

1. INTRODUCTION

Some real-world dual-task situations are rather trivial, like chewing gum while walking or doing chores while thinking. Others are more demanding, like standing in a subway and trying not to miss the stop while talking with a friend, or reading a map while crossing a busy street. A common feature of these activities is that they comprise a sensorimotor component. Performing a sensorimotor task (e.g., standing or walking) simultaneously with a cognitive task (e.g., talking or reading) is a very common activity in everyday life. But how do people handle these or similar dual-task situations? This question gave rise to the empirical investigation in the present dissertation.

One could expect, for instance, that such highly practiced tasks as walking or keeping an upright posture are not demanding at all and, thus, can be perfectly performed in combination with other tasks. However, the available research shows that this is not the case, especially in old age. Why do individuals experience problems with sensorimotor tasks as they get older? Sensorimotor performance is based on humans' ability to keep the body's equilibrium. As a simple act of standing quietly involves processing and coordination of input from vestibular, visual, somatosensory, and motor systems, balance is viewed as a multi-component phenomenon (Woollacott, 2000). The age-specific development in the balance system leads to decreased sensory input, on the one hand, and decrement in efficiency with which the available input is processed, on the other hand. Thus, in situations where cognitive processing capacity or mental resources have to be divided, as in multi-task conditions, older adults show increased difficulties performing a cognitive and a sensorimotor task simultaneously. This difficulty is reflected in larger decrement in performance of older adults compared to their young counterparts. The question arises then how do older individuals manage concurrent performances of sensorimotor and cognitive tasks?

Everyday life observation suggests that older individuals focus their effort more on the sensorimotor than on the cognitive component of a multi-task situation. For example, they stop talking while descending stairs or when they approach the end of an escalator and get ready for stepping off. Why do they set their priorities this way? Several explanations are possible: First, older adults experience larger resource-limitations than young individuals do and are pressurized to select the most important domain(s) of functioning in order to successfully manage their lives. As falls can have dramatic consequences especially in old age, motor control (as in walking or balancing) gains importance and

prioritization of a sensorimotor task in a multi-task situation is more typical later in life. Although older adults can talk and walk simultaneously, they stop talking if they have to navigate around obstacles, that is, in a challenging situation in which resources are extremely taxed. An alternative explanation might be that the efficiency and the flexibility with which individuals budget their limited resources decrease in old age. If older adults were less flexible in the redeployment of their resources, they might choose a conservative strategy and always focus on one task in situations that demand division of mental resources. Alternatively, constraints on resource budgeting might be more typical for sensorimotor than for cognitive functions because motor control can be achieved in the absence of awareness. Furthermore, regardless of the individuals' age, a natural tendency to avoid losses and the lifelong experience with such tasks as walking or keeping upright posture should lead to a robust behavioral pattern in terms of prioritization of one's stability. Combinations of those factors – limited resources, decreased general and domain-specific efficiency – are also plausible accounts.

These considerations can be condensed into the following research questions: How do young and older adults set their priorities, that is, allocate their mental resources in a dual-task situation that involves a cognitive and a sensorimotor component? Can individuals deliberately control the resource allocation? Do young and older adults differ in this respect?

To approach these issues, the present study exploits the theoretical framework of the developmental perspective in general and the selection, optimization, and compensation model (SOC; P. B. Baltes & Baltes, 1990) specifically. The cognitive perspective, in terms of the resource theories (Kahneman, 1973; Navon & Gopher, 1979; Norman & Bobrow, 1975) provided an additional theoretical background and experimental techniques for the current research.