

Eye Movements during Reading, Review

DOC 2013, Rīga, 12.04.2013

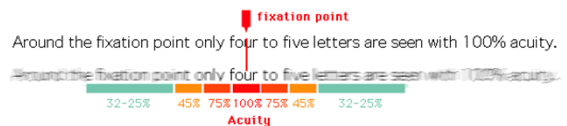
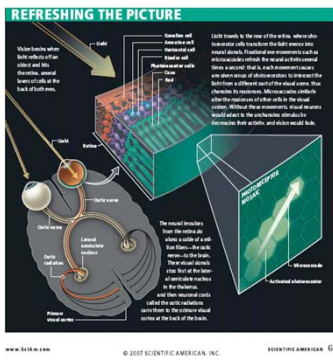
Warning!
 We will not discuss in detail neither Eye movements, nor Reading

Main element of language is a word, and a key feature of written language is its serial order. During reading we are collecting important parts of a sentence by serial shifting of our eyes. Therefore scholars are studying eye movements during reading as the tool for understanding neural processes of Visual cognition.

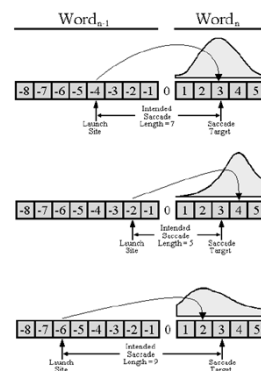
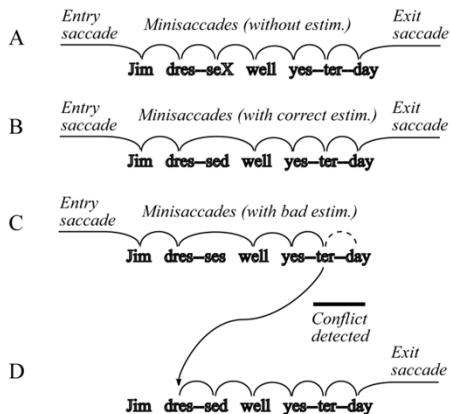
Many features of our brain function we have extracted from animal studies, e.g. Eye movement classification and its neural architecture, ore velocity of information propagation between different brain activity and motor responses.

