

Extrapolation without Subjacency

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1 Subclausal Locality Constraints

1.1 Proposed Constraints

1.1.1 Subjacency (Chomsky 1973)

Chomsky claims that extrapolation is not only clause-bounded (Ross 1986, p. 5) but obeys a stricter, subclausal locality constraint.

- (1) No rule can move an item from position Y to position X in the structure
... [β ... [α ... Y ...] ...] ... X ...
where $Y \neq \alpha$ and α, β are cyclic categories, ... (Chomsky 1973, p. 271)

Chomsky (1973, p. 235) and Akmajian (1975) take the set of cyclic categories to include S (IP) and NP (DP).

Prediction: Extrapolation “out of” a noun phrase embedded inside another noun phrase is impossible.

1.1.2 Generalized Subjacency (Baltin 1981, 1983, 2006)

Baltin proposes an even stricter subclausal locality constraint on extrapolation:

- (2) Generalized Subjacency
In the configuration $A \dots [\alpha \dots [\beta \dots B \dots]_{\beta} \dots]_{\alpha} \dots A'$,

- a. A and B cannot be related where α and $\beta = \text{NP, PP}$, and either one or both of S and S';
b. A' and B cannot be related where α and β are maximal projections of any major category.

(quoted from Baltin 1983, p. 155; see also Baltin 1981, p. 262)

Prediction: Only one maximal projection can intervene between an extraposed relative clause and its *in-situ* position.

- (3) An extraposed phrase is adjoined to the first maximal projection that dominates the phrase in which it originates. (Baltin 2006, p. 241)

Very similar generalizations are given by Akmajian (1975, p. 119), Asakawa (1979, p. 505), Jacobson (1987, p. 62), and Rochemont and Culicover (1997, p. 283) for English, by Wiltschko (1997, p. 360) for German, and by Keller (1995, p. 303) for both languages.

1.1.3 Chomsky's Barriers Approach (Chomsky 1986)

Chomsky (1986) proposes a less restrictive theory of locality.

- (4) γ is a BC for β iff γ is not L-marked and γ dominates β .

- (5) γ is a barrier for β iff (a) or (b):
- γ immediately dominates δ , δ a BC for β ;
 - γ is a BC for β , $\gamma \neq \text{IP}$.

Distinction between arguments (L-marked phrases) and non-theta-marked adjuncts (blocking categories).

Prediction: Extraposition from within a DP that is contained in an adjunct (e.g., of another DP) is ungrammatical.

1.2 Authentic Counterexamples

1.2.1 Generalized Subjacency

Baltin (2006, p. 245) admits that extraposition from a PP inside the VP is grammatical (6), but claims that extraposition from within a fronted PP is ungrammatical (7) (Baltin 2006, p. 246).

- (6) I saw it in a magazine yesterday which was lying on the table.
- (7) *In which magazine did you see it which was lying on the table?

However, fronted PPs with questions words represent a systematic class of counterexamples to Baltin's claim:

- (8) [_{PP} In [_{DP} what noble capacity *t*]] can I serve him [_{RC} that would glorify him and magnify his name?]
(www.christianinconnect.com/lp1pet.htm, 02-19-2007)
- (9) If you need to manage your anger, [_{PP} in [_{DP} what ways *t*]] can you do that [_{RC} which would allow you to continue to function?]
(www.positivearticles.com/Article/Top-Ten-Ways-of-Moving-Through-Anger/5832, 02-19-2007)
- (10) [_{PP} To [_{DP} whom *t*]] can I speak [_{RC} who might know a solution?]
(www.voiceteacher.com/finding_teacher.html, 02-25-2007)

- (11) [_{PP} An [_{DP} wen *t*]] kann ich mich wenden, [_{RC} der
to whom can I myself turn who
mir kluge Tips aus der Praxis geben kann?]
me clever tips from the practice give can
"To whom can I turn who can give me clever tips from practice?"
(www.ruhr-uni-bochum.de/beratungsportal/chat/doku14b.htm, 02-19-2007)

