ACCESSING MEANING, USABILITY, AND USER EXPERIENCE:

WHAT EYE TRACKING MIGHT AND MIGHT NOT TELL US IN THE HEALTHCARE CONTEXT

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Accessing meaning, usability, and user experience: What eye tracking might and might not tell us in healthcare

1. *Accessing meaning – developing mental models/knowledge clusters*
2. *Linking cognition to eye tracking*
3. *Eye tracking and healthcare – the usability problem*
4. *Potential uses*
5. *Eye tracking metrics and usability – minding the gap*

Accessing meaning - knowledge clusters

The Savoy

- *Beautiful restaurant*
- *Greeted*
- *Waitress/ Waiter*
- *Menu*
- *Order food …*
- *A very large bill!*

McDonalds

- *Busy with bright lighting*
- *Queue to order*
- *Look at pictures of meals*
- *Order food …*
- *A smaller bill!*

Accessing meaning - knowledge clusters

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“ I went to the Savoy for lunch. ….

I had a hamburger and fries – great for a quick lunch and so cheap.”

Accessing meaning - knowledge clusters

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" I went to the ~~Savoy~~ McDonalds? for lunch. ….

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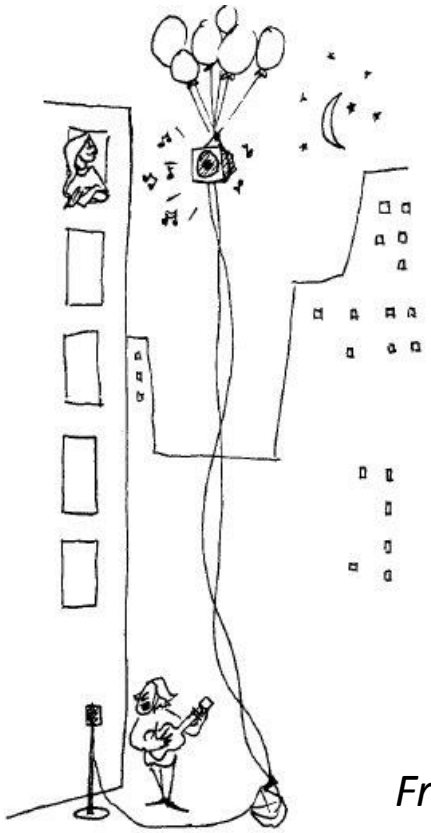
Developing knowledge clusters/mental models from new information

A visual usability problem – lack of appropriate visual cues



From Bransford & Johnson (1972)

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Linking cognition to eye tracking

The eye-mind hypothesis

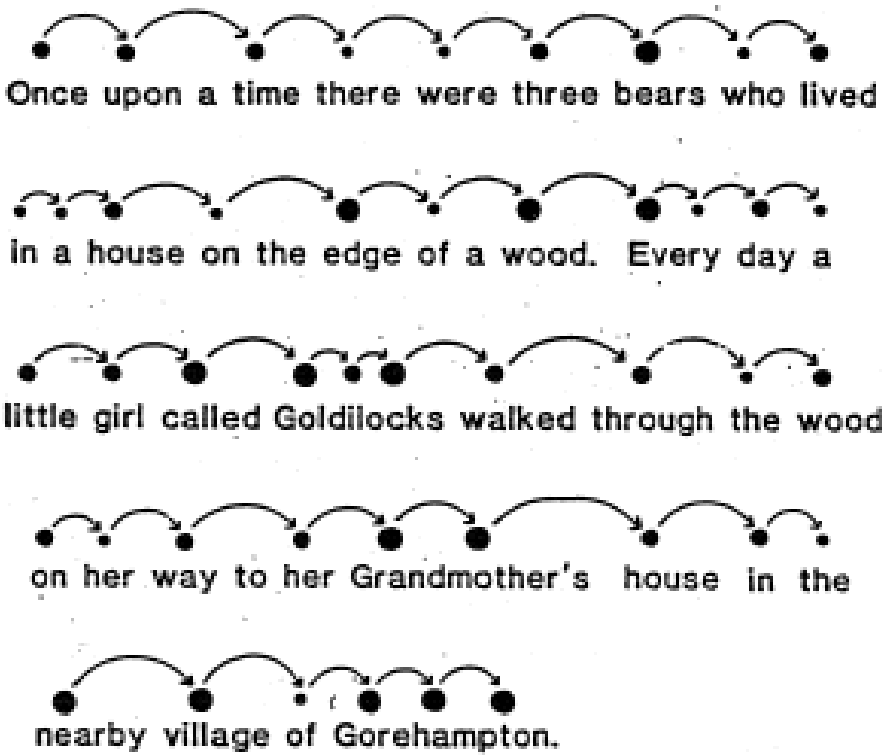
There is a direct link between what is fixated and how information is processed.

