



Competition in the acquisition of Danish noun plural markers

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ABSTRACT

The aim of this study was to explore the acquisition of the Danish noun plural system. A plural elicitation task was administered to 160 monolingual Danish-speaking children aged 3-10 years. Based on earlier studies in other languages we would expect an impact of productivity of the plural marker on the direction of overgeneralizations: Unproductive → Semi-Productive → Fully Productive. However, other factors seem to sometimes overrule this impact: The Semi-Productive plural marker 'Ø' (PL = SG) appears to be the most important attractor of overgeneralizations in Danish children's noun plural formation. The results are discussed in relation to studies of the acquisition of Danish and other languages as well as models of acquisition of inflectional morphology.

KEYWORDS

Danish, first language acquisition, inflectional morphology, morphophonology, noun plural, prosody

1. Introduction

Acquisition of the inflectional system is an essential part of a child's first language acquisition. It emerges at an early stage – children typically produce their first inflected forms within the first two years of life (e.g. Slobin 1985a, 1985b). However, for many languages it takes several years before the inflectional system is fully acquired (e.g. Berko 1958; Brown 1973; Bybee 1995). Noun plural (PL) is one of the first inflectional categories to emerge (e.g. Kjærbæk 2013), presumably due to its high frequency in the language input to children and because it is more semantically transparent than for example the past tense inflection of verbs.

Three central issues are important for the understanding of children's acquisition of morphology, namely: the distributional properties of inflectional morphology; the mechanisms of learning from data; and the developmental patterns and trajectories in child language (Lignos & Yang 2016). Earlier studies have shown that a system that is regular or predictable results in fewer errors committed by the children learning the system than a system with many exceptions (Berman 1986; Maratsos 1983, 1998). Studies have furthermore indicated that factors

such as salience, iconicity, transparency, cue validity, predictability, productivity and frequency play an important role in the acquisition of an inflectional system. *Salience* is the determination of the extent to which a morphological marking is identifiable, more specifically its acoustic prominence (Köpcke 1993: 82; Bittner & Köpcke 2001). *Iconicity* (constructional) refers to the degree to which an inflectional marker is added to a stem vs. modifying the stem, i.e. an inflectional marker is maximally iconic if it is realized in an additive way and minimally iconic if it is realized in a modifying way (Wurzel 1989: 11). *Transparency* concerns to which degree an inflectional form is parsable into its basic units. The PL-form of *car*, namely *cars* (*car+s*), is, for example, more transparent than the PL-form of *foot* which is *feet* (e.g. Albirini 2015). There is morphotactic transparency when the morpheme boundaries coincide with the syllable boundaries. This entails that inflectional morphemes that have a recognizable form (i.e. a form which stays the same across linguistic environments), and which have a fixed position relative to the stem they attach to and a clear function, are easier for children to acquire. It also seems to help if the morphemes are easy to segment from the stem and if the rhythm of the language makes the morphemes perceptually salient (Peters 1997; see section 3.1). Transparency in Danish noun PL-formation is addressed by Kjærbæk, dePont Christensen & Basbøll (2014) and Kjærbæk & Basbøll (2015, 2016)¹. *Cue validity* is here defined as the frequency with which a particular feature occurs in the category which contrasts with the target category. In the context of English PL-morphology, as PL-endings, /-z/ has medium and /-ɪz/ has high cue validity, because there are only a few singular (SG) nouns with stem-final /-z/ and nearly none with stem-final /-ɪz/. The remaining PL-ending /-s/ has relatively low cue validity, because there are relatively many SG nouns in English with stem-final /-s/ (Köpcke 1998). *Predictability* concerns the degree to which a specific PL-form can be predicted based on the phonological, semantic, and structural features of its SG stem (e.g. Laaha & Dressler 2012). Predictability in Danish noun PL-formation is addressed by Ravid et al. (2008). *Productivity* of an inflectional marker concerns the degree to which it can be extended to foreign words, neologisms etc. (e.g. Dressler 2003; Kjærbæk & Basbøll 2016; Kjærbæk et al. 2014; see section 3.2).² Numerous studies present evidence that input *frequency* effects are pervasive in children's first language acquisition – also with regard to inflectional markers: frequent morphemes seem easier to acquire than infrequent morphemes (e.g. deVilliers 1985; Köpcke 1993; Naigles & Hoff-Ginsberg 1998; Kempe, Brooks, Mironova, Pershukova & Fedorova 2007; Ravid et al. 2008; Xanthos et al. 2011; Ambridge, Kidd, Rowland & Theakston 2015). Studies indicate that children appear to pay more attention to type-frequency than token-frequency, i.e. they are more prone to use inflections that appear on many stems than to use inflections that only appear on few stems – even when tokens of the latter are much more frequent overall (Guillaume 1927; Clark 2016).

Studies on children's spontaneous speech have shown that even though a child uses one inflection on one noun, it does not mean that the child uses it on other nouns when it is required.

1 Kjærbæk & Basbøll 2016 is a revised and extended version of Kjærbæk & Basbøll 2015, therefore we generally refer to Kjærbæk & Basbøll 2016.

2 According to Basbøll 2005 (351–384, especially 357–363) productivity of suffixes can be defined cross-linguistically, high productivity being a measure for little integration into the stem of a certain suffix.

This could be seen as evidence that young children do not produce language on the basis of general underlying rules and abstract categories (Cameron-Faulkner, Lieven & Tomasello 2003; Lieven, Pine & Baldwin 1997; Theakston, Lieven, Pine & Rowland 2001). Instead it may be that children start by acquiring inflectional morphology as a property of lexical items rather than a property of a syntactic category (Bloom 1991). Tomasello (2003, 2006) argues that children do not use rules in their language production. Instead of a process of putting words/morphemes together following the grammatical rules of the language, children produce language by combining larger chunks which they have heard in their linguistic input. This is supported by Lieven, Behrens, Speares & Tomasello (2003) who argue that a lot of children's speech production consists of repetitions (with minor variation) of something that has recently occurred in their input.

On the other hand, it is well known from numerous studies that children produce language forms that are not likely to have occurred in their linguistic input. Children have often been reported saying things like **foots* instead of *feet* and **knowed* instead of *knew*. In making these errors children seem to be producing forms they have never heard. This kind of overregularization (where the child adds a regular inflectional marker to an irregularly inflected word) suggests an underlying productive system.

A finding that has received great attention is that children in spontaneous speech produce these overregularizations after they have produced the correct irregular form (e.g. *feet* and *knew*), i.e. children appear to get worse before getting better. This has been referred to as a *U-shaped curve* with three stages: 1) children produce both regular and irregular inflectional forms with very few errors; 2) the error rate appears to increase significantly and the children start to make more and more errors, adding a regular inflectional marker to stems taking an irregular inflectional marker – even to forms which they previously mastered; 3) the error rate slowly decreases, as the children get older, until they produce almost no errors (e.g. Marcus et al. 1992).

Berko (1958) showed that children as young as 4 years old were able to add the correct PL-marker to both conventional and pseudo-nouns (e.g. *wug* – *wug-s*) as well as the correct past tense marker to both conventional and pseudo-verbs (e.g. *blik* – *blik-ed*). Thereby the children demonstrated that “their linguistic knowledge went beyond the individual words in their vocabularies, and that they had rules of extension that enabled them to inflect the nonsense words” (Gleason 1992: 10, cited in Hoff 2014: 196). The study thus showed evidence for productivity in children's speech. Studies on 2-year olds, on the other hand, show few signs of productivity in children's language production (e.g. Tomasello, Akhtar, Dodson & Rekau 1997; Tomasello 2000).

2. Models of processing and acquisition of inflectional morphology

Research on the acquisition of inflectional morphology has been dominated by two conflicting theoretical models: *dual-route models* and *single-route models*. Both models appear to provide a tenable explanation for children's route in their acquisition of the inflectional system of their first language.

According to the dual-route model children memorize irregular forms (e.g. *feet*) but generate the regulars using a rule that applies to all members of the word class (e.g. “add -s”). It is not controversial to claim that children memorize irregular forms, since there does not seem to be any other way to acquire them. The controversy is whether children also produce the regularly inflected forms based on memorization of sound patterns or whether children produce them by applying a rule. According to the dual-route model regular forms are productively generated by rules in a specialized, presumably innate, language module, i.e. we have a rule that applies the regular inflectional marker as the default to new words, regardless of whether they are phonologically similar to old words or not (Berent, Pinker & Shimron 2002; Marcus et al. 1992; Marcus, Brinkman, Clahsen, Wiese & Pinker 1995; Clahsen 1999; Pinker 1999; Sahin, Pinker & Halgren 2006). In the early stage of first language acquisition a rote-learning mechanism stores both regular and irregular forms (the child therefore appears to be using them correctly). This mechanism is later supplemented by a rule-based mechanism, which applies the regular inflectional marker to all members of the category which are not yet stored in the long-term memory – by irregularly inflected words this will result in overregularizations (e.g. **foots* and **knowed*). The child gradually develops a mature morphological system that contains the two systems: 1) regular forms are inflected by a combinatorial operation that connects the stem with the inflectional marker by an abstract symbolic rule that can be extended to new words; 2) irregular word forms are handled by an associative network based on lexical memory and subregularities of minor patterns (e.g. *drink – drank, sing – sang*) which may cause error forms (e.g. *bring – *brang*), whose retrieval blocks the application of the rule (e.g. Pinker 1999; Jaeger, Lockwood, Kemmerer, van Valin, Murphy & Khalak 1996).

