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Inflectional morphology in Cri du chat syndrome – a case study

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Abstract

This study examined morphological skills in a girl with cri du chat syndrome, addressing three questions: (1) To what extent does the subject inflect words; (2) to what extent are words inflected correctly; and (3) to what extent do the inflected words reflect productive morphological rules, and to what extent can they be considered to be rote-learned? The study draws on two sources of data, a corpus of spontaneous utterances collected when the subject was 14 years old, and her performance on a past tense elicitation test at 11;10 and 16;5. It was found that most inflectional forms in the nominal, verbal, pronominal and adjectival paradigms of the target language were attested in the corpus. These forms were in all but a few instances inflected correctly. The most frequent inflection errors were infinitive for present, past or past participle in verbs, and wrong gender in determiners. Furthermore, performance on the elicitation test indicated some knowledge of productive inflectional rules of the target language, despite relatively poor phonetic, phonological and syntactic skills.

Keywords: *Cri du chat syndrome, morphological skills, past tense*

Introduction

Cri du chat syndrome

This paper examines aspects of morphological knowledge and processing skills in one adolescent with cri du chat syndrome (CCS) learning Norwegian. CCS is a rare genetic disorder with an estimated incidence between 1:20,000 and 1:50,000 births (Niebuhr, 1978; Wu & Hansen, 2005) and is associated with a partial deletion on the short arm of chromosome 5. The clinical features of CCS include a high-pitched cry in infancy and childhood (Sohner & Mitchell, 1991; Sparks & Hutchinson, 1980), malocclusion, hyper- and hypotonia, delayed motor development (Carlin & Fraser, 1990), microcephaly (Niebuhr, 1978) mild-to-profound intellectual disability, including problems with verbal processing (Cornish, Bramble, Munir, & Pigram, 1999), a short attention span, hyperactivity, and a stereotypical, aggressive, and self-injurious behaviour pattern (Collins & Cornish, 2002).

Those affected with CCS have delayed speech and language development (see Kristoffersen (2008b) for a review), arguably as a result of delayed motor development as well as intellectual disability. According to the literature, many (reports vary from 23 to 50 %) do not develop spoken language at all (Baird, Campbell, Ingram, & Gomez, 2001; Carlin & Fraser, 1990; Cornish & Pigram, 1996; Wilkins, Brown, & Wolf, 1980). When they do develop spoken language, however, receptive skills have been found to be significantly better than expressive skills (Cornish, et al., 1999; Cornish & Munir, 1998). Within the domain of phonetics and phonology it has been shown that individuals with CCS have frequent articulatory errors (Kristoffersen, 2004, 2008a). Also severe problems in the domain of syntax have been documented (Kristoffersen, 2009). Within morphology Wium & Kristoffersen (2008) examined knowledge of past tense forms in three subjects with CCS by means of an elicitation task. All three subjects demonstrated some knowledge of past tense inflection patterns; all of them, however, produced more errors than a group of typically developing 4-year-olds who participated in another study using the same elicitation task

(Ragnarsdóttir, Simonsen, & Plunkett, 1999). On the other hand, for all three subjects with CCS it was the case that the majority of the correct responses were in the inflectional class with highest type frequency, and the majority of their overgeneralizations were to the same class. In this respect the three individuals with CCS performed in a way similar to the youngest TD children participating in the Ragnarsdóttir et al. (1999) study.

Clearly, performance on a past tense elicitation task will provide a picture of knowledge and processing skills related to inflectional morphology. However, this picture will necessarily be tied to the test situation. One aim of the present study, therefore, was to examine morphological skills as they appear in communicatively real situations.

Morphological skills in typically developing children acquiring Norwegian

Typically developing (TD) children acquiring Norwegian on average start producing morphologically complex forms at around 18 months of age (Kristoffersen, et al., 2010). From the emergence of these first complex forms to full mastery of the morphological system of Norwegian, however, it takes several years. For example, within the domain of verbal morphology it has been shown that Norwegian 4-year-olds are able to produce correct past tense forms of all major inflectional classes, but the rate of correct forms at this age was only 51% (Ragnarsdóttir, et al., 1999). Also 8-year-olds participating in the same study produced incorrect past tense forms. However, the share of incorrect past tense forms (10%) in this age group was not significantly different from normal adults participating in another study using the same instrument (Bjerkan, 2000; Simonsen & Bjerkan, 1998).

