SV assimilation in Catalan and the implications for an asymmetrical *NC constraint

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This paper reviews the facts about the proposed asymmetry of the *NC constraint, that is, the constraint against nasal-voiceless obstruent sequences proposed by Pater (1996). The analysis presented in this paper is framed within a theory which includes the feature SV (sonorant voicing) in the representation of sonorants and possibly voiced obstruents. I first reexamine the facts motivating the *NC constraint and the effects it triggers. Then, I illustrate the existence of a constraint on voiceless obstruent-nasal sequences (*CN), and argue that this constraint is better represented as a constraint on sequences of a voiceless obstruent followed by an SV-bearing consonant (*C-SV). Finally, I will show that the *NC constraint can also be redefined as a *SV-C constraint, thus showing the actual symmetry of the two constraints.

I. Theoretical Framework: the SV-hypothesis.

In this paper I assume the SV hypothesis, as developed in Rice and Avery (1989, 1991), Piggott (1992), Rice (1993), and Avery (1996). The main assumptions are:

- SV (Sonorant Voicing or Spontaneous Voice) is an organizing node for sonorants and dominates the sonorant features (nasal, approximant, lateral);
- [nasal] is the unmarked or predictable feature for SV and as such is usually absent from the underlying representation of nasals;
- SV may be present in obstruents when they pattern with the sonorants in phonological processes (e.g., triggering voicing). In that case, the feature [nasal] is present in the underlying representation of nasals, as illustrated in (1) (irrelevant structure is omitted).

(1)

<table>
<thead>
<tr>
<th>voiced obstruent</th>
<th>nasal</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>[l]</td>
<td>[l]</td>
</tr>
<tr>
<td>SV</td>
<td>SV</td>
</tr>
<tr>
<td></td>
<td>[nasal]</td>
</tr>
</tbody>
</table>

- the SV node is active in the phonology: it can be the target or trigger of spreading, it can be copied, and it can delink (see the above references for details).\(^1\)

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\(^1\) A brief word might be added about the phonetics of SV-bearing segments (for more details see the references listed at the beginning of this section). The phonetic correlate of the node SV is related to a vocal tract configuration in which the vocal cords vibrate in response to the passage of air, as described in Chomsky and Halle (1968). This vocal tract configuration is characteristic of sonorants given that in the realization of these sounds the air flows unobstructed through the oral or the nasal cavity. With respect to SV in obstruents, the property of bearing SV has been related to phonetic characteristics such as the glide-like quality of SV stops in Spanish (Avery, 1996), also applicable to other languages such as Catalan, or to alternations between plain stops and pre- or post-nasalized stops (Piggott, 1992). Given that the phonetics of SV is not a main issue in this paper, I adopt the possibility of representing voiced obstruents with an SV node without further argumentation.
2. The *NC constraint

Nasal-voiceless obstruent sequences, NC clusters, are disfavoured in many languages. This fact has led phonologists to propose a constraint against this type of cluster, known as the *NC constraint. This view is articulated in Pater (1996) as in (2).

(2) *NC    No nasal/voiceless obstruent sequences

Pater justifies the markedness of this constraint with reported evidence from language typology, phonetics and acquisition. Pater’s analysis is cast within the framework of Optimality Theory so that the strength of this constraint depends on how highly ranked it is with respect to other constraints such as faithfulness constraints, and the strategy used to get rid of the NC cluster depends on the specific ranking of the relevant constraints. In addition, one of the arguments for the markedness of this constraint is that it is asymmetrical. In other words, nasal-voiceless obstruent clusters are disfavoured but no constraint guards against voiceless obstruent-nasal clusters. This paper argues against this supposed asymmetry by providing evidence from strategies used to resolve CN clusters. Let us review first the arguments in support of the *NC constraint.

2.1. Arguments for *NC

Arguments for the existence of a universal, but violable, *NC constraint come from acquisition, phonetics, and typology, as outlined in Pater (1996):

- Acquisition. Observations from child language indicate that NC clusters are more marked than nasal-voiced obstruent clusters. Pater reports evidence from a study of a child’s acquisition of English showing that NC clusters emerged considerably later than nasal-voiced obstruent clusters. The same observations have been made concerning Greek and Spanish child language.

