Cognitive Simulations of Eye Movements during Information Seeking on the Web

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Model: Block Level

Visiting all the blocks:

- Cognitive idea of *gist*: constructing in advance a path visiting all blocks.
- Problem similar to the traveling salesman problem with a cost criterion based on cognitive constraints.
- 2 parameters α_H and α_G correspond respectively to the weight of a upward and leftward movement.
- Most appropriate values of α_H and α_G estimated from empirical data.

Revisiting some blocks:

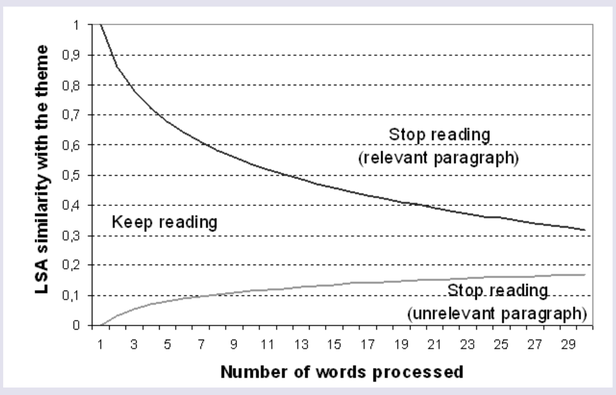
- In a second phase, revisits based on three cognitive processes: visual, semantic and memory.
- Visual process will tend to focus on nearby blocks or visually attractive.
- The process of memory will favor blocks seen earlier (and forgotten).
- The semantic process will avoid blocks less associated with the goal.

Model: Word Level

At the word level, the model is based on semantic information contained in the sequence of words fixated and compared with the goal of information foraging using LSA (Latent Semantic Analysis). This level enables the model to modulate the memory weight of the block, for further visits.

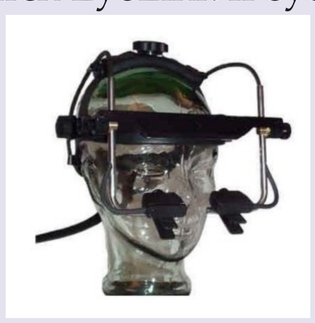
3 cases:

- Words unrelated to the goal (using the LSA semantic measures): reading is abandoned, value=0.
- Words semantically highly similar to the goal: reading is abandoned, value=similarity.
- Model keeps reading until it can make a decision.