Ragnarsdóttir et al. (1999) also found that the order of acquisition of these classes was contingent on the relative type frequency of the classes, in that the inflection class with highest type frequency was acquired before classes with lower type frequency. In addition to these type frequency effects, Ragnarsdóttir et al. (1999) also found that token frequency played a role, in that there were more correct responses among frequent verbs than among the less frequent verbs. Another important finding from their study was that

there was a clear relationship between the error types and the correct responses in the TD children, in the sense that when a particular pattern was a strong source of overgeneralizations, the number of correct responses in the same class was also high.

Development of morphological skills in atypically developing children

In atypically developing children morphological skills may be affected in various ways and to various degrees. For example, Eadie, Fey, Douglas & Parsons (2002) compared morphosyntactic skills in English-speaking children with Down syndrome (DS) and children with specific language impairment (SLI) with those of MLU-matched TD children. They found that children with DS and SLI performed significantly more poorly than the TD children on all measures of grammatical morphology. The children with SLI and DS also differed on certain points; for example, the children with DS performed relatively well on irregular forms (both 3rd person present and past tense forms), whereas the SLI children had problems with the 3rd person present form. Conversely, the children with SLI performed comparatively well on the regular past tense forms, which were more of a challenge for the DS children. Laws & Bishop (2003) similarly investigated language skills in children with DS and SLI, using elicitation tasks to assess productive morphological skills. They found deficits in the ability to mark verbs for tense in both groups of impaired children relative to controls. Also Italian children with DS and SLI have problems with morphology, but, according to a study by Caselli, Monaco, Trasciani and Vicari (2008) their problems were fewer than those of the English children participating in the previously mentioned studies. In another study, Roberts, Rice & Tager-Flusberg (2004) found that one subgroup of children with autism in their sample had problems with production of tense morphology to an extent similar to that found with children with SLI. In general, the morphological problems seen in these populations have been attributed to limitiations in auditory-verbal processing.

In a study of Norwegian children with SLI Bjerkan (2000) examined past tense performance using the same test as Ragnarsdóttir et al. (1999), and found that most of the children with SLI performed at about the same level as two year younger TD children, with type and token frequency influencing their performance to various degrees

depending on inflection class. Likewise, Christensen (2010) found that Danish children with SLI had significant difficulties with past tense inflections across a variety of tasks.

Also inflections in other lexical categories have turned out to be a problem for atypically developing children. In the nominal domain studies have shown that grammatical gender is a problem for children with SLI (Orgassa & Weerman, 2008; Roulet-Amiot & Jakubowicz, 2006) and with Williams syndrome (Karmiloff-Smith, et al., 1997). In sum, there are commonalities as well as differences in morphological impairment across types of impairment, across structures, and across languages.

Rule-governed vs. rote-learned morphological skills

Knowledge about morphological skills in children with atypical language development is of course valuable in itself, since such knowledge forms an important and necessary basis for designing successful intervention programs for these children. But this issue is also interesting in a broader theoretical perspective. Acquisition of inflectional morphology can be discussed with reference to the so-called past tense debate, where two conflicting views on how inflectional forms are acquired and processed stand against each other. These two views are commonly referred to as the single-mechanism and the dual-mechanism models (see Dąbrowska (2004) and Pinker & Ullmann (2002) for critical reviews). According to the single-mechanism model both regular and irregular forms are rote-learned, and subsequently generalized over, to form more general inflectional schemas. In the dual-mechanism model, in contrast, regular forms are processed by a symbolic rule combining a stem and an inflectional ending, whereas irregular forms are rote-learned to become part of the lexicon. The symbolic rule operates independently of any phonological or semantic property of the stem, and is insensitive to frequency effects. To the extent that the findings from the present study indicate how morphological forms are processed, they will be relevat to this controversy.

Research questions

In the only existing study of morphology in CCS, Wium & Kristoffersen (2008), knowledge of inflectional forms was assessed by means of an elicitation task, whereas use of such forms in naturalistic language samples was not evaluated. The latter measure

is important, as it taps the subjects' skills in producing morphologically complex forms in communicatively real situations. Naturalistic language samples also provide an opportunity to estimate the share of correctly and incorrectly inflected words in obligatory contexts, which is not possible with an elicitation task. Thus, the two different methodologies in fact yield knowledge of different domains. In the present study morphological skills were assessed by both methods. Three questions were addressed: (1) To what extent did the subject of this study inflect words; (2) to what extent did she inflect words correctly; and (3) to what extent did her inflections reflect productive morphological rules, and to what extent could they be considered as rote-learned? Answers to the first two questions were sought in a small corpus of utterances collected when the subject was 14 years. The third question was approached by examining her past tense inflections at two different ages, 11;10 and 16;5, by means of a picture elicitation test (Ragnarsdóttir et al. 1999)). Even if this task was designed to elicit verb morphology only, its role in the present study was to obtain a measure of the morphological processing skills in this subject.

