



Case Study Eye Tracking: Medical Diagnosis

A special form of visual guidance based on the eye movements of experts is a valuable method to improve perceptual skills, e.g. in medical diagnosis. This is the conclusion of a study on the performance of medical students when diagnosing epileptic seizures from normal behavior of infants.

BACKGROUND

Perceptual skills enable people to differentiate between relevant and irrelevant information, e.g. when diagnosing a disease. Recording of experts studying patient cases were used to create instructional videos using special forms of visual guidance to convey those skills to medical students.

Involved facilities were:

- Open University of the Netherlands, CELSTEC
- Knowledge Media Research Center, Germany
- Viborg Hospital, Department of Paediatrics, Denmark
- Lund University, Sweden
- Aarhus University, Centre of Medical Education, Denmark

www.smivision.com/medicaldiagnosis

FURTHER READING

„Learning perceptual aspects of diagnosis in medicine via eye movement modeling examples on patient video cases” - published in the Proceedings of the 32nd Annual Conference of the Cognitive Science Society

CHALLENGE

To improve the acquirement of clinical knowledge and especially perceptual skills, it is important to have an expert model to learn from.

Developing skills for practical experience with patients requires a method of applied learning. The challenge is to guide the attention of students to important aspects relevant for medical diagnosis.

SOLUTION

The verbal comments and eye movements of a didactically behaving expert were recorded with the iView X™ Hi-Speed system of SMI while diagnosing an infant patient.

Those recordings were replayed to medical students. Eye tracking was used to guide visual attention of the students and to record their eye gaze while watching the educational video.

CONCLUSIONS

Students exposed to a visual model of the experts' behavior, performed better than students which had not been previously exposed to experts' videos with visual guidance. To blur areas of little importance (“spotlight display”) was found to be the most effective form of visual guidance.

When, in a second step, presented with new videos without any guidance, students were able to apply the learned perceptual skills. They focused on the relevant areas on the patient's body and knew how to interpret them.

BENEFIT

Attentional guidance created with SMI eye tracking technology fosters learning of perceptual aspects in medical diagnosis and is a valuable method to improve clinical knowledge.



Halszka Jarodzka, Assistant Professor, Open University of the Netherlands, CELSTEC
 “We chose the iView X™ Hi-Speed system of SMI for this study because we needed to record and visualize attention shifts of the experts with a high level of accuracy.”

STUDY DESIGN

The study examined whether visual guidance of attention can enhance the perceptual part of information processing as part of medical expertise. Participants were shown videos of infants, some of them showing normal behavior, some patterns of epileptic seizures.

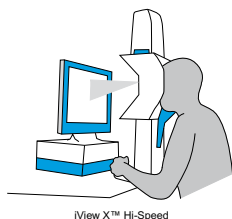
A pre-study questionnaire asked for students' prior knowledge and demographic data, a post-study questionnaire tested diagnostic performance of the students.



Watching videos with the iView X™ Hi-Speed system

The study was conducted with 60 medical students in their final year of university. The participants had no previous knowledge on the task and were randomly separated into three conditions:

- No attentional guidance (control)
- Attentional guidance displaying expert's eye gaze (circle display)
- Attentional guidance by blurring areas not attended by the expert (spotlight display)

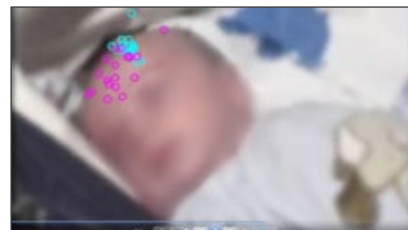


Study setup with the iView X™ Hi-Speed system

The construction and scoring of the performance measure was derived from a task analysis and by the help of domain experts. Analysis concentrated on students' visual attention to and knowledge on the infant's behavior:

- How it changed when being awake
- How it was influenced when someone touched the child

Scoring was done individually for diagnosis of seizures and diagnosis of normal behaviour of the child.



Students' gaze: spotlight group (blue) vs. control group (purple)

FINDINGS

1 Differential vs. seizure behavior!

Correct Diagnosis	No visual guidance	Eye gaze	Spot light
Seizures diagnosis	54%	56%	65%
Differential diagnosis	63%	58%	60%

Comparing the three conditions showed no significant difference when analyzing differential (normal) behavior, whereas performance measures for diagnosis of seizures varied.

2 Displaying perceptual behavior guides students attention!



The screenshot shows the expert's eye gaze displayed as a yellow circle. For the diagnosis of epileptic seizures, this method led to slightly better performance than without visual guidance.

3 Best performance with "spotlight"



Participants in the spotlight display group (screenshot highlights the hand) outperformed the groups without visual guidance and the circle display group in diagnosing epileptic seizures.

SMI EYE TRACKING

The expert model's eye movements were recorded with the SMI iView X™ Hi-Speed eye tracking system featuring a temporal resolution of 240Hz, a high accuracy of less than 0.5 degrees of visual angle and a high precision

of less than 0.01 degrees. The eye tracking data was processed with SMI BeGaze™ software and self-programmed MatLab algorithms. All video material was presented via SMI Experiment Center™.



iView X™ Hi-Speed system

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