Just & Carpenter (1980)

The visual system is …. centrally implicated in learning, higher-order cognitive-affective processes and decision-making.

Wedel & Pieters (2007)

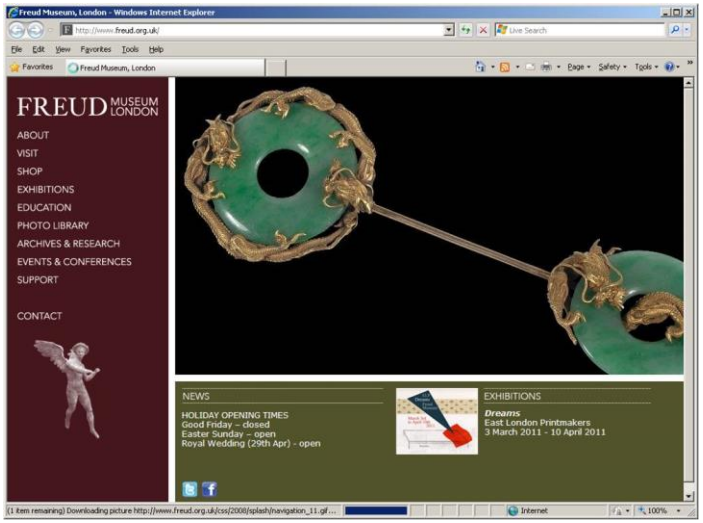
Linking cognition to eye tracking



Fixations: *stops in eye movements where visual information is sampled.*

Saccades: *rapid eye movements between fixations*

Eye tracking, attention and usability



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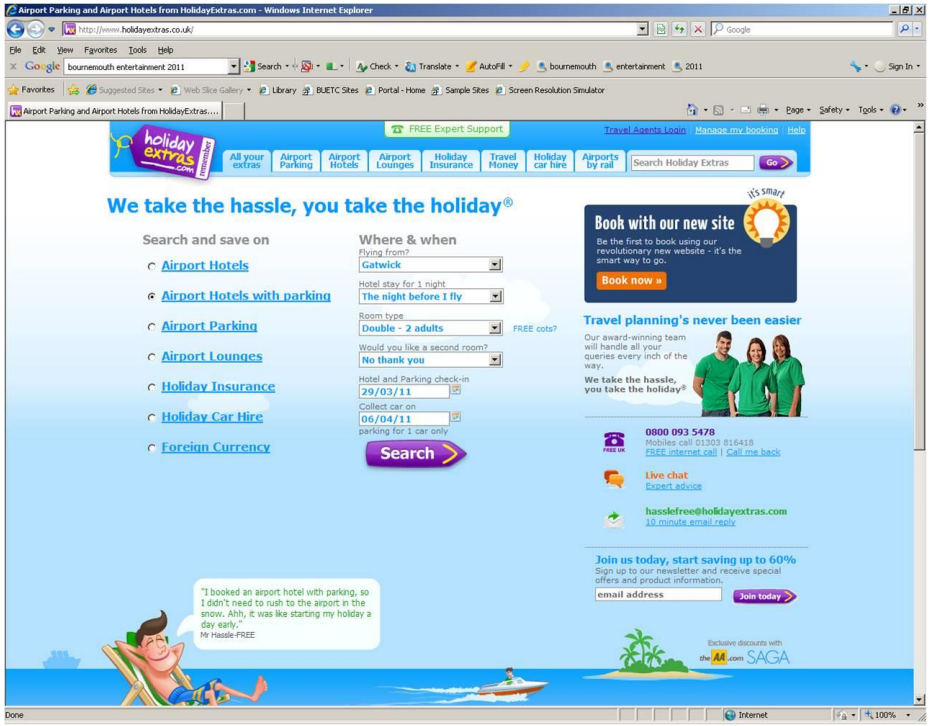

