



## Relationship between plasticity, mild cognitive impairment and cognitive decline

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### Abstract

A topic of great interest in gerontology research is the prediction of cognitive deterioration which marks the transition from mild cognitive impairment (MCI) to dementia. In this area the term *plasticity* is a construct of prime importance. Previous studies have demonstrated the existence of plasticity in healthy older persons, and it is thought that this is what discriminates between healthy individuals and those at risk for dementia. The aim of the present study is to demonstrate that plasticity exists in persons with MCI, and that a lack of plasticity may be one of the risk factors related to cognitive decline. An adapted version of the Auditory Verbal Learning Test—the AVLT of Learning Potential—was used to assess plasticity. Participants in the research were 203 older persons whose cognitive status had previously been determined using a cognitive screening test. The results show that plasticity exists in persons with MCI and that its presence is associated with less marked cognitive decline.

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### 1. Introduction

For some time the evolution of cognitive status in the older persons was considered to reflect a universal, cumulative process of decline. In the 1970s, dissatisfaction with this limited point of view led to research into plasticity (developmental reserve capacity) and to the search for evidence that the process is in fact multidimensional and multidirectional, with many different individual trajectories (Baltes, 1987).

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In this new conception of cognitive evolution in older persons, the distinction between performance (a person's present state of ability) and plasticity (potential for performance to improve) has acquired great importance. This concept reflects a far more optimistic and interventionist view about older persons (Baltes & Willis, 1982).

Initially, different research groups focussed on demonstrating the *existence of cognitive plasticity* in older persons (refer to Verhaeghen's meta-analysis, 2000). Later, attention turned to establishing the *limits of plasticity* (i.e., Willis & Schaie, 1986), while the most recent studies have investigated *individual differences in plasticity*. With regard to this third objective, studies by Baltes and colleagues (Baltes & Baltes, 1997; Baltes & Kühl, 1995; Baltes, Kühl, & Sowarka, 1992) show significant differences in plasticity between older persons at risk for dementia and healthy older persons. Their analysis leads them to conclude that the ability to learn is disproportionately reduced in persons with, or at risk for, dementia. Consequently, several studies by these authors have been concerned with establishing and investigating the discriminatory power of techniques that evaluate plasticity with regard to the risk of dementia (Baltes & Raykov, 1996; Raykov, Baltes, Neher, & Sowarka, 2002). Although these results found by Baltes and colleagues, other authors (Bäckman, 1996; Heun, Burkart, & Benker, 1997a, 1997b) have shown that under certain circumstances, persons with MCI or even dementia are able to learn, as documented by the presence of plasticity.

These conclusions are particularly interesting in the light of recent studies that document the relationship between age and dementia. For example, *The Berlin Aging Study* (Baltes & Ulrich Mayer, 1999) finds that at 70 years of age, only 17% of older persons show cognitive deterioration, while at 90 years of age, 50% of the subjects show cognitive deterioration. This effect of age is compounded by the fact that older persons with mild cognitive deterioration (MCI) often develop dementia in only a few years (Collie & Maruff, 2000; Petersen, 2000; Ritchie & Touchon, 2000). In this context, many studies have focused on analyzing the characteristics of older persons with MCI in order to identify factors that contribute to their decline, and to develop techniques which might permit the early diagnosis of MCI as a way to forestall the severe losses due to dementia (Bozoki, Giordani, Heidebrink, Berent, & Foster, 2001; Collie & Maruff, 2000; Shah, Tangalos, & Petersen, 2000).

The basic aim of the present study is to show that plasticity is not directly related to mild cognitive deterioration. This implies that some older persons with MCI would be expected to show significant learning similar to that displayed by persons without MCI in a test of plasticity. It is hoped that the present report will shed light on the relationship between plasticity and cognitive deterioration, since in our view this variable may constitute a useful prognostic indicator to predict the course of cognitive decline. We therefore followed part of the initial sample of participants to determine their cognitive status 1 and 2 years after training, to determine how cognitive status is related with the presence or absence of plasticity in the initial part of the study.

Of the various techniques for assessing plasticity, we chose a version of the Auditory Verbal Learning Test of Learning Potential (AVLT-LP). This choice was informed by research that suggested a possible relationship between declining performance in semantic memory tests and rapid cognitive deterioration (Bozoki et al., 2001; Petersen et al., 1994, 1997). Moreover, the AVLT-LP has been shown to be valid as a tool to evaluate plasticity in older persons and in other populations (Wiedl, Schöttke, & Calero, 2001; Wiedl, Wienobst, & Schöttke, 1999).

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