- (12) [_{PP} In [_{DP} welches SKigebiet *t*]] kann man über die
in what skiing region can you over the
Osterferien fahren [_{RC} das noch Schneesicher ist] [...]
spring break drive that still snow-sure is
"In what skiing region can you travel over spring break that is guaranteed to have snow?"
(www.bergfex.at/forum/allgemein/?&msgID=1000049637, 02-19-2007)

1.2.2 Subjacency

Evidence for Subjacency given by (Akmajian 1975, p. 118):

- (13) A photograph was published last year *of a book about French cooking*.
- (14) *A photograph of a book was published last year *about French cooking*.

Subjacency is still mostly assumed to be relevant for extraposition in English (cf. Baltin 2006).

Constructed English counterexample (Uszkoreit 1990, p. 2333):

- (15) Only letters from those people remained unanswered that had received our earlier reply.

Many authors investigating extraposition in German do not believe that Subjacency holds (cf. Haider 1997; Kiss 2005; Müller 2004; Müller and Meurers 2006). Keller (1995) and Wiltschko (1997) are exceptions.

Constructed German counterexample (Müller 2004):

- (16) *Karl hat mir [eine Kopie [einer Fälschung [des Bildes
Karl has me a copy a.GEN forgery the.GEN picture
[einer Frau t_i]]] gegeben, [die schon lange tot ist]_i.*
a.GEN woman given who already long dead is
“Karl gave me a copy of a forgery of the picture of a woman who has
been dead for a long time.”

Authentic counterexamples to Subjacency (and Generalized Subjacency) for English:

- (17) We drafted [_{DP} a list of [_{DP} basic demands *t*]] that night [_{RC} that had to be unconditionally met or we would stop making and delivering pizza and go on strike.]
(portland.indymedia.org/en/2005/07/321809.shtml, 02-22-2007)
- (18) A wreath was placed [_{PP} in [_{DP} the doorway of [_{DP} the brick rowhouse *t*]]] yesterday, [_{RC} which is at the end of a block with other vacant dwellings.]
(http://www.firerescue1.com/DutyDeaths/278039/, 02-22-2007)

Authentic counterexamples to Subjacency (and Generalized Subjacency) for German:

- (19) *Und dann sollte ich [_{DP} Augenzeuge [_{DP} der
and then should I eye witness the.GEN
Zerstörung [_{DP} einer Stadt *t*]]] werden, [_{RC} die mir am
destruction a.GEN city become that me at the
Herzen lag] – Sarajevo.
heart lay Sarajevo*
“And then I was about to become an eye witness of the destruction of a city that was dear to my heart - Sarajevo.”
(TüBa-D/Z 16294)
- (20) *[...] es sei ihm nicht gelungen, [_{DP} genug Unterstützung
it be him not succeed enough support
[_{PP} für [_{DP} die Bildung [_{DP} einer Übergangsregierung *t*]]]
for the formation a.GEN interim.government*

zu bekommen, [_{RC} die das Wahlsystem reformieren solle.]
to obtain who the election.system reform should
“...he didn’t succeed in finding enough support for the formation of an interim government who could reform the election system.”
(Welt Kompakt, 05-02-2008)

1.2.3 Barriers Approach

Chomsky (1986) claims that only the higher NP headed by *books* is a possible antecedent for the extraposed relative clause in the following example:

- (21) [_{NP} many books [_{PP} with [_{NP} stories *t*]] *t*] were sold [_{CP} that I wanted to read]
(Chomsky 1986, p. 40)

Constructed German counterexample (Müller 2004):

- (22) *weil [_{DP} viele Schallplatten [_{PP} mit [_{DP} Geschichten
because many records with stories
t]]] verkauft wurden, [_{RC} die ich noch lesen wollte.]*
sold were that I yet read wanted
“because many records with stories were sold that I still wanted to read.”
(Müller 2004, p. 10)

Authentic counterexamples to the Barriers account for English:

- (23) I’m reading [_{DP} a book [_{PP} about [_{DP} Elliott Smith *t*]]] right now, [_{RC} who killed himself]
(www.songmeanings.net/lyric.php?lid=3530822107858518290, 02-28-2007)
- (24) For example, we understand that Ariva buses have won [_{DP} a number [_{PP} of [_{DP} contracts [_{PP} for [_{DP} routes [_{PP} in [_{DP} London] *t*]]]]] recently, [_{RC} which will not be run by low floor accessible buses.]
(http://www.publications.parliament.uk/pa/cm199899/cmselect/cmenvtra/32ii/32115.htm, 02-24-2007)

Authentic counterexamples to the Barriers account for German:

(25) ...hielt sie vor allem [DP das Andenken [PP an [DP “die
 ...held she above all the memory of the
 gute alte Zeit” [PP unter [DP ihrem verstorbenen Mann
 good old time under her deceased husband
 t]]]] hoch, [RC der im Mittelpunkt ihres Wahlkampfes
 high who in the center her.GEN campaign.GEN
 stand.]
 stood

“...she mostly kept the memory of the good old times under her
 deceased husband alive who was at the center of her election campaign.”

(TüBa-D/Z 12507)

(26) Statt Unsummen [PP in [DP Sicherheitsstudien [PP
 Instead of enormous sums into security studies
 für [DP Atomkraftwerke t]]]] zu stecken, [RC die ohnehin
 for nuclear power plants to put that anyway
 nicht nachgerüstet werden können,] ...
 not upgraded be can ...

“Instead of investing enormous sums into security studies for nuclear
 power plants that cannot be upgraded anyway...”

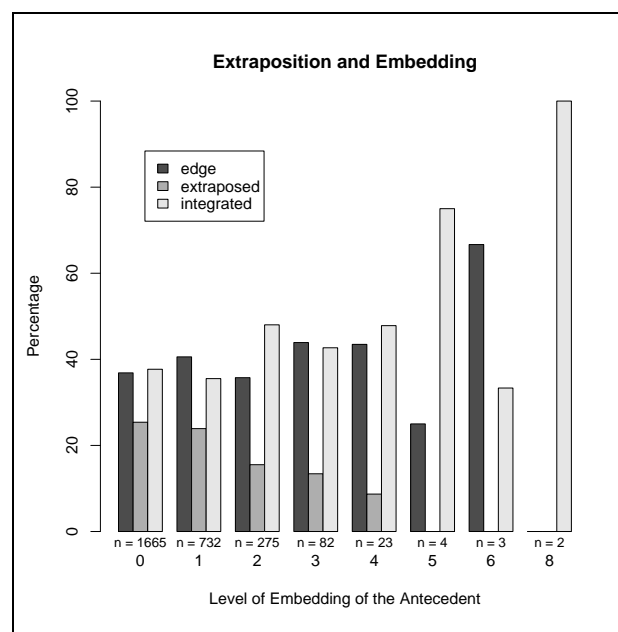
(TüBa-D/Z 20483)

(27) Die Nato hat Deutschland offiziell [PP um [DP die
 the Nato has Germany officially for the
 Entsendung [PP von [DP 250 Mann [PP für [DP die Quick
 dispatch of 250 men for the Quick
 Reaction Force im Norden Afghanistans t]]]] gebeten,
 Reaction Force in.the north Afghanistan.GEN asked
 [RC die die ISAF Stabilisierungstruppe absichert.]
 which the ISAF stabilizing.troop protects

“Nato has officially asked Germany for the dispatch of 250 men for the
 Quick Reaction Force in the north of Afghanistan which protects the
 ISAF stabilizing troop.” (Welt Kompakt, 5. Februar 2008)

2 Corpus Study

- German newspaper corpus TüBa-D/Z
- 2,789 relative clauses
- Likelihood of RC extraposition decreases with deeper embedding
- But the decrease is very gradual:
 - Embedding 0 – 25.4 %
 - Embedding 1 – 23.9 %
 - Embedding 2 – 15.5 %
 - Embedding 3 – 13.4 %
 - Embedding 4 – 8.7 %
 - Embedding 5-8 – 0 %
- Caveat: Other factors were not controlled