In contrast, the single-route model relies on one system – associative memory – to account for the production of both regular and irregular forms. In single-route models, instances are entered into a network and the network gradually builds up (a connectionist model). According to single-route models, learning consists of strengthening or weakening connections between units and is thus strongly affected by factors such as salience, similarity, consistency and frequency (McClelland & Patterson 2002). By using learning algorithms, the network captures statistical regularities in the input, and eventually the system can generalize automatically to regular as well as irregular (new) forms that resemble forms it already knows since the same mechanism computes predictable and unpredictable forms (Plunkett & Marchman 1991, 1993; Rumelhart & McClelland 1986).

Bybee (1985, 1988, 1991) has proposed a continuum of schemata extending from irregular to regular morphology. The advantage of such a schema model is that it eliminates the strict division between the grammar on the one hand, which covers regular and/or productive morphology, and the lexicon on the other hand, in which all exceptions to regular and productive processes are stored (Köpcke 1998: 295). Bybee’s model closely resembles a connectionist model (cf. Rumelhart & McClelland 1986; McClelland 1988) since both theories assume that generalizations arise from patterns in an associative network. The schema contains the features most strongly represented (i.e. represented most often) in existing forms in their positions of occurrence. Since the schema resembles a prototype, matching of form to schema works on a family

resemblance basis rather than a categorial basis. Schemas that apply to fewer forms show more evidence of being tied to the lexicon than a schema that applies to a large number of forms (Bybee 1988: 135).

Natural morphology (Dressler, Mayerthaler, Panagl & Wurzel 1987; Mayerthaler 1981; Wurzel 1984/1989) and cognitive morphology as represented by the schema model (Bybee 1985, 1988; Köpcke 1993) are based on the assumption that speakers subject competing morphological forms to a qualitative evaluation with respect to their symbolizing capacity. The speaker evaluates which of the available inflectional markers best represents the grammatical content to be encoded. Cognitive morphology stresses the signaling capacity of the symbolization, as determined by the perceptual criteria salience, iconicity, cue validity and type/token frequency.

Dual-route models and single-route models deviate with regard to frequency and regularity. With regard to frequency, dual-route models posit that only irregular forms are memorized, i.e. listed in the lexicon – not regular forms. This means that the frequency of the regular PL-forms should have no effect on the acquisition of the noun PL-system. According to single-route models, on the other hand, there will be an effect of the frequency of both the regular and the irregular PL-forms because both the regular and the irregular forms are listed in the mental lexicon and thereby affect the construction of the network.

Frequency and regularity do not always coincide. In many languages, as for example English, they do, i.e. the regular patterns (e.g. addition of *-s* in PL) are more frequent than irregular patterns (e.g. *foot – feet*) both with regard to types and tokens. Other languages, however, as for example German, do not have a clearly dominant PL-marker. The German PL-system primarily consists of phonologically unrelated PL-allomorphs. Part of the literature in this domain argues for the *-s* PL as the default marker (Clahsen 1999) even though the PL-forms with *-s*-suffix are neither the first ones to emerge in child language, nor the only ones to be overgeneralized (Laaha, Ravid, Korecky-Kröll, Laaha & Dressler 2006; Ravid et al. 2008). Based on a study on the acquisition of German PL-marking, Bittner & Köpcke (2001) suggest three developmental phases (though no clear transition from one phase to the other is detected):

- Stage 1: use of lexically stored PL-forms
- Stage 2: avoidance of PL-marking on the noun
- Stage 3: overgeneralization of the Fully Productive PL-marker

Danish is interesting with regard to noun PL-inflection, because where English has one default PL-suffix *-s* (regular inflection) and a small number of exceptions (irregular inflection), Danish – like German – has several competing PL-markers. But unlike German, Danish has a Fully Productive PL-marker which is also the most frequent PL-marker with regard to *lexical frequency* (Basbøll, Kjærbæk & Lambertsen 2011) as well as input frequency – both types and tokens (e.g. Kjærbæk et al. 2014; Kjærbæk & Basbøll 2016). The present study focuses on competition between different inflectional markers in relation to children's acquisition of the Danish noun PL-system.

The current study examines the acquisition of noun PL in Danish-speaking children. Danish pluralization involves two overt PL-suffixes³ and what we will here call a zero PL-suffix (-Ø) in addition to a number of stem alternations (stem changes). We here define a PL-marker as the combination of suffix (incl. -Ø) and stem change (incl. no stem change), and PL-markers are indicated by single quotes. Since the Danish PL-suffixes, PL-stem changes and, thus, also PL-markers, have different degrees of salience, iconicity, transparency, predictability, productivity and frequency, the opportunity is provided to trace children's strategies in acquiring this complex system in the light of current theories of morphological acquisition.

3 The Danish noun plural system

SG indefinite (INDEF) is the basic form of the noun in Danish, i.e. the noun category which has zero as its form throughout. According to an investigation of the Danish noun PL-system in the spoken language (Basbøll et al. 2011), Danish noun PL can be formed in four different ways, departing from the SG form, by:

- a) adding an overt PL-suffix (e.g. *bil* [bi:[?]l] 'car' – *bil-er* ['bi:[?]lɐ] 'car-s')⁴
- b) changing a phoneme of the stem (e.g. *mand* [man[?]] 'man' – *mænd* [mɛn[?]] 'men')
- c) combining suffix addition and stem change (e.g. *fod* [foð[?]] 'foot' – *fødder* ['føð[?]ɐ] 'feet')
- d) changing or adding nothing, viz. PL = SG (e.g. *mus* [mu:[?]s] 'mouse' – *mus* [mu:[?]s] 'mice')

There are three relevant PL-suffixes in Danish child language (two overt and one zero suffix):

- a) *-ɐ* (e.g. *bil* [bi:[?]l] 'car' – *bil-er* ['bi:[?]lɐ] 'car-s')
- b) *-ə* (e.g. *kat* [kad] 'cat' – *katt-e* ['kadə] 'cat-s')
- c) *-Ø* (e.g. *mus* [mu:[?]s] 'mouse' – *mus* [mu:[?]s] 'mice')

There are seven relevant stem changes (eight when no change is included):

- a) Stød addition (e.g. *ballon* [ba'lɒŋ] 'balloon' – *ballon-er* [ba'lɒŋ[?]ɐ] 'balloon-s')
- b) Stød drop (e.g. *hus* [hu:[?]s] 'house' – *hus-e* ['hu:sə] 'house-s')
- c) Syncope (e.g. *gaffel* ['gafəl]⁵ 'fork' – *gaff-er* ['gafɐ] 'fork-s')
- d) *a*-quality change combined with vowel lengthening (e.g. *blad* [blað] 'leaf' – *blad-e* ['blæ:[?]ðə] 'leave-s')
- e) *r*-insertion (e.g. *finger* ['feŋ[?]ɐ] 'finger' – *fingr-e* ['feŋkɐ] 'finger-s')⁶
- f) *n*-insertion (the isolated *øje* ['ʌjə] 'eye' – *øjne* ['ʌjnə] 'eye-s')
- g) Umlaut (e.g. *mand* [man[?]] 'man' – *mænd* [mɛn[?]] 'men')

3 The foreign pl-suffixes *-/s/*, *-/a/* and *-/i/* do not occur in child language and they are therefore not considered relevant here (cf. note 7).

4 Danish [b d g] are voiceless, [p k] aspirated and [t] also affricated. This is not rendered in the phonetic transcription here.

5 /ə/ is most often assimilated, resulting in a syllabic /l/ ([l]).

6 Plurals with insertion of /r/ has two defensible analyses: 1) *-ɐ*-suffix combined with /r/-insertion and syncope; 2) *-Ø*-suffix combined with /r/-insertion (cf. Basbøll et al. 2011: 95). Since we depart from spoken language, we here use the latter.