The rest of the paper is organized as follows: In the next section a brief sketch of the morphology of Norwegian, the target language of the subject, is presented, followed by a section on methodology. After that, the results are presented and discussed. The final section of the paper contains a summary and conclusions.

The morphology of Norwegian – a brief sketch

Norwegian, the target language of the subject of this study, is a Germanic language spoken by ca. 4,900,000 citizens of Norway. Morphologically, Norwegian is slightly more complex than English. Nouns fall into two or three (depending on dialect) declensions, and are inflected for number and definiteness, cf. the paradigms in table I.

Table I. Inflection of nouns in Norwegian

	Declension 1	Declension 2	Declension 3
Singular indefinite	*bil* 'car'	*sol* 'sun'	*hus* 'house'
Singular definite	*bil-en*	*sol-a*	*hus-et*
Plural indefinite	*bil-er*	*sol-er*	*hus*
Plural definite	*bil-ene*	*sol-ene*	*hus-a*

This paradigm is a simplification of the noun system i Norwegian, which is somewhat more complex.

There is a major division of Norwegian verbs into weak ('regular') and strong ('irregular') verbs. Furthermore, there are two weak classes, one larger (WL) with a type frequency of 56% and one smaller (WS) with a type frequency of 40%. As in English, there are a number of strong subclasses, some with a relatively high type frequency, others with only a few members. Norwegian verb paradigms have five cells; imperative, infinitive, present, simple past, and past participle,[1] cf. the example paradigms in table II.

Table II. Inflection of verbs in Norwegian

	Weak verbs: large class	Weak verbs: small class	Strong verbs
Imperative	*kast 'throw'*	*lek 'play'*	*bit 'bite'*
Infinitive	*kast-e*	*lek-e*	*bit-e*
Present	*kast-er*	*lek-er*	*bit-er*
Past	*kast-a*	*lek-te*	*beit*
Past participle	*kast-a*	*lek-t*	*bitt*

Adjectives in Norwegian are inflected for gender (masculine/feminine vs. neuter), definiteness (definite vs. indefinite), number (singular vs. plural), and degree (positive vs. comparative vs. superlative), with more contrasts applying to adjectives modifying a head noun than to predicative adjectives.

Table III. Inflection of adjectives in Norwegian

Indefinite			Definite
masc./fem.	neuter	Plural	Singular/Plural
fin 'fine'	*fin-t*	*fin-e*	*fin-e*

Since the category of degree will not be in focus in what follows, it is not included here.

In the paradigms for personal pronouns, there are distinctions between subject and object case for some pronouns (e.g. *jeg* 'I' vs *meg* 'me'), between masculine, feminine and neuter (only in 3rd person singular: *han* 'he', *hun* 'she', and *det/den* 'it'), and between singular and plural (e.g. *du* 'you-SG' vs *dere* 'you-PL'. Furthermore, among the possessive determiners (with different forms for most persons in the singular and plural) there are distinctions between genders (e.g. *min* 'my-MASC' vs *mi* 'my-FEM' vs *mitt* 'my-

NEUT'), and between non-reflexive and reflexive forms (*hans* 'his-NON-REFL' vs *sitt* 'his-REFL').

Among nouns, verbs and adjectives, the main mode of inflection is suffixation. Some nouns and verbs, however, have inflection by modification, see e.g. the column for strong verbs in table II, where the root vowel of the verb *bite* 'bite' varies between *i* and *ei*. A third possibility is that nothing changes from one cell to another in the paradigm, cf. the singular indefinite and plural indefinite of *hus* 'house' in table I.

Method

Description of the subject

The subject of this study was the author's daughter, Hanna, who has been raised in a monolingual Norwegian-speaking environment. Hanna is a second child, and was diagnosed with CCS at six weeks of age. Diagnosis was suspected on the basis of her cry, and confirmed by chromosomal analysis, which showed a *de novo* terminal deletion with a breakpoint at 14.2. Hanna received physiotherapy twice a week from three through 11 months of age. After that time, she received physiotherapy on a more irregular basis. She was systematically taught Sign support communication – at home, in kindergarten, and at school – from three months of age until she was 13 years old. She received speech therapy from when she was eight until she was 15 years old.