- Phonetic Motivation. Huffman (1993) found that an NC cluster requires an unnaturally quick velar closure so that there is no overlap between nasality and voicelessness, whereas a nasal-voiced obstruent cluster allows a more gradual raising of the velum. This phonetic argument is presented as support for the claimed asymmetry of *NC; according to Zuckerman (1972), while a quick velar closure is a factor for NC clusters, it is not a factor for CN clusters because lowering of the velum is done more quickly and with greater precision than raising it.

- Typology. The generality of the *NC constraint is demonstrated by the range of processes that languages make use of to get rid of NC clusters. Examples of *NC effects are presented next.

2.2. *NC effects

Pater (1996) argues that processes like post-nasal voicing, nasal substitution, nasal deletion and denasalization follow from the existence of this constraint. Here follow some

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2 Throughout the paper a capital C stands for a voiceless obstruent, and, thus, the clusters NC and CN refer to sequences involving voiceless obstruents and nasals. When voiced obstruents are involved, these are specifically referred to as voiced obstruents.
examples of these processes with data from Pater (1996). In addition, given the theory adopted in this paper, an analysis under the SV approach is provided for each process.

2.2.1. Post-nasal voicing

Post-nasal voicing is found in Puyo Pongo Quichua. This language allows NC clusters morpheme-internally but solves heteromorphemic clusters by means of post-nasal voicing. Examples are given in (3); (3b) shows how the stop in the suffix is voiced following a stem-final nasal.

(3) Suffixal alternations in Puyo Pongo Quichua

a. sinik- pa 'porcupine-gen.'  
wasi-ta 'house-obj.'

b. kam-ba 'you-gen.'  
wakin-da 'other-obj.'

Under the SV approach, post-nasal voicing assimilation can be explained by means of an SV copying mechanism as proposed in Rice and Avery (1991). The SV node of the nasal is copied by the following stop, yielding a voiced stop, as illustrated in (4).

(4) Post-nasal voicing as SV copy

\[
\begin{array}{c|c|c|c|c}
\text{kam + pa} & ----> & \text{ka[mb]a} \\
R & R & \text{SV copy} & R & R \\
\mid & \mid & \mid & \mid & \mid \\
\text{SV} & \text{SV} & \text{SV} & \mid & \mid \\
\mid & \mid & \mid & \mid & \mid \\
[\text{nasal]} & [\text{nasal}] & & & \\
\end{array}
\]

2.2.2. Nasal deletion and denasalization

Nasal deletion involves the total deletion of the nasal in the cluster, as shown in (5a). Denasalization is shown in (5b). In this case, the nasal in the NC cluster loses its nasal quality, which can be represented by place assimilation and delinking of the SV node in the nasal.

(5) a. Nasal deletion in Kelantan Malay:

\[\text{NT} \rightarrow \text{T} \quad \text{(cf. ND} \rightarrow \text{ND)}\]

b. Denasalization in Mandar:

\[\text{NT} \rightarrow \text{T T} \quad /\text{maN+tunu/} \rightarrow [\text{mattunu}] \quad \text{to burn'}\]

\[\text{(cf. ND} \rightarrow \text{ND} \quad /\text{maN+dundu/} \rightarrow [\text{mandundu}] \quad \text{to drink')}\]

2.2.3. Nasal substitution

Another strategy used to get rid of unwanted NC clusters is nasal substitution, found in OshiKwanyama, a Bantu language, and Indonesian. Examples are given in (6) and (7), respectively. In these languages heteromorphic NC clusters are resolved by
nasal substitution, that is, the replacement of a root-initial voiceless obstruent by a homorganic nasal.³

(6) OshKwanyama
   a  \( /e:N + pati/ \rightarrow [\text{emati}] \) 'ribs'
   \( /oN + tana/ \rightarrow [\text{onana}] \) 'calf'

(7) Indonesian
   a  \( /\text{maN}+\text{pilih}/ \rightarrow [\text{ma\text{milih}}] \) 'to choose, to vote'
   \( /\text{maN}+\text{tulis}/ \rightarrow [\text{ma\text{nulis}}] \) 'to write'
   \( /\text{paN}+\text{karan}/ \rightarrow [\text{pa\text{karan}}] \) 'composer, author'
   b  \( /\text{maN}+\text{bali}/ \rightarrow [\text{m\text{ambali}}] \) 'to buy'

