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2

The role of salience

One well-known observation in cross-linguistic studies on child language is that Turkish inflection emerges early (e.g. Slobin, 1985; Bittner et al., 2003). The example in (1) demonstrates that, in Turkish, each morphosyntactic feature is encoded in a separate affix and added to a root (or root-affix combination). This results in affixes that have a one-to-one form-feature relation. With a noun like *ev* 'house', each of the features, LOCATIVE and PLURAL, are added to the noun base as separate affixes in a fixed linear order. The affixes are regular (with almost no exceptions to the rules) and clearly segmentable.

(1)	a.	ev		'house'
	b.	ev-*de*	LOCATIVE	'in the house'
	c.	ev-*ler*	PLURAL	'houses'
	d.	ev-*ler*-*de*	PLURAL, LOCATIVE	'in the houses'

The characteristics of Turkish inflection described above (easy segmentation of affixes, a fixed position relative to a stem and one-to-one correspondence between affixes and features) are characteristic for agglutinating languages in general. Further, these characteristics are often cited to explain why children master such inflectional systems early (Aksu-Koç and Slobin, 1985; Peters, 1997; Aksu-Koç and Ketrez, 2003). Likewise, inflection development in languages which lack these properties is expected to be slower.

Slobin (1973, 1982, 1985) was the first to argue that the order in which children acquire inflectional morphemes (and grammar in general) is guided by specific properties of linguistic structure. Based on observations of language development from a large number of typologically different languages, Slobin extracted a number of strategies, which he called 'operating principles'. Operating principles describe how learners analyze language input and how

learners discover grammatical structure. Among the most important operating principles are (i) 'pay attention to the order of the words', (ii) 'avoid exceptions' and (iii) 'pay attention to the end of the words'. In addition, Slobin proposed that, as children acquire the inflectional morphology of their language, they rely on salience factors such as frequency and on conceptual and phonological salience. As a consequence inflectional morphemes which are salient, are perceived and produced early. Similarly, Peters (1997) argued that inflectional morphemes are easy to acquire when they are frequent, easy to segment, have a fixed position relative to the stem and a clear-cut form-feature correspondence.

There are, however, also some properties of inflectional morphemes that deem them less salient, and consequently, tend to emerge later in development. All of the following properties are of this type: Morphemes that encode multiple features; morphemes that are unstressed and/or non-syllabic, and inflectional morphemes which are embedded within words (i.e. infixes). In support of the proposals put forth by Slobin and Peters, empirical studies show that morphemes with salient properties pose little difficulty for children whereas opaque morphemes are acquired later in development (e.g. Brown, 1973; Slobin, 1985; Voeikova and Dressler, 2002; Bittner et al., 2003).

In Chapter 1, I proposed that if I want to account for the observation that certain morphemes are acquired early while others are acquired late, then it is necessary to consider the role of salience. The present chapter discusses the role of five factors that are reported in the literature to contribute to the salience of inflectional morphemes: Phonological salience (2.1), positional salience (2.2), feature salience (2.3), feature complexity (2.4), and input frequency (2.5). In each section, I will summarize important claims and observations regarding a given factor and evaluate the extent to which each factor is expected to influence the acquisition of inflectional morphemes. Section 2.6 concludes the chapter, suggesting that, in order to capture the true role of salience in acquiring a particular morpheme, one needs to examine the cumulative effects of salience factors.

2.1 Phonological salience

The ability to segment a phonological form into smaller chunks is the first step in learning that inflected words consist of root-affix combinations, and hence, the first step in learning inflection (Peters, 1982, 1997). Detection of a particular word part as an affix requires exposure to *lexical* as well as to

paradigmatic variation (Blom, 2003). Lexical variation refers to exposure to several instances of the same affix attached to different roots. In (2), the lexical variation is represented by a plural affix and a set of various fictive roots.

(2) Lexical variation
tra-PLURAL, ple-PLURAL, slo-PLURAL, zpi-PLURAL

A reoccurring affix that is attached to various lexical roots should facilitate children's ability to isolate the affix itself (in this case PLURAL). Once the affix has been isolated, a child is more readily able to discover its corresponding (meaningful) feature. For example, if the child consistently hears *These are apples and these are oranges* and already knows the nouns *apple* and *orange*, she is thought to isolate the –*s* suffix and infer that the instance of –*s* means 'more than one'.

At the same time, the child may notice that the same word forms are in paradigmatic variation. In example (3), paradigmatic variation is represented by a hypothetical root *tra-*, and a set of various affixes representing various features such as PLURAL, ACCUSATIVE, DEFINITENESS, ANIMACY etc.

(3) Paradigmatic variation
tra-PLURAL, tra-ACCUSATIVE, tra-DEFINITENESS, tra-ANIMACY

In theory, when children hear different affixes with the same root, they are able to compare the forms with each other and deduct the phonological information that does not overlap among the roots. Children will notice that one root expresses different meanings when different affixes are attached to it. For example, if a child hears *Yesterday it rained the whole day and today it's raining too,* she is thought to be able to isolate the form *rain* and infer that the suffixes –*ing* and –*ed* encode different features.

