



# SENSECAM 2010

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**Proceedings of the  
Second Annual Sensecam Symposium  
SenseCam 2010**












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Demo



Poster



Presentation





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## Welcome to the Second Annual SenseCam Symposium

Since SenseCam's inception in 2003, work with the device has grown at a truly remarkable pace. Following the first clinical trial in 2005, work by an ever-growing network of collaborators continues to show tremendous potential for the technology as a memory aid. Early on in the SenseCam project, the device's potential as a tool for understanding the mechanisms of memory and cognitive functioning also became apparent and is now actively being pursued. In the meantime a huge variety of other potential applications for the technology continue to be suggested, trialled and developed. Now that SenseCam is more readily available as the Vicon Revue, we fully expect this to continue.

The first annual SenseCam symposium in Chicago was exciting for a number of reasons, but something that participants repeatedly commented on was the way in which it brought together practitioners from such a wide range of backgrounds. For example, as well as researchers and clinicians from the memory, cognition, medicine and neuroscience fields and technologists with a range of expertise, we had experts in public health, law enforcement and privacy. The attendees told us that they appreciated the ability to share ideas and to learn from the experiences and knowledge of those working in different fields. This year's programme includes work in art, ethics and market research and we hope that once again the cross-fertilization of ideas will stimulate interesting and valuable discussions between the attendees, and ultimately inform future research in the community.

SenseCam is a really exciting technology, and we are delighted to be part of the community which is growing up around it.

Welcome to SenseCam 2010!



## Organisation & Acknowledgements

SenseCam 2010 is a collaborative effort designed to bring

the SenseCam community together. SenseCam 2010 is the result of input and hard work of several institutions and individuals who have given over their time to make this exciting event happen. As a result, we would like to acknowledge the efforts and the contributions of those involved, and of course the sponsors who make this symposium possible.



### **CLARITY: Centre for Sensor Web Technologies**

- Daragh Byrne
- Aiden Doherty
- Cathal Gurrin
- Alan Smeaton



### **Microsoft Research Cambridge**

- Emma Berry
- Steve Hodges



### **Vicon**

- Imogen Moorhouse
- Phillipa Timmins
- Emma Wixey

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## Abstracts





## The space I'm in

In this paper, we describe research and development on a project using SenseCam technology for Art Education.

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### Introduction

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As artists, one of our jobs is repurposing technologies from science and developing alternative and creative new applications. At the Mattress Factory, we have been experimenting with SenseCams as a tool to teach students and other populations about memory and space.

### Presentation

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The Mattress Factory is a museum of contemporary art that supports the creation and exhibition of site-specific installation art. The museum's programs derive from a central focus on the creative process and its mission is to (1) provide artists with an integrated residency and exhibition program, (2) educate and encourage visitors to examine the relevance of art and creativity in their own lives and (3) energize its urban neighborhood through the expansion and development of the artistic and education programs.

Deborah Aschheim makes installations based on invisible networks of perception and thought. Her recent work exploring the subject of memory has led her to collaborate with musicians and neuroscientists on projects that are an equal mix of science and poetry. Her recent exhibitions include "Nostalgia for the Future" at the Armory Center in Pasadena, CA; "Deborah Aschheim + Lisa Mezzacappa: Earworms" at the Pasadena Museum, "Deborah Aschheim: Reconsider " at Laumeier Sculpture Park, Saint Louis, MO (2008); "The Lining of Forgetting" at the Weatherspoon Art Museum in Greensboro, NC (2008), and "On Memory" at the Mattress Factory in Pittsburgh, PA (2006-7). Aschheim has been commissioned to make public artworks for the Los Angeles Police Department, for the San Jose International Airport and for the Sacramento

Public Library. She has created outdoor installations for the Wellcome Trust in London, UK, and for Beelden Buiten 2003: Fractals, in Tielt, Belgium. Aschheim is the Hellman Visiting Artist in Memory and Aging at the University of California, San Francisco Department of Neurology.

Together, Aschheim and the Mattress Factory have been working to create dynamic programming that connects users (teachers, students, and the general public) to the world around them by calling attention to the ways in which humans relate to, understand, memorize, and interpret the spaces and environments in which we live, work and play. In their presentation, they will discuss how the SenseCam

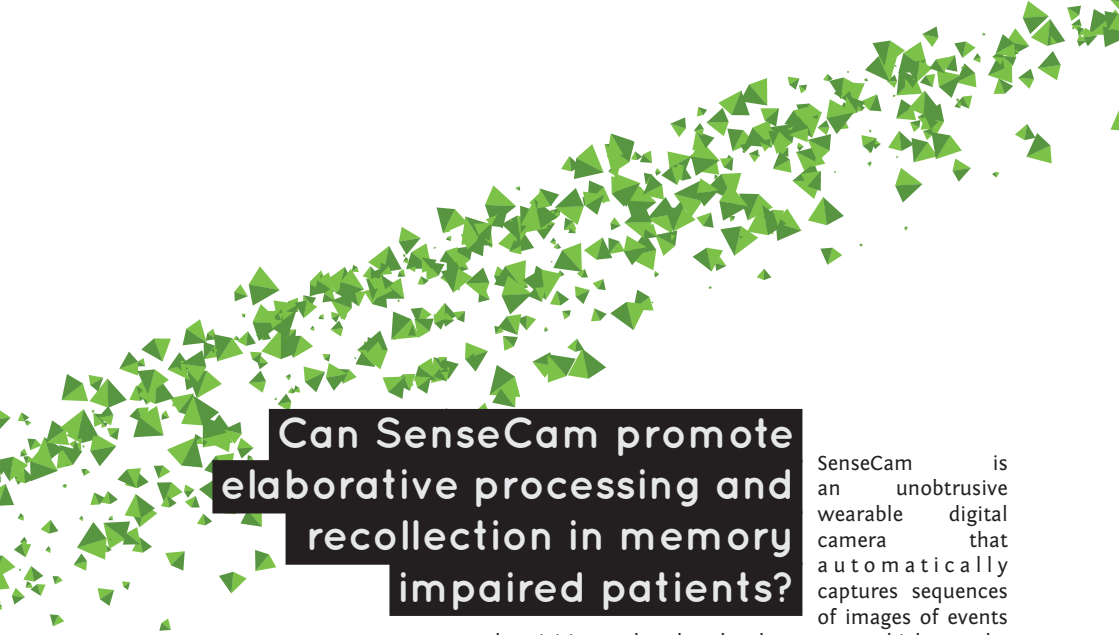
has aided and guided their research and experimentation process. They will offer examples of student-centered learning experiences with SenseCam, and describe intended uses for both classroom and informal learning settings.