Pater (1996) argues against the standard analysis that invokes two ordered rules: nasal assimilation and root-initial post-nasal voiceless consonant deletion. He analyzes nasal substitution as a fusion of the nasal and voiceless obstruent driven by \(*\text{NC}\). I follow his account of nasal substitution. Under the SV approach, fusion can be represented by the fusion of the nasal's SV node with the following obstruent segment, as illustrated in (8) (only relevant structure is given).⁴

(8) Nasal substitution as SV-C fusion in OshKwanyama and Indonesian

\[
\begin{array}{ccc}
N & + & p & \rightarrow & m \\
R & + & R & \rightarrow & R \\
\text{SV} & \text{Place} & \text{SV} & \text{Place} \\
(\text{n}) & \text{[nasal]} & (\text{n}) & \text{[labial]} \\
\end{array}
\]

3. Evidence of a \(*\text{CN}\) constraint

Having reviewed the arguments for a \(*\text{NC}\) constraint, I now present evidence for a constraint on voiceless obstruent-nasal sequences (*CN). I discuss first the typological support for this constraint provided by different repair strategies found in several languages. These CN effects include obstruent deletion, nasal deletion, nasalization and pre-nasal voicing.

3.1. Obstruent deletion and nasal deletion

Obstruent deletion and nasal deletion are found in some Athapaskan languages (K. Rice, p.c.; Howren, 1971). Some examples are given in (9). The deletion of the stop

³ Morpheme-internal NC clusters are allowed in Indonesian, but they undergo post-nasal voicing in OshKwanyama, as evidenced by the treatment of loanwords from English (e.g., sitamba < 'stamp', pelenda < 'print').
⁴ The feature [nasal] is given in parenthesis since it is needed for Oshikwanyama but not for Indonesian. The former has voiced obstruents with a copied SV as a result of morpheme internal post-nasal assimilation, and, consequently, the feature [nasal] is needed to distinguish the oral from the nasal stops; the latter has SV in sonorants only and the feature [nasal] is redundant.
in the cluster is shown in (9a). (9b) shows voicing and nasal deletion, which can be captured as fusion of the nasal with the preceding stop and loss of the feature nasal.

(9)  
   a. Obstruent deletion \[ t + n \rightarrow n \] Sarcee
   b. Voicing and nasal deletion \[ t + n \rightarrow d \] Dogrib, Chipewyan

3.2. Nasal assimilation

Total nasal assimilation is found in Korean (Rice and Avery, 1989) and Chukchee (Odden, 1988). Korean shows stops assimilating in nasality to a following nasal, as illustrated in (10). In Chukchee stops and nasals alternate, with the nasals showing up before a following nasal, as illustrated in (11). Nasal assimilation can be analyzed as the spreading of an SV node leftwards to a preceding consonant.

(10) Nasal assimilation in Korean (Rice and Avery, 1989)

\[
\begin{align*}
\text{kukmul} & \rightarrow \text{kujmul} & \text{'soup'} \\
\text{narpita} & \rightarrow \text{narnpita} & \text{'to sprout'} \\
\text{kat'ni} & \rightarrow \text{karni} & \text{'to be the same'}
\end{align*}
\]

(11) Stop-nasal alternations in Chukchee (Odden, 1988)

\[
\begin{align*}
\text{p\text{n} \rightarrow m\text{j}} & \quad \text{ya-m\text{p}\text{a}-l\text{en}} & \text{'having news'} & \text{p\text{a}p\text{a}l} & \text{'news'} \\
\text{t\text{m} \rightarrow n\text{m}} & \quad \text{ya-n\text{m}\text{a}-l\text{en}} & \text{'he killed'} & \text{t\text{a}m\text{-a}k} & \text{'kill'}
\end{align*}
\]

3.3. Pre-nasal voicing

Instances of final obstruents assimilating in voicing to the following nasal are found in Catalan and Spanish. Examples are given in (12).

