**Hypothesis:** We propose that a major part of the parsing difficulty of doubly center-embedded relative clause constructions (2CE-RC) stems from a mis-match between their syntactic structure and the prosodic phrasing typically assigned to them, which is influenced by phrase lengths as well as syntactic alignment.

**Rationale:** A prosodic division between matrix subject and predicate (NP1 NP2 NP3 VP1 VP2 || VP3) is syntactically well-aligned but severely length-unbalanced for typical examples like (1). However, a balanced example like (2) is better, even though longer.

(1) *The boy the cat the dog chased bit || died.*
(2) *The girl the man I love met || died of cholera in 1962.*

An additional cut yields a 3-phrase analysis (NP1 || NP2 NP3 VP1 VP2 || VP3), which is prosodically acceptable if the inner items are short/light enough to be combined; see (3). Intuitively, this is easier and more natural than typical experimental items like (4), even allowing for the difference in overall sentence length.

(3) *The kind old French lady || that the man I love met || now lives in upstate New York.*
(4) *The ancient manuscript that the grad student who the new card catalog had confused a great deal was studying in the library was missing a page.* (Gibson & Thomas, 1999)

The benefit of shrinking the middle phrase offers a prosodic explanation for the well-known ameliorating effect of an unstressed pronoun as NP3.

An over-long middle phrase could be divided as NP1 || NP2 NP3 VP1 VP2 || VP3. But intuitively this 4-phrase analysis is less helpful to the syntactic parser; see (5).

(5) *The beautiful young woman || the man the girl loved || met on a cruise ship in Maine || died of cholera in 1962.* (Frazier & Fodor 1978)

To explain this, we assume that the parser attempts to relate successive prosodic phrases as syntactic sisters, but cannot do so when VP2 is phrased separately. Wagner (2009) argues that an RC can string-vacuously raise to become sister to its head in a list-like construction; this yields the 3-phrase analysis. But VP2 cannot raise out of an RC (an extraction island) to become sister to the RC-residue, yielding the 4-phrase analysis. VP2 can be a sister only if (mis-)attached as matrix VP, but then would be ousted by the real matrix VP3. This explains why VP2 is often suppressed by the parser, creating the ‘missing VP effect’ (mVPe) in which a 2CE-RC sentence with VP2 missing is falsely perceived as grammatical.

**Indications in prior research:**

(a) Since self-paced reading inhibits natural prosody assignment, robust mVPe is expected in
SPR experiments regardless of phrase lengths. This is so for Christiansen & MacDonald (2009); Gimenes et al. (2009); Vasishth et al. (2010, English).

(b) With full-sentence presentation, greater mVPe is expected where phrase-lengths preclude the 3-phrase pronunciation. This comports with the divergent results of recent non-SPR studies, with mean word-counts for $\text{NP1} + [\text{NP2 NP3 VP1 VP2}] + \text{VP3}$ as follows.

<table>
<thead>
<tr>
<th>Study</th>
<th>Language</th>
<th>NP1+NP2+NP3+VP1+VP2+VP3</th>
<th>mVPe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gibson &amp; Thomas (1999)</td>
<td>English</td>
<td>2+15+4</td>
<td>2mVPe</td>
</tr>
<tr>
<td>Bader &amp; Häussler (2011)</td>
<td>German</td>
<td>2+13+2</td>
<td>mVPe</td>
</tr>
<tr>
<td>Vasishth et al. (2010)</td>
<td>German</td>
<td>2+8+1</td>
<td>No mVPe</td>
</tr>
</tbody>
</table>

**Prosody elicitation experiment:**

**Aim:** To test the benefit of balanced 3-phrase prosody, with overall sentence length controlled.

**Materials:** 12 English 2CE-RC sentences (full sentence presentation), with distributions of phrase-lengths expected to ENCourage versus DISCourage 3-phrase prosody; see (6) versus (7).

(6) *The rusty old ceiling pipes that the plumber my dad trained fixed continue to leak occasionally.*  
ENC: 5+7+4 = 16

(7) *The pipes that the unlicensed plumber the new janitor reluctantly assisted tried to repair burst.*  
DISC: 2+12+1 = 15

**Procedure:** Since 3-phrase pronunciation is unlikely by naïve subjects reading without preview, a familiarization protocol was employed to facilitate it. All target sentences (and fillers) were built up in five steps, as illustrated in (8). (Note: only the ENC version is shown here.)

(8) *My dad trained a plumber.*  
*Here is the plumber my dad trained.*  
*The plumber my dad trained fixed the rusty old ceiling pipes.*  
*Here are the rusty old ceiling pipes that the plumber my dad trained fixed.*  
*The rusty old ceiling pipes that the plumber my dad trained fixed continue to leak occasionally.*

At each step, participants read silently for comprehension, then aloud for recording. They judged the pronounceability and comprehensibility of the fifth sentence. Two expert judges tallied prosodic boundary locations and appropriateness of contours.

**Results:** For $N=24$, results (all $p<.05$) indicate that, as predicted:

(i) 2CE-RC sentences more often received 3-phrase prosody when NP2 NP3 VP1 VP2 were short/light, than when NP1 and VP3 were (matched for overall sentence length).

(ii) Even with familiarization, 2CE-RC sentences were judged harder to pronounce and understand when 3-phrase prosody was not assigned.

**Next step:** Direct test of the missing VP illusion for these length-manipulated materials.