Letter to the Editor

Sex difference in language lateralization may be task-dependent

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Sir,

It has been proposed that language is more strongly lateraled in males than in females. Recent imaging studies, however, have yielded a variety of apparently contradictory observations. A meta-analysis by Sommer et al. (2004) has provided us with an up-to-date collection of 24 studies in which language-related activity was assessed with functional imaging techniques in healthy subjects. By combining 14 studies with sufficient data, which employed a variety of language tasks, Sommer and colleagues concluded that ‘sex difference in language lateralization may be absent at the population level’. They further suggested that ‘sex difference in language lateralization may be observed only with some, as yet not defined, language tasks’, because they ‘found no support for’ the hypothesis that ‘sex differences in language lateralization may be task-dependent’. In our previous review of this topic (Kansaku and Kitazawa, 2001), we suggested, on the contrary, that sex differences in language lateralization are task-dependent, and drew attention to the fact that studies that employed passive listening to stories found clear sex-based differences (Kansaku et al., 2000; Phillips et al., 2001). Although Sommer and colleagues referred to our study (Kansaku and Kitazawa, 2001), we believe that the authors were not entirely accurate in their interpretation of our paper.

Sommer et al. (2004) stated that ‘Kansaku and Kitazawa (2001) suggested that only tasks that present real words instead of non-words elicit a sex difference’. This is incorrect because, in fact, we stated the opposite, as follows. ‘To summarize, during word language tasks, sex differences were found in the inferior frontal gyrus when the subjects performed phonological (Shaywitz et al., 1995; Pugh et al., 1996) or syntax (Jaeger et al., 1998) tasks that could be applied to nonsense words. On the other hand, no sex differences were observed when the subjects were given word language tasks that were intrinsically semantic and applied exclusively to real words, not to nonsense words’.

We pointed out in our previous review article (Kansaku and Kitazawa, 2001) that semantic processing of individual words does not elicit sex differences in language lateralization (e.g. Frost et al., 1999). We suggested that ‘story listening’, which includes less time-demanding processing of global structure, such as a whole sentence or sentences, may lead to sex differences (Kansaku et al., 2000; Phillips et al., 2001). These two statements are supported by Table 1 in Sommer et al. (2004), in which these authors listed 12 studies that employed ‘semantic decision’ as a language task. Of these studies, 10 are listed as reporting no sex difference in language lateralization. Of the remaining two studies, one (Gur et al., 2000) that used a verbal analogy task did not report sex differences, according to the author (personal communication with Dr Gur), and the other was excluded from the meta-analysis of Sommer and colleagues owing to insufficient data (Baxter et al., 2003). By contrast, both of the studies that employed story listening reported sex differences, with the largest (d = 1.76; Phillips et al., 2001) and the third-largest (d = 1.01; Kansaku et al., 2000) effects among the 14 studies. Comparison of the magnitudes of the effects among the story listening tasks (n = 2) and other types of task (n = 12) yielded a significant difference (P = 0.044, Wilcoxon rank-sum test). These observations would appear to contradict the statement in Sommer et al. (2004) that ‘inspection of the data listed in Table 1 revealed no clusters of positive findings with a certain type of language task’ (page 1848, lines 6–8).

In addition, Cohen’s d for story listening tasks seems to have been underestimated. In our calculation, Cohen’s d for
Kansaku et al. (2000) should be 1.77 [95% confidence interval (CI), 1.01–2.52] instead of 1.01 (0.2–1.8) reported in Sommer et al. (2004). Our calculation is based on the difference between activation in the left and right temporal gyri of men (mean ± SD, 12.5 ± 7.3 ml; n = 16) and women (0.36 ± 6.4 ml; n = 14), as shown in Fig. 4b in Kansaku et al. (2000). As for Phillips et al. (2001), Cohen’s d would be as large as 3.0 when calculated from the asymmetry index for men (mean ± SD, 0.58 ± 0.17) and women (0.03 ± 0.20), which is much greater than the value (1.7) listed in Table 1 in Sommer et al. (2004).

Using the correct Cohen’s d for our study (1.77 rather than 1.01), the moderator analysis yields a significant difference between semantic decision tasks (k = 6, n = 254, d = 0.05; 95% CI, −0.20–0.31) and story listening tasks (k = 2, n = 50, d = 1.77; CI, 0.82–2.72). This supports the view that the sex difference in language lateralization is task-dependent; that is, word-based semantic tasks yield little or no sex difference, whereas story listening tasks do.

Regardless of the aforementioned argument, we do not need an elaborate moderate analysis to support the hypothesis that there are sex differences in language lateralization, because it may be sufficient to draw attention to the fact that two independent studies (Kansaku et al., 2000; Phillips et al., 2001), using different stories (essays versus an exciting novel) in different languages (Japanese versus English), reported similar sex differences during story listening, with a high level of statistical significance (P < 0.001). Sommer et al. (2004) stated in their abstract that ‘the putative sex difference in language lateralization . . . may be observed only with some, as yet not defined, language tasks’. In our view, ‘story listening’ is a task that is defined sufficiently clearly.

If we further replace Cohen’s d value in Phillips et al. (2001) with 3.0 instead of 1.7, Sommer et al.’s (2004) main conclusion would appear to be invalid. The mean weighted d value increases from 0.21 to 0.27, making the 95% CI (0.01–0.54) fall within a positive range. However, we wish to stress that we would not conclude from this that a sex difference in language lateralization is generally supported. On the contrary, we wish to emphasize the importance of taking into account differences among behavioural tasks whenever sex differences in language lateralization are considered. This allows us to address a fundamentally important question: why is listening to stories processed differently between the sexes, whereas word-based tasks (dealing with single-word semantics) elicit left-dominant activity in both sexes? We believe that the question might be answered, at least in part, in terms of the time-demand relative to the interhemispheric conduction delay (Ringo et al., 1994), as we have discussed previously (Kansaku and Kitazawa, 2001).

References