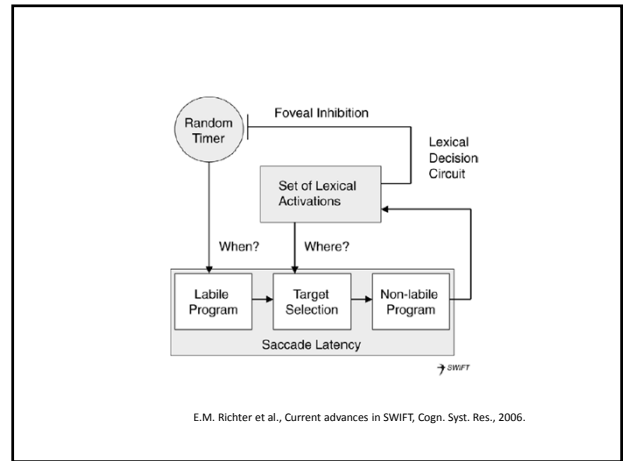
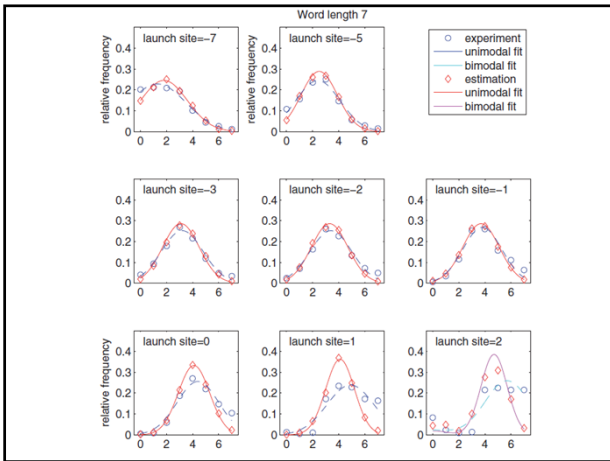
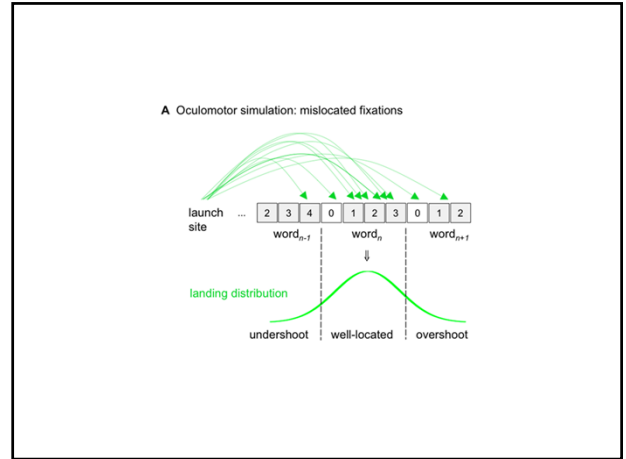
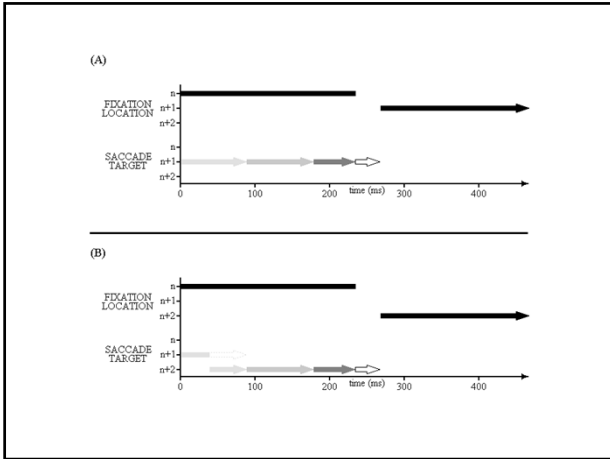
However, reading is not activity of primates!

Exactly studies of primate eye movements by David L. Sparks, Division of Neuroscience – neural substrate of saccades, Houston University, ore Douglas P. Munoz, Department of Physiology, Queen’s University, Ontario - antisaccades, ore Susana Martinez-Conde, Laboratory of Visual Neuroscience, University of Phoenix – microsaccades, and many more led up to contemporary understanding of brain function during Visual perception.



James T. Fulton Vision Concepts (www.4colorvision.com)





$$L_n = \alpha \left(1 + \beta \frac{\log f_n}{F} \right),$$

$$\epsilon_{nj}(t) = x_{nj} - k(t),$$

$$\lambda(\epsilon) = \lambda_0 \exp\left(-\frac{\epsilon^2}{2\sigma^2}\right) \quad \text{with} \quad \sigma = \begin{cases} \sigma_L & \text{if } \epsilon < 0 \\ \sigma_R & \text{if } \epsilon \geq 0 \end{cases}$$