(12)  
   a. Spanish:
   \[ \text{mi[z]no} \rightarrow \text{m[a]no} \] 'same'
   \[ \text{lo[z] monos} \rightarrow \text{lo[z] coches} \] 'the monkeys' vs. 'the cars'
   b. Catalan:
   \[ /s/ \quad \text{va[z]} \rightarrow \text{va[z]os} \] 'glass/es'
   \[ \text{go[z]} \rightarrow \text{go[z]os} \] 'dogs'
   \[ /\text{s}/ \quad \text{va[z] nou} \rightarrow \text{va[z] nou} \] 'new glass'
   \[ \text{go[z]} \rightarrow \text{go[z] menut} \] 'little dog'

In fact, in Catalan, when the obstruent in the CN cluster is a stop, assimilation can result in either a voiced stop or a nasal. In other words, voicing assimilation is obligatory, and nasal assimilation is possible. A similar pattern may also be found in Sanskrit.\(^5\) Some

\(^5\) Rice and Avery (1989) claim that Sanskrit, like Catalan, has obligatory voicing assimilation and optional nasal assimilation, as illustrated by the following examples:

\[
\begin{align*}
\text{tat n} \rightarrow \text{tad} & \rightarrow \text{tan} \\
\text{tri\text{s}tup n} \rightarrow \text{tri\text{s}tup} & \rightarrow \text{tri\text{s}tum}
\end{align*}
\]
examples from Catalan are given in (13); (14) illustrates the representation of obligatory voicing assimilation and optional nasal assimilation under an SV analysis by means of SV copying and [nasal] spreading.

(13) Voicing assimilation and nasal assimilation in Catalan

<table>
<thead>
<tr>
<th>cap ma</th>
<th>set mans</th>
<th>a. ca[bm]a</th>
<th>a. se[dm]ans</th>
<th>b. ca[mm]a</th>
<th>b. se[mm]ans</th>
</tr>
</thead>
<tbody>
<tr>
<td>'no hand'</td>
<td>'seven hands'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(14)

<table>
<thead>
<tr>
<th>ca/p m/a</th>
<th>a. Oblig. Voicing Assimilation</th>
<th>b. Optional Nasalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>R R</td>
<td>ca[bm]a</td>
<td>ca[mm]a</td>
</tr>
<tr>
<td>SV</td>
<td>SV SV</td>
<td>SV SV</td>
</tr>
<tr>
<td>[nasal]</td>
<td>[nasal]</td>
<td>[nasal]</td>
</tr>
</tbody>
</table>

In (14a), which illustrates (13a), regressive voicing assimilation has applied and the stop has copied the SV from the nasal. The optional process of nasal assimilation applies in the forms in (13b). This can be accounted for by the optional spreading of [nasal] to the available SV target of the preceding stop, as illustrated in (14b). A similar account can be provided for nasal assimilation in Korean discussed above and illustrated in (10). Rice and Avery (1989) explain the Korean facts by spreading the sonorant's SV to the preceding stop. An underspecified SV shows up as a nasal by default given that Korean has no underlying voiced stops in contrast with the nasals.

This section, then, has presented evidence from Athapaskan languages, Korean, Chukchee, Spanish, and Catalan showing that languages make use of a number of repair strategies such as obstruent deletion, nasal deletion, voicing assimilation and nasal assimilation to resolve unwanted CN sequences. This alone suggests that the claimed asymmetry of *NC is problematic.

4. Redefinition of the constraint

4.1. Evidence for a larger constraint involving SV: *C-SV

The nasal assimilation and voicing assimilation processes found in Korean and Catalan have been accounted for under the theory of SV as instances of assimilation triggered by segments bearing the SV node. Pre-nasal voicing in Catalan and Spanish is actually part of a process of regressive voicing assimilation that has obstruents as targets and sonorants and voiced obstruents as triggers. Some examples are given in (15) and (16), respectively.

Sanskrit thus appears to add further typological support for *CN. However, M. Hale (p.c.) notes that CN clusters are possible morpheme-internally and that nasal assimilation is not optional in Sanskrit but obligatory. In addition, Hale remarks that assimilated clusters are derived from sequences of a voiced stop followed by a nasal rather than from underlying CN sequences. In that case, nasal assimilation in Sanskrit is not triggered by the *CN constraint.
(15) Regressive voicing assimilation in Catalan.

a. Triggered by sonorants:

/z/ va[z] nou 'new glass' /s/ go[z] negre 'black dog'
va[z] lis 'smooth glass' go[z] lent 'slow dog'

b. Triggered by voiced obstruents:

va[z] gran 'big glass' go[z] gran 'big dog'
va[z] blanc 'white glass' go[z] blanc 'white dog'