3 Experimental Study

3.1 Motivation

- There is no categorical subclausal locality constraint on extraposition in German or English
- Are there systematic gradual effects of subclausal locality?
- If so, how strong are these effects?
- Are there any differences between English and German (as sometimes claimed, e.g. by Inaba 2005)

3.2 Experimental Technique

- Acceptability study (and reading time study¹)²
- Participants read a stimulus displayed on screen
- Participants judged the acceptability/naturalness of the stimulus on a scale from 1 (fully acceptable) to 8 (totally unacceptable)³
- Every participant judged equal numbers of examples of the different conditions and saw only one version of every item.

3.3 Experimental Design

- 3 x 2 factorial design crossing the factors
 - depth of **embedding** of the antecedent
 - height of **attachment** of the relative clause
- The general design was the same for English and German

¹The reading time experiments used the same stimuli as the acceptability studies. However, they have not produced any significant effects, possibly because we have not tested enough participants yet: 36 subjects for German and 30 subjects for English have participated so far.

²We used the Linger system (by Douglas Rohde).

³We have turned the scale around in the plots, so that higher acceptability is represented by higher ratings.

3.4 English

3.4.1 Experimental Design

Conditions:

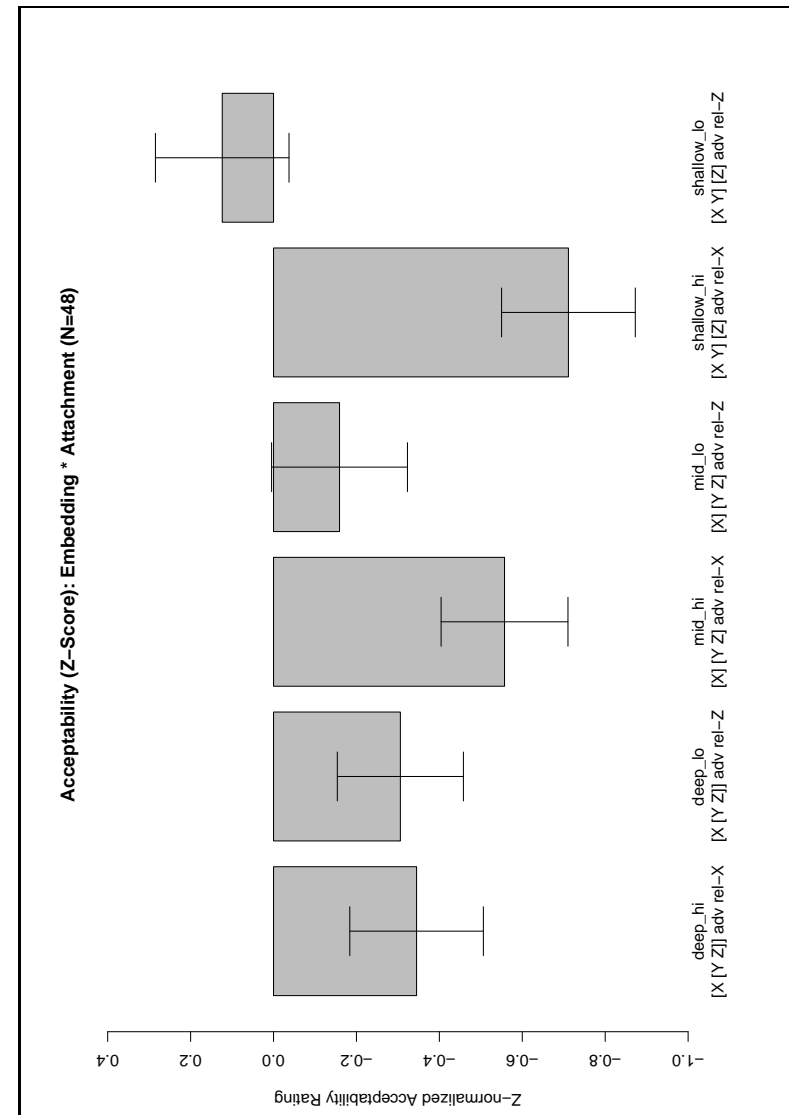
- (28) **Deep-Low:** I consulted [_{DP1} the diplomatic representative [_{PP} **of** [_{DP2} a small country [_{PP} **with** [_{DP3} border disputes t]]]]] *early today* [_{RC} **which threaten** to cause a hugely disastrous war.]
- (29) **Deep-High:** I consulted [_{DP1} the diplomatic representative [_{PP} **of** [_{DP2} a small country [_{PP} **with** [_{DP3} border disputes]]]]] t] *early today* [_{RC} **who threatens** to cause a hugely disastrous war.]
- (30) **Mid-Low:** I consulted [_{DP1} the diplomatic representative] [_{PP} **about** [_{DP2} a small country [_{PP} **with** [_{DP3} border disputes t]]]]] *early today* [_{RC} **which threaten** to cause a hugely disastrous war.]
- (31) **Mid-High:** I consulted [_{DP1} the diplomatic representative t] [_{PP} **about** [_{DP2} a small country [_{PP} **with** [_{DP3} border disputes]]]]] *early today* [_{RC} **who threatens** to cause a hugely disastrous war.]
- (32) **Shallow-Low:** I consulted [_{DP1} the diplomatic representative [_{PP} **of** [_{DP2} a small country]]] [_{PP} **about** [_{DP3} border disputes t]]] *early today* [_{RC} **which threaten** to cause a hugely disastrous war.]
- (33) **Shallow-High:** I consulted [_{DP1} the diplomatic representative [_{PP} **of** [_{DP2} a small country]]] t] [_{PP} **with** [_{DP3} border disputes]]] *early today* [_{RC} **who threatens** to cause a hugely disastrous war.]
- Varying the structure of the matrix clause by changing prepositions to achieve deep, mid, and shallow embedding of DP₃ (inspired by Gibson and Breen 2003)
 - Varying the animacy of the relative pronoun and the number of the verb in the relative clause to force high or low attachment (to DP₁ or DP₃)

