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The role of negative evidence in the acquisition of phonology

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It is generally assumed that children acquire the grammar of a language on the basis of positive evidence only (cf. Baker 1979, Wexler & Culicover 1980, Pinker 1989). I agree with this position insofar it concerns the acquisition of the core grammar. However, I argue that indirect negative evidence, i.e. the non-existence of particular data in the input, can be used to acquire language-specific properties, that lie outside the scope of the core grammar. In this paper I focus on the acquisition of two such language-specific properties in Dutch: the absence of short vowels in open syllables, i.e. the lack of CV syllables, and the non-existence of certain onset clusters that share place of articulation features.

1. Introduction

The general questions which generative linguists try to answer are 'what constitutes knowledge of language?' and 'how is such knowledge acquired?' (Chomsky 1986). Because children acquire language relatively easily and quickly, it is assumed by most linguists that children have some innate knowledge of language. This is referred to as Universal Grammar (UG), and underlies all natural languages. On the basis of the data from a language, and given UG the child has to acquire the grammar of a language. This is the so-called logical problem of acquisition (Hornstein & Lighthfoot 1981), which is sketched in (1):

(1)  The logical problem of language acquisition

Learning theory
DATA <-> UG <-> GRAMMAR

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The UG and the Grammar components in (1) have of course different interpretations in different grammatical theories. I assume here a 'principles and parameters' model along the lines proposed by Chomsky (1981a, b). In such a model, UG consists of a set of principles that apply to all languages and a set of parameters whose values vary within clearly defined limits from one language to another. A grammar of a particular language consists of a set of values for the parameters. This is called the core grammar. In addition to this, the grammar may also contain language-specific properties that lie outside the core grammar.

In this paper I will focus on the acquisition of two such language-specific properties in Dutch: the absence of short vowels in open syllables, i.e. the lack of CV syllables, and the non-existence of certain onset clusters that share place of articulation features. Both CV syllables and onset clusters whose members share place of articulation features are commonly encountered in the Dutch child data. Somehow, children have to unlearn these structures, and the main focus here will be on the question of how they manage to do so.

Most language acquisition researchers assume that children only use simple positive evidence, i.e. data available in the input to children, to acquire the grammar of a language (cf. Baker 1979, Wexler & Culicover 1980, Pinker 1989). I agree with this position insofar it concerns the acquisition of the core grammar. However, I argue in this paper that indirect negative evidence, i.e. the non-existence of particular data in the input, can also be used, namely to acquire language-specific properties, that lie outside the scope of the core grammar, and are therefore not part of the universal set of parameters. From the absence of particular structures in a language the child can deduce the fact that the language does not allow certain structures. However, I claim that children only use negative evidence after the core grammar has more or less been established. The language-specific properties are learned late and do not influence the acquisition of the core grammar. Therefore, at the early stages of development children produce many errors with regard to the language-specific properties. Especially overgeneralisations are regularly found. To retreat to the less general correct forms I claim children have to make use of negative evidence.

The evidence for this claim comes from acquisition data from 12 Dutch children, aged between 1;0 and 1;11 years at the start of a one year period of data collection.
Before proceeding to account for the acquisition of language-specific properties in § 3, I first lay out the main assumptions for the acquisition of a core grammar (§ 2), briefly describe the main characteristics of Dutch syllable structure, i.e. the core grammar and the acquisition of the core syllable structure in Dutch. § 4 summarises the main results.

2. Acquisition of the core grammar in a parametric model

In a "principles and parameters" model the learning process consists of fixing the parameters that underlie the grammar of a language on the basis of the input received. The question is how? To formalise a deterministic learning system Dresher & Kaye (1990) assume that each parameter comes with a default value in UG and a description of a cue to detect the marked value. The default value is the value for which no positive evidence is available; the marked value that for which positive evidence is most available. This is exactly the underlying idea of the 'subset principle', which has shown its usefulness in the acquisition of syntax (Berwick 1985, Wexler & Manzini 1987):

(2) **Subset principle**

If a parameter has two values + and -, and the value - generates a proper subset of the grammatical sentences generated with the choice of value +, then - is the 'unmarked value' selected in the absence of evidence (Chomsky 1986:146).