Starting from a detailed analysis of Danish phonology and morpho(pho)nology (including prosodic morphology, based upon Basbøll 2005), Basbøll et al. (2011) identified 23 competing PL-markers, i.e. different combinations of suffixation and stem change. These PL-markers are very different from markers based on orthography as they are used in Danish grammars, even the largest ones (Hansen & Heltoft 2011), and partly also in the largest Danish pronunciation dictionary (Brink, Lund, Heger & Jørgensen 1991). The Danish PL-markers thus consist of a combination of suffix addition (incl. -Ø) and stem change (incl. no change). We consider each PL-marker a single PL-morpheme (although there are other logically possible interpretations; see Basbøll et al. 2011 for a detailed analysis of the Danish noun PL-system).

TABLE 1: THE LEXICAL FREQUENCY OF THE PL-SUFFIXES (BASBØLL ET AL. 2011: 89)

PL-suffix	All nouns	Percentages of all nouns
-/ɐ/	15,370	87
-/ə/	676	4
-Ø	1,458	8
-/s/	51	0.3
-/ɑ/	35	0.2
-/i/	4	0.02
Total	17,594	100

As shown in Table 1 the *-/ɐ/-* suffix occurs as a PL-suffix in 87% of all Danish nouns. According to Basbøll et al. (2011) about 99% of SG nouns ending in an */ə/* take the PL-suffix *-/ɐ/*. The same applies to about 90% of SG nouns ending in a non-deletable vowel (all other vowels than */ə/*), about 90% of SG nouns ending in a sonorant consonant, and about 75% of SG nouns ending in an obstruent or a glide. Only about 1% of SG nouns taking the PL-suffix *-/ɐ/* have phonemic stem change (which is unproductive). The PL-marker 'Ø' (PL = SG) plays a particular role both in the Danish PL-system and in children's acquisition of the system (see section 8).

3.1 What is a morphological zero?

Following the principles of Basbøll (2005: 352-353, 369; also cf. Basbøll 2009, 2014), we consider a so-called morphological zero as the absence of an overt morpheme. According to this interpretation, there will be no morpheme (inflectional suffix) expressing the SG-form of a noun. In the PL-form of nouns taking the PL-marker 'Ø' (PL = SG; e.g. *mus* 'mouse' - *mus* 'mice'), there will be no overt inflectional suffix expressing the semantic content of PL. In the PL definite (DEF) form of *mus* 'mouse', which is *mus-ene* ['mu:ːsənə] 'the mice', *-ene -/ənə/* is the fully productive suffix expressing PL&DEF (2005: 358), i.e. a fusion of the categories PL and DEF (the same applies to the type *børn-ene* ['bœɹ̥ːnənə] 'the children' with Umlaut, *børn* [bœɹ̥ːn] being the PL of *barn* [ba:ːn] 'child'). The PL INDEF of the type *lærer* ['lɛ:ɹ̥] 'teacher', viz. PL *lærer-e* ['lɛ:ɹ̥ɐ]

'teachers', is formed by the fully productive PL-suffix *-v/* (despite the spelling); the PL DEF of such words, which in the SG end in *-v/*, is again a fused form of PL&DEF, but a different one, viz. *-nə/* (not the fully productive form we find in *mus-ene*). This is, in Basbøll's analysis, due to a lexical redundancy rule (2005: 437). In some respects, but far from all, this agrees with Heltoft's reanalysis of the Danish definiteness system (2001) where he outlines the development right from the earliest Indo-European to Modern Danish.

Uncountable nouns, like *smør* 'butter', are in the NO PL-category, and there are also nouns with NO SG, like *penge* 'money'.

We follow a modified version of Basbøll's (2005) analysis here, accepting *-Ø* as a (kind of) suffix in morphological categories which in the large majority of cases have non-null suffixes, such as PL of nouns, but not in categories which in general do not have (non-null) suffixes, like SG or INDEF of nouns, and neither do we accept sequences of zero morphemes.

3.2 Three degrees of stem change

Kjærbæk et al. (2014) proposed a scale of three degrees of stem change with different levels of complexity:

- 1) No Change (transparent)
- 2) Prosodic Change (partly transparent)
 - *stød* drop, *stød* addition, syncope and *a*-quality/vowel change
- 3) Phonemic Change (not transparent)
 - Umlaut, *r*-insertion and *n*-insertion

An argument for distinguishing prosodic and phonemic stem changes is the following: Grønnum (2007: 43) reports that Danes, when asked to reverse the order of syllables in *Mona* (a girl's name) [*moːna*], give the reply [*næːmo*], and not *[*naːmoː*], which suggests that the prosodic frame of the word – including stress pattern and vowel length – is stored separately from the sequence of segmental phonemes. Umlaut is unpredictable in modern Danish, e.g. *gås* – *gæs* 'goose – geese' is completely isolated. There are a few examples with */a/* – */ɛ/* (*and* – *ænd* 'duck – ducks'), */ɔ/* – */ɛ/* (*hånd* – *hænder* 'hand – hands'), */o/* – */ø/* (*fod* – *fødder* 'foot – feet'). Umlaut is completely unproductive in Danish, whereas Umlaut exhibits some productivity in German (cf. Laaha et al. 2011). There are few examples of *r*-insertion – some also with Umlaut. Diachronically, Umlaut is being gradually lost and is only kept in frequent morphemes (Basbøll et al. 2011).

3.3 Productivity scale

Kjærbæk et al. (2014) proposed a productivity scale with three degrees, thus productivity is not either present or absent. Productivity is here defined as the ability of the inflectional marker to occur on new words. For the PL-system, this means the ability to add the PL-marker to a new SG-noun in order to create its PL-form. The productivity scale for the Danish PL-markers is:

- 1) Fully Productive PL-markers
 - involve addition of the PL-suffix *-/v/* without phonemic stem change
- 2) Semi-Productive PL-markers
 - involve addition of the PL-suffix *-/ə/* or *-Ø* without phonemic stem change
- 3) Unproductive PL-markers
 - involve phonemic stem change or addition of one of the foreign PL-suffixes *-/s/*, *-/a/* and *-/i/*⁷

PL-markers involving addition of the PL-suffix *-/v/* without phonemic stem change are Fully Productive. The PL-suffix *-/ə/* is partly productive. Thus, it has replaced some *Ø*-suffixes: for example, the SG *hus* [hu:ʔs] ‘house’ had an older monosyllabic PL-form *hus*, but now has got a modern disyllabic PL-form *hus-e* [‘hu:sə] ‘houses’. There is competition between *-/ə/* and *-/v/* in many regional forms, for example, the SG noun *hæk* [‘hæge] with the standard PL-form *hække* [‘hæge] ‘hedges’ is in many dialect forms pronounced [‘hæge]; the same goes for the *-Ø*-suffix, for example standard PL *knæ* [kne:ʔ] ‘knees’ and *ben* [be:ʔn] ‘legs’, in some dialect forms pronounced [‘kne:ʔv] and [‘be:nv]. The PL-suffix *-/ə/* is often reduced (assimilated or deleted), which leads to perceptually difficult SG : PL distinctions as e.g. *hus* [hu:ʔs] ‘house’ (stød in the SG-form) vs. *hus-e* [‘hu:sə] / reduced [‘hu::s] ‘houses’ (no stød in the PL-form); and *tov* [tvv] (no stød in the SG-form) vs. *tov-e* [‘tvvə] / reduced [‘tvv:] (no stød in the PL-form; disyllabicity can thus be manifested by a slight lengthening and/or by a slight tonal or other prosodic change). Thus, in spoken Danish PL-forms are often phonetically identical to, or very close to, the SG-form, i.e. PL-formation is not as natural as claimed by earlier studies based on written language (e.g. Braunmüller 1989; Heltoft 1998). According to Ács, Fenyvesi & Jørgensen (2008) Danish written language upholds a clear structure whereas the spoken language can be characterized as unnatural, referring to the principles of Natural Phonology and Morphology as found in Dressler (1985), for example.

The less distinct pronunciation of SG-forms as e.g. *pige* [‘pi:ə] / less distinct [‘pi:] ‘girl’, *kage* [‘kæ:(j)ə] / less distinct [‘kæ:] ‘cake’, *flue* [‘flu:ə] / less distinct [‘flu:] ‘fly’, *lade* [‘læ:ðə] / less distinct [‘læ:ð] ‘barn’, *rive* [‘vi:ə] / less distinct [‘vi:] ‘rake’, *gave* [‘gæ:ə] / less distinct [‘gæ:] ‘gift’, *reje* [‘væ:ɪə] / less distinct [‘væ:ɪ] ‘shrimp’ all end in a full vowel, or a neutral vowel other than [ə], whereas the distinct pronunciation ends in [ə] (Basbøll 2005: 293-322; cf. Ács et al. 2008: 19-23); in such examples the vowel length is vacillating. According to Ács et al. (2008) the PL-formation of the less distinct pronunciation of these SG-forms is more iconic than the PL-formation of the distinct pronunciation of these SG-forms, in the sense that the PL-formation for the reduced form is just additive,⁸ whereas for the distinct form, part of the SG-stem (i.e. the final [ə]), is replaced by [v] in the PL.