Hanna's hearing has been found to be normal. At 13;6 her cognitive functioning was measured by the municipal pedagogical-psychological service (PPS) using *Raven's coloured progressive matrices* (Raven, 1962). According to the report issued by the PPS her performance was similar to that of typically developing children aged 7 – 8. At the same age, Hanna's cognitive functioning was also measured by Bender visual-motor gestalt test (Bender, 1938). Here the report from the PPS states that her performance was variable, similar to that of typically developing children between 4 and 7 years.

Previously, Hanna's syntactic, phonetic and phonological skills have been described in some detail (Kristoffersen, 2008a, 2009). When measured at 9;4, her phonetic and phonological skills were extremely poor in comparison to TD children the same age, and more comparable to children between one and two years of age. For example, in comparison with the 2 to 3-year-old TD children studied by Simonsen (1990), Hanna had very few consonants, thus lacking the means to express a number of

phonological contrasts in the target language. Also, several of her consonants deviated from those of the target language.[2] Moreover, Hanna is able to produce utterances of some complexity, but usually relatively short; the MLU (word) of a subset of the utterances forming the corpus used in the present study was 2.36 (see Kristoffersen (2009) for details). In comparison, three TD Norwegian-learning children between 1;10 and 2;1 had MLUw values between 2.24 and 2.27 (Westergaard, 2005). Also, many of her utterances were non-target-like in several respects, e.g. frequent omissions of lexical as well as grammatical words, deviant word order, and extensive use of prefabricated units. In all, it would come as no surprise if her morphological skills were poor as well. But, as we will see, this is not the case in all respects.

Data and procedure

The data for this study come from two different sources. The first one is a corpus of 552 utterances (containing a total of 1,712 words) compiled by the author during a period of three months when Hanna was between 14;2 and 14;5 of age. The utterances included in the corpus were registered by the author in a diary immediately after Hanna produced them. Within one month after the registration in the diary the utterances were entered into a database. The corpus was compiled following a procedure adapted from Tomasello (1992). The basic guiding principle was to register as many different constructions in naturally occurring interactions as possible during the period under investigation. By different constructions is meant: (a) different argument structure constructions (e.g. intransitive vs. transitive vs. ditransitive constructions); (b) instantiations of the same argument structure construction involving different lexical verbs (e.g. the transitive construction with two or more distinct verbs); and (c) different types of speech acts (statements, questions, orders) instantiating the same argument structure construction (e.g. *She gave me the book* vs. *Give me the book!*).

The second source of data was Hanna's performance on a past tense elicitation test on two occasions, the first when she was 11;10 (reported in Wium & Kristoffersen 2008) and the second when she was 16;5.[3] The test was developed by Ragnarsdóttir et al. (1999), building on the tradition from e.g. Berko (1958) and Bybee and Slobin, to be used in an experimental study comparing past tense formation in TD four-, six-, and

eight-year-old Norwegian and Icelandic children. Sixty verbs were included in the test. The verbs belonged to the two weak classes described above, and the seven subclasses of strong verbs identified by Ragnarsdóttir et al. (1999). Furthermore, the verbs varied with respect to type frequency, token frequency and phonological properties. The procedure of the task was as follows: The subject was shown a picture of someone performing an action. The experimenter introduced each picture to the subject in the following way (with minor variations): "This is a boy who knows how to —. He is –ing. He did the same thing yesterday. What did he do yesterday?" (from Ragnarsdóttir et al., 1999: 595).

Data analysis

Morphological analysis of the forms in the corpus proceeded in two steps. First of all, all forms of nouns, verbs, adjectives, personal pronouns and possessive pronouns were coded by the author according to inflectional form, i.e. nouns into indefinite singulars, definite singulars, indefinite plurals and definite plurals, verbs into present, past, etc. (cf. the morphological sketch of Norwegian above).[4] 7.2% of these inflected forms were recoded by a second coder, yielding an inter-coder agreement of 94.6 %. Second, the proportions of correctly and incorrectly inflected words were calculated using the following procedure: First, it was determined how many of the words in the corpus appeared in obligatory contexts for inflection.[5] Next it was determined how many of the words were inflected correctly, and how many were inflected incorrectly. To take an example, consider the following utterance,

Du	*har*	*med*	*penger?*
you.SG	have.PRES	with	money.PL

'You have brought money?'

which contains three words in obligatory contexts for inflection, *du, har, penger*. All of these are inflected correctly.