It is also their hope to create and direct a dialogue that fosters robust questioning/suggestion from the audience and participants about new/undeveloped uses, potential iterations and continued product development.

### **Acknowledgements** \_\_\_\_\_

The Mattress Factory wishes to thank the Grable Foundation for their generous support of this project.





## Can SenseCam promote elaborative processing and recollection in memory impaired patients?

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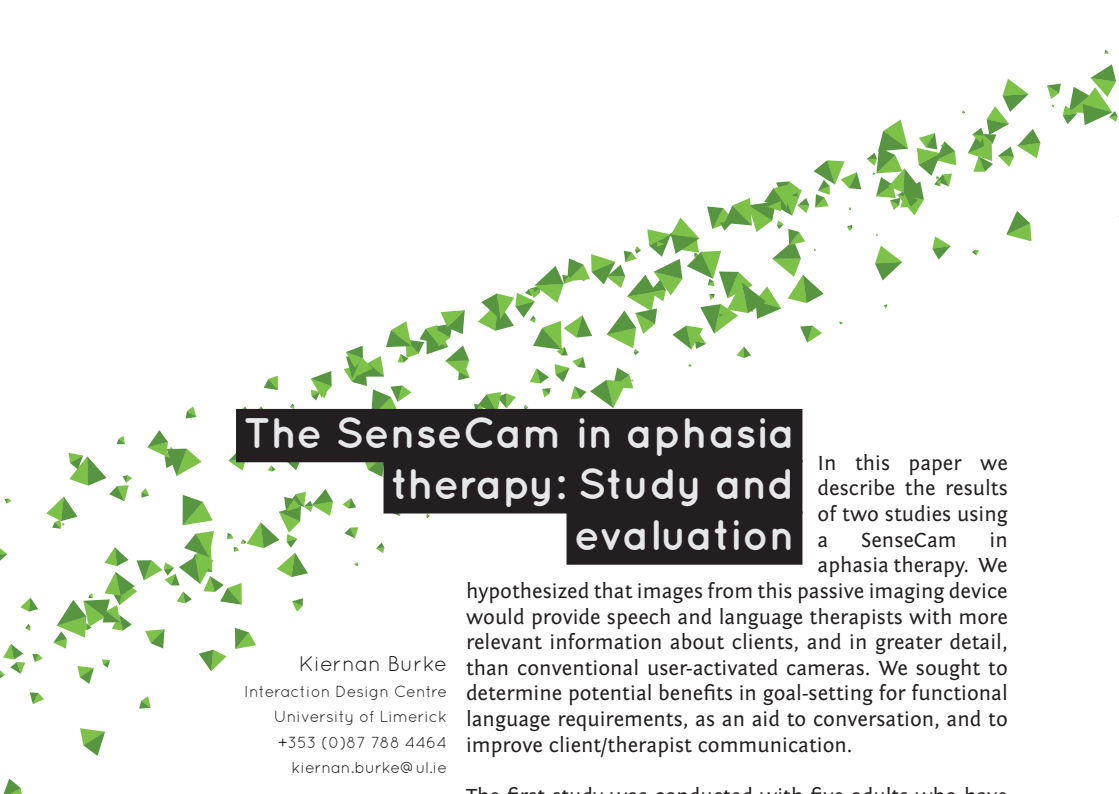
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SenseCam is an unobtrusive wearable digital camera that automatically captures sequences of images of events

and activities undertaken by the wearer, which may be later reviewed on a PC. There is now evidence showing that SenseCam review can facilitate recollection in patients with significant or mild memory impairments. In particular, exposure to rapid glimpses of a patient's activity on a special day has been shown to enhance retrieval of memories of those same events over extended time periods. It is not clear, however, whether this exposure improves memory by enhancing consolidation of memories for those events represented in the image sequence or by altering the mechanisms that govern access to the original experience. The present study employed a single-case experimental design approach to investigate whether SenseCam image sequences, in the context of a therapeutic intervention, could be used to enhance access to memories for more routine events and those not represented in specific image sequences. The intervention aimed to promote elaborative processing and to enhance differentiation and richness of cues in order to support access to information in memory. Thus, the focus of SenseCam review was not on entire days of experience but on patient-specific montages that were created by editing together a representative sample of traces of different activities undertaken in the course of daily life. Here, we report the results of three patients with significant memory impairments in baseline (6 weeks), intervention (8 weeks), and post-intervention (4 weeks) phases. The outcome measures that were administered in each phase of the study included a semi-structured Autobiographical Memory Questionnaire (AMQ) that was developed to evaluate memory for recent autobiographical events (e.g. have you seen any family members this week?) and also the

Autobiographical Memory Task (AMT), which requires participants to supply a specific memory in response to each of 12 cue words (e.g. bright). The results suggest that exposure to SenseCam montages in the context of a therapeutic intervention may affect performance on the AMQ, particularly when the montages include the patients' own materials rather than those of a control participant. Further, a comparison of tests suggests that strategies varied markedly and were influenced by exposure to the SenseCam intervention. These findings provide limited support for the idea that using SenseCam to promote differentiated processing in individuals with significant or mild memory impairments may improve access to memories for routine activities in at least some individuals.