3.4.2 Predictions

- Deep-High vs. Deep-Low
 - Subjacency: High attachment should be more acceptable than low attachment (no vs. severe violation of Subjacency)
 - We do not believe that subjacency has a strong influence on extraposition and therefore predict that there will be no difference in acceptability between high and low attachment for deep embedding of DP₃
- Deep-Low vs. Mid-Low vs. Shallow-Low
 - Subjacency: Clear increase in acceptability from deep to mid to shallow embedding (severe vs. less severe vs. no violation of Subjacency)
 - We predict no or only a very gradual effect of depth of embedding
- Deep-High vs. Mid-High and Shallow-High
 - Attachment to DP₁ in the mid and shallow embedding conditions is predicted to be affected by various processing factors: increased linear distance between antecedent and relative clause (Gibson 2000), intervening argument of the matrix verb, higher number of crossing dependencies (Gibson and Breen 2003)
 - Mid-High and Shallow-High should be less acceptable than Deep-High
 - The magnitude of this effect can be used to gauge the magnitude of potential locality effects (Deep-Low vs. Mid-Low vs. Shallow-Low)

3.4.3 Results

- 24 experimental items – 36 fillers
- 48 participants (students at Stanford University)



- **Mixed Linear Model**

- No significant difference between Deep-High and Deep-Low (p = 0.7303)
- Mid-Low judged as more acceptable than Mid-High (p = 0.0056)
- Shallow-Low judged as more acceptable than Shallow-High (p = 0.0000)
- *High attachment is never more acceptable than low attachment!*

- **Post-Hoc Tuckey Tests**

- Within the low attachment condition
 - * No significant increase from Deep-Low to Mid-Low (p = 0.2153)
 - * Significant increase from Deep-Low to Shallow-Low (p < 0.001)
 - * Significant difference between Mid-Low and Shallow-Low (p = 0.0067)
- Within the high attachment condition
 - * Marginally significant difference between Deep-High and Mid-High (p = 0.0601)
 - * Significant decrease in acceptability from Deep-High to Shallow-High (p < 0.001)
 - * No significant difference between Mid-High and Shallow-High (p = 0.2252)