In all languages, children must first segment word forms in order to acquire inflection. The segmentation process, however, does not entail the same complexity across all languages. Several authors argue that the simplicity of segmenting is determined by a degree of *phonological salience*, i.e. how easy it is to detect the root and the affix in a given word form (Peters, 1997; Gillis, 2003). Brown (1973: 409) refers to phonological salience as "such variables as amount of phonetic substance, stress level, usual serial position in a sentence, and so on". In the context of this thesis, phonological salience refers exclusively to perception of the linguistic input.

Specific claims about the impact of phonological salience on acquisition of inflection (and morphology in general) are made by the Surface Hypothesis, which assumes that surface characteristics of morphology play a significant role in acquiring inflection (Leonard, Sabbadini, Leonard and Voltera, 1987; Leonard, 1989; Leonard and Eyer, 1997; Montgomery and Leonard, 1998). Originally, the Surface Hypothesis was proposed in order to explain cross-linguistic differences in acquisition of inflection by children diagnosed with Specific Language Disorder (SLI).[1] The main claim of the Surface Hypothesis was that children with SLI have a processing-capacity limitation that leads to difficulties in processing affixes with reduced phonetic substance: The so-called *weak* morphological markers, which are vulnerable to final consonant deletion and weak syllable deletion. Leonard defines weak morphological markers as: "Low phonetic substance morphemes are non-syllabic consonant segments and unstressed syllables, characterized by shorter duration than adjacent morphemes, and, often, with lower fundamental frequency and amplitude" (Leonard, 1989: 186).

Support for the Surface hypothesis comes from Italian (Leonard et al., 1987) and from Hebrew (Rom and Leonard, 1990). These data indicate that children with SLI perform as well as typically developing children (when matched by MLU's) with word-final morphemes that are stressed, vocalic, and syllabic. The same children, however, performed worse than (MLU-matched, younger) typically developing children with unstressed monosyllabic inflectional morphemes.

Interestingly, cross-linguistic studies have showed that the same morphemes which pose problems for children with SLI in one language seem to be completely unaffected in another language. Leonard et al. (1987) compared the error patterns of English-speaking children with SLI and Italian-speaking children with SLI. He showed that 3rd person singular inflectional morphemes, which were prone to error in English, were relatively unaffected in the Italian SLI population. In Italian, the 3rd person singular is marked by a vowel at the end of the verb: *–a* or *–e* depending on the infinitival form, whereas in English, there is a non-syllabic unstressed suffix *–s*. These data were in line with predictions made by The Surface Hypothesis, namely, that the

[1] Specific Language Impairment (SLI) is a 'pure' developmental language disorder in that children with SLI seem to develop normally except that they show significant limitations in their spoken language ability. Unlike children with other types of language disorders, they show no signs of hearing impairment, mental retardation, social-emotional disorders or neurological damage. They are, however, still unable to learn a language rapidly and effortlessly (Fletcher, 1999).

English speaking children would have greater difficulties than the Italian speaking children with the 3rd person singular form because the Italian form is syllabic and word final whereas the English suffix is non-syllabic and vulnerable to final consonant deletion. Italian children with SLI, however, also performed poorly with inflectional morphemes that lacked phonological salience.

The findings about the role of phonological salience in acquisition of inflection are not restricted to data from children with SLI. Typically developing Italian children are also reported to experience greater difficulties with phonologically less salient morphemes (Leonard et al., 1987). Similar results were also obtained in a cross-linguistic study conducted by Smoczyńska (1985). Smoczyńska compared the acquisition of case inflection in typically developing Russian and Polish children. She found that, although the inflectional systems are almost identical in terms of morphosyntactic features, Polish children tended to acquire the case system with greater ease than the Russian children. According to Smoczyńska, the critical factor turned out to be phonological: Unstressed final vowels that distinguish cases were reduced to schwa in Russian but not in Polish, thus making the task more difficult for the Russian child.

Based on analyses of various cross-linguistic data, Slobin (1985) argued that children prefer phonologically salient inflectional morphemes over non-salient ones, despite the fact that children sometimes produced the non-salient morphemes first. Slobin documented a phenomenon referred to as 'inflectional imperialism', which he defined as complete or almost complete replacement of competing inflectional patterns by a different single form. Thus, he claims that sometimes children first use a (phonologically unsalient) correct affix and only later, is that affix driven-out by a more salient affix. In Slobin's reports of Russian children (1966), the driven-out forms were predominantly zero morphemes, which are inflectional forms which completely lack phonological substance. Smoczyńska (1985) observed the same pattern in Polish. Slobin claims that children use this to develop a type of default. He states: "if you fail, use only the most salient and applicable functor to express the given notion in the given position" (1985: 1219).