(16) Regressive voicing assimilation in Spanish.

a. Triggered by sonorants:

lo[z] monos 'the monkeys' mi[z]mo 'same'
lo[z] lagos 'the lakes' i[z]la 'island'
I[z]rael

b. Triggered by voiced obstruents:

lo[z] dientes 'the teeth' de[z]de 'since'
Iberian Spanish: ju[z]gar ~ jue[z] 'to judge' ~ 'judge'

Regressive voicing is thus not only triggered by nasals, but it is also triggered by other sonorants and by voiced obstruents. Since under the SV hypothesis sonorants and voiced obstruents that pattern as sonorants are specified for SV, the SV node is responsible for all instances of regressive voicing assimilation in languages like Catalan and Spanish. In other words, all segments that trigger voicing in such languages have an SV node. This indicates that regressive voicing is in fact a strategy used to repair illicit sequences of a voiceless obstruent followed by a consonant bearing an SV node. The *CN constraint can thus be redefined as *C-SV. If *C-SV is active in a language, it will affect all heterosyllabic sequences of a voiceless obstruent followed by an SV-bearing consonant, not just obstruent-nasal sequences. This prediction is in fact born out for Korean. Since Korean nasal assimilation is part of a more general process of sonorantization that has both nasals (as shown in (10) above) and laterals as triggers. An example of the latter is given in (17).6

(17) Laterals as triggers of sonorantization in Korean (Rice and Avery, 1989)

\[ \text{tikitiliil} \rightarrow \text{tiklliil} \quad \text{the letters} \ i \text{ and} l' \]

Assimilation to the lateral is also accounted for by the spreading of SV to the obstruent since the feature [lateral] is a dependent of SV. The SV approach allows a unified account of obligatory regressive assimilation and optional nasal assimilation in Catalan, and sonorantization in Korean. Rather than pointing to a constraint on sequences of a voiceless obstruent followed by a nasal only, these facts point to a constraint on heterosyllabic *C-SV clusters. I present next some arguments for this constraint.

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6 Korean has no underlying voiced obstruents so the only possible SV-bearing triggers are sonorants. In addition, only the coronal stop assimilates to the lateral given that structure preservation blocks [lateral] from spreading to non-coronal places of articulation (Rice and Avery, 1989).
4.2. Arguments for a *C-SV

- **Typology.** One of the arguments against a *CN constraint (now applicable to *C-SV) is that whereas *NC effects are commonly found in the languages of the world, *CN effects are practically unattested. Counterevidence to such claim has already been presented in sections 3 and 4.1. Moreover, the lower number of observable *C-SV effects may just be the deceptive result of the fact that heterosyllabic C-SV clusters in general are much less frequent than NC clusters. Nasals are more common than voiceless obstruents in coda position and, consequently, NC clusters are more frequent than heterosyllabic C-SV clusters. 7

- **Phonetic motivation.** Phonetic motivation for C-SV can also be found. Discussing voicing agreement in Catalan heterosyllabic clusters, Recasens (1993) refers to Westbury and Keating's (1985) claim that it is particularly easy, and thus favourable, to maintain the same abducted or adducted configuration of the vocal folds during the production of a cluster. This favours a sequence of a voiced obstruent followed by an SV-bearing consonant over a C-SV sequence. In addition, Recasens relates the presence or absence of regressive voicing in languages to the language's Voice Onset Time (VOT): regressive voicing is more common in languages with negative VOT and unaspirated voiceless stops, like Catalan, than in languages with positive VOT and aspirated stops, such as English.

- **Sonority restrictions and syllabification.** Further motivation for *C-SV comes from the need to conform to sonority restrictions which require codas to be more sonorous than following onsets. The sonority violation in a syllable contact sequence like [ni] would be smaller after regressive voicing assimilation renders [dn] and even more reduced after nasal assimilation ([nn]). It is important to stress that the *C-SV affects heterosyllabic clusters. In fact, syllabification facts account for the reason why *C-SV is more obviously detected with CN clusters than with other voiceless obstruent-sonorant clusters. While medial CN clusters are commonly heterosyllabic, sequences of an obstruent and a liquid or a glide are often syllabified together. This may obscure the actual C-SV nature of the constraint. Examples from Catalan show how syllabification is a factor: (18a) shows how obstruent-liquid clusters at word boundary constitute a heterosyllabic C-SV cluster which is resolved by regressive voicing. Tautosyllabic clusters are not affected by the constraint, as shown in (18b).