The learner's task is thus to look for cues in the data that trigger the setting of a parameter from the default value to the marked value. If no such cue is found, the parameter is kept in the default value; i.e. nothing happens. Otherwise the parameter is set to the marked value. However, once a parameter has the marked value, it cannot be changed again, since the learner in the model is deterministic.

Such a deterministic learning system has appeared to be quite successful in the domain of stress acquisition, both for machine learners (Dresher & Kaye 1990) and for children (Fikkert 1994a, to appear), although there are also many differences between Dresher & Kaye's machine learner and children (Fikkert 1994a, to appear). For one thing, the machine learner is a **batch mode** learner, i.e. it first collects all data, and then
fixes the parameters, while children are incremental learners to a large extent. A batch mode learner incorporates the idealisation of instantaneous acquisition. Such a learner can in principle make use of negative evidence, since it may assume that it has received all relevant input forms. Since children are incremental learners – they go through several stages before reaching the final steady state – they cannot assume that all relevant data have been encountered, and therefore cannot make use of negative evidence, especially not at the early stages of acquisition. In Fikkert (1994a, b) it was shown that such a model is also able to describe the acquisition of syllable structure. Children start out assuming default CV syllables and extend their template gradually along parametric dimensions. But before I turn to the acquisition data, I will first describe the relevant part of the Dutch grammar.

3. Acquisition of syllable structure in Dutch: the core grammar

The syllable is an important domain for stating phonotactic restrictions. The phonotactic restrictions on the syllable are of two kinds: (i) those that restrict the number of skeletal positions in each syllable constituent; and (ii) those that place restrictions on the nature of consonantal sequences (the non-heads) within the syllable. Phonotactic restrictions of the first type are often expressed by parameters.

3.1. Phonotactic restrictions on the number of skeletal positions

Dutch syllables consist of an obligatory nucleus (a vowel) preceded by zero or more (maximally two) consonants (the onset), and followed by zero or more consonants (the coda). Nucleus and coda form the rhyme. Two onset parameters can be distinguished that play a role in the characterisation and acquisition of Dutch onsets. They are given in (3):

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There are very few restrictions on consonant-vowel sequences in adult languages, and virtually none in Dutch, although, as Levelt (1993, 1994) has pointed out, restrictions on consonant-vowel sequences are frequently found in the early stages of child language. I come back to this in § 4.2.
(3) **Onset parameters**

a. **MINIMAL ONSET PARAMETER**: are onsets obligatory? (Y/N)
b. **MAXIMAL ONSET PARAMETER**: can onsets be branching? (Y/N)

The underlined value is the unmarked value. Dutch requires the marked value for both parameters.

Since Dutch has onsetless syllables, syllables with singleton onsets and syllables with complex onsets, it requires the marked value for each of the parameters in (3). Children start out assuming the underlined default values, i.e. they start with syllables that have an obligatory, but simplex onset. At the next stage onsets are optional, i.e. onsetless syllables appear. Finally, complex onsets are acquired. The first complex onsets consist of a plosive followed by a liquid or glide (approximant). Although I have somewhat simplified the developmental process, for onsets the development can be schematised as in (4):

(4) **Onset development**

\[ C \rightarrow (C) \rightarrow C_{\text{plosive}}C_{\text{approximant}} \]

There are also two parameters defining possible rhyme templates, given in (5):

(5) **Rhyme parameters**

a. **CODA PARAMETER**: are closed syllables allowed? (Y/N)
b. **NUCLEUS PARAMETER**: can the nucleus be branching? (Y/N)

The underlined value is the unmarked value. Dutch requires the marked value for both parameters.

Dutch allows both closed syllables and branching nuclei, and therefore also requires the marked values for the parameters in (5). However, rhymes and onsets in Dutch are maximally bipositional (Kager & Zonneveld, 1986). Kaye & Lowenstamm (1981) go further in that they claim that universally rhymes are maximally bipositional (6):

(6) **Maximal rhyme constraint** (universal)

Rhymes are maximally bipositional.

Kager & Zonneveld’s argument rests on the near absence of non-final
syllables in underived words containing more than two rhyme positions, i.e. the near absence of words like those in (8b-d). Thus, Dutch syllables can have the representations in (7), where a branching nucleus represents a long vowel or a diphthong. A short vowel followed by a consonant is represented as a branching rhyme.