Given the proposals and the observations provided by various studies, I can conclude that phonological salience has a strong impact on the ability to process and segment root-affixes. It has been shown that children notice the phonologically salient morphemes before the phonologically non-salient ones. Crucially, a morpheme's level of phonological salience is dependent on the

presence or absence of a (full/reduced) vowel: Inflectional morphemes containing a full vowel as in (4a) are more salient than those containing a reduced vowel (i.e. schwa), as in (4b). Inflectional morphemes containing a reduced vowel are more salient than inflection without a vowel as in (4c) and finally, inflectional morphemes marked by zero morphemes, as in (4d), are considered non-salient.

(4) a. (he is) walk – *ing*
b. (he) walk –*ed*
c. (he) walk –*s*
d. (they) walk –*ø*

On the basis of the observations summarized in this section, I have formulated a scale of phonological salience for inflectional morphemes in (5).

(5) full vowel > reduced vowel > no vowel > zero morpheme

The implicational scale presented in (5) also makes it possible to make predictions about ease of acquisition. Specifically, it implies that more phonologically salient morphemes will be acquired earlier than less phonologically salient morphemes. Thus, children are expected to acquire syllabic affixes earlier than non-syllabic affixes. The scale in (5), for example predicts that an English-speaking child will acquire the syllabic suffix –*ing* earlier than the non-syllabic –*s*. This prediction is supported by empirical observations regarding acquisition of English morphology (e.g. Brown, 1973; Smolík, 2005).

2.2 Positional salience

Positional salience has to do with the tendency for children to focus more on lexical items that are in utterance-final position, as exemplified in (6a) or in word-final position, as exemplified in (6b).

(6) a. I'm waiting for the *bus*
b. wait*ing*

A number of studies suggest that positional salience plays a role in predicting children's early word production and perception. For example, a perception

experiment with one-year-olds showed that recognition of a recently learned word is better if it occurs in utterance-final position (Fernald and McRoberts, 1993). Similarly, Shady and Gerken (1999) found that two-year-olds performed better in a picture identification task when the target words were presented at the ends of a sentence. The authors claimed that the element in utterance-final position is prosodically highlighted, which is thought to facilitate children's acquisition.

Various production studies have also demonstrated that acquisition speed is also affected by how frequently an item occurs in the utterance-final position (Gillis and Verlinden, 1988; Naigles and Hoff-Ginsberg, 1998). Wijnen, Kempen and Gillis (2001), however, found that infinitival verb forms are often acquired earlier than their input frequency would predict. Wijnen et al. (2001) analyzed longitudinal spontaneous speech data from two monolingual Dutch boys: Peter and Matthijs (available via CHILDES, MacWhinney, 2000). The authors suggest that position is likely to have a stronger impact than frequency. They argue that, in Dutch, the early emergence of infinitives is best explained by a combination of factors: Positional salience, frequency related to lexical variation, and the relatively high semantic salience of infinitives as compared to finite verbs.

Positional salience has also been shown to influence the learning of computational models. Freudenthal, Pine, and Gobet (2003), for example, showed effects of positional salience with the computational model: MOSAIC (Model of Syntax Acquisition in Children). Like children, MOSAIC learns from naturalistic input. The artificial learner produces utterances that can be directly compared with children's utterances. MOSAIC shows that young children's tendency to use both correct finite verbs and incorrect optional infinitives can be explained by input frequency in combination with an utterance-final bias.

In 1973, Slobin proposed that language learners find word-final affixes particularly salient. Based on Peter's (1982) work on segmentation, and on extensive cross-linguistic research of more than 40 languages, Slobin (1985: 1038) formulated the following operating principle: "Pay attention to the last syllable of an extracted speech unit". In support of this principle, Slobin presents cross-linguistic evidence from children's acquisition of case inflection and their acquisition of articles. Slobin notes that children learning languages which are rich in inflection (i.e. Russian, Polish, Serbo-Croatian, Finnish, Hungarian, and Turkish) tend to use morphemes that encode the ACCUSATIVE

and the DATIVE. In these languages, these particular morphemes are coded as noun suffixes. Children learning German, however, acquire these morphemes relatively late in acquisition (Stern and Stern, 1907: reference cited in Slobin, 1973), presumably because they are realized as forms of pre-nominal articles. In his analysis, Slobin considers the *article* + *noun* combination as a single unit and not as two separate lexical items.

Similarly, a cross-linguistic comparison of article acquisition reveals that English articles (which are prenominal, e.g. *a roof* or *the garden*) are much slower to develop than the definite article in Bulgarian (which is a noun suffix, e.g. *gradina –ta* 'the garden') (Brown, 1973; Gheorgov, 1908: reference cited in Slobin, 1973). Slobin (1973) interprets these findings as evidence that there is no morphosyntactic feature absent from children's early language. Instead, he argues that young learners pay attention to the last syllable of the extracted speech unit. However, upon further analysis of the examples provided by Slobin, it could also be that children are simply better at acquiring bound morphemes (i.e. word formation) than they are at acquiring free morphemes (i.e. constituent formation).