(18)  a. Heterosyllabic clusters  

| C[σ [L-escu[b].la | σ[CL- [b]lau | 'spit it (fem)' | 'blue' | o.[β]li.dar | 'to forget'
| (cf. esco[p]lir | [p]loure | 'to spit' | 'to rain' | re.[p]li.car | 'to reply'
| C[σ [r-ca[b]. riu | σ[Cr- | 'no river' | 'broth' | co.[β]rir | 'to cover'
| (cf. /kap/ | [p]rat | 'no, any' | 'field' | a.[p]ro.par | 'to approach'

7 Furthermore, the claim that typology supports the marked status of NC clusters (as opposed to CN clusters) is also weakened by examples of processes that indicate the opposite. For instance, Southern Sotho has post-nasal devoicing as part of a strengthening process (A. Miller-Ockhuizen, p.c.). Post-nasal devoicing turns nasal-voiced obstruent clusters into NC clusters, as illustrated by the alternation [b] ~ [p] in the forms [be], 'ugly', and [nho em-pe], 'an ugly thing' (Guma, 1971).
I have proposed arguments from typology, phonetics, sonority sequencing and syllabification that show that heterosyllabic C-SV sequences are also marked, justifying the proposed *C-SV constraint.\(^8\) I will show next that *NC can also be included in a larger constraint, namely, *SV-C.

5. *NC as part of a larger constraint: *SV-C

It has been shown that CN effects can be incorporated into an account that sees nasals as having an SV-node and that groups nasals and other SV-bearing consonants together. In order to argue for the symmetry of the two constraints, CN and NC, we need to find evidence for NC as being part of a constraint on SV-C, the way we have restated CN as C-SV. Otherwise, it could be argued that the asymmetry between *NC and *CN follows precisely from the fact that the *CN constraint is part of a *C-SV constraint whereas the *NC constraint is a true constraint on nasal-obstruent sequences. However, examples of *NC belonging to a larger constraint are also found, as for instance in Japanese, Basque and Chipewyan.

Kawasaki (1996) claims that the *NC constraint does not account for types of progressive assimilation triggered by voiced consonants other than nasals. These include post-glide voicing in Japanese sonorantization and post-liquid voicing in Basque. In both cases, Japanese and Basque, post-nasal voicing also occurs. Examples of voicing assimilation in Japanese are given in (19a) and (19b).

(19) Japanese
   a. Post-nasal voicing  /mi + te/ → [mite]     'see (gerundive)'
                              /sin + te/ → [sine]   'die (gerundive)'
                              /kam + te/ → [kande] 'chew (gerundive)'

   b. Post-glide voicing   /kag + te/ → [kayde] 'smell (gerundive)'

Chipewyan also provides evidence for a *SV-C constraint. As illustrated by the examples in (20), progressive voicing in Chipewyan is triggered by all sounds bearing an SV node, that is, sonorants and voiced fricatives (there is no voicing contrast in stops).

The examples in (20) show sequences of prefixes followed by the same stem. The stem-initial consonant is voiced by a preceding voiced segment. The forms in (a) through (d) show the absence of voicing in the stem consonant when the prefix ends in a voiceless consonant. The forms in (e) through (g) show that voicing takes place, not only after a nasal, as in (e), but also after a lateral (f) and a voiced fricative (g).

(20) Chipewyan (Li, 1946)

\[
\begin{array}{ll}
C + C & SV + C \\
\text{senel-še} & 's/he is raising me up' \\
\text{nes-še} & 'I am growing up' \\
\text{senčθ-šo} & 's/he raised me' \\
\text{nuh-še} & 'you (pl.) grow up' \\
\text{ni-že} < \text{ni-n-že} & 'you (sg.) are growing up' \\
\text{niže} & 'we are raising him up' \\
\text{nēθ-žo} & 's/he grew up'
\end{array}
\]