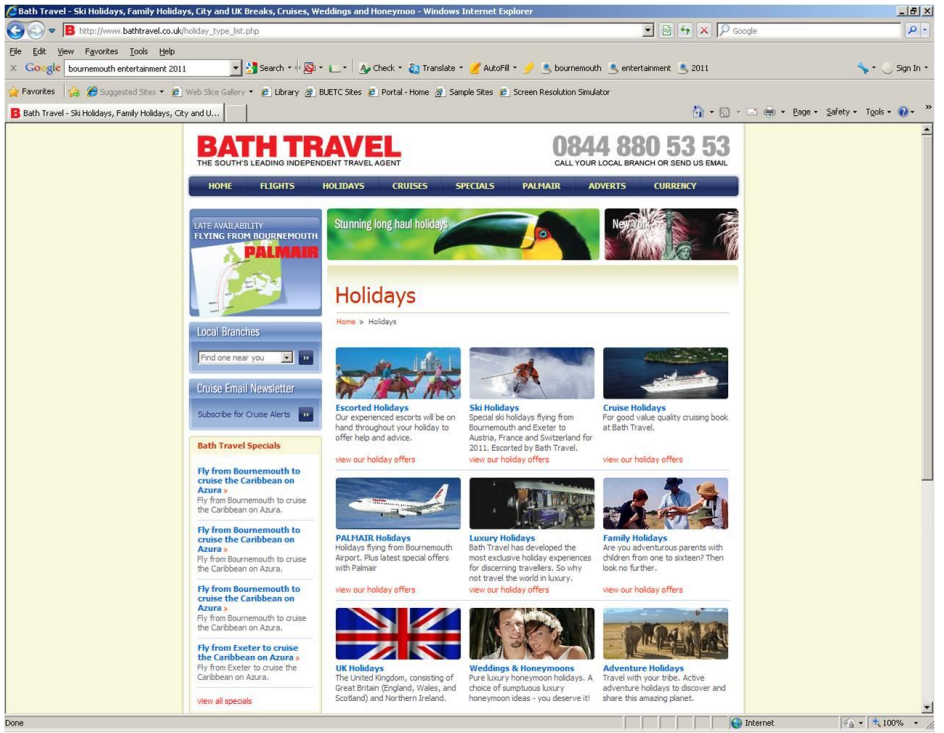

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Eye tracking and healthcare

The usability problem

- *Health technology has tremendous potential to improve quality of care, patient safety, efficiency within health care systems*
- *There are often strong forces driving the adoption of healthcare technology (e.g., government funding, incentives)*

BUT

- *Healthcare workers often not keen to adopt new technologies*
- *Patients often find equipment difficult to use and 'give up'*
- *Due to **design and usability problems** creating errors and user frustration*

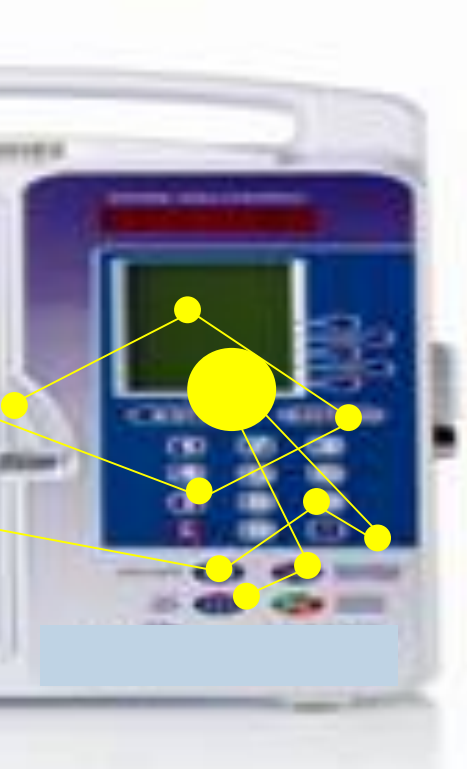
Asan & Yang (2015)

Eye tracking and healthcare – healthcare professionals

The usability problem

Eye tracking and usability

How can eye tracking help with healthcare technology?