7 The pl-suffixes *-/s/*, *-/i/* and *-/a/* are only found in foreign nouns (except for one Danish example: *høne* ‘hen’ – *høn-s* ‘hens’ (collective)) and they are not relevant for (smaller) children. However, *-/s/* is expanding due to English loans.

8 Perhaps with a slight difference in syllabicity, however.

4. Acquisition studies on Danish noun plurals

Danish-speaking children typically produce their first noun PL-forms around their second birthday, but there is still a long way to go before the whole noun PL-system is fully acquired (e.g. Kjærbæk et al. 2014).

Kjærbæk & Basbøll (2016) studied the frequency of the PL-suffixes in *naturalistic spontaneous child language input* to six Danish-speaking children in the ages of 0;10-3;11 and found that *-/v/* is the most frequent PL-suffix followed by *-Ø* and *-/ə/* (see Table 2).

TABLE 2: FREQUENCY OF THE PL-SUFFIXES IN NATURALISTIC SPONTANEOUS CHILD LANGUAGE INPUT (KJÆRBÆK & BASBØLL 2016: 673)

Suffix	Types	Tokens
<i>-/v/</i>	64 %	55 %
<i>-Ø</i>	20 %	31 %
<i>-/ə/</i>	12 %	10 %
Total	96 %	96 %

In a *picture-based elicitation task* inspired by Berko (1958), Kjærbæk et al. (2014) asked Danish-speaking children to produce the PL-form of nouns on the basis of their SG-form, and the study showed that Danish-speaking children produce most correct PL-forms of nouns taking the PL-suffix *-/v/* which is the fully productive PL-suffix in Danish – and also the most frequent PL-suffix in the language input to Danish-speaking children as shown in Table 2. But the study also indicates that the PL-suffix *-/v/* is followed rather closely by the PL-suffix *-/ə/*, whereas the PL-suffix *-Ø* seems to be acquired late compared to the other two suffixes. Please note, however, that nouns taking the PL-marker ‘Ø’ (PL = SG) were not included in the task, i.e. all nouns taking the PL-suffix *-Ø* in the elicitation task also have phonemic stem change.

Kjærbæk et al. (2014) found clear evidence for a scale of three degrees of stem change with different levels of complexity going from transparent to partly transparent to not transparent. The Danish-speaking children participating in the task produced very few stem errors in the No Change category (transparent), followed by Prosodic Change (partly transparent), and the highest percentage of errors occurred in the Phonemic Change category (not transparent).

Table 3 shows the input frequency of the Danish PL-markers in a corpus of *naturalistic spontaneous child language input* (the parent’s language production) and *output* (the child’s language production) divided according to their degree of productivity, as reported in Kjærbæk & Basbøll (2016).

TABLE 3: INPUT FREQUENCY OF THE DANISH PL-MARKERS DIVIDED ACCORDING TO THEIR DEGREE OF PRODUCTIVITY (KJÆRBÆK & BASBØLL 2016: 677)

Degree of productivity	Types	Tokens
Fully Productive	63 %	50 %
Semi-Productive	31 %	32 %
Unproductive	6 %	18 %
Total	100 %	100 %

The study found that Fully Productive PL-markers have an input frequency in *naturalistic spontaneous speech* of 63 % (types); Semi-Productive PL-markers have an input frequency of 31 % (types), whereas the Unproductive PL-markers have an input frequency of only 6 % (types). Kjærbæk et al. (2014) show that in the younger age groups, Danish-speaking children in a *picture-based elicitation task* produce more correct PL-forms of nouns taking a Fully Productive PL-marker compared to nouns taking a Semi-Productive PL-marker, but the amount of correctly produced PL-forms in the two categories appear to coincide in the older age groups. Unproductive PL-markers have much lower correctness rates in the *picture-based elicitation task* compared to the other PL-markers. The study furthermore shows that the children produce very few PL-error forms with a wrong stem change and/or wrong suffix. Instead, the children either produce the correct PL-form or produce a form with no overt PL-marker – it appears that the Danish-speaking children produce a form identical to the SG-form as a default when they are not sure how to produce the correct PL-form. It is difficult (if at all possible) to determine whether a child intends to repeat the SG-form given by the investigator or whether the child intends to produce a PL-form, i.e. these forms can either be interpreted as a repetition of the SG-form or as an overgeneralization of the Semi-Productive PL-marker ‘Ø’ (PL = SG) – this will be discussed in section 8.

Kjærbæk & Basbøll (2016: 681) present a detailed analysis of the PL-error forms produced by children in *structured interviews*. 19% of all PL-error forms are children producing the Fully Productive PL-marker ‘v’, 6% are children producing the Semi-Productive PL-marker ‘ə’, whereas 67% of all error forms are children producing a form with no overt PL-marker, i.e. either repetition of the SG-form or overgeneralization of the Semi-Productive PL-marker ‘Ø’ (PL = SG). 70% of the forms produced with no overt PL-marker take the Fully Productive PL-marker ‘v’ in adult standard pronunciation, i.e. if we interpret these forms produced by the children as overgeneralizations of the Semi-Productive PL-marker ‘Ø’, the overgeneralization goes in the opposite direction of what would be expected if productivity alone is the relevant factor. Out of the rest of the error forms (i.e. the 33% that are not changes to the Semi-Productive marker ‘Ø’), 70% are overgeneralizations of the Fully Productive PL-marker ‘v’ (i.e. in the expected direction). There are very few overgeneralizations of an Unproductive PL-marker (taking the PL-suffix -Ø or -v/, both with phonemic stem change) – and never of the Unproductive foreign PL-markers ‘s’, ‘a’ and ‘i’.

5. Hypotheses of the present study

Earlier studies on other languages have shown that overgeneralization errors are characterized by going from less productive PL-markers towards more productive PL-markers (e.g. Laaha et al. 2006), but surprisingly, in a study based on *structured interviews*, Kjærbæk & Basbøll (2016) showed a different pattern for Danish-speaking children. The study showed that 47 % of all error forms went from a Fully Productive to a Semi-Productive PL-marker, 19 % went from a Semi-Productive to another Semi-Productive PL-marker – whereas only 20 % went from an Unproductive or Semi-Productive PL-marker to a Fully Productive PL-marker. In the present paper, we present similar analyses from a *picture-based elicitation task*.

In order to learn more about children's underlying grammatical system, this study investigates which effect the competition between the different PL-markers has in Danish-speaking children's acquisition of the noun PL-system. The study explores the principles followed by Danish-speaking children when they are to select a PL-marker among several competing PL-markers in a *picture-based elicitation task*. The children's error forms are particularly relevant to understand this issue.

We focus on productivity of the PL-marker, and we compare the results with results from other studies on Danish-speaking children's acquisition of the noun PL-system based on other types of data in order to shed light on the PL-marker 'Ø' (PL = SG) – both methodologically and theoretically.

Based upon earlier studies of other languages, we hypothesize that: (a) the general error direction of the PL-error forms goes from Unproductive → Semi-Productive → Fully-Productive PL-markers, as indicated in for example Laaha et al. (2006). However, based upon earlier studies of Danish, we expect that: (b) the Semi-Productive PL-marker 'Ø' (PL = SG) plays a particular role in the Danish noun PL-system and in Danish-speaking children's PL-formation – as indicated in for example Basbøll et al. (2011); Kjærbæk et al. (2014); and Kjærbæk & Basbøll (2016) – and that this effect can overrule the general hypothesis.

6. Method

6.1 Participants

The sample for the study consisted of 160 children (80 girls, 80 boys) between the ages of 3-10 years from Odense, Denmark. All children were monolingual native speakers of Danish from a middle-to-high socioeconomic background, with no hearing, language, or developmental problems.

