**Wh-island amelioration at the interfaces: Syntax, processing, and semantic distinctness**

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1. **Introduction.** Relativized Minimality (RM), which prohibits movement of a constituent when c-commanded by another constituent that shares the probed feature, has played a pivotal role in syntactic theories [1,2]. Based on cross-linguistic and developmental data on wh-extraction, Rizzi and colleagues [3-5] have recently proposed a revision of RM (henceforth *featural RM*): the degree of overlap in formal features between the extracted constituent and the intervener determines the degree of syntactic ill-formedness. If the same set of formal features is shared (1), the identity relation causes a severe degradation. However, if the formal features in the extracted constituent form a superset of those of the intervener (2), then the degradation is (claimed to be) less severe. This way, featural RM offers a novel syntactic explanation of the classic observation [6] that D-linking ameliorates a wh-island violation.

(1) **Who** [+Q] did you wonder who [+Q] would invite __? [identity relation]

(2) **Which visitor** [+Q,+N] did you wonder who [+Q] would invite __? [inclusion relation]

The present study reports 3 English acceptability judgment studies that test a novel prediction of featural RM: (3) with two D-linked wh-phrases should be just as unacceptable as (1) due to the feature identity relation between the two wh-phrases. We show that this prediction is not borne out, and in fact, sentences like (3) show a further improvement in acceptability compared to its counterparts like (1) or (2). We argue that the semantic distinctness plays a critical role in amelioration of wh-island violation.

(3) **Which visitor** [+Q,+N] did you wonder **which teacher** [+Q,+N] would invite __? [identity relation]

2. **Experiments.** All three judgment experiments used a 7-point scale and were conducted with English native speakers on Amazon Mechanical Turk. **Experiment 1** (25 participants, 16 items, 4 conditions) compared ratings of (2), (3) and their baseline conditions without extractions out of wh-islands (4a,4b).

(4) a/b. **Which visitor** [+Q,+N] wondered who [+Q]/**which teacher** [+Q,+N] would invite the visitor?

We found that, as expected, extraction out of wh-islands in (2) and (3) generally caused a significant degradation compared to their baseline conditions (4) (p<.001). However, the acceptability of (3) was significantly higher than that of (2) (p<.01), contrary to the prediction of featural RM.

While this finding challenges featural RM, it is critical to ascertain that our experimental method provides a reliable measure of ungrammatical wh-extraction. To this end, **Experiment 2** (32 participants, 24 items) used the 4 conditions of Experiment 1 in addition to 4 more conditions (5) with the aim of replicating a) results of Experiment 1, and b) the widely attested D-linking effect, i.e., the acceptability contrast between (2) and (1) (=5c), which was not tested in Experiment 1.

(5) a/b. **Who** [+Q] did you wonder who [+Q]/**which teacher** [+Q,+N] would invite __? [cf. (2),(3)]

c/d. **Who** [+Q] wondered **who** [+Q]/**which teacher** [+Q,+N] would invite the visitor? [cf.(4)]

Results revealed that there was no significant difference among extraction conditions (2), (5a), or (5b), but compared to these conditions, (3) showed a marginally significant improvement (p<.096). This suggests that D-linking either failed to ameliorate wh-island violations, or was weaker than expected.

It is important to note, however, that both Experiments 1 and 2 only used animate wh-phrases (e.g., *who, which visitor*, etc.). The large number of animate nouns in the wh-extraction sentences may have increased confusability and processing demands, and this may have masked the D-linking effect. In order to address this possibility, **Experiment 3** (31 participants, 24 items with 8 conditions) used the same structural manipulations as Experiment 2, but the object of the embedded verb was changed to an inanimate noun (6). As a consequence, the extracted *wh*-phrase was also inanimate (6a,6b,6c,6f).

(6) a/b. **What** [+Q] did you wonder who [+Q]/**which shopper** [+Q,+N] would buy __?

c/d. **Who** [+Q] wondered who [+Q]/**which shopper** [+Q,+N] would buy the camera?

e/f. **Which camera** [+Q,+N] did you wonder who [+Q]/**which shopper** [+Q,+N] would buy __?

g/h. **Which salesman** [+Q,+N] wondered who [+Q]/**which shopper** [+Q,+N] would buy the camera?
There were two main findings, both of which indicate that the animacy contrast in the two wh-phrases critically conditions the wh-island amelioration effect. First, (6e) was rated as significantly better than (6a) ($p < .05$), suggesting that the D-linking of the extracted wh-phrase caused an amelioration of wh-island violation. This replicates the observation in the literature [6], unlike in Experiment 2 where both wh-phrases were animate. Second, we replicated the main findings of Experiments 1 and 2 that extraction of a D-linked wh-phrase over a D-linked intervener (6f) results in a significantly higher acceptability than any other extraction conditions (6a,6b,6e) ($ps < .001$). Moreover, this improvement was much larger than in previous experiments, such that it was no longer significantly different from its baseline condition (6h).

3. Summary. The main findings from Experiments 1-3 can be summarized as follows. (F1) Extraction out of wh-islands caused a general degradation across the three experiments, even when the extracted wh-phrase was D-linked. (F2) We found consistent evidence against featural RM: there was a reliable amelioration of wh-island violation in wh-extraction like (3), which holds a feature identity relation between the D-linked extracted constituent and the D-linked intervener. (F3) An animacy contrast between the extracted constituent and intervener was critical for revealing classic D-linking effects as well as for enhancing the amelioration effect in wh-extraction with two D-linked wh-phrases.

4. Proposal. We argue that a complete understanding of our acceptability judgment data require consideration of syntax, semantics as well as constraints on memory mechanisms that support sentence comprehension. First, we take (F1) to indicate that there is a formal constraint on wh-extraction that is independent of D-linking [1,2]. However, we depart from featural RM [3-5] and argue that acceptability variance among various wh-island violations is not conditioned by degrees of overlap in formal features.

Second, following the spirit of [7,8], we argue that the variations in wh-island amelioration effects (F2, F3) are largely conditioned by the semantic distinctness of the extracted constituent and the intervener. One semantic factor that determines the degree of semantic distinctness is domain restriction in wh-phrases. In the case of wh-extraction with two D-linked wh-phrases like (3), each wh-phrase presupposes a set of visitors and teachers such that their domains do not overlap. On the other hand, in (2) in which we found no amelioration effect, the semantic domains of the two wh-phrases overlap because the presupposed set of visitors must be a subset of potential answers to who, i.e., all of the people in the relevant contextual domain [9]. The other factor that modulates the semantic distinctness status is animacy. This explains why the classical D-linking effect was observed when the extracted constituent and the intervener contrasted in animacy, as well as why (6f) with two D-linked wh-phrases that contrasted in animacy showed a boost of amelioration effects.

Finally, we propose that the effects of semantic distinctness result from memory constraints on parsing processes. Sentence processing studies on wh-dependencies have shown that the increase of representational similarity of the extracted constituent and intervener has a direct impact on the difficulty in memory encoding and maintenance of those referents [10,11]. For example, [10] demonstrated that in processing object clefts, processing difficulties increased when the extracted constituent and the intervener matched in NP type (e.g., *It was John that Bill saw ___ in the parking lot*) compared to when the NP type mismatched (e.g., *It was the barber that Bill saw ___ in the parking lot*). We suggest that these memory encoding difficulties are modulated by domain restriction and animacy distinctness as well, and that they have consequences for acceptability judgment. This calls for further investigations between locality constraints and constraints on parsing long-distance dependencies [12,13].