

– Applied Eye Tracking Research –

Investigating Perceptual and Cognitive Processes

Halszka Jarodzka

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Publications addressed in this talk

- Jarodzka, H., Scheiter, K., Gerjets, P., & van Gog, T. (2010). In the eyes of the beholder: How experts and novices interpret dynamic stimuli. *Learning and Instruction*, 20, 146-154.
- Balslev, T., Jarodzka, H., Holmqvist, K., de Grave, W., Muijijens, A., Eika, B., Van Merriënboer, J., & Scherpbier, A. (2011). How do paediatricians diagnose? Visual attention and cognitive processes. *Manuscript submitted for publication*.
- Van Meeuwen, L., Jarodzka, H., Brand-Gruwel, S., Van Merriënboer, J., De Bock, Jeano, & Kirschner, P. (in prep.). Processes Mediating Expertise in a Visual Task: Eye Movements, Verbal Reports, and Spatial Abilities in Air Traffic Control
- Jarodzka, H., Scheiter, K., Gerjets, P., Van Gog, T., & Dorr, M. (2009). How to convey perceptual skills by displaying experts' gaze data. In N. A. Taatgen, & H. van Rijn (Eds.), *Proceedings of the 31st Annual Conference of the Cognitive Science Society* (pp. 2920-2925). Austin, TX: Cognitive Science Society.
- Jarodzka, H., Balslev, T., Holmqvist, K., Nyström, M., Scheiter, K., Gerjets, P., & Eika, B. (2010). Learning perceptual aspects of diagnosis in medicine via eye movement modeling examples on patient video cases. In S. Ohlsson & R. Catrambone (Eds.), *Proceedings of the 32nd Annual Conference of the Cognitive Science Society* (pp. 1703-1708). Austin, TX: Cognitive Science Society.
- Van Gog, T., Jarodzka, H., Scheiter, K., Gerjets, P., & Paas, F. (2009). Attention guidance during example study via the model's eye movements. *Computers in Human Behavior*, 25, 785-791.
- Dorr, M., Jarodzka, H., & Barth, E. (2010). Space-variant spatio-temporal filtering of video for gaze visualization and perceptual learning. In S. N. Spencer (Ed.), *Proceedings of ETRA 2010: ACM Symposium on Eye-Tracking Research & Application* (pp. 307-314) Austin, Texas, USA.
- Holmqvist, K., Nyström, N., Andersson, R., Dewhurst, R., Jarodzka, H., and van de Weijer, J (in press). *Eye tracking: a comprehensive guide to methods and measures*, Oxford, UK: Oxford University Press

Overview

- What is eye tracking?
- What is cued retrospective reporting?
- ET research at CELSTEC

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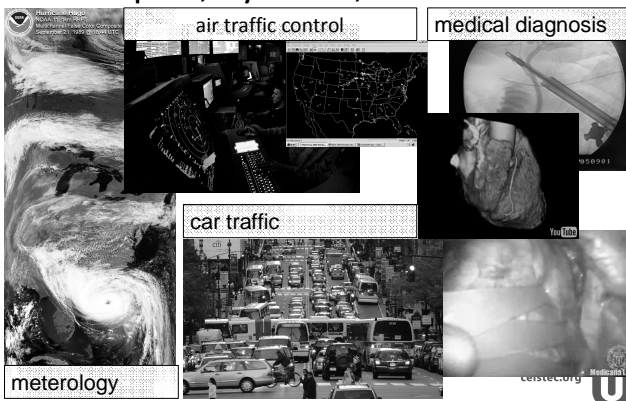


What is eye tracking and what do we need it for?

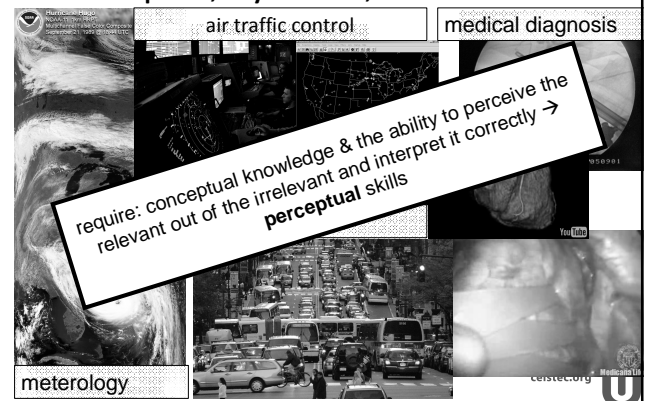
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Complex, dynamic, visual tasks

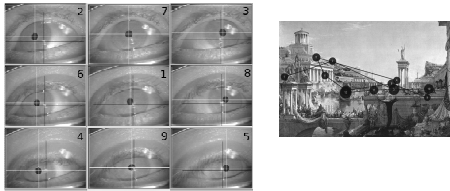


Complex, dynamic, visual tasks



What is eye tracking?