6.2 Materials

In order to gain insight into the acquisition of PL-formation in Danish and to gain insight into which principles Danish-speaking children use in order to solve the problem of competing PL-markers, a *picture-based elicitation task* modeled after the classical Wug-test on both conventional and pseudo-words (Berko 1958) was conducted. The task (with 46 items; only convention-

al nouns) required participants to provide the PL-form of a SG-noun presented by an investigator. This *picture-based elicitation task* aimed to examine children's ability to inflect SG-nouns in their PL-form under structured experimental context-free conditions and hence required a high degree of meta-linguistic awareness. Since the PL-markers 's', 'a' and 'i' are very rare in child language, they were not included in the task. Furthermore, only items with an overt PL-marker were included, i.e. items with the PL-marker 'Ø' (PL = SG) were not included since they are methodologically problematic: when using a classical *picture-based elicitation task* which consists in eliciting the PL-form of a given SG-noun, it cannot - in the case of the PL-marker 'Ø' (PL = SG) - be determined whether a zero form produced by the child is a correctly produced PL-marker 'Ø', or simply a repetition of the SG-noun given by the investigator (see also Laaha et al. 2006).⁹

6.3 Procedure

The children were tested orally and individually. The task required participants to provide the PL-form of a SG-noun presented by the investigator in both the oral and the visual mode simultaneously. The SG-noun was presented within a fixed sentence, and with the support of a picture, and participants were asked to complete the fixed sentence frame using the PL-form. For example, the investigator showed a picture of a car and said: *Her er en bil* 'Here is a car'. Then the investigator showed a second picture of two instances of the same object and asked: *Her er to hvad?* 'Here are two what?', and the child's task was to provide the respective PL-form. Test items were presented in random orders and were preceded by three training items.

The children's produced forms were coded phonologically with regard to both stem and suffix, and it was therefore possible to compare each child's produced PL-forms with the adult standard pronunciation of the same forms in order to investigate which principles Danish-speaking children use to solve the problem of competing PL-markers when producing a PL-form (see also Kjærbæk 2013; 2015; Kjærbæk et al. 2014; Kjærbæk & Basbøll 2016; Laaha et al. 2011).

7. Results

The results of the *picture-based elicitation task* are presented here with focus on the produced PL-error forms (for results on correctly produced PL-forms see Kjærbæk 2013, 2015; Kjærbæk et al. 2014; Kjærbæk & Basbøll 2016).

Table 4 shows the direction of the children's produced PL-error forms in the elicitation task categorized into degree of productivity, i.e. which PL-marker does the noun take in standard Danish compared to the PL-marker the children produce to create a PL-form.

⁹ The *picture-based elicitation task* was conducted within the framework of an international research team coordinated by prof. Wolfgang U. Dressler. All decisions taken within the framework were followed (e.g. not including nouns taking the pl-marker 'Ø' (PL = SG)) increasing the possibility of comparison across languages.

TABLE 4: ERROR DIRECTION OF THE CHILDREN'S PRODUCED ERROR FORMS IN THE PICTURE-BASED ELICITATION TASK IN TERMS OF PRODUCTIVITY OF THE PL-MARKER

Error direction	Percentage of all errors
Unproductive → Semi-Productive	27
Fully Productive → Semi-Productive	24
Semi-Productive → Semi-Productive	20
Unproductive → Fully Productive	11
Fully Productive → Fully Productive	6
Semi-Productive → Fully Productive	6
Unproductive → Unproductive	4
Fully Productive → Unproductive	2
Semi-Productive → Unproductive	0.4

The most frequent error patterns are children overgeneralizing a Semi-Productive PL-marker – either instead of an Unproductive PL-marker (27%), a Fully Productive PL-marker (24%) or instead of another Semi-Productive PL-marker (20%), i.e. 71% of all error forms are overgeneralizations of a Semi-Productive PL-marker. The Fully Productive PL-markers are only overgeneralized 23% of the time and the Unproductive PL-markers only 6% of the time.

Table 5 shows the error pattern in the *picture-based elicitation task* in terms of productivity of the PL-marker – but now adding the information of the PL-suffixes to show a more detailed picture. The error forms are grouped according to degree of productivity and PL-suffix.

TABLE 5: ERROR PATTERN OF THE CHILDREN'S PRODUCED ERROR FORMS IN THE PICTURE-BASED ELICITATION TASK IN TERMS OF PRODUCTIVITY OF THE PL-MARKER (WITH SPECIFIED PL-SUFFIX)

Error direction	Percentage of all error forms
Fully Productive <i>-/v/</i> → Fully Productive <i>-/v/</i>	6
Semi-Productive <i>-/ə/</i> → Fully Productive <i>-/v/</i>	6
Unproductive <i>-/v/</i> → Fully Productive <i>-/v/</i>	3
Unproductive <i>-∅</i> → Fully Productive <i>-/v/</i>	8
Fully Productive <i>-/v/</i> → Semi-Productive <i>-/ə/</i>	2
Semi-Productive <i>-/ə/</i> → Semi-Productive <i>-/ə/</i>	0.1
Unproductive <i>-/v/</i> → Semi-Productive <i>-/ə/</i>	0.5

Unproductive -Ø → Semi-Productive -/ə/	3
Fully Productive -/v/ → Semi-Productive -Ø (PL = SG)	22
Semi-Productive -/ə/ → Semi-Productive -Ø (PL = SG)	20
Unproductive -/v/ → Semi-Productive -Ø (PL = SG)	3
Unproductive -Ø → Semi-Productive -Ø (PL = SG)	20
Others	6

Looking deeper into the error forms we see that 22% of all error forms are children producing a Semi-Productive PL-marker with the PL-suffix -Ø (i.e. the marker 'Ø' (PL = SG)) instead of a Fully-Productive PL-marker with the PL-suffix -/v/. 20% of all error forms are children producing the Semi-Productive PL-marker 'Ø' (PL = SG) instead of a Semi-Productive PL-marker with the PL-suffix -/ə/, and 20% of all error forms are children producing a Semi-Productive PL-marker with the PL-suffix -Ø (PL = SG) instead of an Unproductive PL-marker with the PL-suffix -Ø. Thus, 65% of all the overgeneralizations are in favor of the Semi-Productive PL-marker 'Ø' (PL = SG). We also see that the children sometimes overgeneralize to a PL-marker of the same productivity and with the same PL-suffix, i.e. they produce another stem (change) (6%). The children rarely overgeneralize the PL-suffix -/ə/ (6%).

Table 6 shows the direction of the PL-error forms in the *picture-based elicitation task* categorized according to degree of productivity of the PL-marker and with specification of the PL-suffix - but exclusively focusing on the attractor of the overgeneralization, viz. the right-hand side of this substitution, i.e., differences purely in categories of stem change within the three main types (No Change, Prosodic Change, Phonemic Change; see section 3.1) are ignored; this leads to small differences in percentages when compared to Table 5.

TABLE 6: ERROR DIRECTION OF THE CHILDREN'S PRODUCED ERROR FORMS IN THE PICTURE-BASED ELICITATION TASK IN TERMS OF THE OVERGENERALIZATION ATTRACTOR'S PRODUCTIVITY OF THE PL-MARKER

Error direction	Percentage of all error forms
→ Fully Productive -/v/	23 %
→ Semi-Productive -/ə/	6 %
→ Semi-Productive 'Ø' (PL = SG)	65 %
Others	6 %

In Table 6, we see that 23% of all error forms in the task are children producing the Fully Productive PL-marker 'v', 6% are children producing the Semi-Productive PL-marker 'ə', whereas a striking 65% of all error forms are children producing the Semi-Productive PL-marker 'Ø' (PL = SG). It seems that Danish-speaking children to a high extent produce a form identical to the SG-

form as a default when they are not sure how to produce the correct PL-form. As stated earlier these forms can either be interpreted as a repetition of the SG-form or as an overgeneralization of the Semi-Productive PL-marker ‘Ø’ (PL = SG) – we will discuss this further in the next section.

Discussion

The results of the study show that 65% of all error forms in the *picture-based elicitation task* are children producing the Semi-Productive PL-marker ‘Ø’ (PL = SG), whereas only 23% of all error forms are children producing the Fully Productive PL-marker ‘v’. It seems, as said above, that Danish-speaking children to a high extent produce a form identical to the SG-form when they do not know the correct PL-form.

One explanation may be that it is simply caused by the type of elicitation task, where the investigator provides the child with a SG-form and asks the child to produce the PL-form. The children may simply repeat the SG-form given by the investigator. If this is the case, we would expect to see the same pattern when completing the task with children acquiring other languages. Gillis et al. (2008) conducted the same *picture-based elicitation task* with German-, Dutch- and Hebrew-speaking children as we did with Danish-speaking children but did not find the same pattern for the three other languages – in fact there was a significant difference for all ages with Danish in the top, viz. with most SG-forms.

A further observation speaking against this explanation is that other studies on Danish-speaking children’s acquisition of the noun PL-system based on *naturalistic spontaneous speech* (Kjærbæk & Basbøll 2017) and *structured interviews* (e.g. Kjærbæk et al. 2014; Kjærbæk & Basbøll 2016) show similar results.