Does this help solve the problem?

- *Indicates the visual cues employed by users*
- *No. of fixations and fixation duration can tell us where long processing times or confusion are arising*
- *The fixation 'path' can help to inform about 'workflow'*
- *Workload **may** be indicated by pupil dilation*

- *Measures indicate the usability of equipment*
- *Can be used to evaluate if 'improvements' are effective*
- *Can be used to examine individual differences in use (e.g., differences arising from due to health, age, role in a team)*

Eye tracking and healthcare

Can be combined with other usability measures

- *Cognitive walkthroughs*
- *System usability scales*
- *Post-test interviews*
- *Gaze replay*
- *Workload (e.g. NASA-TLX)*
- *Situation awareness (e.g. SPASA questionnaire)*

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Potential uses in healthcare?

- *Surgical interfaces/healthcare devices*
- *Patient homecare support*
- *Alarms in theatres – multimodal systems*
- *Social systems and team work*
- *Mobile tracking of systems in use*
- *Hospital/ care home navigation*
- *On-line health information (website design)*
- *Computerised order system*

How can eye tracking help with healthcare technology?

BUT ….

Need to be aware of what eye tracking measures really mean

Poole & Ball (2005)

Eye movement metric	What is being measured
No. of fixations overall	More fixations indicate less efficient search
Fixations per interest area	More fixations indicate that the information is more important or more noticeable
Fixation duration	Indicates difficulty extracting information
Repeat fixations	Indicates confusion; inability to extract meaningful information
Time to 1st fixation	Faster times indicate that this information grabs attention

How can eye tracking help with healthcare technology?

Need to be aware of what eye tracking measures really mean

Other metrics	Types of measure
Saccades	No. of saccades, regressive saccades, saccade amplitude …
Scanpath	Duration, length, regularity, direction
Pupil response & blink	Used to indicate workload, fatigue, situation awareness (e.g. Jiang, Zheng, Bednarik & Stella, 2015)

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Mind the gap between processing and eye tracking

Eye tracking may not always indicate cognitive processing

Henneman et al. (2014)

- *Found that healthcare workers did not notice errors in patient records even if the eye tracking data showed that they were looking at it.*
- *This indicates that there may be a mismatch between gaze, attention, and cognitive processing.*

Pilot data from our laboratories

- *Indicates that individuals may make instantaneous decisions before eye movements have really begun.*
- *This may be because users can make some decisions by taking in the gist of a scene which occurs in 60-70 milliseconds (see Oliva et al., 2006)*

Potential uses in healthcare?

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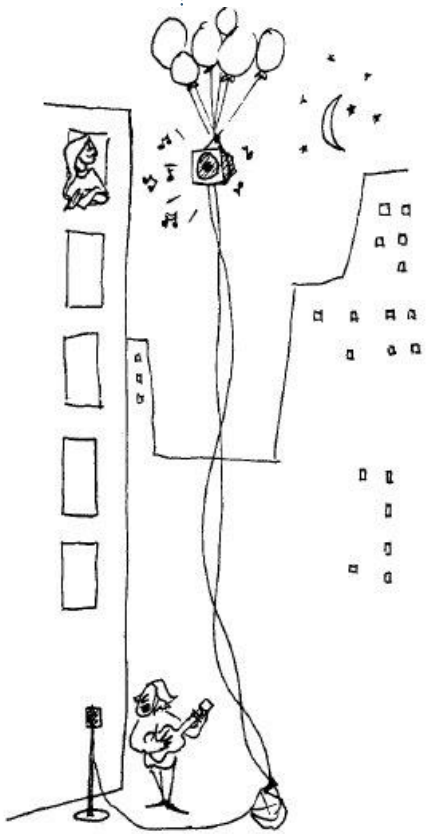

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