The neural basis of action understanding is a hotly debated issue. The mirror neuron account promoted by Rizzolatti and colleagues holds that motor simulation in fronto-parietal circuits is critical to action understanding including speech comprehension, while others emphasize the ventral stream in the temporal lobe. Evidence from speech strongly supports the ventral stream account, but on the other hand, evidence from manual gesture comprehension (e.g., in limb apraxia) has led to contradictory findings. Here we present a lesion analysis of sign language comprehension in life long deaf signers with focal lesions. Sign language is an excellent model for studying mirror system function in that it bridges the gap between the visual-manual system in which mirror neurons are best characterized and language systems which have represented a theoretical target of mirror neuron research. As part of a large sign aphasia research program, sign comprehension was assessed in a group of 34 deaf, life-long signers with left or right focal brain injury by asking subjects to follow a set of commands adapted from the Boston Diagnostic Aphasia Examination (e.g., “point to the ceiling”). This task was part of a larger language and spatial cognitive assessment battery. Lesions were transferred to a common space using the MAP-3 method. Subjects were excluded if the lesions were bilateral, unmappable, if available scans were acute, or behavioral assessment occurred less the 3 months post stroke. This resulted in a set of 14 left (LHD) and 10 right hemisphere (RHD) damaged subjects. The RHD group was used as a behavioral control group. Two analyses were conducted on the LHD cases. The first partitioned the set of 14 subjects into those within 1 s.d. of the RHD mean (n=4) and those more than 2 s.d. below the RHD mean (n=6) and then compared lesion maps of these two groups. The second partitioned the subjects on the basis of lesion location: those with fronto-parietal but minimal temporal lobe involvement (n=6) and those with substantial temporal lobe involvement (n=4). Both analyses suggest that left frontal damage is not associated with significant deficits in sign language comprehension and point instead to a more temporal or temporal-parietal focus (Figure 1). Behavioral performance of patients with lesions involving the left frontal cortex was comparable to control (RHD) participants (Figure 2). We conclude that the mirror system does not seem to be a critical site for action understanding in the form of sign language comprehension.
Figure 1. Lesion subtraction maps (abnormal - normal), where abnormal is defined as 2 s.d. below the control mean and normal as within 1 s.d. of the control mean. Darker reds and black are regions more strongly associated with comprehension deficits, whereas blue regions are not associated with comprehension deficits.

Figure 1. A. Lesion overlap map for patients with lesions affecting frontal cortex but with minimal posterior temporal lobe involvement. B. Sign language comprehension score (max=16) in RHD, left frontal, and left temporal/temporal-parietal lesioned deaf signers.