## The SenseCam in aphasia therapy: Study and evaluation

In this paper we describe the results of two studies using a SenseCam in aphasia therapy. We

hypothesized that images from this passive imaging device would provide speech and language therapists with more relevant information about clients, and in greater detail, than conventional user-activated cameras. We sought to determine potential benefits in goal-setting for functional language requirements, as an aid to conversation, and to improve client/therapist communication.

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The first study was conducted with five adults who have moderate to severe post-stroke aphasia. We designed this study to observe the effects of introducing the SenseCam images in a weekly group conversation. Each of the persons with aphasia wore the SenseCam during the active hours of a single day. The acquired images were then edited and presented in the weekly group session as two short slide shows of personal narratives, and printed pages of selected images for each individual. The session was attended by the facilitating therapist, clients and their therapists, and the principal investigator. The session was videotaped and made available to therapists for subsequent viewing. A week after the the session we conducted an interview with the therapists to elicit observations and impressions. Lastly, we posted an online survey to; obtain opinions on the usefulness (or not) of the SenseCam in needs assessment and supported communication compared to existing methods; elicit opinion on the level of patient involvement compared to sessions without SenseCam images; solicit suggestions for any methods or devices that a therapist deemed more beneficial.

As the abundance and relevance of images acquired by a passive-imaging device is without precedent in aphasia therapy, we anticipated a positive response by

clients and therapists, and this was the case. Therapists were unanimous in the opinion that the SenseCam was superior to existing technologies and that it offered distinct advantages for goal-setting, as an aid to conversation, and helping therapists to better understand their clients. However there are several obstacles to the incorporation of this device into clinical practice which we address following the description of the second study:

In the second study, three clients wore the SenseCam for seven days. (A fourth client thought that he had damaged the camera and didn't use it.) During this time patients were also asked to write a diary page per day, and to take photos

with a disposable camera. None of the clients took pictures with the disposable camera, but did make diary entries. The clients encountered no difficulties using the SenseCam. (This was not determined in the first study as the clients only wore the camera for a single day, and either the investigator or client's communication partner provided assistance.) The three clients we discuss were at least two years post-stroke. Their impairment ranges from mild to moderate to severe. In followup interviews client diaries and images were used. We discuss differences in the diary and SenseCam information that emerged in the interview.



## Supporting episodic memory from personal lifelog archives using SenseCam and contextual cues

Digital lifelogg technologies are making it increasingly viable for individuals to build personal information archives (PIAs) capturing digital

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artifacts associated with events and activities from their lives. One of the most significant applications of PIAs is to act as a source of memory cues to trigger the data owner's episodic memory. An important components of this cueing function is provided by visual stimuli such as those provided by SenseCam.

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Previous work has demonstrated that an average day's SenseCam image data can be divided into around 20 events. While it is valuable in some situations to explore archives from specific days, it rapidly becomes unwieldy to manually navigate long term PIA collections. People may want to recall details from specific events or reminisce about certain aspects of their past. It is desirable that the images, which can serve these functions, be provided to them efficiently.

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To support users conveniently retrieving SenseCam images from their PIAs, we are developing a system which enables people either to search or browse for their required events or information based on what they are likely to remember. The system contains a search function, which enables users to search for events or episodes (clusters of images) by contextual features including their location, names of people around them at that time, weather, etc. The results are organized dynamically in a multi-level structure, based on what people tend to remember about events. A timeline based preview area is provided to enable people to quickly grasp the content in selected time period, and locate their target event on temporal dimension. Landmark events

represented by keyframe SenseCam images, together with text associated with context information such as name of location, people, and keywords extracted from computer activities (e.g. subject of emails, documents) are displayed along the timeline for the given period, acting as memory cues. From this high level preview users can zoom in to smaller time units based on these landmark events or other features that they recognize associated with their target episodes.

To develop the algorithm to automatically extract possibly good memory cues, we conducted an experiment to explore the features of SenseCam images and types of context information which tend to be good memory cues for people to recognize

and recall events. In this experiment, three research students who have been collecting PIAs including SenseCam data for 20 months performed cued recall tests for 30 episodes. SenseCam images and related context data which were extracted based on certain criteria (e.g. type, concept of the image, Galvanic Skin Response around the time the image was captured), were provided for the participants to uncover one by one until they believe that they could recall most of details of these episodes. They then verified their recollection against further data from their PIA. Our presentation will describe this experiment in detail, and introduce our integrated interactive search system for multi-level exploration of PIAs.



## The new reality: Lifelogging and qualitative market research

Qualitative market research is a hugely important industry that provides those that need it with a

greater understanding of how people think and behave. The output produced by the industry has an important role in developing all manner of vital things in our lives – from government social policy to the correct balance of celebrities featured in our magazines. Given this importance, it is clearly essential that the information that we provide is accurate – not estimate.