Counter evidence to this claim and evidence for the claim that positional salience does play a role in acquisition of affixes comes from a study by Daneman and Case (1981), in which English-speaking children were taught artificial inflection rules. In this study, children learned two nonce verbs: *pum* and *bem*. In addition, the children were taught that the form that the verb takes is dependent on the number of animals who witnessed the action. If the actions were observed by one animal, the verbs were suffixed as *pum –abo* or *bem –abo*; and if the actions were observed by several animals, the verbs were prefixed as: *aki– pum* or *aki– bem*. The researchers hypothesised that if children were indeed paying greater attention to the word-final morphemes, then the suffixed verbs should be acquired earlier than the prefixed verbs. The results of the study showed that this was indeed the case.

The aforementioned studies support the notion that positional salience has a strong impact on children's acquisition of lexical items as well as their acquisition of inflectional morphemes. The overarching prediction is that elements which occur in utterance-final position or in word-final position should be acquired earlier than elements that occur in other positions.

2.3 Feature salience

It has been hypothesized that grammatical features underlying all languages are highly salient and hence, expected to surface early in children's language (e.g. Pinker, 1984). A salient feature is one which can be referred to in the world. Salience of morphosyntactic features has been proposed to play a significant role in development of grammar (Slobin, 1973; Pinker, 1984). Features are defined as elements into which linguistic units, such as words, can be broken down. Examples of morphosyntactic features include NUMBER (SINGULAR, PLURAL, DUAL….), PERSON (FIRST, SECOND, THIRD), CASE (NOMINATIVE, ACCUSATIVE, LOCATIVE….), GENDER (FEMININE, MASCULINE, NEUTER) and so on. However, it is important to note that the manifestation of features varies across languages. In Dutch, for example, attributive adjectives are marked for NUMBER, DEFINITENESS and GENDER. In other languages, some of these features are unmarked. A language could also express features other than those expressed in Dutch, for example ANIMACY.

Although cross-linguistic comparisons demonstrate a great deal of variation with respect to features, there have been attempts to make cross-linguistic generalizations. Greenberg (1963), for example, observed that features cluster according to general patterns such that 'no language has a dual unless it has a plural' (Universal 34, Greenberg, 1963: 94). Talmy (1985, 1988) showed that many features seem to be excluded from grammatical expression. For example, there is no known language where verb inflectional morphemes distinguish whether an event occurred in the daytime or night time, nor are there any known languages that include verb inflections that encode whether the speaker is bored or interested. Talmy (1985) provides a list of features that are typically realized as verb affixes or particles. He contrasts this list with a list of features that are not grammatically encoded on verbs. Examples from the two lists are given in (7).

(7) a. *grammatically encoded features*

- tense
- aspect
- causality
- voice
- mood
- person

- number of event participants
- gender of the participant
- speaker's evidence of making claim (e.g. hearsay)
- personation (action on self vs. other)
- speech act type
- social status of interlocutors
- positive or negative status of an event's existence

b. *non-grammatically encoded features*

- color of an event participant (occurrence during night or daytime, a cold or a hot day)
- speaker's state of mind (e.g. bored, interested)
- spatial setting (e.g. indoors/outside)
- etc.

Talmy's extensive typologically research is related to an earlier proposal which holds that there exists a set of universal semantic primitives underlying all languages (Postal, 1966; Bierwisch, 1967; Bickerton, 1981). According to Postal, the semantic primitives are innate items. What must be learned, Postal maintains, is only the mapping between fixed sets of semantic primitives and sets of phonological and syntactic properties. It should be explicitly noted, however that children must also be able to first detect those primitives which receive lexical/grammatical expression in her language, and those which do not.

Some researchers have adopted Greenberg's typological universals and Talmy's analysis of grammatical features to explain how children learn inflectional paradigms and how they learn to map forms and features. For example, Slobin (1985: 1173), referring to the grammatically encoded features in Talmy's list (7a), suggested that "such notions must constitute a privileged set for the child, and that they are embodied in the child's conceptions of 'prototypical events' that are mapped onto the first grammatical forms universally". Pinker (1984) takes a similar position by saying that "the child can extract […] the potentially grammatically relevant semantic features of the sentence participants (their NUMBER, PERSON, GENDER, etc.) …" (1984: 30). The issue regarding whether the features are innate or whether they arise from prior experience is not relevant, as long as the child is, at some point, able to detect the features. Pinker put forth a model that works on a pre-established

ranking of features. The highest ranked features are most likely to appear early in the ambient language. Thus, if a child were able to capture the relevant features, she would be spared the task of initially scanning the entire inventory of grammatical features by 'weighting of hypotheses' based on 'cognitive salience' (Pinker, 1984: 170). Pinker's feature accessibility hierarchy corresponds to the frequency of occurrence of grammatical features in the languages of the world (see also Bowerman, 1985).

More recently, Harley and Ritter (2002) have proposed a feature hierarchy which aims to capture typological universals as well as developmental patterns in language acquisition in pronominal systems. The hierarchy is empirically sound and captures a wide range of languages. Although the main focus is on pronouns, the hierarchy can also be applied to verbal inflection: In order to express agreement relation between a (subject) pronoun and a verb, the same morphosyntactic features are at play. I will not go into details of the hierarchical organization, as these are not important for the purposes of this thesis. Instead, I will focus on the relevant information that the hierarchy provides with respect to acquisition of verbal inflection.