The results from the past tense elicitation test will be presented in terms of three measures. The first is the proportion of correct responses (i.e. correct past tense forms provided), and the second is the proportion of overgeneralisations to another inflectional

pattern. These two measures will be given both across and within inflection classes, and discussed with reference to type frequency in the target language. The third measure concerns the relationship between correct responses and token frequency, where the correctly inflected verbs will be categorized as high frequency verbs and low frequency verbs, following Ragnarsdóttir et al. (1999).

Results

Morphological forms in the corpus

Morphological forms in the corpus are described in what follows by tabulating the attested inflectional forms of nouns, verbs, adjectives, personal pronouns and possessive determiners. Table IV shows the attested inflectional forms of nouns.

Table IV. Inflectional forms of nouns represented in the corpus

	Masculine	Feminine	Neuter
Singular indefinite	√	√	√
Singular definite	√	√	√
Plural indefinite	√		
Plural definite	√		√

We see that two forms in the inflectional class of the feminine gender were lacking, the plural indefinite and the plural definite. In addition, there was no plural indefinite form of a neutral noun found in the corpus.[6]

Next, consider the verbal inflectional forms laid out in table V. Of the possible forms imperative, infinitive, present, simple past and past participle (cf. table II above), all were attested in the corpus. There was, however, a gap in the imperative cell of the large class of weak verbs.

Table V. Inflectional forms of verbs represented in the corpus

	Weak verbs: large class	Weak verbs: small class	Strong verbs
Imperative		√	√
Infinitive	√	√	√
Present	√	√	√
Past	√	√	√
Past participle	√	√	√

Table VI shows that Hanna produced adjective inflections of all types.

Table VI. Inflectional forms of adjectives represented in the corpus

Indefinite			Definite	
Masc./Fem.	Neuter	Plural	Singular	Plural
√	√	√	√	√

Finally, the utterances constituting the corpus show that Hanna had a good grasp of the various forms of personal pronouns and possessive determiners in the target language. Recall that personal pronouns in Norwegian come in singular and plural forms, as well as subject and object case forms. Among the possessive determiners, distinctions can be drawn between singular and plural, between masculine/feminine and neuter, and between reflexive and non-reflexive forms. All these distinctions in personal pronouns and possessive determiners were attested in the corpus.

Proportion of correctly and incorrectly inflected forms

Tables IV-VI show that many of the inflectional forms of the target language were produced by Hanna, but these forms did not show to what extent she produced correctly inflected forms in her utterances. To address that question the proportion of correctly and incorrectly inflected words in the corpus was calculated. In total there were 1,712 words in the corpus. Of these, 1,034 were in contexts where they would be obligatorily inflected in the target language. Table VII summarizes the results of calculating correctly and incorrectly inflected words.

Table VII. Proportion of correctly and incorrectly inflected words

Category	N	%
Obligatory contexts for inflected words	1,034	100
Correctly inflected words	1,010	98
Incorrectly inflected words	24	2

The incorrectly inflected words were nouns, pronouns or verbs. Tables VIII-IX summarize the variation among the incorrectly inflected verbs and nouns/pronouns.

Table VIII. Errors in verbal inflections.

	N
Total number of incorrectly inflected verbs	15
Infinitive for present	10
Infinitive for past	2
Infinitive for past participle	2
Present for past	1

Table IX. Errors in nominal (nouns and pronouns) inflections.

	N
Total number of incorrectly inflected nouns	9
Wrong gender: masculine for feminine	3
Wrong gender: masculine for neuter	2
Indefinite plural for definite plural	1
Indefinite singular for indefinite plural	1
Wrong pronominal case: accusative for nominative	1
3rd sg. reflexive for 3rd sg. non-reflexive pronoun	1

In sum, these results show that there was morphology in Hanna's utterances. However, they do not show to what extent can we speak of a productive morphology, and to what extent the inflected forms are rote learned? In order to approach these questions, we applied a past tense elicitation task. The next section presents the results of this task.

Past tense elicitation task

Table X shows the proportion of correct responses and overgeneralizations at the two measure points (11;1 and 16;5), in comparison with performance of TD children on the same elicitation task, as reported by Ragnarsdóttir et al (1999).