(7) Dutch syllable templates

The maximal rhyme constraint in (6) and the bipositional representation of long vowels and diphthongs explain the data in (8): a short vowel can be followed by a cluster, as shown in (8a), but long vowels, diphthongs, and checked short vowels cannot (8b-d).

(8)

a. tempo 'tempo' /tempo/ t em p o:

b. *teempo /teempo/ t eim p o:

c. *teimpo /teimpo/ t eim p o:

d. *telmpo /telmpo/ t elm p o:

However, in word-final position -VVC and -VCC sequences are common. The final C is often called extrasyllabic (Kager 1989) or extrarhymal (Fikkert 1994a), and makes the preceding syllable superheavy. However, in Fikkert (to appear) I claim that -VVC and -
VCC sequences are in fact to be analysed as disyllabic.² They contain a 'normal' bipositional rhyme followed by a degenerate syllable. The development in the acquisition of rhymes is a bit more complicated than that for onsets. It is incompletely sketched in (9). At the first stage, the child has no closed syllables (i.e. no branching rhymes), and no branching nuclei, i.e. no systematic vowel length distinctions. At this stage the child has the default syllable CV. At the next stage closed syllables are realised: the child has a branching rhyme, but no branching nucleus. Branching nuclei appear at stage 3. However, at this stage the rhyme still seems to contain maximally two positions: either a branching rhyme or a branching nucleus, but not both. Only later the child learns that in word-final position more variation is possible.

² The arguments come from stress facts. In the unmarked case, stress in words ending in a closed -VC syllable falls on the antepenultimate syllable if the penultimate is open, and on the penultimate syllable if it is closed; words ending in -VVC and -VCC receive final stress in the unmarked case. Most analyses of Dutch stress make use of 'late extrametricality': a final -VC syllable is made extrametrical after foot assignment. This means that main stress, which normally falls on the rightmost foot in the word is on the second foot from the right if the final syllable contains a -VC rhyme. However, in Fikkert (1994a, to appear) I argue that main stress falls on the first branching foot (i.e. disyllabic) from the right. If the word does not contain a branching foot, main stress falls on the rightmost foot. If the so-called superheavy syllables consist of a 'normal' bipositional rhyme followed by a degenerate syllable (consisting of an onset only), it follows automatically that stress falls on the final (reanalysed as the prefinal) syllable. Late extrametricality of final -VC rhymes only is no longer needed.
Developmental stages in the acquisition of rhyme structure

Stage 1 Stage 2 Stage 3

\[
\begin{align*}
\text{Rh} & \quad \text{Nh} & \quad \text{Rh} \\
\text{V(t)} & \quad \text{V(t)} & \quad \text{Cl} \\
& \quad \text{[+son]} \\
\end{align*}
\]

Where \( V(t) = \) any vowel, \( \text{Cl} = \) set of consonants that can appear in the coda (usually obstruents only, but children can differ in the set of consonants they allow in coda position); \([+\text{son}] = \) second part of long vowel or diphthong, or sonorant consonant.

If the maximal rhyme constraint is indeed universal, as claimed by Kaye & Lowenstamm (1981), it is expected that rhymes in the child’s output forms do not exceed the bipositional maximum. However, the input to the child contains many monosyllabic words which on the surface violate the maximal rhyme constraint, since many monosyllabic Dutch words have in addition to a bipositional rhyme an extrarhymal consonant and/or an appendix. It therefore seems that crucial evidence for the existence of the maximal rhyme constraint is lacking. However, since the children’s output forms clearly obey this constraint, I conclude that it is universal, and need not to be learned. What need to be learned are language-particular deviations from this constraint.

3.2. Phonotactic restrictions on consonantal sequences

Sonority is said to play a crucial role in defining the second type of phonotactic restriction (Hankamer & Aissen 1974, Selkirk 1984, Clements 1990). That is, sequences of consonants in the same syllable have to obey the Sonority Sequencing Principle (SSP):

\[
\text{Sonority Sequencing Principle (SSP)}
\]

In any syllable, there is a segment constituting a sonority peak which is preceded and/or followed by a sequence of

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3 This is certainly true for the input forms that the child uses for his or her output.
segments with progressively decreasing sonority values.