According to Harley and Ritter, children first make a morphological contrast between [+SPEAKER] and [-SPEAKER], after which, they acquire morphemes that encode the feature [+ADDRESSEE]. Children are also expected to express the feature [-PLURAL] earlier than the feature [+PLURAL]. In (8), I summarize the predictions for acquisition of verbal inflection that are in line with Harley and Ritter's hierarchy.

(8) a. [+SPEAKER] = [-SPEAKER] > [+ADDRESSEE]
b. [-PLURAL] > [+PLURAL]

Based on the hierarchy in (8), I can predict variation across children: Children either start with the singular form marked for [+SPEAKER; -ADDRESSEE] (i.e. 1st person) or with the singular form marked for [-SPEAKER; -ADDRESSEE] (i.e. 3rd person). The study of child Italian (Leonard et al., 2002) seems to support this prediction. These authors report that two- and three-year old children overuse these two forms when they do not realize the correct verbal agreement (see also Chapter 1, Section 1.2).

On the assumption that children will seek morphosyntactic expression for the most salient features that they can refer to, it is expected that features with direct referents in the world such as NUMBER or PERSON will be expressed first

in any given language. However, this prediction seems to be contradicted by studies investigating acquisition of grammatical GENDER. It is crucial to mention that GENDER represents two distinct concepts: (1) it refers to natural gender; that is, it corresponds to male and female distinctions in human beings or sexed animals; and (2) it refers to an agreement feature called 'grammatical gender', which is unrelated to natural gender. According to Adger (2003: 40) "Many languages have what is called grammatical gender, where words are assigned a gender category (masculine, feminine, neuter) which bears no obvious semantic relation to what the word refers to". It is clear that grammatical GENDER is a morphosyntactic feature that does not necessarily have referents in the world. This means that grammatical GENDER is rather a property of individual nouns and not of the referents of those nouns. This property shows up in a process of syntactic agreement.

Given the characteristics above, grammatical GENDER is less salient than NUMBER. Therefore, grammatical GENDER is expected to be acquired later. Various studies have shown, however, that despite its low feature salience, grammatical GENDER surfaces early in the development. For example, Karmiloff-Smith (1979) carried out experiments with French-speaking children between ages 3;2 and 12;5, in order to explore their acquisition of determiners. In these experiments, nonce nouns were used to learn about the types of cues that children use in attributing gender and marking gender agreement. Karmiloff-Smith observed a preference for phonological cues in children up to the age of nine. Reliance on phonological cues was gradually replaced by reliance on semantic cues, although the phonological cues were never completely abandoned. Using a procedure very similar to Karmiloff-Smith's, Pérez-Pereira (1991) conducted a study on gender acquisition by Spanish-speaking children. In this study, he observed the same gender attribution strategies. Slobin (1985) reported that in Slavic languages, the gender categories are acquired later when they do not follow the general pattern of the phonological regularities (see also Polišenská, 2006 and Rodina, 2006 for similar observations in Czech and Russian, respectively). In line with these findings, grammatical gender in Dutch, which has almost no morphophonological or semantic correlates, has been reported to surface relatively late in children's development (Deutsch and Wijnen, 1985; Van der Velde, 2003).

In sum, I expect that, out of the set of grammatically encoded features, children will first express salient features because these features are meaningful since they correspond to natural classes with direct referents in the world. Some examples of salient features include PERSON and NUMBER. However, studies

strongly suggest that, despite its low feature salience, grammatical GENDER may surface early in children's language due to other factors such as phonological regularities. Importantly, the observations about children's acquisition of grammatical GENDER indicate that children pay attention to various factors during acquisition. I will come back to this in the final section in this chapter, and once again in Chapter 3.

2.4 Feature complexity

Feature complexity refers to how many morphosyntactic features are associated with a particular morpheme. For example, the nominal plural marker *–s* in English (e.g. *tables*) only requires knowledge about whether the number of referents is singular or plural. On the other hand, the present tense marker *–s* (e.g. *he talks*) requires knowledge about whether the subject is singular or plural, whether it is a first, second, or third person, and whether the event is in the present tense. Brown (1973) established a complexity hierarchy, which predicted that morphemes that encode more features are more difficult to learn than morphemes associated with fewer features. Similarly, Clark (1993) argued that an inflection system, which allows children to map form and feature on a one-to-one level (i.e. an inflection system where one morphological form corresponds to one morphosyntactic feature), is expected to be acquired earlier than an inflection system where children have to map many features to one single form.

According to Pinker (1984), the differences that underlie the process of form-feature mapping are reflected, cross-linguistically, in children's development (see also MacWhinney, 1978). In order to account for cross-linguistic variation and, in particular, for the well-known differences between agglutinating and fusional languages, Pinker put forth a hypothesis about how learners build paradigms. To explain how the hypothesis works, consider first the examples in (9), where we have the declension of the word *house* in Turkish (agglutinating inflection) and Czech (fusional inflection).

