

The effect of posture and inter-manual distance on audio-tactile interaction: a developmental study

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The Crossed-Hands Deficit (CHD)—a performance cost in spatial localization tasks when hands are crossed—stems from conflicts between body-centered and external reference frames. While this phenomenon is well-established, the role of inter-manual distance and its interaction with posture in shaping audio-tactile integration remains largely unexplored, particularly from a developmental perspective. In this study, adults ($n = 12$) and children aged 6 to 15 ($n = 24$) performed an auditory localization task where target sounds were delivered on each hand, either alone or paired with a synchronous tactile stimulus (either on the same hand or the opposite hand). The task was carried out across different postures (crossed vs. uncrossed) and hand distances (close, medium, far).

Results revealed that the CHD affected both children and adults but manifested differently across age groups. Adults showed performance costs primarily in the close-hand condition, suggesting an ability to use spatial distance to resolve reference frame conflicts. In contrast, children exhibited a more generalized deficit, with performance impaired by hand crossing regardless of distance. This pattern was especially pronounced in younger children, who displayed reduced accuracy in crossed conditions and heightened sensitivity to incongruent tactile cues. Crucially, younger children resulted incapable of localizing a sound presented solo when their hands were crossed, suggesting that audio-proprioceptive integration is still immature and congruent tactile information necessary to perform the task. These findings highlight the developmental trajectory of multisensory spatial processing and introduce inter-manual distance as a critical, yet previously underexamined, factor in resolving cross-modal spatial conflicts.

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