The sonority scale is given in (11):

(11)  \textit{Sonority Scale}

\begin{center}
Vowels – Glides – Liquids – Nasals – Fricatives – Plosives
\end{center}

where the sonority value decreases from left to right.

In general, Dutch syllables obey the SSP: only in word-initial position do we find /sl/-Plosive-(Liquid) clusters, where the /s/ does not obey the SSP. However, since in general onsets are maximally bipositional, /s/ is also behaving exceptionally from that perspective. Moreover, acquisition data also seem to suggest that /s/ is not part of the /s/-Plosive-(Liquid) cluster. I therefore assume that the /s/ is not part of the same syllable as the following cluster, but licensed by the word instead of the syllable.\footnote{I cannot go into the details of the argumentation here. The reader is referred to Fikkert (1994a).} Also word-final sequences that do not obey the SSP can be found. I assume again that those segments disobeying the SSP lie outside the syllable.

The most frequent and unmarked onset clusters in Dutch consist of an obstruent (plosive or fricative) followed by a liquid. Obstruent-Glide and Obstruent-Nasal clusters do occur, but are more marked and far less frequent, probably due to effects of sonority distance. I will focus on the adult $C\text{obstruent}_C\text{liquid}$ clusters in the remainder of the paper.

As mentioned above, once children produce clusters, they have $C\text{plosive}_C\text{approximant}$ clusters, i.e. plosive-glide clusters do occur quite regularly, but plosive-nasal clusters do not: they are replaced by plosive-approximant clusters. I will discuss these clusters in more detail in § 4.2.

4. The acquisition of language particular constraints

In addition to the core grammar, Dutch has also language particular
constraints. I already mentioned that at word endings more possibilities are allowed. Here, I will focus on two other constraints.

4.1. The 'No CV syllables' constraint in Dutch

It has been argued that rhymes in Dutch are not only maximally bipositional (by the universal maximal rhyme constraint), but are also minimally bipositional (Kager 1989). This is expressed by the constraint in (12):

(12)  \textit{Minimal rhyme constraint} (language-specific)

Rhymes are minimally bipositional.

The argument for the minimal rhyme constraint is the absence of short vowels in open syllables. Furthermore, distributionally, long vowels and diphthongs pattern like combinations of a short vowel plus a consonant: long vowels can occur in open syllables (13a, b), but short vowels cannot (13c); they have to be followed by a consonant (13d):

(13)  a. \textit{thee}  'tea' /\text{tet}/

b. \textit{tij}  'tide' /\text{tel}/

c. * \textit{te6} /\text{t}/

d. \textit{tel}  'second' /\text{tel}/

Thus, Dutch does not allow short vowels in open syllables. Therefore, syllables containing short vowels are always closed, while on the other
hand syllables containing long vowels, which occupy two skeletal positions, can be open. As a consequence, Dutch does not allow the 'universal' syllable CV. This, however, contradicts the claim that the CV syllable is universal. Yet, the primacy of the simple open CV syllable is commonplace in the literature (cf. Jakobson 1941/68), the idea being that the existence of all other types of syllables presupposes the existence of the CV syllable. Also on the basis of the subset principle children should universally start with the default or unmarked CV syllable, and they do. The question is: "how do Dutch children learn to ban the CV syllable from their inventory?"

Contrary to the maximal rhyme constraint, the minimal rhyme constraint is language-specific. This property of Dutch is typically learned late: children frequently produce rhymes consisting of a short vowel, especially in final unstressed syllables, and still do so in the final recording sessions at age 3. At that time, they have mastered the distinction between long and short vowels, although this distinction comes in relatively late. This is probably also related to the fact that although Dutch has a vowel length distinction, vowel length does not contribute to weight. This makes the vowel length distinction less perspicuous and hard to learn.

In addition to the vowel length distinction children have to learn that CV syllables are not allowed in Dutch. This minimal rhyme constraint has to be learned on the basis of indirect negative evidence; that is, the absence of rhymes consisting of short vowels. In a sense such evidence is available, since the child will never find a match when comparing his or her output forms containing V rhymes with the input forms. The complete absence of matching between output forms with V rhymes and target words constitutes the (indirect) evidence for learning this language-particular constraint.