According to Bittner & Köpcke (2001), omission of PL-marking on the noun (i.e. PL-marker ‘Ø’, PL = SG) is to be expected when children are uncertain about the PL-form to be used, or when the lexically stored PL-form cannot be activated quickly or confidently enough in the production process since no patterns or regularities for PL-formation have been established yet. For the vast majority of nouns, the SG-form is the more salient, more permanently stored form of the noun. Bittner & Köpcke (2001) furthermore report that it comes out clearly that the search for a PL-form is especially neglected in those cases where the noun is associated with a quantifier. This does not come out as clearly for the Danish-speaking children, since Kjærbæk et al. (2014) found that 48% of the ‘Ø’-forms were produced out of context (i.e. with no quantifier), only 1% were produced in a SG-context (e.g. *en bil* ‘a car’) whereas 51% were produced in a PL-context (e.g. **to bil* ‘two car’).

Thus, it is still puzzling that Danish-speaking children produce relatively more zero forms than German-, Dutch- and Hebrew-speaking children in the same task. An explanation could be found in the fact that the PL-marker ‘Ø’ (PL = SG) is a very important morphological category in Danish, in German it occurs but it is less important, whereas it is not found in the two other languages, viz. Dutch and Hebrew (Gillis et al. 2008).

A further explanation could be that the dropping of the PL-suffix *-/ə/* in the distinct form [ə] often results in a PL-form which is almost identical to the SG-form, as in *hus* [hu:ʔs] ‘house’ – *huse*

[ˈhu:sə] / [ˈhu:s] ‘houses’ and *tov* [tʊv] ‘rope’ – *tove* [ˈtʊvə] / [ˈtʊv:] / [ˈtʊv] ‘ropes’ (see section 3), and thereby PL-forms identical, or almost identical, to their corresponding SG-forms are even more frequent in Danish. Nouns which in the standard take the *-ə/-*suffix are overgeneralized to the PL-marker ‘Ø’ (PL = SG) 23% of the time in the *picture-based elicitation task*.

According to Basbøll et al. (2011: 100-103) the zero PL-suffix is strongly overrepresented for nouns with neuter gender (tables 12 and 13), and the PL-suffix depends on the final phoneme of the SG-stem, classified in terms of sonority (tables 14 and 15). Partly for historical reasons, monosyllables in Danish are less regular in their morphology and morphophonology than words with more, and in particular with many, syllables (cf. Basbøll et al. 2011: 90-93 for an example from Danish PL-formation). Since monosyllables are important in early language acquisition, we have investigated the lexical frequencies¹⁰ of the different PL-markers of monosyllables, focusing upon the PL-marker ‘Ø’ (PL = SG). For all monosyllabic nouns (with a PL-form), 34% take the Semi-Productive PL-marker ‘Ø’ (PL = SG) compared to 40% for the Fully Productive PL-marker ‘v’¹¹ and 24% for the Semi-Productive PL-marker ‘ə’. There is thus strong competition between the three regular PL-markers in monosyllables. When the final segment of the stem is taken into account, in particular the distinction between stem-final V and C is important (Danish monosyllables cannot end in /ə/ or /v/): For monosyllabic nouns ending in a C (whether a glide, sonorant or obstruent), there is strong competition between the three Fully Productive (‘v’: 38%) and Semi-Productive (‘ə’: 25%, ‘Ø’: 38%) PL-markers. For monosyllabic nouns ending in V, however, the respective percentages for the PL-markers are: Fully Productive ‘v’: 65%, Semi-Productive ‘ə’: 6%, Semi-Productive ‘Ø’: 24%. The competition for V-final monosyllables is thus mainly between a dominating Fully Productive PL-marker ‘v’ and the Semi-Productive PL-marker ‘Ø’ (PL = SG).

For monosyllabic *neuter* nouns, a total of 75% take the PL-marker ‘Ø’ (Fully Productive ‘v’: 12% and Semi-Productive ‘ə’: only 3%). For stem-final V, neuter nouns take Fully Productive ‘v’ in 57% and ‘Ø’ (PL = SG) in 43%, and never Semi-Productive ‘ə’. For stem-final C (classified in the three sonority types: glide, sonorant C and obstruent), the percentage for ‘Ø’ (PL = SG) varies between 75 and 81%. Thus ‘Ø’ (PL = SG) is strongly dominant for C-final neuter nouns. It seems that the cue strength of the PL-marker ‘Ø’ (PL = SG) overrules the fact that it is only partially predictable, Semi-Productive, non-salient, non-iconic and non-frequent (although more frequent in child language than in the Danish lexicon).

Bittner & Köpcke (2001: 56) put forward a hypothesis regarding the sequence of acquisition in nominal PL-formation up to age 3;0 (see also section 2):

- Stage 1: use of lexically stored PL-forms
- Stage 2: avoidance of PL-marking on the noun
- Stage 3: overgeneralization of the Fully Productive PL-marker

¹⁰ All lexical frequencies given in this paper stem from the OLAM base which has been further developed since Basbøll et al. 2011, so the numbers are not strictly comparable.

¹¹ In this section ‘v’ and ‘ə’ refers to the PL-marker regardless of prosodic change.

Even if we choose to regard the Danish-speaking children's overgeneralization of the PL-marker 'Ø' (PL = SG) as avoidance of PL-marking on the noun, the results of the present study do not support this hypothesis. The reasons are: 1) "avoidance of PL-marking on the noun" (i.e. PL = SG) (Stage 2) is the most frequent error form in Danish-speaking children in all age groups (also for the 10 year olds) and in different elicitation tasks (*naturalistic spontaneous speech, structured interviews, picture-based elicitation task*); 2) there is no increase in the rate of overgeneralization of the Fully Productive PL-marker with age (Stage 3; cf. Kjærbaek & Basbøll 2016).

A noun ending in what phonologically could be the Fully Productive PL-suffix *-/v/* seems to be a reason for the children not to add a suffix when producing a PL-form. 13% of the items have stem-final */v/* (e.g. *fætter* ['fɛdɐ] 'cousin', *søster* ['søsɔdɐ] 'sister' and *datter* ['dadɐ] 'daughter'). We see a much higher degree of overgeneralization of the PL-marker 'Ø' (PL = SG) with these items (40%) than with other items (22%). A similar result might be expected for nouns ending in what could be the Semi-Productive PL-suffix *-/ə/* (e.g. *bamse* ['bamsə] 'teddy bear' and *æble* ['ɛ:blə] 'apple'), but this is not the case. Only 15% of these are overgeneralizations of the PL-marker 'Ø' (PL = SG). An explanation for this could be that about 99% of nouns with stem-final */ə/* take the PL-suffix *-/v/*, and thus have a high degree of predictability (Basbøll et al. 2011).

According to Bybee's schema model, the highest degree of similarity to PL-schemata should give the highest repetition of stimuli items (overgeneralization of the PL-marker 'Ø' (PL = SG); 40% in the present study); then should come the monosyllabic neuter nouns with stem-final C – in the Danish noun PL-system they will most likely take the PL-marker 'Ø' – which give the second highest repetition of stimuli (overgeneralization of the PL-marker 'Ø' (PL = SG); 23% in the present study); and last all other forms which have the lowest degree of similarity to PL-schemata (20% in the present study). If we see these results in the light of the schema theory and the cue strength hypothesis, they show a striking departure from randomness. In agreement with what Köpcke (1998) shows for both English and German, Danish-speaking children tend to repeat stimuli to a greater extent when they already resemble a PL-schema.

Our results indicate that already at the age of three years an analysis of the input has taken place, and the children have formed a first hypothesis on PL-formation. The results furthermore indicate that the abilities needed to apply this hypothesis as a PL-formation pattern have been developed. It seems that Danish-speaking children from a very early age are aware of the possibility to form a PL-noun with no overt PL-marker (PL = SG), and they furthermore know that monosyllabic neuter nouns with stem-final C are most likely formed with no overt PL-marker (PL = SG).

Conclusion

In order to learn more about children's underlying grammatical system, this study investigated the principles followed by Danish-speaking children when they are to select a PL-marker among several competing PL-markers, focusing on the productivity of the PL-marker (specified for PL-suffix).

The PL-suffix *-/v/* has a high input frequency and a stable phonology which leads to early acquisition and sometimes overgeneralization. The PL-suffix *-/ə/* has a much lower input frequency, and it is opaque since it is often reduced or assimilated. This leads to relatively early acquisition, but the suffix is seldom overgeneralized. The PL-suffix *-Ø* has a low input frequency and it is not phonologically expressed. This leads to late acquisition, but the *-Ø*-suffix is often overgeneralized. Danish-speaking children do not overgeneralize the phonemic stem change Umlaut, nor do they overgeneralize the foreign suffixes *-/s/*, *-/a/*, and *-/i/*.

