

Supplemental Material S1. Reaction times in the dual task.

One way in which our dual-task paradigm departed from many typical ones was our use of accuracy rather than reaction time (RT). We used accuracy for a number of reasons, many of which derive from our long-term goal of developing measures that could be used in a large cross-sectional evaluation of individuals with hearing loss. First, as an individual difference measure, RT is heavily confounded with general speed of processing. This declines substantially with age, creating potential confounds (and many of the individuals we planned to test in the larger project would be older). Second, we used a mouse-click response rather than button-pressing because we wanted our tasks to remain similar to the Visual World Paradigm (as they would eventually be related to this task, as we describe in the discussion). Third, 4-choice button task might introduce significant cognitive demands—since the words (and grids) change on every trial, listeners must hold in working memory the mapping between options on the screen and the button. Finally, because we used mouse-clicking (as a response and not button-pressing) we were concerned that variability in the more complex and less constrained motor response might make it difficult to use RTs.

However, it is possible that RT would have been more sensitive to the differences between our two vocoding conditions (which accuracy did not distinguish in any experiments). Thus, we conducted an additional analysis of RT.

S1.1 Experiment 1

We examined the average reaction time (RT) to the grid-response trials to see if listening condition also impacted response speed. Reaction time was measured from the onset of response screen. Baseline RT (the average RT during baseline grid-matching trials, which was then centered) and listening condition were included as fixed effects, with random intercepts by subject. Figure S1.1A shows the mean RT in each condition.

We found a significant effect of baseline RT ($B = 600.26$, $SE = 14.02$, $t = 18.53$, $p < .001$), suggesting that subjects who were faster at grid-matching remained faster in the dual-task trials. We found an overall effect of listening condition: when we compared this model to a reduced model that did not contain listening condition, the full model was significantly different from the reduced model ($\chi^2 = 11.67$, $df = 2$, $p = .0029$). Examining the individual coefficients, RT was slower in the vocoded conditions compared to the unmodified condition ($B = 32.39$, $SE = 14.02$, $t = 2.31$, $p = .02$). Unexpectedly, within the vocoding conditions, 8-channel vocoding trials were slower than 4-channel ($B = -61.16$, $SE = 24.28$, $t = -2.52$, $p = .01$). This was somewhat surprising.

One possible explanation is that participants were less occupied by the 4-channel vocoding because it is quite difficult—in a sense they gave up, and were able to respond faster because they were guessing on some trials (this could also explain the lack of a difference in the accuracy of grid-matching between 4- and 8-channel vocoding). As a whole, however, this suggests listening condition shows significant effects on RT—particularly when we consider vocoded vs. unmodified speech. Taken together, our accuracy and RT analyses confirm that our dual task design was largely successful. Subjects were both slower and less accurate when attending to

both visual grids and vocoded speech compared to when speech was unmodified.

S1.2 Experiment 3

We also examined RT in the grid-matching trials on Experiment 3. These are shown in Figure S1.1B. Baseline RT (centered) and listening condition were included as fixed effects, with random intercepts by subject (as in Experiment 1). Subjects with faster baseline RTs were also faster in the dual-task trials ($B = 718.99$, $SE = 41.35$, $t = 17.39$, $p < .001$).

Unlike in Experiment 1, there was no overall effect of listening condition on RT ($\chi^2(2) = 2.36$, $p = .31$). This was also confirmed in the individual contrasts (Unmodified vs. Vocoded: $B = -9.33$, $SE = 14.23$, $t = -0.66$, $p = .51$; 8-channel vocoding vs. 4-channel vocoding: $B = 34.24$, $SE = 41.35$, $t = 1.39$, $p = .17$). It is unclear why we did not replicate the RT results from Experiment 1 when we observed the same effects on grid-matching accuracy. This task relies on mouse-clicking as a response and it is possible that this introduced some variance to response times (which is in part why we intended to use accuracy as the primary DV).

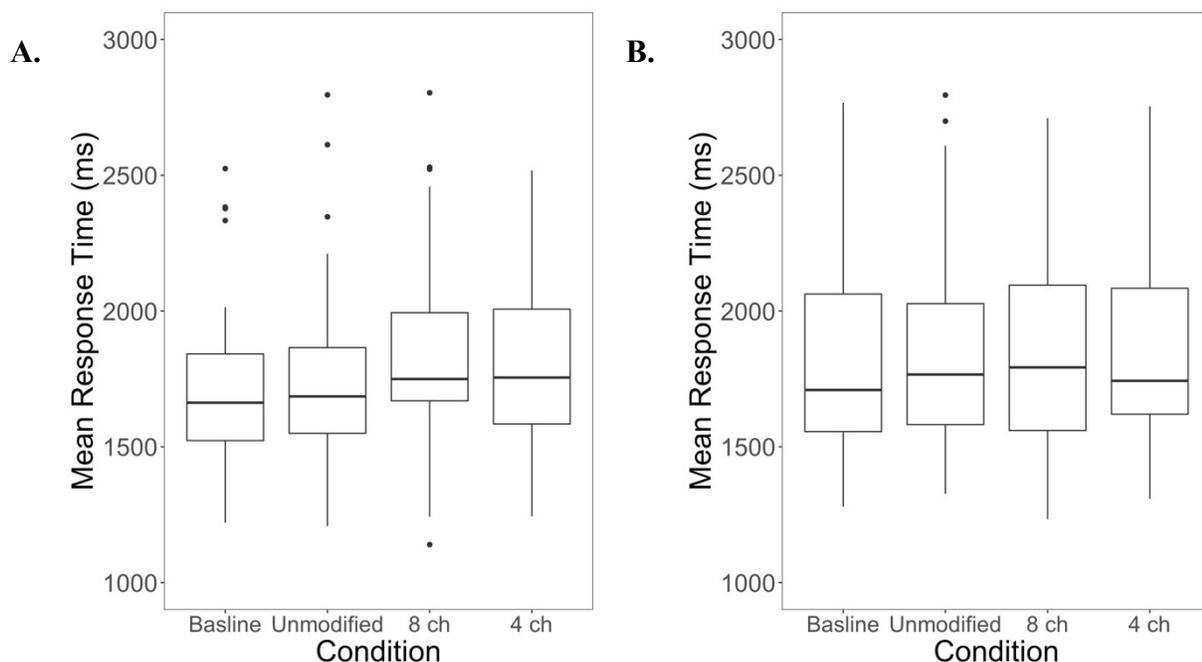


Figure S1.1 Mean response time in each grid-matching condition from (A) Experiment 1 and (B) Experiment 2.