3.5 German

3.5.1 Experimental Design

Conditions:

- (34) **Deep-Low:** Ich habe [DP_1 eine ältere Nonne [PP **aus** [DP_2 einem traditionellen Kloster [PP **mit** [DP_3 einem strengen Verhaltenskodex t]]]]] *interviewt* [RC **der** große Hingabe an die täglichen Rituale verlangt.]
- (35) **Deep-High:** Ich habe [DP_1 eine ältere Nonne [PP **aus** [DP_2 einem traditionellen Kloster [PP **mit** [DP_3 einem strengen Verhaltenskodex]]]] t] *interviewt* [RC **die** große Hingabe an die täglichen Rituale verlangt.]

(36) **Mid-Low:** Ich habe [DP_1 eine ältere Nonne] [PP **zu** [DP_2 einem traditionellen Kloster [PP **mit** [DP_3 einem strengen Verhaltenskodex t]]]]] *interviewt* [RC **der** große Hingabe an die täglichen Rituale verlangt.]

(37) **Mid-High:** Ich habe [DP_1 eine ältere Nonne t] [PP **zu** [DP_2 einem traditionellen Kloster [PP **mit** [DP_3 einem strengen Verhaltenskodex]]]]] *interviewt* [RC **die** große Hingabe an die täglichen Rituale verlangt.]

(38) **Shallow-Low:** Ich habe [DP_1 eine ältere Nonne [PP **aus** [DP_2 einem traditionellen Kloster]]] [PP **zu** [DP_3 einem strengen Verhaltenskodex t]]] *interviewt* [RC **der** große Hingabe an die täglichen Rituale verlangt.]

(39) **Shallow-High:** Ich habe [DP_1 eine ältere Nonne [PP **aus** [DP_2 einem traditionellen Kloster]] t] [PP **zu** [DP_3 einem strengen Verhaltenskodex]]] *interviewt* [RC **die** große Hingabe an die täglichen Rituale verlangt.]

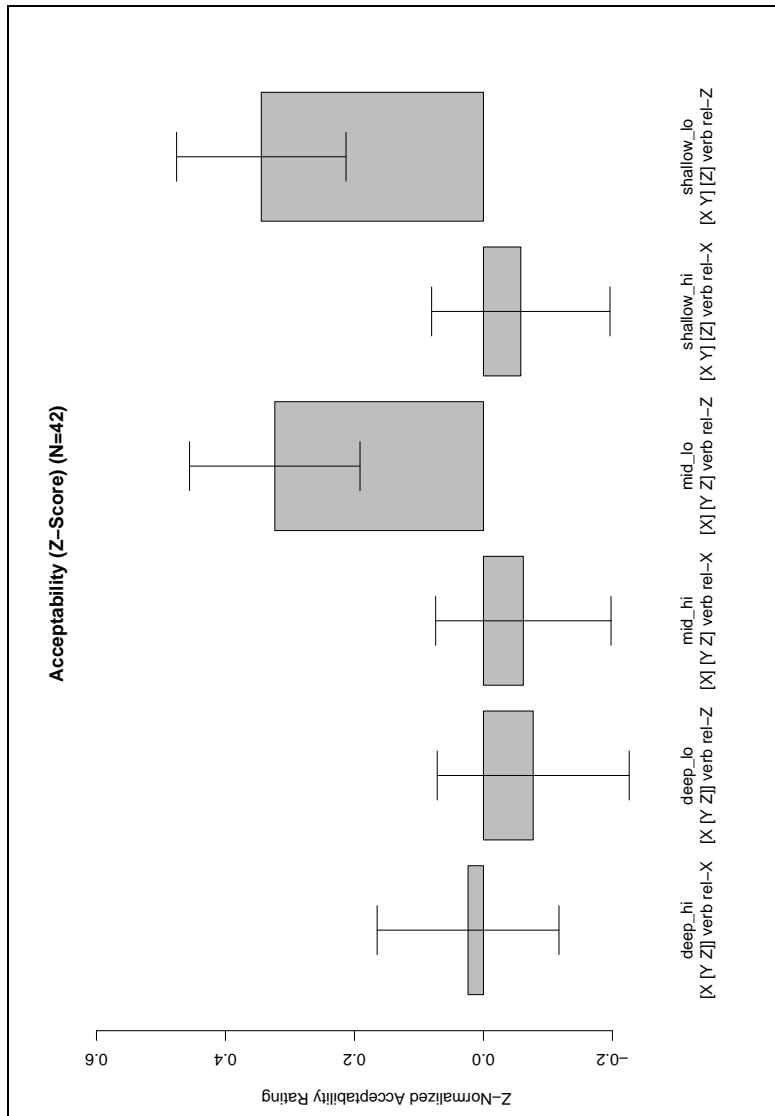
- Varying the structure of the matrix clause by changing prepositions to achieve deep, mid, and shallow embedding of DP_3 (inspired by Gibson and Breen 2003)
- Varying the gender of the relative pronoun to force high or low attachment (to DP_1 or DP_3)