Table X. Correct responses and overgeneralizations on past tense elicitation task

	Correct responses[a]	Overgeneralizations[b]
Hanna 11;10 (Wium & Kristoffersen 2006)	30%	23%
Hanna 16;5	32%	24%
TD 4-year-olds (Ragnarsdóttir et al. 1999)	51%	28%

[a]Proportion of correct responses = % of all responses; [b]Proportions of overgeneralizations=% of all errors.

From table X we see that both at 11;10 and 16;5, Hanna inflected slightly less that one third of the 60 verbs correctly, which is well below the share of correct responses reported for TD Norwegian 4-year-olds. Furthermore, we observe that the share of overgeneralizations made by Hanna was approximately the same at the two points of

observation, and only slightly below the share of overgeneralizations made by the TD 4-year-olds.

In table XI the number of correct responses distributed over the three inflectional patterns WL (weak verbs, large class), WS (weak verbs, small class) and S (strong verbs) when Hanna was 11;10 and 16;5 is laid out. For comparison the corresponding figures for TD 4- and 6-year-olds are also given.

Table XI. Correct responses by inflectional pattern

	Hanna 11;10	Hanna 16;5	TD 4-year-olds	TD 6-year-olds
WL	44%	6%	85%	94%
WS	18%	47%	47%	71%
S	30%	37%	33%	60%

Proportion of total number of verbs in each class represented in the instrument.

From table XI we see that even though the number of correct responses in the group of strong verbs increased from 11;10 to 16;5, she inflected around one third of the strong verbs correctly at both measure points. The share of correct responses in the two other classes, in contrast, changed from 11;10 to 16;5. First, the number of correct responses in the WL class decreased dramatically between the two measure points, from 44% to 6%. At the same time, the share of correct responses in the WS class increased, from 18% to 47%. A comparison with the performance of TD children shows that Hanna's correct responses in the S verbs were similar to those of TD 4-year olds. Furthermore, her performance at 16;5 on the WS class was slightly better than the TD 4-year-olds. In contrast, her share of correct responses in the WL class was far below both TD 4-year-olds and 6-year-olds.

Table XII presents the number of verbs with high token frequency where Hanna responded with a correct past tense form. As we can see, both in the WS class and among the S patterns more than half of the verbs had high token frequency.[7]

Table XII. Proportion of high token frequency verbs inflected correctly

Age	*WL*	*WS*	*S*
11;10	2/5	2/3	7/9
16;5	0/1	5/8	6/10

In table XIII the overgeneralizations distributed over inflectional class(es) are laid out.

Table XIII. Hanna's overgeneralizations by inflectional class

	11;10	16;5
Overgeneralization into the WL class	14%	0%
Overgeneralization into the WS class	9%	7%
Overgeneralization into a strong pattern	0%	12%

Proportion of overgeneralizations of total number of errors.

Again, we see a distinct change from 11;10 to 16;5. At 11;10 overgeneralizations to the WL class were more frequent than to the WS class. At that point there were no overgeneralizations to the S class. At 16;5, in contrast, there were no overgeneralizations to the WL, 7% to the WS class, and 12% to a strong pattern.

Finally, focussing on overgeneralizations to a strong pattern, which only occurred when she was tested at 16;5, we looked in more detail at the patterns which formed the model for the overgeneralizations, and the type frequency of these patterns.

Table XIV. Overgeneralizations to a strong pattern

	Pattern in target language	Model pattern for overgeneralization
ligge–lagg (for *ligge–lå*) 'lie'	Strong	Strong, subgroup 1
ringe–rang (for *ringe–ringte*) 'ring'	WS	Strong, subgroup 1
gynge–hang (for *gynge-gynga*) 'rock'	WL	Strong, subgroup 1
skinne–sjann (for *skinne–skinte*) 'shine'	WS	Strong, subgroup 1
slikke–slakk (for *slikke–slikka*) 'lick'	WL	Strong, subgroup 1

The classification of strong verbs in Norwegian in column 3 is from Ragnarsdóttir et al. (1999).