$$\lambda_n(t) = (M_n)^{-\eta} \sum_{j=1}^{M_n} \lambda(\epsilon_{nj}(t))$$

A. Nuthman, R. Engbert, Mindless reading revised: SWIFT model, Vis. Res. 2008.

$$\frac{da_n(t)}{dt} = F_n(t)A_n(t) - \omega$$

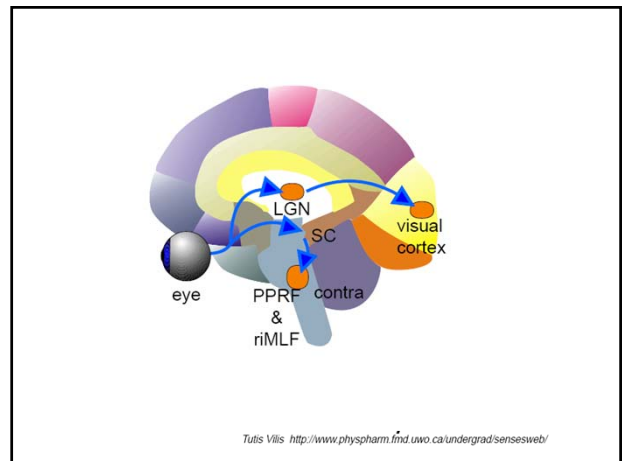