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At present the majority of data gathering in the industry is dominated by interrogatory techniques in methodology such as focus groups and formal depth interviews. These are enormously successful techniques that continue to deliver excellent results. However, one potential problem that this kind of approach is a reliance on the vagaries of the human memory.

This presents researchers with a variety of potential issues that must be considered when coming to analyse and make sense of what people tell us in interviews and focus groups.

In methodology commonly employed, researchers spend a lot of time asking people to recall thoughts and behaviour that took place some considerable time in the past – and often relating to things that are processed at a fairly subconscious level. People will do their best to remember accurately, but in reality what we invite people to do is to guess, confabulate, estimate or to refer back to relevant schemas.

In the past, the most common way to address this issue was to have people actively record things as they went along – but in doing so we asked them to disrupt both their normal behaviour and their thought processes.


Enter passive lifelogging and SenseCam. This allows us to observe life as it takes place in all its wider context and detail. Having done this we use the output of the cameras for analysis to define an interview agenda - with the images from SenseCam becoming the stimulus. Discussions are then rooted in observed reality rather than a version of it cobbled together by a limited and subjective memory.

A good example of the advantage of using lifelogging as a methodology can be seen in a recent project we undertook looking at people's 'green behaviour'. Subjects were asked to wear the camera over a couple of days - but were not told the specific agenda of the research. Using a traditional diary to record specific 'green acts' would have inevitably run the risk of encouraging people to exaggerate an aspect of their lives that is generally viewed as positive by others. Using lifelogging allows the diary filter to be applied retrospectively so as not to influence the behaviour at the time.

In another recent project, we looked at the role and consumption of chocolate on Christmas Day. Using SenseCam allowed us access to an important situation for the manufacturers of chocolate that we would not normally be party to. Believe it or not, people tend to prefer Christmas without the alien presence of research practitioners - and this approach gave us a unique and realistic glimpse into an emotive and important occasion.

In short, our application of lifelogging provides a new perspective on the lives of people we seek to understand - and from this comes the new insight which is the very reason the qualitative research exists.





## The school journey: Food and physical activity

The new standards for school food make it easier

for primary and secondary school pupils in England to choose and eat healthier food and drink at lunchtime and throughout the school day. Outside school, however, there are powerful forces which encourage children to purchase energy dense foods that are high in fat, sugar and salt, and which create many opportunities for them to do so. It is important to understand how factors outside of school mediate against the adoption of healthier lifestyles and to explore how that environment may be changed so that healthier options can be adopted.

The focus of this project is:

- to understand about opportunities for food consumption and physical activity on the way to and from school, and at break and lunch time if off the school site;
- the associated rationales and motivations; and
- to quantify food purchases and consumption and physical activity during these journeys.

There are major challenges to the objective assessment of teenage children's behaviours. It is unlikely that self-reporting will be truthful or complete, and the presence of observers throughout a journey is both unfeasible and likely to have a profound impact on children's behaviours. A combination of objective measures and individual reflection on behaviours and motives is therefore likely to be helpful. We believe that SenseCam in combination with a GPS device can be used to identify when and where a participant has been at any given time on the journey to and from school.

From the SenseCam records (supported by information from the LA, Environmental Health, etc.), a map of the territory covered in the journeys can be assembled, and the key points of interest (e.g. newsagents, local food shops, convenience stores, opportunities for physical activity)

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plotted. From this a method would be devised for reporting the character of the journeys, all purchases (including food purchases and consumption and sharing with friends), and physical activity.

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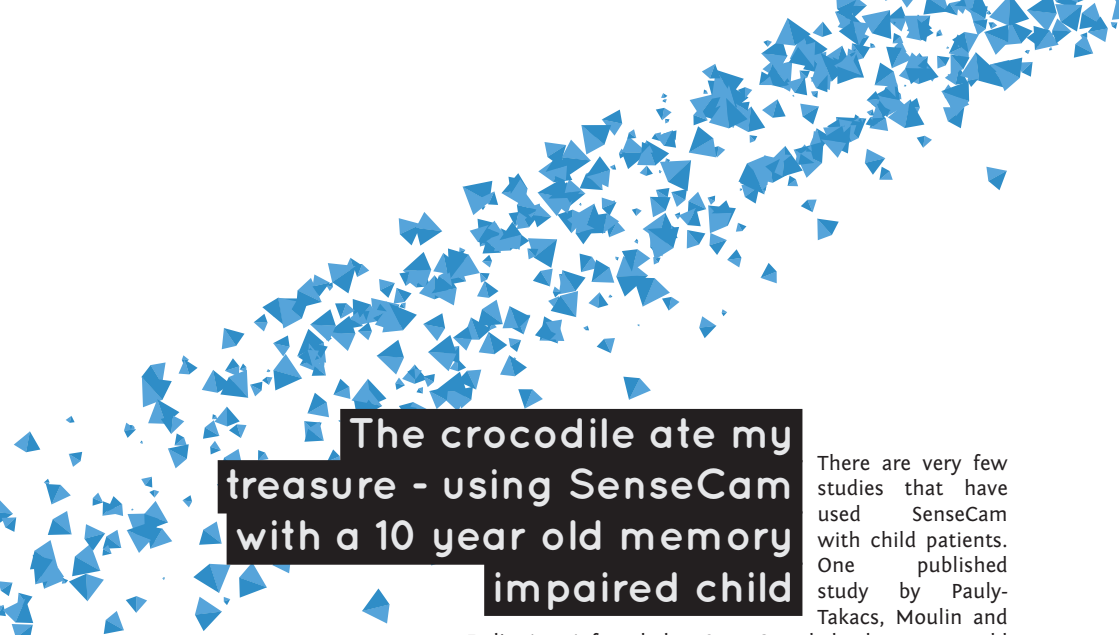


