Prosody and the *that*-trace effect: an experimental study

The *that*-trace effect, in which the acceptability of embedded subject extraction declines sharply when the complementizer is present, is traditionally taken to be a purely syntactic phenomenon (e.g. Chomsky, 1981; Pesetsky & Torrego, 2001; Rizzi & Shlonsky, 2006). Some recent accounts, however, attribute it instead to a prosodic filter (Kandybowicz, 2006; Ha, 2010; Sato & Dobashi, 2013). They claim that phenomena such as contrastive focus prosody and contraction can greatly improve *that*-trace sentences, unlike what one would expect of a purely syntactic effect. Here we subject these claims to experimental scrutiny and show that they do not appear well founded, thus weakening support for prosodic approaches to the *that*-trace effect. We do this by means of two formal acceptability experiments, where we look specifically for evidence of amelioration in *that*-trace sentences with (1) contrastive focus and (2) contraction of *that* with the following auxiliary.

**Method.** In both experiments, stimuli were recorded by a trained phonetician in a recording booth, and each stimulus (context + test sentence) was subsequently analyzed intonationally to ensure that the prosody was consistent across stimuli and experiments. 28 native English speakers rated the acceptability of these audio stimuli on a 7-point scale. Each participant heard 3 tokens of each condition, and stimuli were counterbalanced using a Latin Square. The two experiments were interleaved as subexperiments comprising a single larger experiment. **Experiment 1:** All test sentences (samples in (1)-(6)) were *wh*-questions with a gap in the embedded clause, following a 3x2x3 design: presence of *that* (*that* vs. no *that*), gap site (subject vs. object), and placement of contrastive focus (matrix verb vs. embedded verb vs. none (“broad” focus)). Experimental/filler ratio: 1:1. Each test sentence was preceded by a context that made the contrastive focus felicitous (Culicover & Rochemont 1983). Stimuli were recorded with default contrastive or broad focus intonation: each test sentence consisted of one intonational phrase with no IP-medial intermediate phrases. Sentences with contrastive focus had a nuclear L+H* pitch accent on the focused word followed by de-accenting (Pierrehumbert & Hirschberg, 1990), and broad focus *wh*-questions had a L+H* pitch accent on the *wh*-word followed by a gradual fall (Bartels, 1997). **Experiment 2:** All test sentences (samples in (7)-(10)) were *wh*-questions with a subject gap, following a 2x3 design: sentence type (gap in embedded clause vs. gap in matrix clause followed by relative clause) and presence/type of *that* (non-contracted *that* vs. *that* contracted with following auxiliary (*that’ll*) vs. no *that*). Experimental/filler ratio: 1:3. *That’ll* and *that will* were consistently pronounced as [ðæ?l] and [ðæ?wil], respectively. Each test sentence in Experiment 2 was also preceded by an appropriate context to match the presentation of stimuli in Experiment 1.

**Sample stimuli for Exp 1 (contrastive focus; subject gap on left, object gap on right)**

1. Who do you THINK (that) __ hugged John?  
2. Who do you think (that) __ HUGGED John?  
3. Who do you think (that) __ hugged John?  
4. Who do you THINK (that) John hugged ____?
5. Who do you think (that) John HUGGED ____?
6. Who do you think (that) John hugged ____?

**Sample stimuli for Exp 2 (contraction; gap in embedded clause on left, in matrix clause on right)**

7. Who do you guess that’ll irritate the judge?  
8. Who do you guess (that) will irritate the judge?  
9. Who talked to the man that’ll irritate the judge?  
10. Who talked to the man (that) will irritate the judge?

**Results.** For both experiments, results from each participant were standardized prior to analysis and were analyzed using mixed-effects model comparisons with subject and item as random intercepts. **Experiment 1:** In the broad focus case, as expected, subject gaps with *that* are significantly worse than the other three conditions (i.e., participants clearly show a *that*-trace effect, p < 0.001). This *that*-trace sentence improves in the two contrastive focus cases, but a very similar amelioration occurs in the subject
gap cases without *that* (i.e., there is no interaction between presence of *that* and focus type in the subject gap cases, p = 0.16). The ameliorating effect that contrastive focus has been claimed to have on the *that*-trace phenomenon is thus real, but misleading: it is not specific to the *that*-trace sentence and is part of a general amelioration that occurs in all the subject gap cases. **Experiment 2:** Here too, there is a clear *that*-trace effect: embedded subject gaps are significantly worse with *that* than without. Unlike what has been claimed, though, the effect remains even when *that* is contracted with the following auxiliary (post-hoc comparison of *that* *will* vs. *that’ll*: $\beta = 0.1; \text{SE} = 0.11; t = 0.8 [\text{n.s.}]$). Such contraction also has no effect on relative clause *that*, although absence of *that* in that case leads to severe degradation, as expected (p < 0.001).

**Discussion.** Despite what has been claimed in the recent literature, we do not find evidence for amelioration of *that*-trace sentences with either contrastive focus or *that* contraction. It is always possible, of course, that there are other prosodic factors affecting *that*-trace that we have not uncovered in these experiments, but the fact that we were not able to detect two of the central prosodic effects that have been claimed makes it less likely that such an approach will be successful. If so, then the *that*-trace phenomenon may ultimately be a primarily syntactic effect after all, just as earlier analyses claimed.