One further point that needs to be considered is whether this constraint is learned as a rule or on a lexical basis, i.e. word by word. The children in this study still produced many CV syllables at the end of the recording period. I will therefore postpone the discussion of this point until § 4.2.
4.2. the 'No homorganic Onset Clusters' constraint in Dutch

A second language-specific constraint is the non-existence of homorganic onset clusters in Dutch onsets. Although all obstruent-sonorant clusters in principle obey the SSP, not all combinations of obstruents and sonorants constitute well-formed onsets. Plosive-nasal clusters obey the sonority hierarchy and are not totally prohibited: /kn/ is a possible onset cluster; however, /pn/, /bn/, /tn/ and /dn/ clusters are not allowed. On the other hand, although almost all combinations of obstruent-liquid are allowed, /tl/ and /dl/ are not,8 but they are frequently produced by children, unlike clusters with a nasal as its second member, which are rare in child language.

It is often claimed that /tl/ and /dl/ clusters, and for that matter also for example /pl/, /bl/, /fl/ and /lm/ clusters, are prohibited in adult Dutch because of the Obligatory Contour Principle (OCP) (Booij to appear), which states that adjacent identical elements on the melodic tier are prohibited (Leben 1973, McCarthy 1986, 1989). In the examples above, both members of the clusters have the same place feature specification: either both elements are coronal, or they are both labial.9 Although it is true that Dutch has a constraint which prohibits onset clusters of which both members share place of articulation features, these clusters can only be ruled out by the OCP if we assume the representation in (14a). However, since coda clusters often share place of articulation features (words like hand 'hand' /hant/, lamp 'lamp' /lamp/, bank 'bank' /baŋk/ are very frequent) and are not prohibited by the OCP, they should have the representation in (14b). It remains unclear why onset consonants and coda consonants are represented differently. More generally, the OCP does not prohibit adjacent segments from sharing features, but prohibits two adjacent segments which each are specified for the same place of articulation.

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8 /sr/ is not allowed on the surface, although some researchers claim that it is, since many people produce /sxr/ clusters as /sr/ clusters. Trommelen (1983) assumes that /str/ is underlying /sr/. The /t/ is an intrusive stop. Since these clusters play a marginal role in child language I will not discuss them further.

9 This does not explain why the OCP does not hold for /tr/ and /dr/ clusters, of which both elements are also coronal. Yet, these clusters occur freely. Again, this issue must await further research.
articulation. In other words, (14a) is prohibited by the OCP, but not (14b):

(14) a. 

b. 

\[
\begin{array}{c|c}
C & C \\
\hline
\text{PoA} & \text{PoA}
\end{array}
\]

Homorganic clusters would have to be represented as (14b), although Dutch (like many other languages) has a constraint prohibiting such representations for place of articulation in onset clusters: plosives and sonorants in onset clusters which share place of articulation features are generally prohibited.

However, as Levelt (1993, 1994) has pointed out, children seem to favour words with one single place of articulation per word at the early stages of acquisition. The phenomenon that children make (non-adjacent) consonants similar with respect to place of articulation features is known as consonant harmony. Consonant harmony is often viewed as the spreading of place of articulation features from one consonant to another non-adjacent one. Alternatively, planar segregation is assumed (McCarthy 1989): in such a view consonants and vowels are on different planes, and, therefore, consonant harmony involves spreading from one consonant to another adjacent consonant. Levelt, however, argues against a consonant harmony account or a planar segregation account (McDonough & Meyers 1991), and gives strong arguments for a consonant-vowel interaction account and for an account in which templates play a crucial role. The consonant-vowel interaction account explains why consonants preceding front vowels (which are [coronal] in Levelt’s account) often have a coronal place of articulation, while consonants preceding round vowels (which are considered to be [labial]) are often labial. Examples of both cases are given in (15a, b):
Negative evidence in the acquisition of phonology