\(^8\) In addition, with respect to the argument that child language data evidences that NC clusters are more marked than voiced obstruent-nasal clusters, it can be argued that this simply follows from the fact that voiceless consonants in general are acquired later than voiced ones. Until the adult voicing contrast (i.e., the adult VOT cut-off values) is acquired, children's productions are perceived by adults as voiceless (even though children may in fact be making a distinction) (Macken and Barton, 1980).
To sum up, evidence from Japanese, Basque and Chipewyan points to the existence of a larger constraint on SV-C sequences, which includes *NC. This predicts that if the *SV-C (or *C-SV) constraint is effective in a language (or highly ranked) it will be violated by all sequences of SV+C, that is, it will rule out all sequences of any SV-bearing consonant and a voiceless obstruent, not just nasal-obstruent sequences. It should be noted, though, that the claim made here is not that all illegal clusters will be resolved by the same repair strategy, but that the constraint affects all SV-C (or C-SV clusters). This point is illustrated by Japanese. As illustrated in (19) above, Japanese has an active *SV-C constraint and resolves SV-C clusters involving nasals and glides by means of progressive voicing. When the SV element is a liquid, however, the solution is not voicing but SV delinking, as illustrated in (21).9


Thus, Japanese illustrates that the effect of having an active SV-C constraint is that all SV-C sequences in the language are ruled out, regardless of the different strategies used to resolve different clusters.

6. Conclusion

This paper argues against the claimed asymmetry of *NC and against the claim that CN effects are unattested, providing evidence from regressive voicing and nasal assimilation in Catalan, Spanish, Korean and Chukchee. Further evidence from several languages indicates that *NC and *CN are actually part of a larger constraint involving SV consonants rather than nasals. The effects triggered by the redefined *SV-C and *C-SV constraints are summarized in Table (22). In addition, the theory of SV permits a unified analysis of SV-C and C-SV effects in terms of copying or spreading of SV (post- and pre-nasal voicing, regressive and progressive voicing assimilation, nasal assimilation and sonorantization), delinking of SV (denasalization, nasal deletion), fusion (nasal substitution) or segment deletion.

(22)

<table>
<thead>
<tr>
<th>*SV-C effects</th>
<th>*C-SV effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>•progressive voicing (Chipewyan)</td>
<td>•progressive voicing assimilation</td>
</tr>
<tr>
<td>•post-nasal voicing</td>
<td>(Catalan, Spanish, Portuguese)</td>
</tr>
<tr>
<td>(Puyo Pongo Quechua, Greek)</td>
<td>•sonorantization (Korean)</td>
</tr>
<tr>
<td>•post-liquid &amp; post-nasal voicing</td>
<td>•nasal assimilation (Catalan,</td>
</tr>
<tr>
<td>(Basque)</td>
<td>Chukchee)</td>
</tr>
<tr>
<td>•post-glide &amp; post- nasal voicing</td>
<td>•C deletion (Sarcee)</td>
</tr>
<tr>
<td>(Japanese)</td>
<td>•voicing &amp; nasal deletion</td>
</tr>
<tr>
<td>•nasal deletion (Kelantan Malay)</td>
<td>(Dogrib, Chipewyan)</td>
</tr>
<tr>
<td>•denasalization (Mandar)</td>
<td></td>
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<tr>
<td>•desonorantization (Japanese)</td>
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<tr>
<td>•nasal substitution (Indonesian,</td>
<td></td>
</tr>
<tr>
<td>OshiKwanyama)</td>
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</tr>
</tbody>
</table>

9 I follow Rice’s (1993) account that Japanese allows only a nasal consonant, a glide or the first half of a geminate in a rhyme. In the case of [r]-C clusters, if SV were transmitted to the obstructant, an ill-formed cluster would arise (i.e., *[rd]); post-sonorant voicing is therefore limited to the post-nasal or post-glide context.
The characterization of the constraints as involving SV consonants rather than nasals is obscured by the fact that nasals are more common in this environment than other SV consonants. Although further research involving more languages is required in order to provide further and stronger support for *SV-C and *C-SV, the redefinition of the constraints in fact emphasizes the actual symmetry of the two constraints and their effects.

Ultimately, the symmetry of *C-SV ~ *SV-C may be suggestive of a broader constraint requiring voicing agreement in heterosyllabic clusters, and languages may differ with respect to effects triggered in terms of directionality preferences.

References