The present study based on a *picture-based elicitation task*, draws basically the same picture of Danish-speaking children's PL-error patterns as earlier studies based on *naturalistic spontaneous child language* (Kjærbæk & Basbøll 2017) and *structured interviews* (Kjærbæk & Basbøll 2016). This is interesting due to the large difference in methodology between the three studies and therefore strengthens the picture seen in the three studies. Thus, these studies give a detailed and valuable insight into the acquisition of the Danish noun PL-system.

The significant role of the PL-marker 'Ø' (PL = SG) in the Danish PL-system, and its relevance for the child, has been endorsed by the studies reported here, thus it is not just a result of the elicitation method.

The results of the study seem to support the hypotheses put forward in section 5, namely that (b) the Semi-Productive PL-marker 'Ø' (PL = SG) plays a particular role in the Danish noun PL-system and in Danish-speaking children's PL-formation, overruling the effect of the general hypothesis (a) that the general error direction of the PL-error forms would go from Unproductive → Semi-Productive → Fully-Productive PL-markers.

The results are compatible with single-route models and especially with the schema model since Danish-speaking children clearly do not simply add the Fully Productive PL-marker by rule. Furthermore, Danish-speaking children tend to repeat stimuli (overgeneralize the PL-marker 'Ø' (PL = SG)) to a greater extent when they already resemble a PL-schema. All in all, we have found that Danish-speaking children show a strong tendency to overgeneralizing the PL-marker 'Ø' (PL = SG): Danish-speaking children seem to regard 'Ø' as a PL-marker from a very early age.

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References

- Ács, Péter, Katalin Fenyvesi & Henrik Jørgensen. 2008. Dansk fonologi og morfologi set i lyset af de såkaldte naturlighedsteorier. *Nydanske Sprogstudier (NyS)* 36. 10-37.
- Albirini, Abdulkafi. 2015. Factors affecting the acquisition of plural morphology in Jordanian Arabic. *Journal of Child Language* 42(4). 734-762.
- Ambridge, Benn, Evan Kidd, Caroline F. Rowland & Anna Theakston. 2015. The ubiquity of frequency effects in first language acquisition. *Journal of Child Language* 42(2). 239-273.
- Basbøll, Hans. 2005. *The Phonology of Danish*. Oxford: Oxford University Press.
- Basbøll, Hans. 2009. Is nothing something, or isn't it anything? Zeroes in Danish prosodic morphology. In Bruce Fraser & Ken Turner (eds.) *Language in Life, and a Life in Language: Jacob Mey - a Festschrift [Series: Studies in Pragmatics 6]*. Oxford: Emerald. 19-24.
- Basbøll, Hans. 2014. Danish stød as evidence for grammaticalization of suffixal positions in word structure. *Acta Linguistica Hafniensia* 46(2). 137-158.
- Basbøll, Hans, Laila Kjørnbæk & Claus Lambertsen. 2011. The Danish noun plural landscape. *Acta Linguistica Hafniensia* 43(2). 81-105.
- Berent, Iris, Steven Pinker & Joseph Shimron. 2002. The nature of regularity and irregularity: Evidence from Hebrew nominal inflection. *Journal of Psycholinguistic Research* 31(5). 459-502.
- Berko, Jean. 1958. The child's learning of English morphology. *Word* 14(2-3). 150-177.
- Berman, Ruth. 1986. A crosslinguistic perspective: Morphology and syntax. In Paul Fletcher & Michael Garman (eds.) *Language acquisition*. Cambridge: Cambridge University Press. 429-447.
- Bittner, Dagmar & Klaus-Michael Köpcke. 2001. On the acquisition of the German plural markings. *ZAS Papers in Linguistics* 21. 21-32.
- Bloom, Louis. 1991. *Language Development from Two to Three*. Cambridge: Cambridge University Press.
- Braunmüller, Kurt. 1989. Er det danske sprogs morfologi naturlig? In Mette Kunøe & Erik Vive Larsen (eds.) 2. *Møde om Udforskningen af Dansk Sprog*. Århus: Aarhus Universitet. 73-88.
- Brink, Lars, Jørn Lund, Steffen Heger & Jens Norman Jørgensen. 1991. *Den Store Danske Udtaleordbog*. København: Munksgaard.
- Brown, Roger. 1973. *A First Language: The Early Stages*. Cambridge, MA: Harvard University Press.
- Bybee, Joan L. 1985. *Morphology: A Study of the Relation Between Meaning and Form*. Amsterdam: Benjamins.
- Bybee, Joan L. 1988. Morphology as lexical organization. In Michael Hammond & Michael Noonan (eds.) *Theoretical Morphology*. San Diego: Academic Press. 119-141.
- Bybee, Joan L. 1991. Natural morphology: The organization of paradigms and language acquisition. In Thom Huebner & Charles Ferguson (eds.) *Crosscurrents in Second Language Acquisition and Linguistic Theory*. Amsterdam: John Benjamins. 67-91.
- Bybee, Joan L. 1995. Regular morphology and the lexicon. *Language and Cognitive Processes* 10(5). 423-455.

- Cameron-Faulkner, Thea, Elena Lieven & Michael Tomasello. 2003. A construction based analysis of child directed speech. *Cognitive Science* 27(6). 843-873.
- Clahsen, Harald. 1999. Lexical entries and rules of language: a multidisciplinary study of German inflection. *Behavioral and Brain Sciences* 22(6). 991-1060.
- Clark, Eve. 2016. *First Language Acquisition*. Cambridge: Cambridge University Press.
- deVilliers, Jill G. 1985. Learning how to use verbs – lexical coding and the influence of the input. *Journal of Child Language* 12(3). 587-595.
- Dressler, Wolfgang U. 1985. *Morphology: The Dynamics of Derivation*. Ann Arbor: Karoma Press.
- Dressler, Wolfgang U. 2003. Degrees of grammatical productivity in inflectional morphology. *Italian Journal of Linguistics = Rivista di Linguistica* 15(1). 31-62.
- Dressler, Wolfgang U., Willi Mayerthaler, Oswald Panagl & Wolfgang Ullrich Wurzel. 1987. *Leitmotifs in Natural Morphology*. Amsterdam: John Benjamins.
- Gillis, Steven, Agnita Souman, Inge Molemans, Sim Dhollander, Katja Rehfeldt, Laila Kjærbaek, Hans Basbøll, Claus Lambertsen, Sabine Laaha, Johannes Bertl, Wolfgang U. Dressler, Naama Lavie, Ronit Levie & Dorit Ravid. 2008. The classical task: From singular to plural form in Dutch, Danish, Austrian German, and Hebrew. Presented at *the XI Congress of the International Association for the Study of Child Language*. Edinburgh, UK, July 28-August 1, 2008.
- Gleason, Jean Berko. 1992. *Language Acquisition and Socialization*. University lecture, Boston University [cited after Hoff 2014].
- Grønnum, Nina. 2007. *Rødgrød med fløde: en lille bog om dansk fonetik*. København: Akademisk Forlag.
- Guillaume, Paul. 1927. Le développement des éléments formels dans le langage de l'enfant. *Journal de Psychologie* 24. 203-229.
- Hansen, Erik & Lars Heltoft. 2011. *Grammatik over det danske sprog I-III*. København: Det Danske Sprog- og Litteraturselskab.
- Heltoft, Lars. 1998. Det danske morfologiske system. In Kjeld Kristensen (ed.) *Selskab for Nordisk Filologi. Årsberetning 1996-1997*. København: Selskab for Nordisk Filologi. 85-99.
- Heltoft, Lars. 2001. Reanalysing structure: The Danish definite article, its predecessors and development. *Acta Linguistica Hafniensia* 33(1). 67-90.
- Hoff, Erika. 2014. *Language Development*. Wadsworth, Cengage Learning.
- Jaeger, Jeri J., Alan H. Lockwood, David L. Kemmerer, Robert D. van Valin, Brian W. Murphy & Hanif G. Khalak. 1996. A positron emission tomographic study of regular and irregular verb morphology in English. *Language* 72(3). 451-497.
- Kempe, Vera, Patricia J. Brooks, Natalija Mironova, Angelina Pershukova & Olga Fedorova. 2007. Playing with word endings: Morphological variation in the learning of Russian noun inflections. *British Journal of Developmental Psychology* 25(1). 55-77.
- Kjærbaek, Laila. 2013. *Tilegnelse af bøjningsmorfologi: En undersøgelse af substantivernes pluralisbøjning hos normalt udviklede børn i alderen 0-10 år*. Ph.d.-afhandling. Syddansk Universitet.
- Kjærbaek, Laila. 2015. Danske børns tilegnelse af bøjningsmorfologi – udviklingen af substantivernes pluralisbøjning i alderen 0-10 år. *Nydanske Sprogstudier (NYS)* 48. 106-138.