(9)

a. Turkish/agglutinating inflection

	NOM *house*	GEN *of a/the house*	LOC *in a/the house*
SG	ev	ev *–in*	ev *–de*
PL	ev *–ler*	ev *–ler –in*	ev *–ler –de*

b. Czech/fusional inflection

	NOM *house*	GEN *of a/the house*	LOC *in a/the house*
SG	dům	dom *-u*	(v) dom *-ě*
PL	dom *-y*	dom *-ů*	(v) dom *-ech*

The example in (9a) clearly shows that in Turkish, the same suffix encoding CASE (GENITIVE or LOCATIVE) is attached to the singular and the plural form. PLURAL is always signalled separately by the same suffix. Since each suffix corresponds to only one feature, more than one suffix is needed, since words are marked for both PLURAL and CASE. Czech, on the other hand, never has more than one suffix. Instead, each suffix expresses NUMBER, CASE, GENDER and ANIMACY simultaneously.

Following Pinker (1984), learning inflection is a process where children learn about morphosyntactic features that underlie the inflectional paradigm (e.g. NUMBER, GENDER, PERSON or CASE) through systematic hypothesis testing. This implies that the learner uses information from the environment and tries out "hypotheses" about the target language in order to learn about inflectional properties of the paradigm. This process of learning is also called the trial-error learning strategy. Agglutinating inflection, which is associated with one-to-one form-feature mapping, is simple in terms of feature complexity. In languages such as Turkish, Hungarian or Finnish, a single affix corresponds to a single feature. The affixes are ordered in fixed and linear order, as exemplified in (10).

(10) noun + *suffix* [PLURAL] + *suffix* [POSSESSIVE] + *suffix* [LOCATIVE]

In agglutinating languages, paradigm learning involves a gradual expansion from one to more features. Basically, the learner starts out with an initial hypothesis about the relation of a certain morpheme to a certain feature, e.g. PLURAL. Gradually, more hypotheses about the correspondence between morphemes and features are introduced. As example (11) illustrates, with a noun like *ev* 'house', a learner of Turkish adds each feature such as PLURAL, POSSESSIVE or LOCATIVE to the noun as separate morphemes.

(11) ev-*ler-im-de* [PLURAL; POSSESSIVE; LOCATIVE] 'in my houses'

In contrast, fusional inflection is associated with different levels of feature complexity, since multiple features can be expressed by a single morpheme. This can be seen in example (12), where suffixes *–ě* and *–ech* express a bundle of features [SINGULAR; LOCATIVE] and [PLURAL; LOCATIVE].

(12) a. noun + *suffix* [SINGULAR; LOCATIVE]
dom *–ě*

b. noun + *suffix* [PLURAL; LOCATIVE]
dom *–ech*

As is the case in agglutinating languages, children acquiring fusional languages start out with a simple hypothesis. For example, a child might first isolate an inflectional morpheme, then map it to a single feature, i.e. [PLURAL]. In this respect, there is no difference between the acquisition of agglutinating languages and fusional languages. As the learner notices that the paradigm exhibits more inflectional contrasts than is predicted by the initial simple hypothesis, she must add more features and test whether the paradigm conforms to the adjusted feature space. Because the feature complexity in fusional languages is higher than that in agglutinating languages, it is expected that children will take longer to master paradigms in fusional languages. According to Pinker (1984), the more features the fusional paradigm exhibits, the more complex set of calculations the child must perform.

A number of cross-linguistic investigations support this prediction. For example, research focusing on the acquisition order of inflectional contrasts demonstrates that verbal and nominal inflectional morphemes were first acquired in agglutinating languages, such as Turkish and Finnish (at the age of 1;8) (for the early acquisition of Turkish morphology in general see Aksu-Koç and Slobin, 1985; Aksu-Koç and Ketrez, 2003). In a study of child Hungarian, Gábor and Lukács (2006) showed that typically agglutinating noun inflectional morphemes were productive at the age of 2;10, whereas the more fusional verb inflectional morphemes were mastered at the age of 4;7, revealing a developmental difference of almost two years. In contrast, children acquiring fusional inflection systems tended to overuse morphemes and needed more time before they inflected correctly (e.g. Slobin, 1977, 1985; Bittner et al., 2003).

In conclusion, feature complexity predicts that an inflectional morpheme is considered more salient when it encodes fewer morphosyntactic features.

This implies that the fewer features a morpheme encodes, the sooner it should be acquired. Thus, an inflectional morpheme that is associated with a single feature is expected to be in place earlier than an inflectional morpheme that is associated with a bundle of features.

