possibility that the neurodevelopmental processes which underlie L1 respectively L2 acquisition are not restricted to particular aspects of language, such as uninterpretable features. Rather globally acting mechanisms, like synaptogenesis or synaptic pruning, that shape the brain to efficiently compute sensory input during a sensitive period of brain development could provide the basis of a unitary account for the different aspects of language that lead to problems in L2 acquisition.

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