



SenseCam as an aid for autobiographical memory in an amnesic patient & other clinical applications

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Summary of talk

- What is SenseCam?
- How might SenseCam aid autobiographical memory?
- Our Preliminary Study
 - Patient History
 - Method
 - Results
 - Discussion: What does it all mean?
- Ongoing & Future Studies

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SenseCam: A Photographic Diary

Total recall
The camera that records your whole life

Size comparison

Possible uses

- Families could share images of each other's day and create a family archive
- SenseCam could benefit the forgetful, offering reminders of people and places
- The device would provide an instant record of many crimes and accidents

Sensors respond to changes in light or movement by taking pictures of the wearer's surroundings, gathering 170 images an hour

Clare Harrison Collins

2.09pm 2.15pm 2.18pm 2.21pm

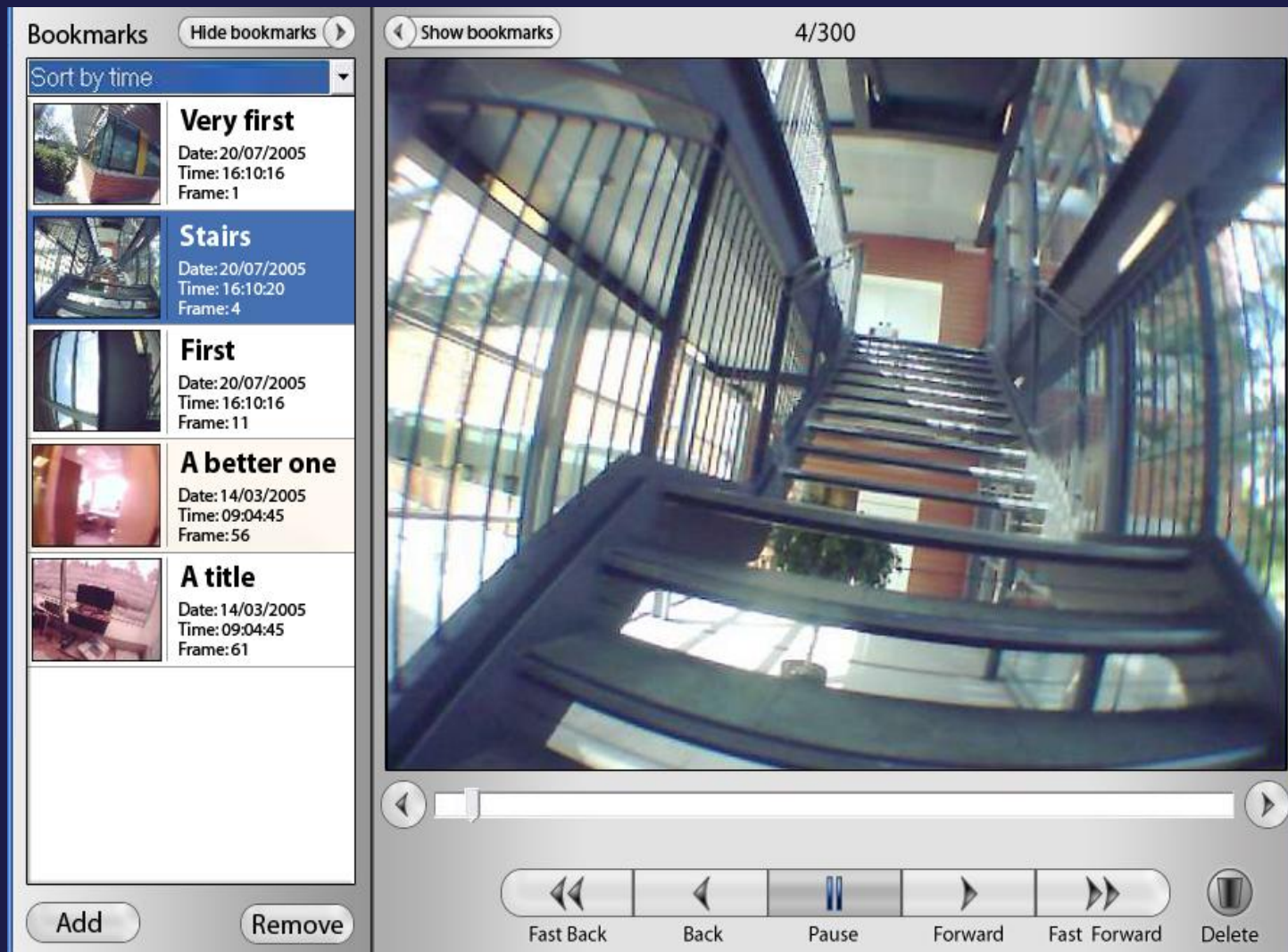
Human 'black box' to log your daily life



SenseCam: A Photographic Diary



Easy to use software...