## Accuracy and completeness of autobiographical memory

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Most studies of autobiographical memory lack any means of verifying subjects' recall, or else can only do so for certain kinds of experiences (e.g., those explicitly recorded by subjects at the time of occurrence). In this study, we employed SenseCam to unobtrusively capture pictures from everyday experience that could later be used to evaluate the accuracy and completeness of autobiographical memory. Nine college students wore SenseCam for two days, and later returned to the lab for testing sessions at retention intervals of approximately one week and one month. During the tests, subjects first recalled everything they could from a specified period of time ("timeslice") without looking at pictures, and as guided by category cues (e.g., Locations, Actions, Thoughts). They then reviewed the pictures from that timeslice and made corrections and additions to their initial recall. Results suggested that autobiographical memory is fairly accurate ( $M = 79\%$ ,  $SD = 14\%$ ) and fairly complete ( $M = 71\%$ ,  $SD = 14\%$ ) after one week to one month, and that pictures from everyday experience stimulated memory even for non-visual information.






## The crocodile ate my treasure - using SenseCam with a 10 year old memory impaired child

There are very few studies that have used SenseCam with child patients. One published study by Pauly-Takacs, Moulin and

Estlin (2010) found that SenseCam helped a 13 year old with profound memory problems to generate personal semantic memories. For this young man with problems resulting from a brain tumour and its treatment, viewing the SenseCam images did not however appear to support episodic memory recollection in the manner which has been described in studies with adults (Berry et al, 2007). This study describes the experimental use of the SenseCam in a 10 year old child AB with a memory impairment related to hypoxic-ischaemic encephalopathy following a prolonged birth. Two experimental 'treasure hunts' were carried out to provide an analogue of real life events with AB wearing a SenseCam. AB's viewing of the SenseCam images did not trigger any significant recall of events that were not directly visible in the pictures, suggesting viewing images provoked only limited episodic recall. However as with CJ the repeated viewing of SenseCam images did aid AB's recall both ten days after the event and at 6 weeks. There remains a need to demonstrate that this increased recall is transferable to real life events and is at a functionally meaningful level.

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## An exploration of the utility of affective response in SenseCam archives

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SenseCam-based lifelogs capture details of personal events from peoples' lives which

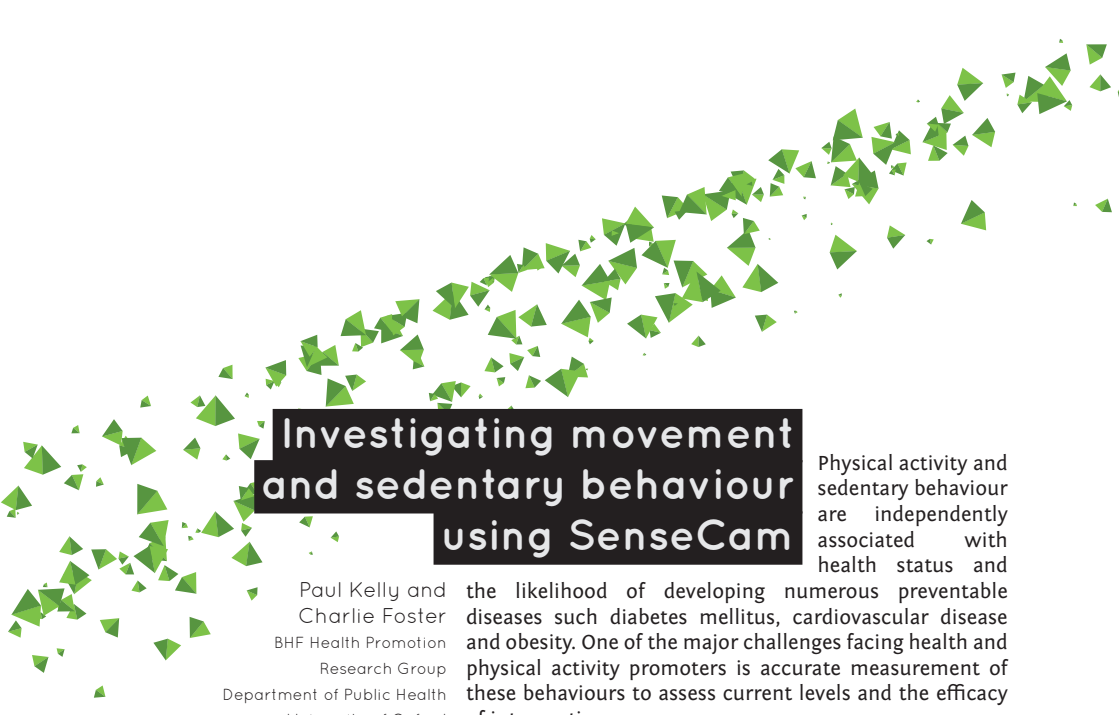
can be used by the individuals in various ways or shared with others. When gathered over an extended period these lifelogs become vast data archives. Locating interesting events from within these archives is challenging, but an important research question to be addressed in order to make these collections useful and usable. One potential source of information to identify events of importance to an individual is their affective state during the capture of the information. Previous work has shown an individual's biometric response to be related to their overall arousal levels. Significant or important events tend to raise an individual's arousal level, causing a measurable biometric response. We propose that events which are important to an individual at the time they occur may be useful to the individual again in the future. We further propose that such incidents are associated with emotional responses that can be detected by measuring an individual's biometric response when experiencing these events. Thus recording biometric response as part of a lifelog may enable us to identify important events in a lifelog. We examined the utility of using biometric response to identify significant and memorable events from lifelogs, and the role of these events in self reflection. Self reflection is an important adult process leading to further self awareness and development. Self reflection is often opportunistic, triggered by something that someone mentions or an artifact seen, and can lead an individual to relive past events, possibly gaining further insight into them self as an individual. While lifelogs may afford new possibilities for self reflection, due to their sheer volume and the number of years they may span means to automatically extract this information is important. We believe that employing biometrics, and the insights into an individuals affective state which they offer, might not only allow us to identify