2.5 Input frequency

The question about whether acquisition of inflectional morphemes can be ascribed to input frequency remains controversial. In the literature, there are indications that children's output is significantly affected by statistical regularities, and that children tend to acquire the forms that occur most frequently in their input early (e.g. Pine, Lieven and Rowland, 1998; Serratrice, Joseph and Conti-Ramsden, 2003). It has been suggested that input frequency, in combination with other factors, can also explain why children acquire some inflectional morphemes before others (e.g. Brown, 1973; Wijnen et al., 2001). This section provides a brief summary of the relevant empirical investigations.

Serratrice, Joseph and Conti-Ramsden (2003) reported on a significant correlation between the order of acquisition of regular/irregular English past tense forms and parental input frequency. They concluded that frequency is a relevant factor since the output of the investigated children closely resembled the input distributions of the regular and the irregular past tense forms.

Pine, Lieven and Rowland (1998) looked at input frequency effects in children's use of tensed and untensed (infinitive) verb forms. They counted the frequencies of tensed and untensed verbs in the input of twelve English-speaking mothers, and found that the relative input frequencies were highly similar across participants. Pine et al. showed a strong, significant correlation between the age of acquisition of finite and non-finite forms and input frequency. Based on this outcome, Pine et al. conclude that frequency of occurrence in children's input is a powerful predictor of the acquisition order of finite and non-finite forms in English.

Similarly, Schlichting (1996) observed that Dutch children tend to acquire the verb form that appears most frequently in their input, and therefore suggests that there is a relationship between the input frequency and the acquisition order:

"A verb which is more frequent in finite form(s) than in non-finite form(s) in Child Directed Speech is (first) acquired in finite form(s); a verb which

is more frequent in non-finite form(s) than in finite form(s) in Child Directed Speech is first acquired in non-finite form(s)"(Schlichting, 1996: 118).

However, there is also evidence that the relationship between input frequency and order of acquisition is not as straightforward as suggested by the studies summarized above. Brown (1973), who concentrated mainly on the acquisition of early child English morphology, was the first to document a limited role of input frequency with respect to the acquisition order of morphological forms. In his analysis, he did not find any detectable relationship between the input frequency of the 14 grammatical morphemes and their order of acquisition (but see Moerk, 1978 for a reanalysis of Brown's data and different results).

Similar to Brown, Smolík (2005) investigated frequency effects on the acquisition of English grammatical morphemes. Smolík's research included noun plurals, regular and irregular past tense forms, 3rd person singular and progressive. He reported that input frequency, by itself, was not a crucial causal factor in the acquisition order of the investigated categories. Smolík observed that the effect of input frequency on the acquisition of inflectional morphemes differed per category. Input frequency was found to influence the acquisition of noun plurals and the regular past tense more than it influenced the progressive and past tense irregular inflectional morphemes. Further, the acquisition of 3rd person singular did not seem to be affected by the input frequency. Smolík suggested that there must be some other factor that makes progressives easier to acquire than 3rd person singular forms.

Gillis and Verlinden (1988) analysed input effects in a Dutch-speaking child from 0;11 – 1;11. This study showed that the most frequent verbs that the child heard were finite modals, auxiliaries, and copulas. Gillis and Verlinden observed that, despite their high frequency, these types of finite verbs appeared later in the child's output than infinitives, which were reported to be less frequent in the input.

The study by Wijnen et al. (2001), as mentioned in Section 2.2, also revealed only moderate correlations between frequency of verb forms in the input and the age of first appearance. Wijnen et al. analyzed the order of acquisition of finite and non-finite forms of lexical verbs in relation to the input frequency. The first step was to identify the lexical verbs that appeared in both finite and non-finite forms in children's speech. The next step was to determine the input frequency of these forms and relate the frequencies to the order of

acquisition. Wijnen et al. found that Dutch children almost always produce the non-finite form of lexical verbs before they produce the finite forms, despite the fact that non-finite forms are sometimes less frequent than finite forms. This outcome led Wijnen et al. (2001) to the conclusion that frequency is not the only factor that accounts for the early acquisition of non-finite forms. They suggested, instead, that combination of factors contributes to the salience of verb forms. In Dutch, the finite form often occurs in utterance-final position. The authors claimed that this position is quite salient, and that children's sensitivity to this position can explain the early emergence of this particular form.

Hsieh, Leonard and Swanson (1999) also concluded that other salience factors besides input frequency are at play. Hsieh et al. showed that frequency, in combination with positional salience affects the developmental order of inflectional morphemes. They observed, for example, that the plural *–s* (as in *two rabbits*), which is acquired before the homophonous 3rd person suffix (as in *she loves him*), occurred more frequently in the salient unit-final position.

Given both the studies that support the notion that input frequency affects morphosyntactic development as well as the studies that do not, it is logical to wonder what might be responsible for the conflicting findings. The conflicting results might be due to the fact that studies use different methods to calculate frequency. Token-based frequency refers to a simple count of all forms whereas type-based frequency corresponds to a calculation of a specific type of morphological form. It has been proposed that for children's inflectional morphemes to become productive, type frequencies in the input are more effective than token frequencies (Clark, 1993). That is, children's default pattern is strongly influenced by the number of types of a particular morpheme heard in the input. Evidence for this position comes from studies investigating overusage patterns in inflection development. For example, more than 90% of French verbs belong to the highly regular first-conjugation (*–er*) but many of the verbs used most frequently with young children are irregular and belong to the third-conjugation (*–re*). Investigation of children's verb usage showed that children consistently regularize third-conjugation verbs by overusing the first-conjugation inflection, despite the fact that they hear many more third-conjugation verb tokens than they do first-conjugation verb tokens (Guillaume, 1927: reference cited in Clark, 1993).