SenseCam movies



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What is autobiographical memory?

- Autobiographical memory has two features:
 - Like episodic memory, it enables you to remember personally experienced events at a specific time and place
 - Autobiographical memory is accompanied by a sense of reliving as well as the belief that the remembered event actually occurred

Improving memory with SenseCam

- Autobiographical memory critical to quality of life
 - Forms basis for semantic memories
 - Guides actions, builds self-concept, creates bonds
- SenseCam records experiences
 - Without conscious thought or intrusion
 - Captures events from patient's point of view
 - Plays back quickly in simple-to-use, easy-to-view 'movie'
- Subsequent viewing of image sequences
 - Cues recall & so consolidates storage of memories

Summary of talk

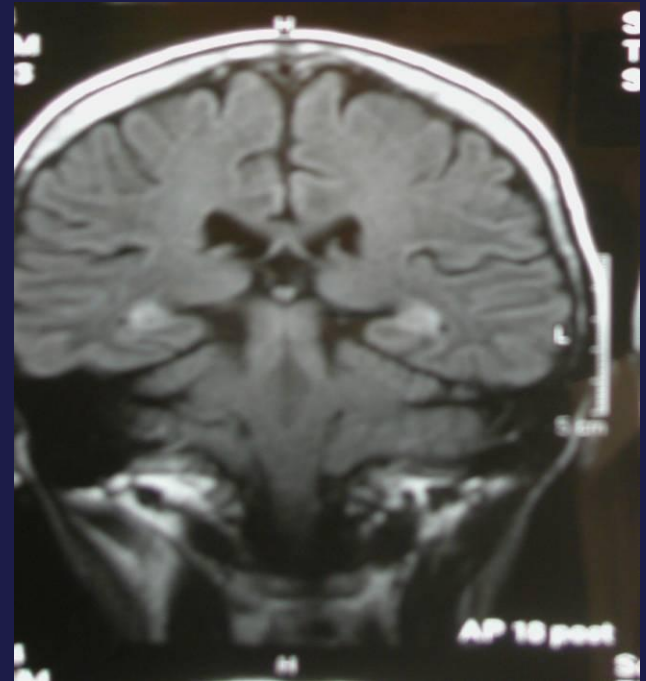
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Client history

- 63-year old woman, born and educated in South Africa
- Gained a BA Higher Diploma in Bibliography and Librarianship
- Her husband is a retired businessman whose work took them around the world
- Prior to her illness she was working as a freelance proof-reader and copy-editor

Clinical history: 'Mrs B'

- Cambridge Memory Clinic, Addenbrooke's Hospital
- Diagnosed with limbic encephalitis in 2002
- MRI scan March 2005
- Now has marked amnesia
 - usually no memory a couple of days after event



Summary Neuropsychological Profile July 2004

	Pre-morbid	Non verbal recall & recog	Verbal recall	Verbal recog	Remote Memory	Visuo-percept	Exec	Lang Skills
Well Above Average								
High-Average								
Normal								
Mild								
Moderate								
Marked								

Mrs B's autobiographical memory

- Autobiographical Memory Interview
 - Childhood autobiographical – 2/9
 - Early adult life autobiographical – 3/9
 - Recent life autobiographical – 3/9
- Dead or Alive?
 - 1960s – 70%
 - 1970s – 100%
 - 1980s – 13%
 - 1990s – 42%
 - 2000s – 50%

Loss of memory: Mrs B's difficulties

- Mrs B and her husband lead an active social life, playing golf and entertaining
- Mrs B keeps an informal written diary but regularly reviewing this does not improve her memory
- This leads to a lack of confidence in company & a fear of forgetting people
- Anxiety generalised to everyday life

Aiding memory with SenseCam

- Goals of patient and husband
 - To improve Mrs B's episodic memory
 - To share experiences with each other
 - To improve Mrs B's self-esteem and confidence

Using SenseCam to aid recent memory

- Procedure
 - Experimental condition: SenseCam used to record 'special' days (N=9)
 - Control condition: written diary used to record special days (N=3)
 - Baseline condition: no memory aid used to help recall special days (N=2)
 - Information reviewed every 2 days for 2 weeks
 - Memory evaluated before each review
 - Results of nine SenseCam events and three diarised events averaged

Procedure: experimental details

- The day after special event, Mr B asks his wife if she recalls the previous day's events
- He notes and marks her responses on a scale of 0% to 100% (to be described)
- He immediately shows her the images
- A few days later, Mr B again asks his wife what she recalls of the event and grades her responses
- He then shows her the images again and so on

In this way we could assess whether Mrs B's memory of an event improved with successive viewings of the event

Procedure: experimental details (continued)

For each event, Mr B documented 10 key points he considered important:

