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Mirror (a)symmetry?

Smorenburg, A.R.P.

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Abstract

The work presented in this thesis aimed to get more insight into the previously reported positive effects of mirror visual feedback in children with spastic hemiparetic cerebral palsy (SHCP) and into visuo-proprioceptive interactions in children and adolescents with SHCP during goal-directed matching tasks. Individuals with SHCP have unilateral motor impairments that hamper them in accurate movement performance. In conjunction with the motor problems, these individuals experience sensory problems. The first study in this thesis (chapter two) found that mirror visual feedback of the impaired arm in SHCP led to significantly higher levels of neuromuscular activity than mirror visual feedback of the less-impaired arm. This indicates that the mirror-effect was not just caused by the illusory perception of symmetry between two limbs, and confirmed that the beneficial effect is dependent on mirror visual feedback of the less-impaired arm. In chapter three and four it was demonstrated that the ability of children with SHCP to match one (matching) hand with the position of the other (reference) hand, without visual information, is deteriorated when compared to typically developing children. However, if visual information of the static reference arm was available to the participants, the matching accuracy of the matching hand was significantly higher. Mirror visual feedback of the reference arm, generated by placing a mirror in between the arms in the sagittal plane, created the illusion that both hands were already at the endpoint. However, this did not impact upon the matching accuracy of the matching arm and resulted in similar error scores as regular feedback of the reference arm. Chapter five showed that moving the less-impaired arm in synchrony with the impaired arm resulted in higher matching accuracy than moving the impaired arm alone. Moreover, mirror visual feedback of the less-impaired arm improved matching accuracy for a subset of the participants. The effects of a short practice of a bimanual matching task with (mirror) visual feedback of the less-impaired arm on matching accuracy of the impaired arm was studied in chapter six. The results showed a higher matching accuracy of the impaired arm after the practice period. However, the role of the mirror is still inconclusive in this respect. From this it can be concluded that for individuals with SHCP practice of a matching movement with visual feedback can improve proprioceptive control of movement. Taken together, the work in this thesis showed that the deficit in position sense of the impaired arm in individuals with SHCP can be modified by visual feedback of the less-impaired arm. Although the role of mirror visual feedback is still inconclusive, it seems that motor learning might induce a transfer from visual to proprioceptive control of movement, which can have implications for therapy.