- Kjærbaek, Laila & Hans Basbøll. 2015. Testing hypotheses on frequency effects – noun plural inflection in Danish children. In Elena Babatsouli & David Ingram (eds.) *Proceedings of the International Symposium on Monolingual and Bilingual Speech 2015*. 168-181.
- Kjærbaek, Laila & Hans Basbøll. 2016. Interaction between input frequency, transparency and productivity in acquisition of noun plural inflection in Danish. *Poznań Studies in Contemporary Linguistics* 52(4). 663-686.
- Kjærbaek, Laila & Hans Basbøll. 2017. Interaction between cognitive and other factors in the acquisition of Danish noun plural inflection. Presented at *the Fourteenth International Cognitive Linguistics Conference*, Tartu, Estonia, July 10-14, 2017.
- Kjærbaek, Laila, René dePont Christensen & Hans Basbøll. 2014. Sound structure and input frequency impact on noun plural acquisition: Hypotheses tested on Danish children across different data types. *Nordic Journal of Linguistics* 37(1). 47-86.
- Köpcke, Klaus-Michael. 1993. *Schemata bei der Pluralbildung im Deutschen. Versuch einer kognitiven Morphologie*. Tübingen: Narr.
- Köpcke, Klaus-Michael. 1998. The acquisition of plural marking in English and German revisited: schemata versus rules. *Journal of Child Language* 25(2). 293-319.
- Laaha, Sabine, Dorit Ravid, Katharina Korecky-Kröll, Gregor Laaha & Wolfgang U. Dressler. 2006. Early noun plurals in German: regularity, productivity or default? *Journal of Child Language* 33(2). 271-302.
- Laaha, Sabine & Wolfgang U. Dressler. 2012. Suffix predictability and stem transparency in the acquisition of German noun plurals. In Ferenc Kiefer, Mária Ladányi & Péter Siptár (eds.) *Current Issues in Morphological Theory: (Ir)regularity, Analogy and Frequency*. Amsterdam: John Benjamins Publishing Company. 217-236.
- Laaha, Sabine, Laila Kjærbaek, Hans Basbøll & Wolfgang U. Dressler. 2011. The impact of sound structure on morphology: An experimental study on children's acquisition of German and Danish noun plurals focusing on stem change. *Acta Linguistica Hafniensia* 43(2). 106-125.
- Lieven, Elena, Heike Behrens, Jennifer Speares & Michael Tomasello. 2003. Early syntactic creativity: A usage-based approach. *Journal of Child Language* 30(2). 333-370.
- Lieven, Elena, Julian Pine & Gillian Baldwin. 1997. Lexically-based learning and early grammatical development. *Journal of Child Language* 24(1). 187-219.
- Lignos, Constantine & Charles Yang. 2016. Morphology and language acquisition. In Andrew Hippisley & Gregory Stump (eds.) *The Cambridge Handbook of Morphology*. Cambridge: Cambridge University Press. 765-791.
- Maratsos, Michael. 1983. Some current issues in the study of the acquisition of grammar. In Paul Henry Mussen, John H. Flavell, Leonard Carmichael & Ellen M. Markman (eds.) *Carmichael's Handbook of Child Psychology*. New York: Wiley. 709-786.
- Maratsos, Michael. 1998. The acquisition of grammar. In Deanna Kuhn & Robert S. Siegler (eds.) *Handbook of Child Psychology: Cognition, Perception, and Language*. New York: Wiley. 421-466.
- Marcus, Gary F., Ursula Brinkmann, Harald Clahsen, Richard Wiese & Steven Pinker. 1995. German inflection: the exception that proves the rule. *Cognitive Psychology* 29(3). 189-256.

- Marcus, Gary F., Steven Pinker, Michael Ullman, Michelle Hollander, T. John Rosen & Fei Xu. 1992. *Overregularization in Language Acquisition. Monographs of the Society for Research in Child Development* 57. Illinois: The University of Chicago Press.
- Mayerthaler, Willi. 1981. *Morphologische Natürlichkeit*. Wiesbaden: Athenaion [English translation: 1988. *Morphological Naturalness*. Ann Arbor: Karoma Press]
- McClelland, James L. 1988. Connectionist models and psychological evidence. *Journal of Memory and Language* 27(2). 107-123.
- McClelland, James L. & Karalyn Patterson. 2002. Rules or connections in past-tense inflections: what does the evidence rule out? *Trends in Cognitive Sciences* 6(11). 465-472.
- Naigles, Letitia R. & Erika Hoff-Ginsberg. 1998. Why are some verbs learned before other verbs? Effects of input frequency and structure on children's early verb use. *Journal of Child Language* 25(1). 95-120.
- Peters, Ann M. 1997. Language typology, prosody, and the acquisition of grammatical morphemes. In Dan I. Slobin (ed.) *The Crosslinguistic Study of Language Acquisition: Volume 5: Expanding the Contexts*. Mahwah, NJ: Erlbaum. 135-198.
- Pinker, Steven. 1999. *Words and Rules: The Ingredients of Language*. London: Weidenfeld and Nicolson.
- Plunkett, Kim & Virginia Marchmann. 1991. U-shaped learning and frequency effects in a multi-layered perceptron: implications for child language acquisition. *Cognition* 38(1). 1-60.
- Plunkett, Kim & Virginia Marchman. 1993. From rote learned to system building: acquiring verb morphology in children and connectionist nets. *Cognition* 48(1). 21-69.
- Ravid, Dorit, Wolfgang U. Dressler, Bracha Nir-Sagiv, Katharina Korecky Kröll, Agnita Souman, Katja Rehfeldt, Sabine Laaha, Johannes Bertl, Hans Basbøll & Steven Gillis. 2008. Core morphology in child directed speech: Crosslinguistic corpus analyses of noun plurals. In Heike Behrens (ed.) *Corpora in Language Acquisition Research: History, Methods, Perspectives*. Amsterdam: John Benjamins Publishing Company. 25-60.
- Rumelhart, David E. & James L. McClelland. 1986. On learning the past tense of English verbs. In James L. McClelland, David E. Rumelhart & the PDP Research Group (eds.) *Parallel Distributed Processing: Explorations in the Microstructure of Cognition. Volume 2: Psychological and Biological Models*. Cambridge, MA: MIT Press. 216-271.
- Sahin, Ned T., Steven Pinker & Eric Halgren. 2006. Abstract grammatical processing of nouns and verbs in Broca's Area: Evidence from fMRI. *Cortex* 42(4). 540-562.
- Slobin, Dan I. (ed.). 1985a. *The Crosslinguistic Study of Language Acquisition. Volume 1: The Data*. Hillsdale, NJ: Lawrence Erlbaum.
- Slobin, Dan I. (ed.). 1985b. *The Crosslinguistic Study of Language Acquisition. Volume 2: Theoretical Issues*. Hillsdale, NJ: Lawrence Erlbaum.
- Theakston, Anna, Elena Lieven, Julian Pine & Caroline Rowland. 2001. The role of performance limitations in the acquisition of verb-argument structure: An alternative account. *Journal of Child Language* 28(1). 127-152.
- Tomasello, Michael. 2000. Do young children have adult syntactic competence? *Cognition* 74(3). 209-253.

- Tomasello, Michael. 2003. *Constructing a Language: A Usage-Based Theory*. Cambridge, MA: Harvard University Press.
- Tomasello, Michael. 2006. Acquiring linguistic constructions. In Deanna Kuhn & Robert S. Siegler (eds.) *Handbook of Child Psychology. Volume 2*. Hoboken, NJ: Wiley. 255-298.
- Tomasello, Michael, Nameera Akhtar, Kelly Dodson & Laura Rekau. 1997. Differential productivity in young children's use of nouns and verbs. *Journal of Child Language* 24(2). 373-387.
- Wurzel, Wolfgang U. 1984. *Flexionsmorphologie und Natürlichkeit*. Berlin: Akademie-Verlag. [English translation: 1989. *Inflectional Morphology and Naturalness*. Dordrecht: Kluwer Academic Publishers].
- Xanthos, Ari, Sabine Laaha, Steven Gillis, Ursula Stephany, Ayhan Aksu-Koç, Anastasi Christofidou, Natalia Gagarina, Fordana Hrzica, Nihan N. Ketrez, Marianne Kilani-Schoch, Katharina Korecky-Kröll, Melita Kovačević, Klaus Laalo, Marijan Palmovic, Barbara Pfeiler, Maria D. Voeikova & Wolfgang U. Dressler. 2011. On the role of morphological richness in the early development of noun and verb inflection. *First Language* 31(4). 461-479.