Drive to East Cowes, walk to ferry, ferry to Southampton, taxi to hospital, see Narinder (neuropsychologist), taxi back to shopping centre, lunch in restaurant, walk to ferry, walk to car, drive home

If Mrs B recalled 7 out of the 10 key events, she would score 70%

Assessment of longer-term memories

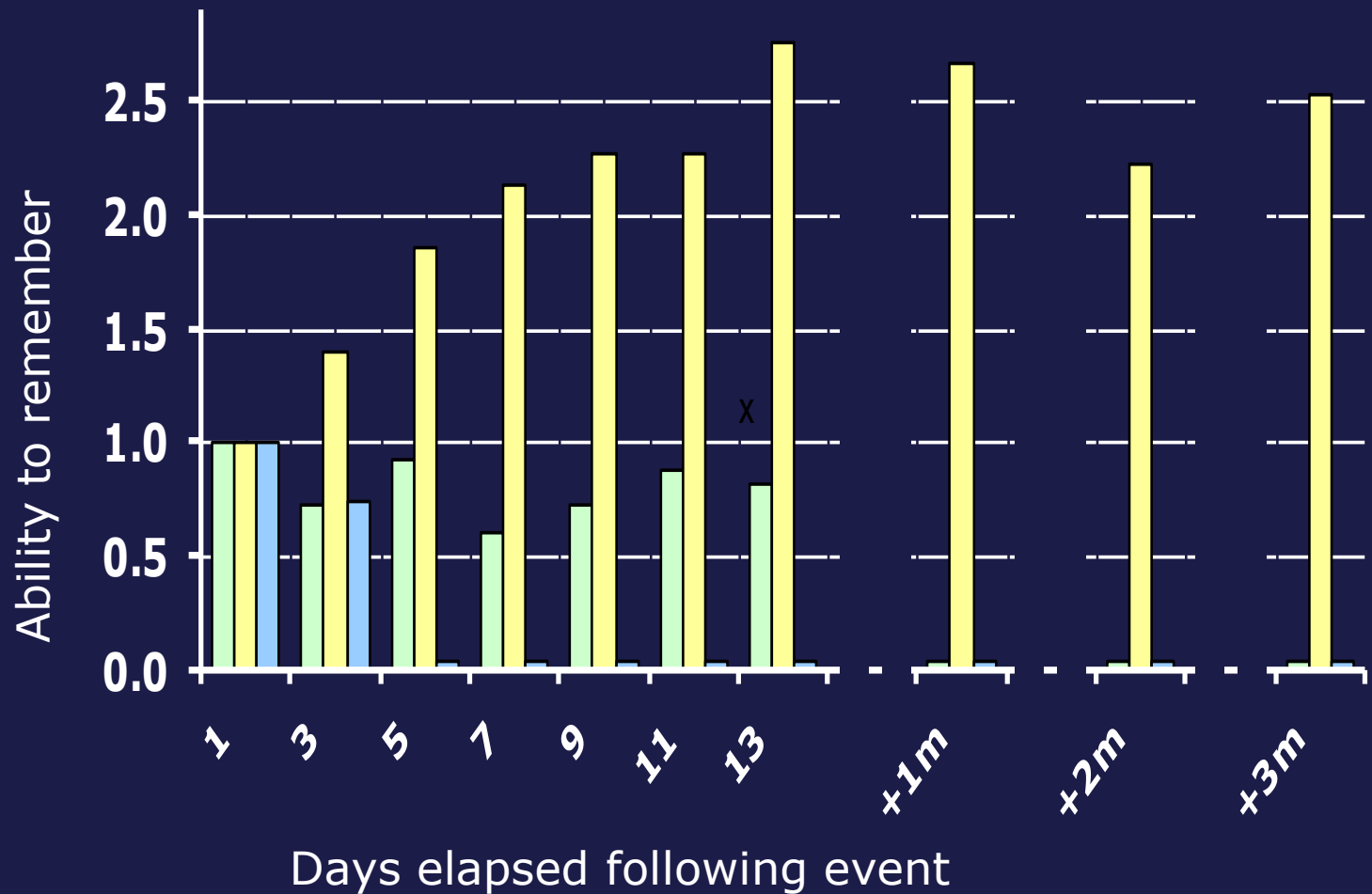
- After 3 months with SenseCam, Mr B showed his wife all of the SenseCam movies they had recorded (N=9)
- Mrs B did not look at the images for 1 month
- Mr B then tested her on her recall of all 9 events
- Same again done at 6 months, with 2 month gap between last image viewing and testing of recall
- Same again done at 7 months, with 3 month gap between last image viewing and testing of recall

Client & carer measures (cont.)

- SenseCam Feedback
 - Was the camera/laptop/software easy to use?
 - Any problems?
 - Uncomfortable or embarrassing?
 - Quality of images
 - Beneficial as a memory aid?
- Written Diary Feedback
 - Was it easy to use?
 - Beneficial as a memory aid?