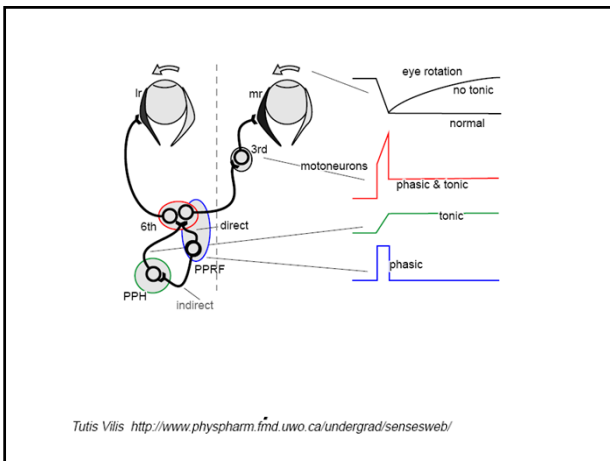
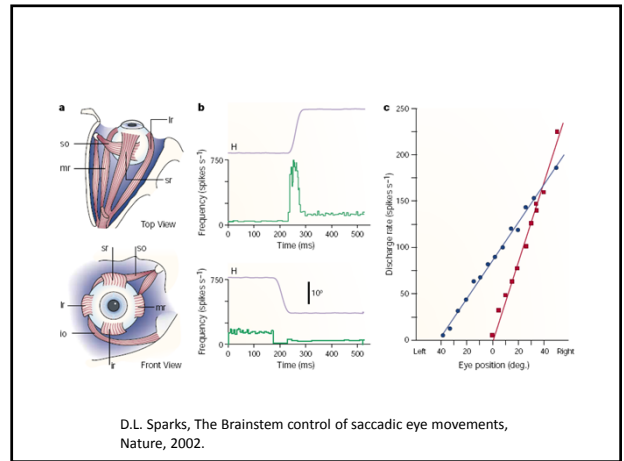
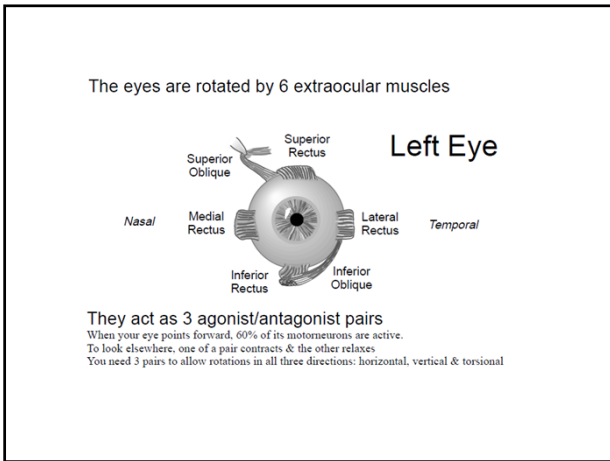
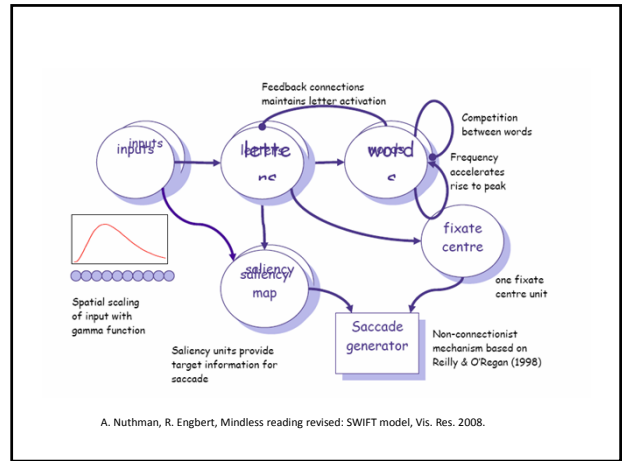
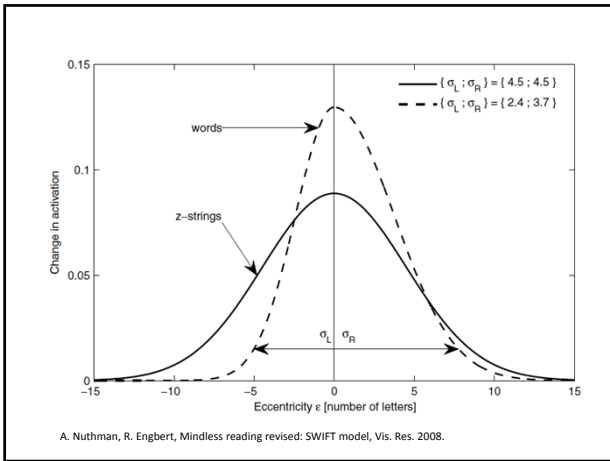
$$\pi(n, t) = \frac{a_n^i(t)}{\sum_{j=1}^N a_j^i(t)}$$

