

# Visuospatial inattention and processing speed: Predictors of long-term outcome and patterns of change after ischemic stroke

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Avhandlingen för avläggande av filosofie doktorsexamen i psykologi, som med vederbörligt tillstånd av samhällsvetenskapliga fakultetsstyrelsen vid Göteborgs universitet kommer att offentligas försvaras fredagen den 29 november 2019, klockan 10.00 i sal F1, Psykologiska institutionen, Haraldsgatan 1, Göteborg.

Fakultetsopponent: Dr. Tom Manly, MRC Cognition and Brain Sciences Unit, University of Cambridge, UK.

Föreliggande uppsats grundar sig på följande artiklar:

- I. Gerafi, J., Samuelsson, H., Viken, J. I., Blomgren, C., Claesson, L., Kallio, S., Jern, C., Blomstrand, C., & Jood, K. (2017). Neglect and aphasia in the acute phase as predictors of functional outcome 7 years after ischemic stroke. *European Journal of Neurology*, *24*, 1407-1415.  
doi:10.1111/ene.13406
- II. Gerafi, J., Samuelsson, H., Viken, J. I., Blomgren, C., Claesson, L., Kallio, S., Jern, C., Blomstrand, C., & Jood, K. Visuospatial inattention following a left hemispheric stroke predicts long-term functional outcome. *Manuscript unpublished*.
- III. Gerafi, J., Samuelsson, H., Viken, J. I., Jern, C., Blomstrand, C., & Jood, K. (2019). The presence and prediction of lateralized inattention 7 years post-stroke. *Acta Neurologica Scandinavica*. *Manuscript accepted pending minor revision*.
- IV. Gerafi, J., Samuelsson, H., Viken, J. I., Jern, C., Blomstrand, C., & Jood, K. Patterns of change in visual processing speed after ischemic stroke: A long-term descriptive study. *Manuscript unpublished*.



# Abstract

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Gerafi, J. (2019). *Visuospatial inattention and processing speed: Predictors of long-term outcome and patterns of change after ischemic stroke*. Department of Psychology and the Stroke Research Group at the Department of Neuroscience and Physiology, the Sahlgrenska Academy, University of Gothenburg, Sweden.

Impairments of visuospatial attention, language, and processing speed (PS) are common early after stroke and have been associated with unfavorable short-term functional outcomes but little is known about this relationship in the long-term. This thesis investigates 1) the potential importance of visuospatial inattention (VSI) and language impairments (LI) as predictors of functional outcomes 7 years after an ischemic stroke (studies I-II) and 2) presence of lateralized inattention 7 years after stroke and potential predictors of this phenomenon (study III). Study IV gives a detailed description of the long-term course of PS across 3 months and 7 years after an ischemic stroke. A cohort of 375 consecutive stroke patients was assessed early after stroke for the occurrence (studies I-II and IV) and severity (studies III-IV) of VSI using the Star Cancellation Test (SCT, studies I-IV) and Letter Cancellation Test (LCT, studies III-IV). Language impairments were investigated (studies I-II) by the language item from the Scandinavian Stroke Scale (SSS). At the 7-year follow-up, functional outcomes were measured by the modified Rankin Scale (mRS), the Frenchay Activities Index (FAI) (studies I-II and IV), and the recovery item of Stroke Impact Scale (SIS) (study IV). Patients with a recurrent stroke during the follow-up period were excluded (all studies). The presence of lateralized inattention at the 7-year follow-up (study III) was assessed with the SCT, the LCT, and the neglect item from the NIH Stroke Scale (NIHSS). The long-term course of PS (study IV) was measured by a mirrored copy of the SCT with a time limit of 30 seconds, follow-up assessments of SCT, LCT, and NIHSS were also included in this study. In **study I**, 235 stroke survivors were included at the follow-up and VSI and stroke severity (SSS) were identified as the significant independent predictors of unfavorable outcomes in mRS and FAI. The early screening of LI did not provide independent prognostic information beyond the information provided by VSI and stroke severity. In **study II**, 105 individuals with left hemispheric stroke were included at the 7-year follow-up. It was found that the presence of VSI was rather common observed in about one of five patients. VSI was the most important independent predictor of unfavorable outcomes in mRS and FAI. Individuals with both VSI and LI had increased risk of poor outcome compared to those with signs of one of these symptoms. In **study III**, 188 stroke survivors were included at the 7-year follow-up and about one of ten had signs of lateralized inattention. Independent baseline predictors for these long-term signs were total omissions in target cancellations and inferior performance on visual processing speed. In **study IV**, 148 subjects were included at follow-up and impaired PS was observed in about one of three individuals at baseline with significant improvement in scores at 3 months followed by a clear decline at 7 years. It was also found that slow PS was related with inferior functional outcome at the 7-year follow-up, also after adjusting for age. Age was related with scores in PS but did not explain the scores of PS for those with lowest speed. **Conclusions:** Studies I-II emphasize the importance of identifying early symptoms of VSI not only after right hemispheric stroke but also after left hemispheric stroke and particularly for individuals with severe symptoms of LI. A combination of attention and language deficits at the acute phase seems to be rather common among patients with left hemispheric stroke and indicates an increased risk of unfavorable outcomes. Studies III-IV are the first studies to recognize PS as a significant predictor of long-term lateralized inattention and to describe changes in speed across two follow-ups up to 7 years in a stroke cohort. The results from these two studies emphasize the importance of further long-term studies of PS after stroke.

*Keywords:* visuospatial inattention, language impairment, long-term functional outcome, ischemic stroke, neglect, aphasia, lateralized inattention, processing speed

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