3.5.2 Predictions

Same as for English. The only difference is that there are no additional crossing dependencies in the Mid-High and Shallow-High conditions because of the verb-final structure of the German clause.

3.5.3 Results

- 24 experimental items – 36 fillers
- 42 participants (students at Ruhr-Universität Bochum)



- **Mixed Linear Model**

- No significant difference between Deep-High and Deep-Low ($p = 0.2757$)
- Mid-Low judged as more acceptable than Mid-High ($p = 0.0002$)
- Shallow-Low judged as more acceptable than Shallow-High ($p = 0.0001$)
- *High attachment is never more acceptable than low attachment!*

- **Post-Hoc Tuckey Tests**

- Within the low attachment condition
 - * Significant increase from Deep-Low to Mid-Low ($p = 3.53e-05$)
 - * Significant increase from Deep-Low to Shallow-Low ($p < 1e-05$)
 - * No significant difference between Mid-Low and Shallow-Low ($p = 0.972$)
- Within the high attachment condition
 - * No significant differences between Deep-High and Mid-High ($p = 0.614$), Deep-High and Shallow-High ($p = 0.642$), and Mid-High and Shallow-High ($p = 0.999$)

4 Discussion

4.1 Evidence against the Importance of Subjacency

- The difference in acceptability between Deep-High and Deep-Low predicted by Subjacency did not occur, neither for English nor for German.
- Examples with severe Subjacency violations thus do not seem to be necessarily worse than parallel examples without such violations.

⇒ This result further strengthens our claim that the influence of subclausal locality constraints on extraposition has been overrated

4.2 Evidence for the Existence of Gradient Subclausal Locality Effects

- But there also was an increase in acceptability from Deep-Low to Mid-Low to Shallow-Low in both experiments.
- Compared to the influence of processing factors affecting high attachment, these locality effects were either larger (German) or of the same magnitude (English).

⇒ This suggests that there is some kind of gradient, noncategorical locality constraint after all.⁴

5 Conclusion

- Extraposition in English and German does not obey categorical subclausal locality constraints.
- Two acceptability studies of English and German extraposition yielded results which are partly incompatible with predictions made by subclausal locality constraints.
- The results of these experiments and of a preliminary corpus study on German suggest that there may be gradient, noncategorical subclausal locality effects.
- The similarity of the results of the German and English experiments would be unexpected if extraposition in English was a fundamentally different process from extraposition in German (as e.g. proposed by Inaba 2005).
- The decrease in acceptability from Deep-High to Mid-High and Shallow-High in English (as opposed to German) suggests that the number of crossing dependencies might be an important factor (for English) (cf. Gibson and Breen 2003).

⁴However, since the three embedding conditions also varied the argument structure of the verb, etc., further experimental and corpus evidence is needed to clarify this question.

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