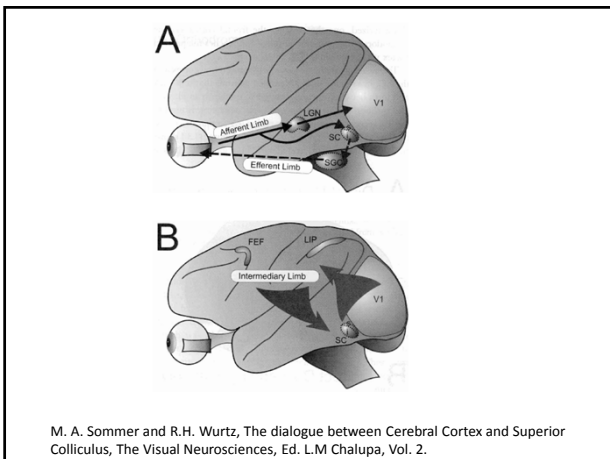
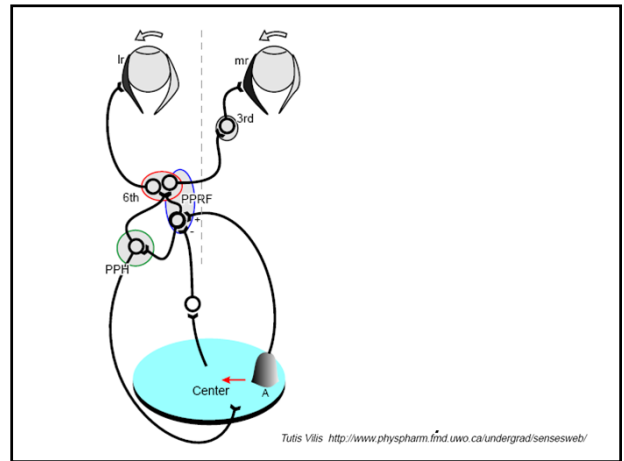
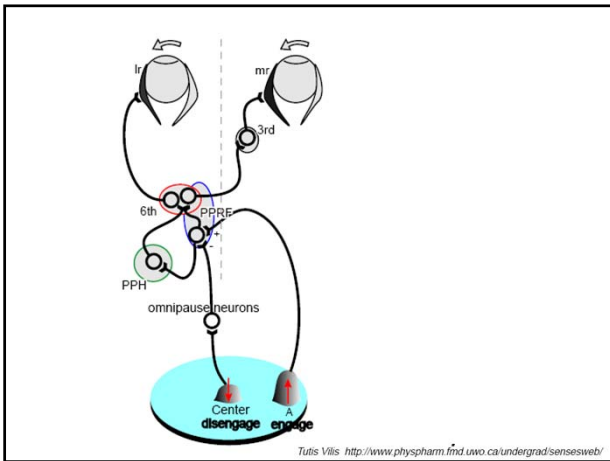
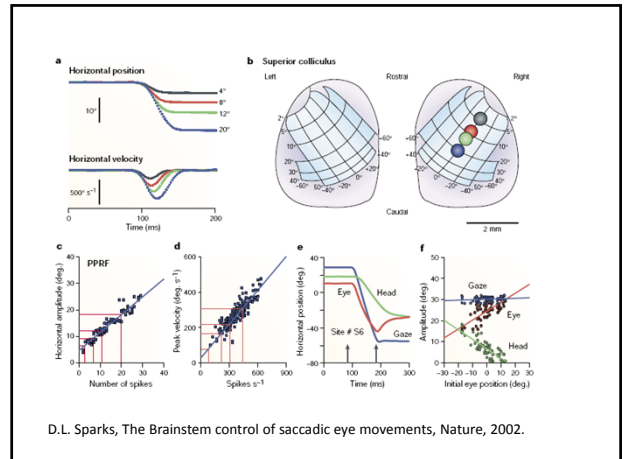
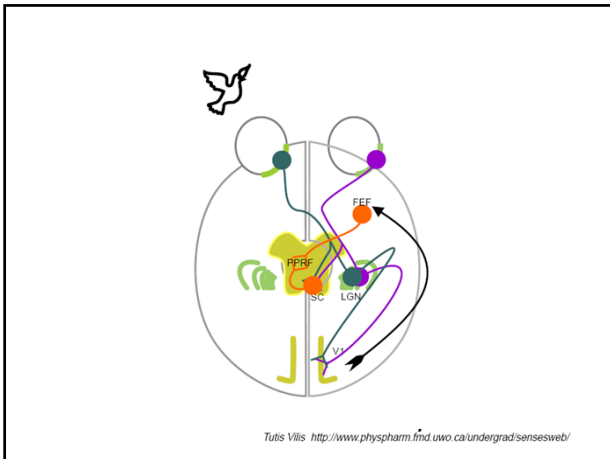
$$l = A + l_{SYS} + l_G.$$