important moments within SenseCam archives but may also offer a source complimentary to the SenseCam through which introspection can be empowered.

Our presented exploration uses 3 subjects' 1 month SenseCam collections annotated with biometric data. Subjects were presented with events from their SenseCam collections with varying associated biometric response and questionnaires completed to determine

if biometric response corresponded with memorable-ness, significance and utility in self reflection of events. Post questionnaire interviews were then conducted. Experiment results show preliminary relationship between SenseCam event importance and biometric response, and indicate that biometric records may serve as a good enabling technology for applications supporting self reflection.





## Investigating movement and sedentary behaviour using SenseCam

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the likelihood of developing numerous preventable diseases such as diabetes mellitus, cardiovascular disease and obesity. One of the major challenges facing health and physical activity promoters is accurate measurement of these behaviours to assess current levels and the efficacy of interventions.

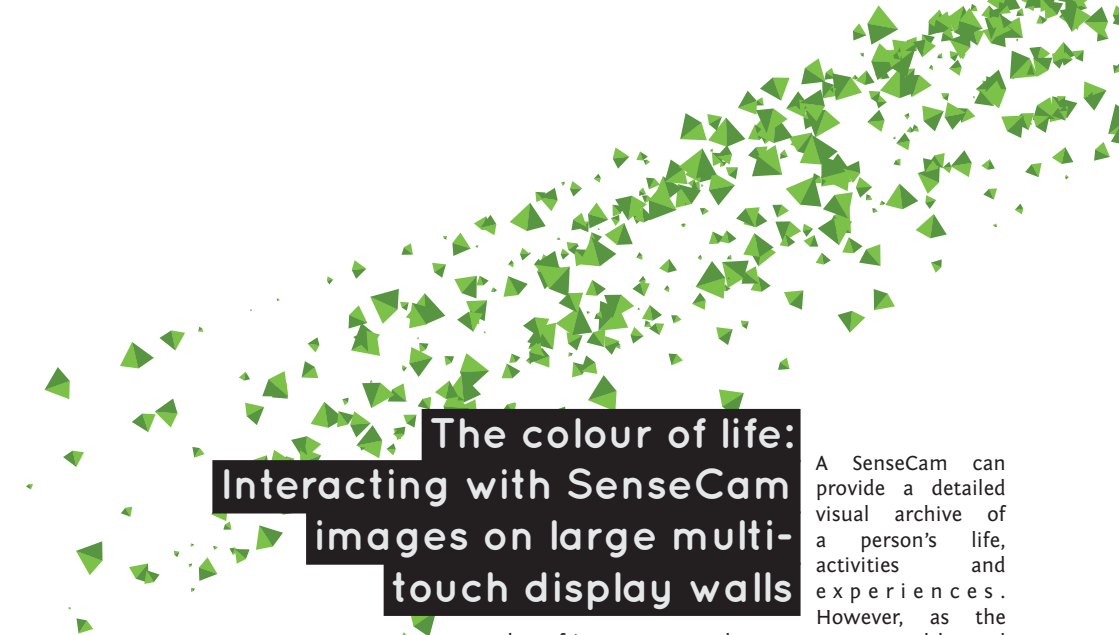
Microsoft SenseCam is believed to have great potential to improve our measurement of these behaviours as the digital images are closer to direct observation, the criterion measurement, than other available technologies. We have been using SenseCam to investigate and measure different domains of active and sedentary behaviours. Active travel (walking and cycling) is known to have great potential for increasing total physical activity levels, and we present an update of our 2009 pilot using SenseCam to test the validity of self-reported data. We also outline the study developed from this pilot, due to commence in October 2010.

We also present results from a feasibility study using SenseCam to investigate sedentary behaviour in the home. The risk and burden of sedentary behaviour is becoming clear, but we know little about the domains and correlates of this inactivity. SenseCam may have the potential to deepen our knowledge by revealing duration and frequency of such behaviours as television watching, computer and internet use, reading and study, eating and sitting. It may also be able to tell us more about how these behaviours interact.

### ACKNOWLEDGMENTS

We would like to thank the Sensors and Devices Group, from Microsoft Research Cambridge and Vicon UK.





## The colour of life: Interacting with SenseCam images on large multi- touch display walls

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A SenseCam can provide a detailed visual archive of a person's life, activities and experiences. However, as the number of images captured per year can extend beyond one million, gaining an insight into an individual's lifestyle in a fast, effective and intuitive manner is a challenging prospect. In this work, we develop an interactive image browsing tool, which incorporates visualisation techniques that can capture not only a snapshot of an individual's lifestyle over long periods of time, but also how that lifestyle varies with changing days, weeks, or years.

