Dissociation between numerosity and duration processing in aging and early Parkinson disease

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Abstract

Numerosity and duration processing were shown to be underlain by a single representational mechanism, namely an accumulator, and to rely on a common cerebral network located principally in areas around the right intraparietal sulcus. Several neuropsychological studies have reported impairments of temporal estimation in patients with Parkinson disease (PD; e.g., Pastor et al., 1992), whereas non-symbolic numerical estimation has never been explored in this population. Moreover, aging seems to be a factor influencing performance in both numerical and temporal estimation, as declining performance with age was reported in duration production tasks (e.g., Baudouin et al., 2006) and in counting or arithmetical tasks (e.g., Li et al., 2010; Duverne & Lemaire, 2005). However, the effect of aging on non-symbolic numerical comparison capacities has never been investigated.

Here, we investigated for the first time both numerical and temporal estimation abilities in three groups of participants: healthy young adults, healthy old adults and non-demented PD patients, who had to compare either the numerosity of flashed dot sequences or the duration of single dot displays.

First, the results demonstrate an effect of aging on duration comparison, healthy old participants making more errors than young participants. Secondly, performance of PD patients on this duration task was worse than the one of the healthy old group. Importantly, no difference was found between the three groups for numerosity comparison.

This dissociation suggests the existence of distinct mechanisms and/or representations for temporal and numerosity processing, and support the idea that partly independent systems underlie the processing of these magnitudes.

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