A we can see from table XIV all overgeneralizations were formed on the basis of one model, the first subgroup of strong verbs in Norwegian, with modification from an infinitive root vowel *i, e, y* to the past root vowel *a*. This is the subgroup with the highest type frequency, counting 40 members.[8]

Discussion

In spite of poor phonological and syntactic skills Hanna seems to have mastered at least some aspects of Norwegian morphology. Judging from the utterances constituting the

corpus used for this study, in the majority of cases (98%) she inflected words of different classes correctly in obligatory contexts, i.e. in contexts where words should be inflected according to the rules of the target language. The few errors she did make belong to two categories also found in children with other types of language disorders, wrong gender in the nominal forms, and wrong form among verbs. Problems with gender agreement in other atypical populations have been attributed to the fact that the inflected elements are distributed across several words within a noun phrase (cf. Orgassa & Weerman, 2008; Karmiloff-Smith, et al., 1997), for example ***den*** *stor**e*** *bil**en*** 'the big car', where the agreeing elements are the determiner *den*, the inflection *–e* on the adjective *store*, and the inflection *–en* on *bilen*, all exponents of masculine gender in Norwegian. One challenge with gender agreement for individuals with limitations in verbal-auditory processing is to extract and internalize general information about these distributed patterns from exemplars. Problems with verbal-auditory processing have also been found in individuals with CCS (Cornish et al., 1999). Thus, the fact that Hanna has some problems with gender agreement might be interpreted as a result of these limitations. Moreover, the errors Hanna makes in the verbal domain are with one exception substitutions of a form expressing tense or aspect (i.e. the past participle) with the infinitive form, cf. Table VIII. These errors again reflect certain problems with morphological forms expressing tense, problems which are also found with other atypical populations, and generally attributed to processing limitations. Again, Hanna's error patterns might be interpreted in a similar direction.

Turning to Hanna's performance on a past tense elicitation test, this was in most cases poorer than what was found for TD 4-year-olds acquiring Norwegian, indicating that her knowledge of the morphological system of Norwegian is at best partial, with an overall rate of correct responses of around 30% at both measure points, and the rate of overgeneralizations just below one fourth of all errors. In what follows, these findings will be discussed with reference to morphological skills in TD children and to morphological skills in persons from other atypical populations.

The proportion of correct responses in the elicitation task at the two measure points, 30% and 32% respectively, and only one fourth of the errors being overgeneralizations to another pattern, might be taken as an indication that the many

correctly inflected forms in the corpus were rote learned and not the result of applying more general inflectional rules. On the other hand, the fact that Hanna does overgeneralize in quite a few instances indicates that she has some knowledge of productive morphological processes in Norwegian.

As noted in the Introduction (and shown in table XI), TD children acquiring Norwegian gradually acquire the inflectional patterns of verbs in their target language, with the type frequency of the different patterns being an important governing factor. If we look at Hanna's performance at the two measure points it is not evident that there is either a type frequency effect or a developmental trend. Furthermore, which inflectional class constitutes the main source of overgeneralizations for TD children appears to change over time, cf. the findings from Ragnarsdóttir et al. (1999) where the WL class was most important for 4-year-olds, and the WS class most important for the 8-year-olds. Recalling the figures from table XI, we see that the majority of Hanna's overgeneralizations at 11;10 was in the WL and WS classes; at 16;5 the majority of overgeneralizations was in the WS and S classes. A possible interpretation is that Hanna here follows the same course of development that we have seen in typical development (although at a slower pace) where also the strong patterns become more important as a source of overgeneralizations as the children grow older. Also, the fact that the number of overgeneralizations to the WL class decreases between 11;10 and 16;5 in parallel with a decrease in overgeneralizations into the same class might point to a synchronization of correct responses and overgeneralizations within classes, identified also for TD children by Ragnarsdóttir et al. (1999).

In the face of these results other questions arise, for example, why we don't find an increase in overgeneralizations into the WS pattern when the number of correct responses in WS increased between 11;10 and 16;5? A second question would be why the number of overgeneralizations into a strong pattern increase (0-17%) between 11;10 and 16;5, when the number of correct responses in this class is the same at the two measure points? It is outside the scope of this paper to answer these questions in any detail, but they all point in the general direction that Hanna's knowledge of morphological processes is different from that of TD children aged 4 – 8 years acquiring Norwegian, probably with more reliance on rote learning of individual forms than learning of productive rules.