Following Clark (1993), I assume that it is easier to detect and isolate an inflectional affix when it occurs with a variety of different lexical roots (types). For example, it would be easier to detect the recurrent 3rd person singular

inflection –*s* if it occurred with several words: *reads, walks, cooks, falls, breaks* than if it was heard repeatedly with a single word: i.e. *reads, reads, reads, reads, reads.* That is, the more types of a given morpheme in the input, the more accessible the morpheme should be and the earlier children should acquire it. Token frequencies are less relevant for the development of inflection. In the example above, the child would have heard five instances of the 3rd person singular –*s* in each situation. In the later context, however, she would have a difficult time separating the root from the suffix since she wouldn't have heard the suffix with any variation. Consequently, she would be expected to have difficulties separating the root from the suffix and would be likely to store the entire word *reads* in her mental lexicon.

The empirical findings make it clear that it would be too simple to say that children learn frequent forms before infrequent forms. In the case of agreement inflection, we have seen that there is more to it than a mere token or type frequency count of items from the input. Further, it seems very likely that the salience of any given morpheme is dependent on the input frequency as well as on a variety of other salience factors.

2.6 Concluding remarks: Cumulative effects of salience factors

In this chapter, I have addressed five factors that have been proposed to contribute to the salience of inflectional morphemes: Phonological salience, positional salience, feature salience, feature complexity and input frequency. The main observation within each factor is that, in the early developmental stages, children seem to acquire the more salient morphemes before the less salient ones. In (13) – (17), I summarize predictions that result from these factors.

(13) *Phonological salience*: Phonologically salient morphemes will be acquired earlier than less phonologically salient morphemes: It is expected that children acquire morphemes that contain a full vowel prior to morphemes that contain reduced vowel. The acquisition of morphemes containing no vowel is expected to follow the acquisition of morphemes containing full or reduced vowels. Zero morphemes are expected to be acquired last.

(14) *Positional salience*: Morphemes placed in the final position of an utterance (sentence level) or of an extracted speech unit (word level) are acquired earlier than morphemes placed in the front or in the middle-position.

(15) *Feature salience*: Morphosyntactic features that correspond to natural classes with direct referents in the world are considered conceptually salient and, hence, expected to be expressed earlier than morphosyntactic features without these properties.

(16) *Feature complexity*: An inflectional morpheme is considered salient when it encodes fewer morphosyntactic features: The fewer features a morpheme encodes, the sooner it should be acquired.

(17) *Input frequency:* The higher the frequency of a given inflectional morpheme in the child's input, the earlier its acquisition.

To date, most investigations examining salience as a factor in children's developmental patterns have focused on a single factor such as input frequency (e.g. Serratrice et al. 2003; Smolík, 2005) or phonological salience (e.g. Leonard et al. 1989). Although this is a very understandable research strategy, it leads to a scattered picture that does not represent the issue in its full complexity. In fact, in most of these studies, researchers acknowledge that it is not a single factor but instead, an accumulation of factors that make certain morphemes more salient than others. Consequently, one would expect that it is not a single factor but an accumulation of factors that explain the order in which children acquire inflectional morphemes (e.g. Brown, 1973; Leonard, 1989; Wijnen et al., 2001; Smolík, 2005).

I hypothesize that in the early developmental stages, children's attention is drawn to the most salient morphemes. Given the likelihood that it is a variety of factors that influence the accessibility of a morpheme, I believe that an explanation of inflectional development which takes into account, all of the factors (13) – (17), should be very promising. In order to approach this task, however, one must devise a method which measures the cumulative effects of the salience factors by weighing them in terms of their relevance. One model which seems to be related to the current research strategy is the Competition model (henceforth: CM) of MacWhinney (1987), Bates and MacWhinney (1989), and MacWhinney and Chang (1995). Similar to my own goals, the CM acknowledges that several different cues aid in the language development

However, the CM differs from my aims here since it focuses "on inflections as cues to underlying thematic roles and pragmatic functions" (Kempe and MacWhinney, 1998: 545). In other words, whereas the CM examines inflections as cues to learn other properties of language, the present study does not look into whether or not inflectional morphemes are cues to learn underlying functions, but instead, aims to determine whether salience factors can account for variation in the acquisition of agreement inflection.

As for now, my method is explorative and represents one possible way to measure salience of morphemes. In order to assess the cumulative effects of the salience factors, I will base my method on an assumption that the factors in (13) – (17) have equal weights, i.e. all factors are considered equally relevant in their contribution to salience. In Chapter 3 I will address this method in more detail.