Results

Memory of an event over time



Results

- There is a difference in average recall per viewing between SenseCam and the written diary:

$$\chi^2 (1) = 13.10, p < 0.001.$$

- There is a significant trend effect across SenseCam viewings but not across written diary viewings:
 - SenseCam viewings = $\chi^2 (1) = 62.59, p < 0.001$
 - Written diary viewings: $\chi^2 (1) = 0.29, p < 0.6$

Results: Client feedback

- When asked about the effectiveness of SenseCam generally, Mrs B replied:

'I think it is a terrific help, I really and truly do...'

'When I go out I do not spend my time worrying about whether I will remember the person the next day...the person I am talking to...I'm less worried'

'It really helps me to remember, if I see the beginning of a clip it comes flooding back to me...'

Results: Client feedback

- When asked about the effectiveness of SenseCam generally, Mr B said:

Sharing experiences again was a 'sheer pleasure'

'It has enormous potential as a memory aid and has been a great success for us personally'

Results: Client feedback (continued)

- SenseCam generally easy to use, but...:
 - Image quality not good in poor light
 - In-built map facility, showing details of the location of the image, and time-stamping, would also be useful

(Addressed by version 2b)

- Written diary (Mr B only – Mrs B no recall)
 - Time consuming and boring because no images
 - Limited benefit for time spent
 - Unwilling to carry on study

Discussion: Observations

- SenseCam unlikely to be successful unless:
 - There is a committed spouse or carer, at least initially
 - The client is happy to wear the camera
 - There is a strong working alliance with the family

Discussion: How does it happen?

- Both written diary and SenseCam successful:
 - Regular reviewing of the images/diary could be characterised as a form of spaced repetition, allowing for a gradual consolidation of autobiographical memories
 - The process of talking through the events, may facilitate recall or consolidation of autobiographical memories
 - Possible that Mrs B's recall is impaired by her mild executive dysfunction, and that viewing the images or diary allowed her to organise her search more effectively

Why is SenseCam significantly more successful than written diary?

- Evidence that autobiographical memory is rich with visual imagery (Brewer, 1988, Greenberg & Rubin, 2003)
- SenseCam may be similar to images in normal autobiographical memory
 - Images are time-compressed
 - Images represent short-time slices determined by changes in goal processing
 - Formed outside awareness
 - Images are taken from egocentric viewpoint
 - Visual

Discussion: Summary of Results

- SenseCam generally easy to use
- SenseCam aided recall of autobiographical events
- Recall is retained in the longer term
- Client remembers the event, not the images
- Subjectively, confidence increased, anxiety reduced & delight at sharing experiences
- Written diary not as beneficial

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Ongoing research: MSRC

- SenseCam as an autobiographical memory aid in other patients with memory loss:
 - Alzheimer's disease (N=10)
 - Infections of the Brain (N=2)
 - Epilepsy (N=2)
 - Traumatic Brain Injury (N=2)
 - Developmental disorders (N=1)
- SenseCam factors facilitating memory rehabilitation (Mrs B):
 - Evaluating image-reviewing schedules for maximum memory consolidation:
 - Optimum retention interval (between autobiographical event and initial viewing of images)
 - Optimum rehearsal intervals

Ongoing research: collaborative work

- Collaboration with Professor Barbara Wilson & Dr Fergus Gracey, Oliver Zangwill Centre, and Professor Jon Evans, Psychological Medicine, University of Glasgow
- Hoping to look at the role of SenseCam as a tool for the assessment and treatment of cognitive and emotional disorders following brain injury:
 - Rehabilitation
 - Assessment and re-training for executive dysfunction
 - Re-learning of everyday skills
 - Therapy
 - Recalling difficult events
 - Identifying and reviewing stimuli that led to adverse mood states
 - Challenging biased recall of events in depression/anxiety

Ongoing research: collaborative work

- Collaboration with Professor Martin Conway, Leeds Memory Group, University of Leeds, using SenseCam in experimental and neuroimaging studies:
 - Using SenseCam to ask questions such as 'How do we forget over time?' and 'How do our memories decline with age?'
 - Investigating the functional neuroanatomy of episodic memory using neuroimaging techniques
 - Investigating episodic memory in normal healthy populations and the extent to which SenseCam stimulates recall and strengthens learning

Summing up

- External memory aids are an effective way of treating memory impairment, but most support prospective memory
- SenseCam may help people remember past events, and this may improve confidence & reduce anxiety
- SenseCam may have other useful applications, such as aiding rehabilitation, therapy and facilitating research into autobiographical memory
- A combined approach is probably most effective – psychotherapy, occupational therapy, advice, reducing memory demands, cognitive strategies, altering the environment, medication and using external memory aids

Questions?