As noted above, productive morphological skills are affected to various degrees in atypical populations. As this study has shown, this is also the case with CCS, at least as far as the present case is concerned. However, Hanna's morphological skills as they emerge from her performance on the elicitation experiment are markedly different from her skills evident from the corpus data. This is not surprising, but may be interpreted in several ways. On the one hand, the test situation might have been too demanding for her, which is the interpretation given by Wium (2006) with reference to Hanna's performance on the elicitation test at 11;10. On the other hand, it might be argued that the two sources of data actually tap different skills; the test is designed to investigate processing more than the knowledge itself. It may be the case that Hanna knows these forms, but that her processing skills (lexical retrieval, memory etc.) are affected by the syndrome. The fact that she actually produces correct forms in 98% of the utterances in the corpus supports this conclusion.

A final question arising from these findings is why Hanna's morphological skills – at least judged by the corpus data – appears to be far better than her phonetic, phonological and syntactic skills, as these were assessed by Kristoffersen (2008a, 2009). In all of these areas one of the challenges is to combine smaller elements into larger structures, i.e. phonemes into syllables and words, morphemes into words, and words into phrases and sentences. However, one can argue that this challenge is greater within the phonetic/phonological and syntactic domain than within the morphological domain. The reason for this is of course that the number of phonemes that form a word and the number of words that form phrases and sentences potentially can be much larger than the number of morphemes that make up words. Accordingly, it may be easier for Hanna to get the morphological forms correct than even modestly long words and sentences. Also, it is clear that delayed motor development at least in part is responsible for her problems in the phonetic and phonological domain. Since morphological production is not dependent upon motor skills in the same way, the superiority of her morphological skills over her phonetic/phonological skills is not entirely surprising.

Summary and conclusion

In this paper the morphological skills of a Norwegian-speaking girl with cri du chat syndrome were examined. Two different types of data were used, on the one hand

naturalistic language data, and on the other performance on an elicitation experiment designed to measure past tense inflections. The two types of data produced different profiles of the subject's morphological skills. Judged by the utterances produced in naturalistic contexts, she was able to inflect most words correctly. In other words, we might conclude that she knew morphological patterns of the target language just as well as TD children and adults with typical language skills, in clear contrast with her skills within the phonological and syntactic domain, which where comparable to TD toddlers (cf. Simonsen, 1990; Westergaard, 2005, on phonological and syntactic skills of TD Norwegian-learning children. However, her performance on the past tense test clearly indicated that her knowledge of productive morphological processes did not match that of TD 4- to 8-year-old children learning Norwegian, probably with more reliance on rote learning of individual forms than learning of productive rules. [9]

Given that this study focuses on one single case, and that the data underlying the analyses are relatively scarce (due to individual characteristics of the subject), it is of course important to be extremely careful in drawing any general conclusions concerning morphological skills in CCS from this study alone. Furthermore, such generalizations are also difficult for another reason, namely that the language skills of persons with CCS vary immensely (Kristoffersen, 2008b), and, accordingly, what seems to be the case for one person, is not necessarily true for another. What this study has shown, however, is that individuals with CCS have the potential to produce morphologically complex forms. The study also emphasizes the importance of attending to the finer details of grammatical skills in order to make assessments which will be useful in a therapeutic context, not only for children with CCS, but also with other language disorders.

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NOTES

[1] There is also a present participle form, which due to its marginality in the system is not included here.

[2] Since 9;4 I have not followed her phonetic and phonological development systematically, but in general her skills in these areas have not developed much since then.

[3] Even though the subject's processing skills are measured at two different times, it is difficult from these two measures to ascertain whether any differences represent a true development or only random variation.

[4] The focus on inflectional morphology comes as a natural consequence of the almost total lack of derivational forms and compounds in the corpus.

[5] The notion of obligatory context was developed in Brown (1973), and can be defined as a context in a language where an adult native speaker according to the grammar of this language would have to use a particular inflectional form.

[6] Gaps like these are most likely accidental.

[7] For details on how the verbs with high and low token frequency were selected, see Ragnarsdóttir et al. (1999:596f.).

[8] In one of these cases, *gynge–hang*, for *gynge–gynga*, there is a possibility that Hanna confuses the verb *gynge* with *henge* 'hang', with the past tense form *hang*. On the other hand, since Hanna saw a picture showing an act of rocking, and not hanging, and the input was the present tense form *gynger,* and not *henger*, there is little reason to believe that that was the case.

[9] One of the reviewers asks to what extent this reliance on rote-learning could be supported by observations regarding other requisite cognitive skills such as memory and pattern detection that might be relatively preserved in this syndrome. To my knowledge there are no studies that examine cognitive skills in CCS in enough details to address this issue appropriately (however, see Cornish et al. (1999) for some general information). The question will, however, be an obvious starting point for further research.

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