The image retrieval tool incorporates the Colour of Life algorithms [1], which can represent an overview of millions of images with a single visualisation. The Colour of Life algorithms focus on the relationship between lifestyle and colour, by capturing the colours to which we are exposed in our lives (and therefore captured by SenseCam images), collating similar colours for specific time periods and depicting how those colours change over time with a flowing time-line - see Figure 1(a) which depicts the life of a SenseCam user over the period of 8 days. In this figure, time is orientated along the horizontal axis and larger vertical peaks indicate higher user activity for a given period of time. In Figure 1(a), the normal working week consists of the rhythmical blue, pink (work) and yellow (home) peaks and troughs for each day (with less activity at the start and end of the days), whereas time outdoors increases at the weekend, especially during the night (and hence the darker colours on the left hand side of the figure).

The Colour of Life visualisation, while providing information on changes in lifestyle, does not provide

sufficient context to understand the exact activities of a user for a given time period. For example, on the left of Figure 1(a) there is an area of red, that does not occur anywhere else during the 8 days of activities images – where was the user at this point in time and what was he doing? In this work, we build an interactive image browsing tool based around the Colour of Life visualisation. We exploit the use of high resolution multi-touch display walls, where we extend the Colour of Life algorithms to produce an intuitive visualisation, which incorporates image mosaicing (see Figure 1(b)).

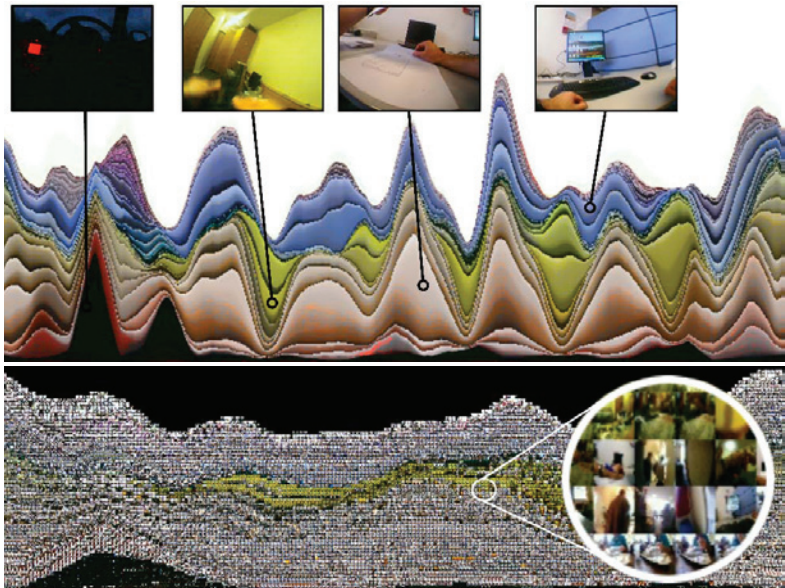


Figure 1: The Colour of Life Visualisations  
 a) Above: Default visualisation.  
 b) Below: Image mosaicing visualisation – zoomed section on the right.

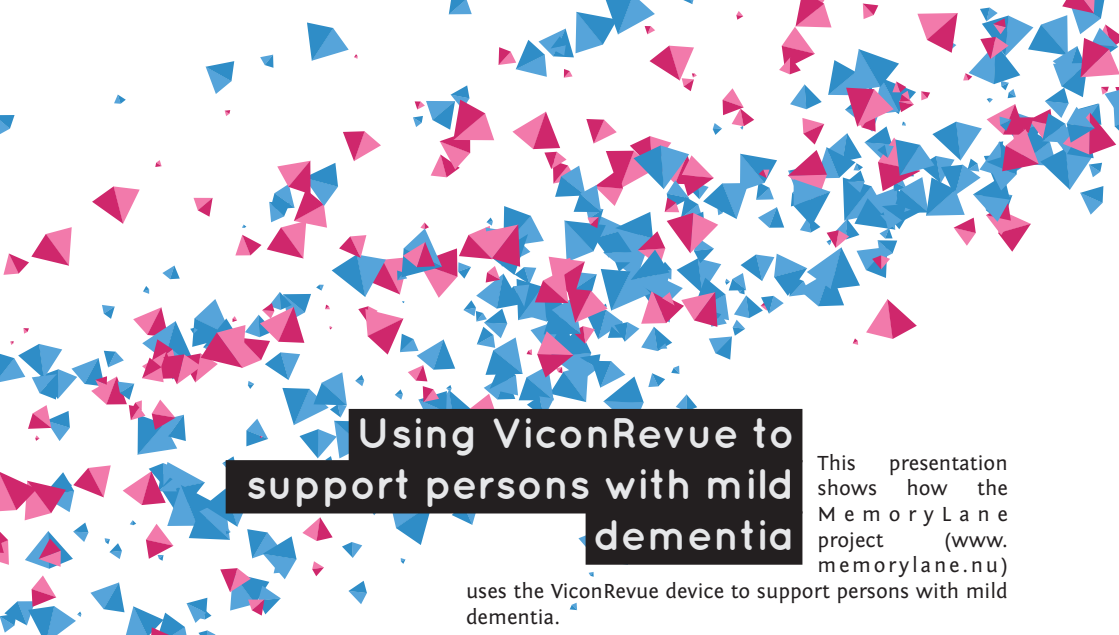
Through this we incorporate coarse lifestyle data with more fine detailed contextual information on human activities into one interactive visualisation tool. As an additional feature, we have investigated the use of image classification within the framework of the Colour of Life. One such example is the categorisation of images as being as social (i.e. interacting with other people) or nonsocial. Using such a classification, we can depict a person's social lifestyle, and how that varies over time.