- Tracking the movements of the eyeball(s) to learn **where** a person looked at, for how **long**, and in which **order**.



Holmqvist, K, Nyström, N, Andersson, R, Dewhurst, R, Jarodzka, H, & van de Weijer, J (2011). *Eye tracking: a comprehensive guide to methods and measures*, Oxford, UK: Oxford University Press.

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Overcoming shortcomings of eye tracking by methodological triangulation

- Eye tracking data tells us *where* a person looked at, for how *long*, and in which *order*.
 - But not *why*!
- Additional information needed (methodological triangulation)

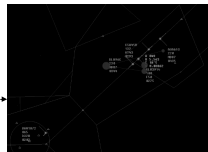
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What is thinking aloud?



ATC Task



Cued Retrospective Report

"I could also have chosen to make this airplane to fly higher than the others, but I chose this solution."
"I saw him descending, so that's where I looked at."
"So I thought what to do with it..."

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Research on eye tracking

- Expertise difference studies
- Training & usability studies

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Expertise difference studies

- research questions
 - task analysis: What is the optimal approach to a given task?
 - deficiency detection: At which steps have laymen or even experts difficulties to perform the task?
 - instructional design: How may the task be designed to facilitate task performance?

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Expertise difference studies

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EXPERTS

NOVICES



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Expertise difference studies

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EXPERTS



measures

Performance

RESIDENTS



Eye movements

Thinking aloud

NOVICES

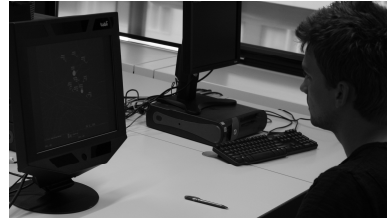
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Expertise difference studies

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• Air Traffic Control



measures

Performance

Eye movements

Spatial ability

Thinking aloud

Knowledge Level
Experts (n=8)
Intermediates (n=8)
Novices (n=15)

x

Task Difficulty
3 x Easy
3 x Medium
3 x Difficult



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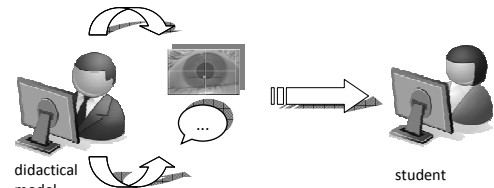
Training & usability studies

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Novel Instructional Approach: Eye Movement Modeling Examples

(Van Gog, Jarodzka, Scheiter, Gerjets, & Paas 2009)



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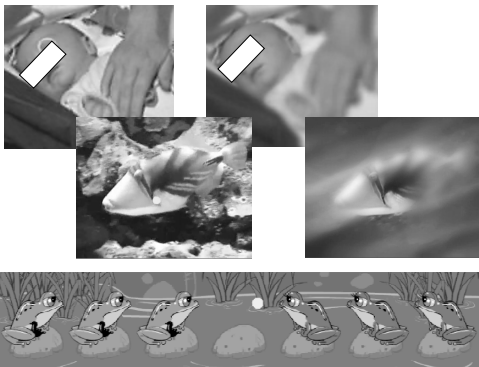
Jarodzka, H., Scheiter, K., Gerjets, P., Van Gog, T., & Dorr, M. (2009). How to convey perceptual skills by displaying experts' gaze data. In N. A. Taatgen, & H. van Rijn (Eds.), *Proceedings of the 31st Annual Conference of the Cognitive Science Society* (pp. 2920-2925). Austin, TX: Cognitive Science Society.

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EMME in different applications



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Influence of different display designs to facilitate task performance

Jarodzka, H., Scheiter, K., Gerjets, P., Van Gog, T., & Dorr, M. (2009). How to convey perceptual skills by displaying experts' gaze data. In N. A. Taatgen, & H. van Rijn (Eds.), *Proceedings of the 31st Annual Conference of the Cognitive Science Society* (pp. 2920-2925). Austin, TX: Cognitive Science Society.

Jarodzka, H., Balslev, T., Holmqvist, K., Nyström, M., Scheiter, K., Gerjets, P., & Eika, B. (2010). Learning perceptual aspects of diagnosis in medicine via eye movement modeling examples on patient video cases. In S. Ohlsson & R. Catrambone (Eds.), *Proceedings of the 32nd Annual Conference of the Cognitive Science Society* (pp. 1703-1708). Austin, TX: Cognitive Science Society.

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