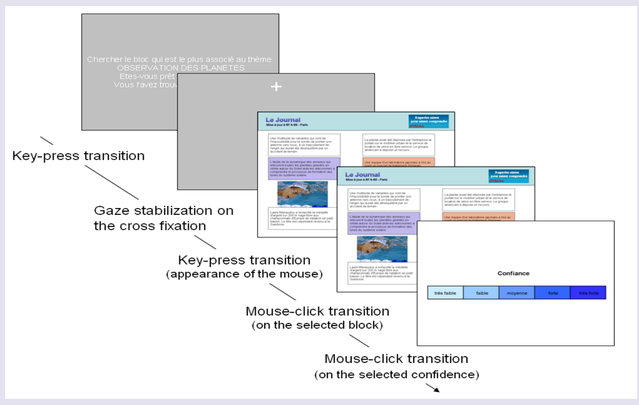


Experimental Data Collection

38 participants.
SR research EyeLink II eye tracker



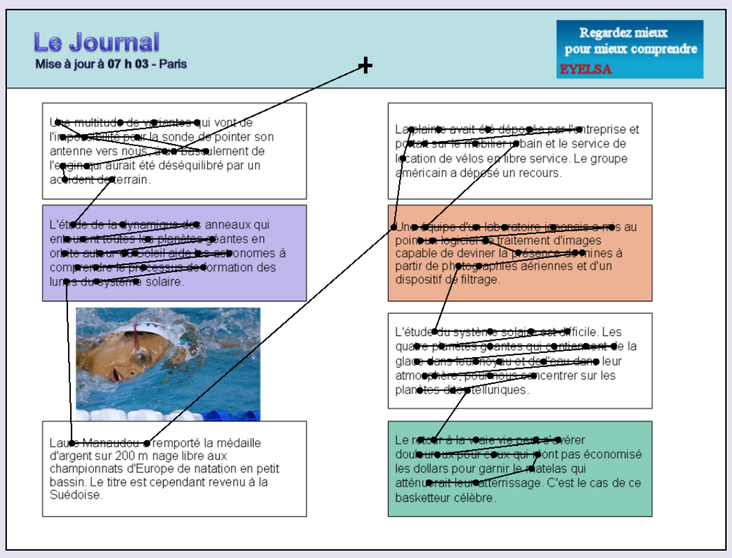
Experimental Process



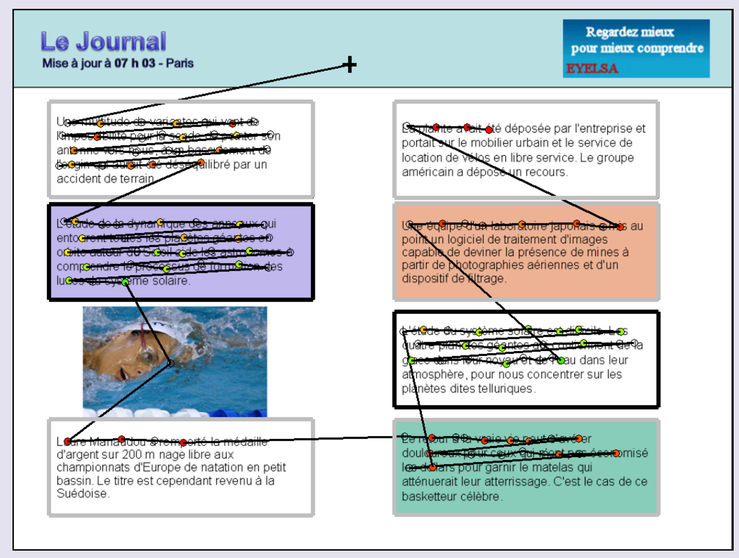
Comparisons between Model and Human Scanpaths

20 different user's search goals.
Each of the 38 users saw all the pages ⇒ 760 scanpaths (38 × 20 goals).
36 random combinations of parameters α_H and α_G simulate 36 instances of the model ⇒ 720 scanpaths (36 × 20 goals).

Example of a human scanpath

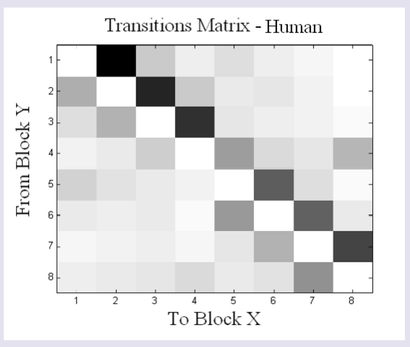


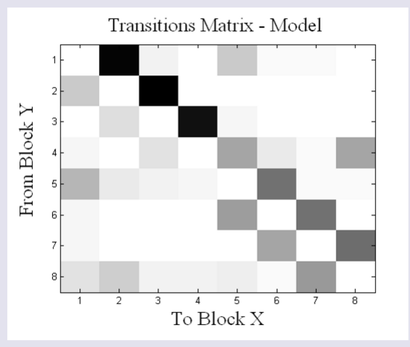
Example of a model scanpath



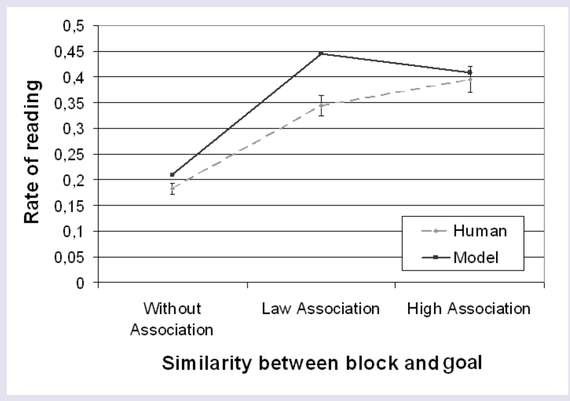
Block Level Comparisons:

Scanpath	% Human	% Model
N :	46,90%	47.81%
U :	28,17%	26.29%
Z :	15,09%	9.16%
N2 :	1,48%	5.18%
U2 :	3,64%	6.77%
Z2 :	4,72%	4,78%





Word Level Comparisons:



References

[1] Chanceaux, M., Guérin-Dugué, A., Lemaire, B., and Baccino, T. A Model to Simulate Web Users' Eye Movements. In Marco Winkler, editor, *Proceedings of INTERACT'09, International Conference on Human-Computer Interaction*, LNCS, (to appear).

[2] Chanceaux, M., Guérin-Dugué, A., Lemaire, B., and Baccino, T. Towards a model of information seeking by integrating visual, semantic and memory maps. In Caputo, B., and Vincze, M., editors, *Proceedings of the 4th International Cognitive Vision Workshop*, volume LNCS 5329, pages 65–78, 2008.