$$l_{SYS} = \delta_{SYS}(A_0 - |A|)$$

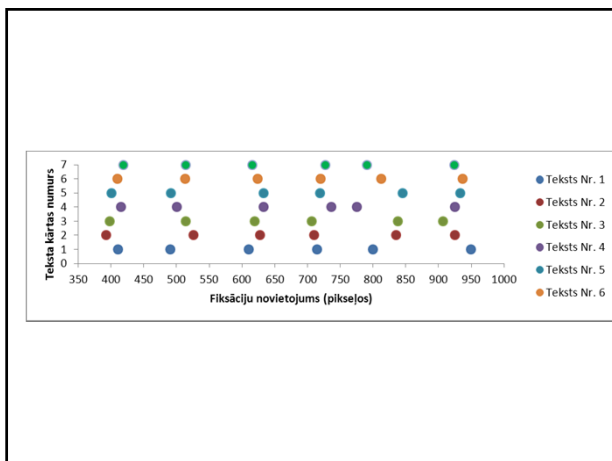
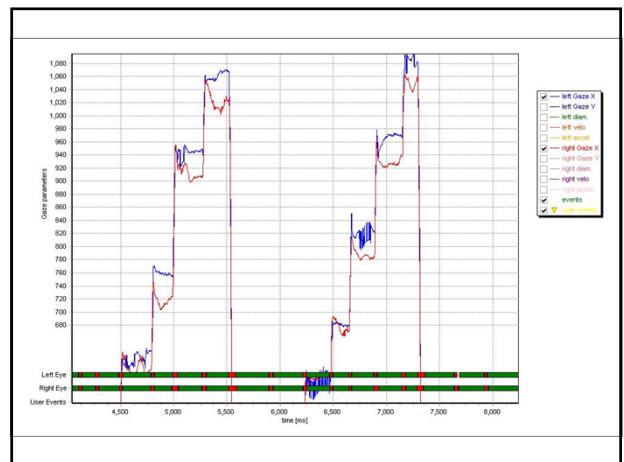
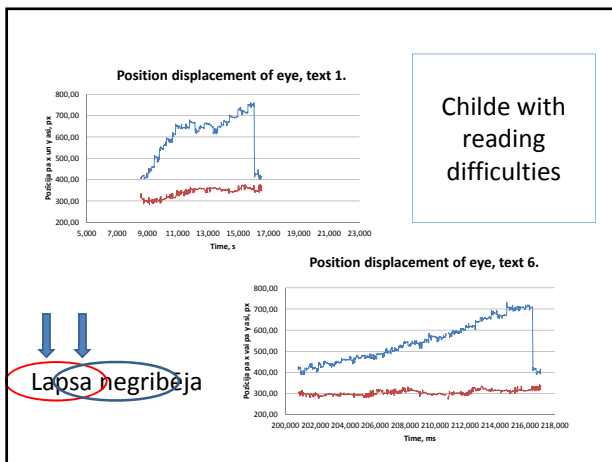
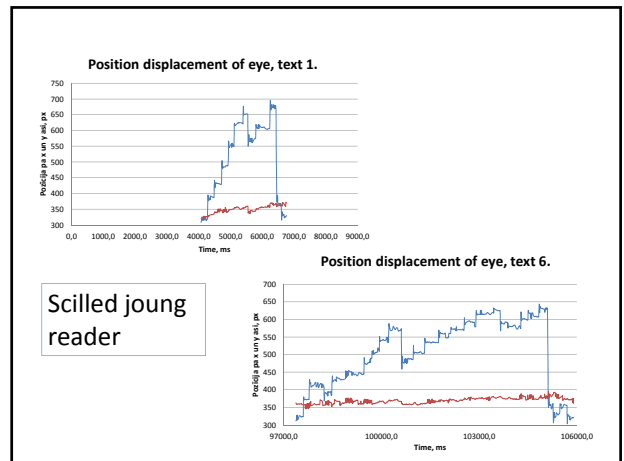
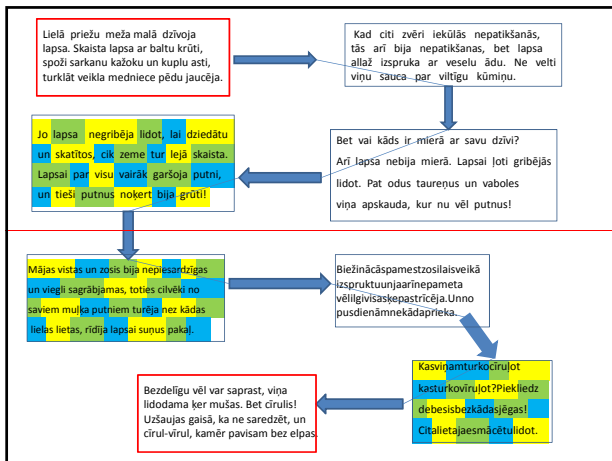
$$\sigma_G = \delta_0 + \delta_1 |A|$$

A. Nuthman, R. Engbert, Mindless reading revised: SWIFT model, Vis. Res. 2008.





- Some examples of our student **Lāsma Ekimāne, Liāna Fiļimonova, Ilze Laicāne et al.**, contribution to Eye movement research in Department of Optometry and Vision science, University of Latvia:
1. Task dependent Gaze behaviour of different capacity readers;
 2. Binocular fixation instability during reading;
 3. Horizontal dot ray scanning and reading;
 4. Recurent reading of similar texts



Thank you for attention!

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