In developed countries, the incidence of cerebral palsy (CP) is stable at about 2–2.5 per 1,000 live births (Lin, 2003). Although the risk of CP is greater in premature babies, at 5-80 per 1,000 live births, the majority of cases of CP are full term babies. CP can cause movement problems that range from mild to severe and in some cases can have a significant impact on an individual’s functional independence. Despite the frequent occurrence of CP in the western world, the understanding of the neuropathophysiology and motor system dysfunctions of CP remains limited.

An important step further into neuropathophysiology and the discovery of mechanisms of recovery after cerebral palsy might be provided by modern brain imaging techniques (Thirumala et al., 2002; Palmer, 2004). These techniques are suitable to identify areas, pathways, and mechanisms involved in motor recovery in CP, as well as in establishing the effects of different rehabilitation regimes on changes in the brain. When used in combination with clinical examinations, neuroimaging studies could improve diagnosis and management, and provide insights into the mechanisms of brain plasticity (Accardo, Kammann, & Hoon, 2004; Chen, Cohen, & Hallet, 2002). To date, the challenge in this field is to select the appropriate neuroimaging technique that helps improve diagnosis and management of childhood neurodevelopmental disorders (Hoon & Melhem, 2000; Russ & Hand, 2004).

With respect to motor system dysfunctions in CP, there is still a void in research on the particulars of the movement deviations associated with CP. For example, to establish the status of the (impaired) hand function several dexterity tests, such as the Purdue pegboard (Tiffin, 1968) and box and block test (Mathiowetz et al., 1985) are available. Typically, these tests have movement duration, or the number of task-items performed within a certain time limit, as their main outcome variable. Although informative and easily administered in a clinical setting, these tests do not provide sufficient information to set up a guided rehabilitation program. Also, the processes responsible for an impaired hand function or the adaptive strategies that might be employed by the participant to perform the different test items cannot be uncovered by these tests. As such, these tests have a limited value for intervention as they do not inform us on the specific motor system dysfunctions in CP. It is therefore vital that we explore movement solutions and modes of intervention in CP by taking account of the context, the task, and the individual. Research at

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both the neuropathophysiology and behavioral level must be considered to advance our understanding of movement deviations in CP and the impact of rehabilitation. In addition, the study of individuals with movement disorders provides a unique opportunity to test the explanatory power of existing models of motor control under boundary conditions.

The six articles that constitute this special issue of *Motor Control* dealing with cerebral palsy are aimed at uncovering the specific motor dysfunctions in CP. All of the papers report behavioral research on movement deviations in CP, with special emphasis on adaptive strategies, underlying processes, and learning potential.

With respect to the adaptive strategies, the first (Ricken et al.), second (Van Roon et al.), and third (Volman) papers address possible adaptive strategies during upper limb control in CP. Ricken et al. examined the coordination of the impaired and non-impaired arm during reaching to a stationary and moving ball. They showed that children were able to make successful interceptions when using the impaired arm, although coordination of the impaired arm was different from that of the non-impaired arm. Movements performed with the impaired arm were slower, displayed smaller elbow and shoulder excursions, and had a larger trunk involvement. Despite this altered coordination pattern, or possibly because of it, movements were performed with equal success among both hands, signifying adaptive strategies to cope with the altered functional properties of the impaired limb. In the second paper, Van Roon et al. examined whether increased visual monitoring of the impaired limb is an adaptive strategy for accuracy containment in tetraparetic participants. To that end, they had participants perform large amplitude drawing movements on a digitizing tablet, while, in some conditions, the availability of visual information of the moving limb was blocked. Unexpectedly, when visual information was not available, movement accuracy decreased to a similar degree in both tetraparetic participants and in healthy controls. The study also found, however, that tetraparetic participants increased movement duration and pen pressure. This could indicate adaptive strategies to cope with the lack of visual information. Hence, similar to Ricken et al., it is clear that these participants employ adaptive strategies that ensure, or increase the chance for, successful task performance. In the third paper, by Volman, accommodation between both limbs was examined in a bimanual rhythmic drawing task in which both spatial and temporal congruency were manipulated. Although movements of the impaired arm were slower, less fluent, and temporally more variable, no clear tendency was found for one hand leading the other under the different task constraints imposed. Form incongruence resulted in accommodation of both affected and non-affected arm in a similar way as in non-disabled participants, suggesting that planning aspects are not affected. Amplitude incongruence, however, resulted in accommodation of either the affected arm (large circles required) or non-affected arm (small circles required), and to an increase or decrease of temporal variability of the affected arm. Based on these findings, Volman concludes that aspects of movement execution, but not aspects of movement planning, are affected in hemiparesis.

The fourth (Te Velde et al.) and fifth (Mutsaarts et al.) articles address the underlying processes for deviations in upper limb movements, with special emphasis on planning and control processes. The article by Te Velde et al. examined whether planning and control deficits in CP were associated with left or right hemisphere damage. In two experiments, collision avoidance in a road crossing simulation task
was studied in children with hemiparesis and age-matched controls. Children had to push a doll across a scale-sized road between two successively approaching toy vehicles. When using the preferred hand, participants with hemiparesis collided more often with the toy vehicles compared to controls. In addition, children with left hemisphere damage initiated their movement later than children with damage to the right hemisphere. When using the non-preferred hand, differences in velocity control among children with left and right hemisphere damage were found. The authors conclude that deficits in planning are associated with left hemisphere damage, whereas the relationship between right hemisphere damage and control deficits could not be confirmed by their findings.

In the fifth article, by Mutsaarts et al., anticipatory planning during complex object manipulation was studied. Participants had to grasp a hexagonal knob using one of five possible grasping patterns as quickly as possible following a starting cue and were shown to anticipate the comfort of the different grasping patterns before movement onset, as controls did. If, however, they had to rotate the knob 60° or 120° clockwise or counterclockwise after grasping, participants with hemiparetic cerebral palsy did not complete their planning processes before movement onset, which was contrary to controls. Based on these findings, the authors conclude that participants with hemiparesis might use a step-by-step planning strategy, in which the latter parts of a movement sequence are planning during movement execution.

In the final article, by Ledebt et al., the learning potential of children with hemiplegic CP was examined. In a clinical training study, balance control as prerequisite for independent walking was studied. Specifically, the aim was to examine the effects of balance training with visual feedback on stance and gait in school-age children with congenital hemiplegia. The children received three training sessions per week during six weeks. Not only was performance improved on the tasks that were trained, but more importantly, the walking pattern became more symmetrical following training. The authors conclude that balance training might be successfully used in children with hemiplegia to improve symmetry in standing and walking.

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