Commentary

No Difference in Short-Term Memory Span Between Sign and Speech

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The conclusions of Bavelier, Newport, Hall, Supalla, and Boutla (2006, this issue) are undermined by an inappropriate procedure for measuring articulation rate. They measured duration for reading a matrix of 200 letters (D. Bavelier, personal communication, May 17, 2006), which may involve a considerable load on visual attention, translation from print, and articulatory planning. This procedure may slow responses to a point where constraints on articulatory production cease to matter. With appropriate methods (see the footnote to Table 1), articulation rates are much faster than they found (cf. our Table 1 with their Table 1), which suggests their methods did indeed introduce processing difficulties.

With our methods, the stimuli we used in our study (Wilson & Emmorey, 2006) produce equal articulation rates in American Sign Language (ASL) and English, $t(3) = 0.57$, $d = 0.24$, $p_{rep} = .64$. In contrast, the English stimuli Bavelier et al. used are articulated substantially faster than the ASL stimuli in their previous study (Boutla, Supalla, Newport, & Bavelier, 2004), $t(3) = 5.40$, $d = 1.20$, $p_{rep} = .96$. We conclude that (a) the equal spans and equal WAIS (Wechsler Adult Intelligence Scale) scores for English and ASL that we reported (Table 1) cannot be explained by failure to match articulation rate, and (b) the span difference between English and ASL seen when comparing the results of Bavelier et al. and Boutla et al. (Table 1) *can* be explained by failure to match articulation rate.

Bavelier et al. also compare span for English digits with span for the ASL letters they used in their earlier study, but growing evidence shows that digits are not comparable to other stimuli in short-term memory (e.g., Knops, Nuerk, Fimm, Vohn, & Willmes, 2006). Contra Bavelier et al., this lack of comparability cannot be explained by the fact that letters share more vowel sounds than numbers do. Instead, numbers have a privileged status in short-term memory, and cannot be treated as equivalent to other stimulus categories.

In short, Bavelier et al. do not present any new comparison that contradicts our findings. But have they nevertheless cast doubt on our findings?

The stimuli Bavelier et al. used are articulated substantially faster than our English stimuli, $t(3) = 4.07$, $d = 1.29$, $p_{rep} = .94$, which suggests that articulation rate accounts for the difference in span between these two sets. But contrary to what Bavelier et al. imply, this does *not* show that our stimuli are more phonologically similar. Phonological similarity and articulation rate are separate factors.

Might phonological similarity nevertheless contribute to the difference between their results and ours? Perhaps. Our stimulus set is indeed more phonologically similar, though not by much. (In our stimuli, vowel sounds are shared by *F*, *S*, and *X*; by *B* and *V*; and by *H* and *K*. In the stimuli used by Bavelier et al., vowel sounds are shared by *M* and *S*, by *G* and *P*, and by *H* and *K*.) But this misses the point. The real question is not how one set of English stimuli compares with another, but how English compares with ASL.

Could the equal spans for English and ASL that we found (Wilson & Emmorey, 2006) be explained by failure to match phonological similarity? This is possible, but Bavelier et al. have provided no evidence that speaks to this question. Our data still stand as the best comparison to date between ASL and English.

Finally, we address the four- to six-item limit on ASL span. We agree that speech can yield higher spans, but this is of little theoretical interest. Instead, these higher spans are attributable to the well-understood factor of articulation rate, for which speech holds an enormous advantage. We conclude that known factors account for differences in span, and that there is no residual difference when these factors are controlled.

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TABLE 1

Articulation Rate for Various Letter Sets, Compared With Span and Wechsler Adult Intelligence Scale (WAIS) Score for Those Sets

Stimulus set	Span (longest sequence)	WAIS score (total sequences)	Articulation rate (items per second)
Wilson and Emmorey (2006)			
English (*B*, *F*, *H*, *K*, *L*, *R*, *S*, *V*, *X*)	5.6	8.1	4.5
ASL (*B*, *F*, *H*, *K*, *L*, *R*, *S*, *V*, *X*)	5.3	8.3	4.4
Bavelier et al. (2006)			
English (*G*, *P*, *M*, *Y*, *S*, *L*, *R*, *K*, *H*)	6.8	10.3	5.5
Boutla et al. (2004)			
ASL (*B*, *C*, *D*, *F*, *G*, *K*, *L*, *N*, *S*)	4.4	—	4.5

Note. Articulation rate was measured using sequences of 4 to 6 letters because this is the critical range in which subjects failed with the letter sets used in earlier experiments (Wilson & Emmorey, 2006; Boutla, Supalla, Newport, & Bavelier, 2004), but succeeded with the new letter set introduced by Bavelier, Newport, Hall, Supalla, and Boutla (2006, this issue). Subjects were hearing native signers who repeated each sequence rapidly after familiarization. Duration for American Sign Language (ASL) was measured from when the first letter was fully formed to when the last letter was fully formed. Span and WAIS scores are taken from previous publications.

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