46

Eva's CV-interaction data

a. brood 'bread' /bro:t/ → [bɔ:t] (1;4.12)
opjes 'cat' /pui:s/ → [puif] (1;4.12)
slof 'slipper' /slaif/ → [poif] (1;4.12)
koiffie 'coffee' /ˈnɔfə:/ → [ˈpɔfi:] (1;6.1)
b. bed 'bed' /bed/ → [det] (1;4.12)
bijten 'to bite' /ˈbeita(n)/ → [ˈdeite] (1;4.26)
Bert name /ˈbet/ → [det] (1;4.26)
vis 'fish' /vɪs/ → [dɪs] (1;6.1)

Crucial for the discussion here is that in child language place features are often specified for a string of segments. Words with many different places of articulation are mastered only quite late. This same tendency is found in clusters, as is shown in the data in (16):

(16) a. Jarmo
trein 'train' /treɪn/ → [tlei] (1;10.9)
blaadjes 'leaves' /ˈblætʃəs/ → [ˈtlætʃəs] (2;1.8)
draaien 'to turn' /ˈdraiə(n)/ → [ˈtlætʃə] (2;2.27)
trommel 'drum' /ˈtroməl/ → [ˈtloʊnt] (2;2.27)
strand 'beach' /ˈstrænd/ → [ˈtloʊnt] (2;3.9)
drinken 'to drink' /ˈdrɪŋkə(n)/ → [ˈtloʊnt] (2;4.1)
broek 'trousers' /ˈbruːk/ → [ˈpuutk] (2;3.9)
blokjes 'blocks' /ˈblɒkʃəs/ → [ˈpuutk] (2;3.9)

10 This in itself is an argument against the planar segregation account of consonant harmony in which consonants and vowels are on different planes. Planar segregation is said to explain why consonants can spread across vowels without violating the crossing constraint (association lines may not cross; Goldsmith 1976a, b). However, crucial in this account is that the child's syllable template is restricted in such a way that given a string of consonants and a string of vowels the linear order of consonants with respect to vowels is entirely predictable. This is arguably not the case if the child's template already allows complex clusters. See Levelt (1993, 1994) for further discussion.
b. **Tirza**

<table>
<thead>
<tr>
<th>Word</th>
<th>Dutch Form</th>
<th>IPA</th>
<th>Age (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>glijden 'to slide'</td>
<td>/χleijə(n)/</td>
<td>['tlaijə]</td>
<td>2;2.0</td>
</tr>
<tr>
<td>vlees 'meat'</td>
<td>/vleis/</td>
<td>['tlers]</td>
<td>2;2.0</td>
</tr>
<tr>
<td>slak 'snail'</td>
<td>/slak/</td>
<td>['tlark]</td>
<td>2;2.12</td>
</tr>
<tr>
<td>vlinder 'butterfly'</td>
<td>/vlindər/</td>
<td>['tlindi]</td>
<td>2;3.12</td>
</tr>
</tbody>
</table>

c. **Enzo**

<table>
<thead>
<tr>
<th>Word</th>
<th>Dutch Form</th>
<th>IPA</th>
<th>Age (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>smeren 'to smear'</td>
<td>/smeirefn/</td>
<td>['fmeirə]</td>
<td>2;5.9</td>
</tr>
<tr>
<td>snoepje 'sweet'</td>
<td>/snuipjə/</td>
<td>['snuijə]</td>
<td>2;6.11</td>
</tr>
</tbody>
</table>

In other words, the child has to learn to segmentalise the place features.11

It is important to note that the child receives no positive evidence for the clusters in the child's production forms in (16). Yet, they are frequently produced at the early stages. The child has to discover that these clusters are absent in the target language, i.e. s/he has to make use of indirect negative evidence. The child has to learn from the absence of onset clusters which share place of articulation that Dutch has a constraint which prohibits such onset clusters. Such evidence is available to the child, since his or her production forms with homorganic onset consonants never match the adult target forms. Again, the question is whether this is learned by rule or on a word-by-word basis. The data seem to suggest the former: from a certain point all homorganic onset clusters are replaced by non-homorganic ones.

