## MRI patterns of cerebral atrophy in dementia

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# 8 English Summary

The goal of this thesis has been the data-mining of structural *in vivo* brain MRI data of patients with dementia in order to identify key neuroanatomical locations. The uniqueness of this approach has been the absence of a priori hypotheses about these locations. The proposed algorithm (voxel-based morphometry - VBM) identified key brain structures which atrophy in dementia.

In the **introduction** a brief background of the dementias, and in more detail Alzheimer's disease (AD), is provided. Furthermore, a historical account of the role of imaging in dementia is presented: the shift from an exclusionary to an inclusionary approach. Additionally, the algorithms used in this thesis are introduced and their building blocks explained.

**Chapter 2** focuses on a comparison between a group of patients with AD and a group of healthy elderly controls (HECs). Known anatomical locations involved in dementia are identified, i.e. medial temporal lobe (MTL), but atrophy spreading further out is also noticed: atrophy of the thalamus and caudate nucleus and cortex with sparing of the sensorimotor strip and the occipital cortex.

**Chapter 3** deals with the concept of mild cognitive impairment (MCI) and in doing so compares three groups: one group of patients with MCI, one group with AD and one group of HECs. The striking finding was the ´inverted lateralization´ concept: MCI patients had right-sided cerebral atrophy compared to controls while AD patients had left-sided cerebral atrophy. The implications of inverted lateralization are discussed and further expanded in the discussion section. Moreover, thalamic atrophy was found to have a pivotal role in the continuum HEC - MCI - AD.

**Chapter 4** goes deeper into the concept of MCI and examines a group of MCI patients for a period of three years. At the end of that period the

patients who converted to AD were compared to the patients who did not yet convert to AD. It is there found that these two groups already differed at baseline in the sense that spread of atrophy beyond the MTL towards the lateral temporal and parietal cortex were already present in the converters.

In **chapter 5** we attempt to describe patients with the early-onset form of AD. We were surprised to find that the structure distinguishing the two groups was not the hippocampus but the precuneus. Precuneus atrophy was associated with biparietal atrophy but not with hippocampal atrophy and the patients with precuneus atrophy were characterized by visuospatial deficits.

**Chapter 6** analyzes the relationship between patients with AD and patients with dementia with Lewy bodies (DLB). We found relative absence of hippocampal atrophy in DLB compared to AD, unfortunately not all AD patients are characterized by hippocampal atrophy at the early stage, thereby reducing the practical use of such a finding.

In the **discussion chapter** we examine the isolated findings from the various chapters and attempt to bring them in concert. Afterwards we give an account of possible drawbacks of the algorithms used in this thesis. Computer-aided diagnostic (CAD) systems are discussed and eventually we hint towards future directions in the field.