The classic problem concerning negative evidence is that one cannot conclude from the absence of a particular phenomenon in the data that this phenomenon does not exist and/or is ungrammatical. However, even though adult Dutch speakers have not encountered CV-syllables and homorganic onset clusters in their language, they do not fail to have the intuition that these properties are ill-formed in Dutch. From this I conclude that negative evidence can be used, but only if, after a certain period of learning, certain phenomena are still not found, even though on

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11 It could be the case that it is much harder to process words which contain segments with different places of articulation. That is, the fact that children favour one single place feature per word could be a performance constraint rather than a competence constraint. Nevertheless, the child has to learn that these clusters are not allowed in the language. Although the constraint is found in many languages, it is by no means universal.
the basis of the core grammar they are expected to occur. The fact that at a certain point in the development homorganic onset clusters are changed into non-homorganic ones across the board confirms this idea.\textsuperscript{12}

The 'no homorganic onset clusters' constraint is clearly learned later than the parameter setting which allows complex onsets. This is in accordance with the hypothesis that language-specific constraints lie outside the scope of the core grammar, which means that these constraints are not learned on a parametric basis. It is crucial that parameter values are learned on the basis of positive evidence only, but that implicit negative evidence seems to be needed to learn language-specific constraints. Even if the child were to get explicit negative evidence as to the ungrammaticality of homorganic onset clusters, it has never been shown that this kind of evidence works. Rather, the only way to 'recover' from these 'disallowed' clusters is by using implicit negative evidence. Thus, the child has to deduce from the data that consonant clusters sharing one place of articulation cannot be in a single onset.

A different but related issue is the fact that all obstruent-sonorant adult targets are produced as obstruent-liquid/glide at the early stages. That is, obstruent-liquid/glide clusters seem to be the least marked cluster type for onsets. Obstruent-nasal clusters are first realised as obstruent-liquid (or glide) clusters, as shown in (17):

\cite{Negative evidence in the acquisition of phonology}

Alternatively, our phonological theory needs to be improved, so that positive evidence exist to acquire these properties. This, however, easily leads to a considerable expansion of the number of (universal) parameters, many of them only being relevant in a small sample of the world's languages. However, we should keep this in mind during future research.
(17) Target plosive-nasal clusters

a. **Catootje**
   knopen 'buttons' /'knoipə(n)/ → ['kloipən] (2;4.26)
   knot 'knot' /knot/ → [knot] (2;6.7)

b. **Leon**
   knoopje 'button' /'knoipəj/ → ['kloipəj] (1;11.12)
   knoopjes 'buttons'/'knoipjəs/ → ['kloipəs] (1;11.12)

c. **Jarmo**
   knippen 'to clip' /'kniptə(n)/ → ['kjiptə] (2;2.6)

It seems that in order to change the cluster from the unmarked obstruent-
approximant to obstruent-nasal clusters there has to be positive evidence
available to the child. Therefore, we do not expect to find
overgeneralisations of obstruent-nasal clusters to obstruents other than /k/ and /s/. These are not attested either. Universally, obstruent-liquid
clusters are less marked than obstruent-nasal clusters (cf. Cairns 1988).
In other words, to allow obstruent-nasal clusters the marked option for
clusters must be chosen. This is done on the basis of positive evidence.
Thus, the non-existence of, for example, /pn/ clusters is of a different
nature than the non-existence of /pu/ or /tl/ clusters.

5. Summary and conclusions

We have seen that language-particular constraints, such as the one which
prohibits homorganic consonants in onsets, can be learned on the basis
of implicit negative evidence: the absence of homorganic onset clusters,
or rather, the non-existence of a match between input and output onset
clusters, leads to the acquisition of such constraints.
We further saw that children have CV syllables from the start, and more
importantly, these syllables remain part of their output for quite a long
time, although they have never received positive evidence for them. The
only way they can learn that Dutch does not allow CV syllables is by
making use of indirect negative evidence: the fact that short vowels never
occur in open syllables. In other words, from the fact that their own CV
output syllables never correspond to the adult input syllables, children
may come to the generalisation that Dutch has a 'minimal bipositional
Negative evidence in the acquisition of phonology

rhyme constraint'. Thus, whereas the core grammar seems to be learned on the basis of positive evidence only, language-specific constraints may be learned on the basis of indirect negative evidence. However, these constraints are typically learned late: the child must have received enough evidence to be able to make generalisations on the non-existence of particular structures. Moreover, the child's own 'errors' are particularly important to discover the generalisations based on implicit negative evidence.

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