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## Acknowledgements

This work is supported by Science Foundation Ireland under grant 07/CE/I1147.



## Using ViconRevue to support persons with mild dementia

This presentation shows how the MemoryLane project ([www.memorylane.nu](http://www.memorylane.nu))

uses the ViconRevue device to support persons with mild dementia.

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The aim of the MemoryLane project is to support persons with mild dementia through creation of digital life stories for later context-dependent retrieval. The MemoryLane prototype consists of a mobile device which logs context data using GPS and Bluetooth sensors while also hosting a Mobile Cognitive Assistant, a ViconRevue camera, and a Review Client on a touch screen computer which analyses logs, recognizes activities, and presents them to the user for reviewing and adjusting.

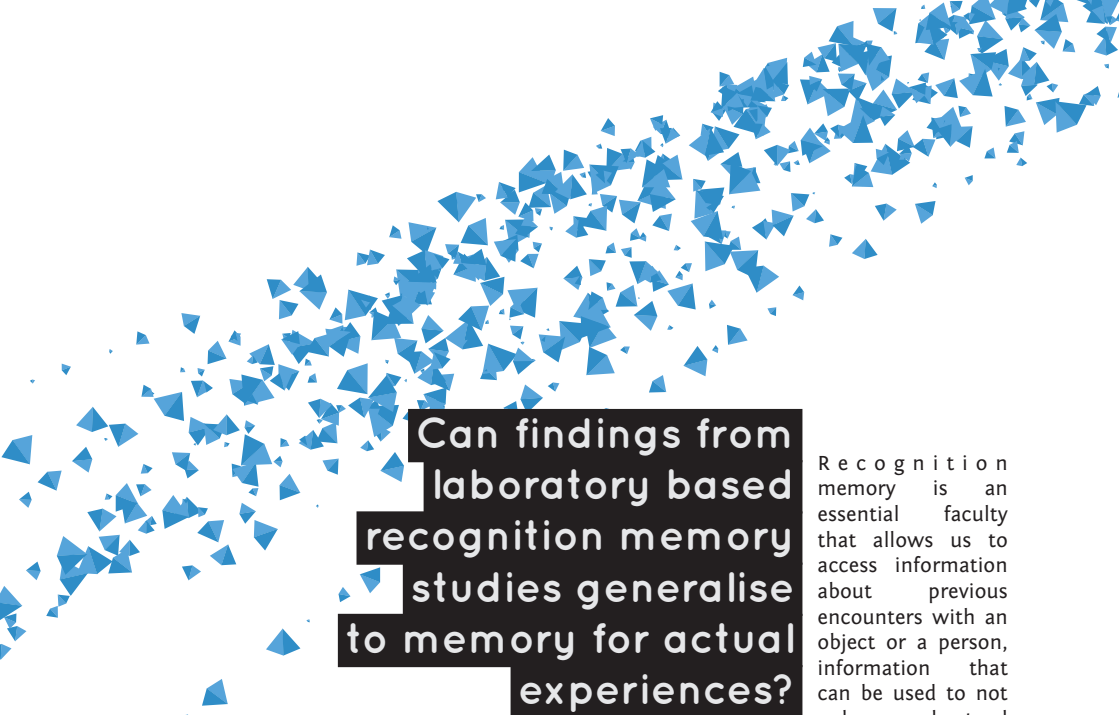
For persons with mild dementia and their carers, it is important to get an overview of the captured images and their meaning, not just viewing them in sequence. Therefore the MemoryLane Review Client allows the user to view all images related to an activity as thumbnails, and to manually annotate activities with context information such as the place visited and the persons present. Activities that are significant life events can be added to the Life Story of the person, for use in reminiscence therapy and for day-to-day use.

After recognising activities based on logged context data, the Review Client adds captured images to the activities according to their time periods. Periods of time with no known context are also represented as activities. When reviewing, the user can adjust the context and content data related to an activity. For instance, the user can skip some images, add some images from external sources, add a new place or a new person based on the images of the activity, add more persons to the activity, or even discard the whole activity.

Image filtering is a central component of the MemoryLane Logging Kit. Filtering images while transferring them will suppress dark, blurry and similar images. After using the ViconRevue device, we believe that some main usability issues should be addressed and significant features should be added:

- “The manual shutter” and “privacy” buttons look very much the same, causing uncertainty how to operate the device. Making the privacy button bigger, possibly red and with the caption “STOP”, while the manual shutter button could have the caption “IMAGE” will improve the usability of the device.
- The privacy indication should clearly show to all nearby that the device is not capturing images.
- The yellow light sometimes blinks repeatedly when an image or sensor data is taken, which can be disturbing. Persons with mild dementia should have the option to have image-taking indications disabled, even when taking pictures (where allowed by law).
- The ViconRevue must automatically turn on when disconnected from the computer or charger. It is very important to add a configurable option to always turn on the device when disconnected especially when the device is going to be used by a person with dementia.

In conclusion, the ViconRevue camera blends well into the MemoryLane system. Image filtering algorithms created for non-fisheye cameras show similar performance when used on ViconRevue images.



# Can findings from laboratory based recognition memory studies generalise to memory for actual experiences?

Recognition memory is an essential faculty that allows us to access information about previous encounters with an object or a person, information that can be used to not only understand

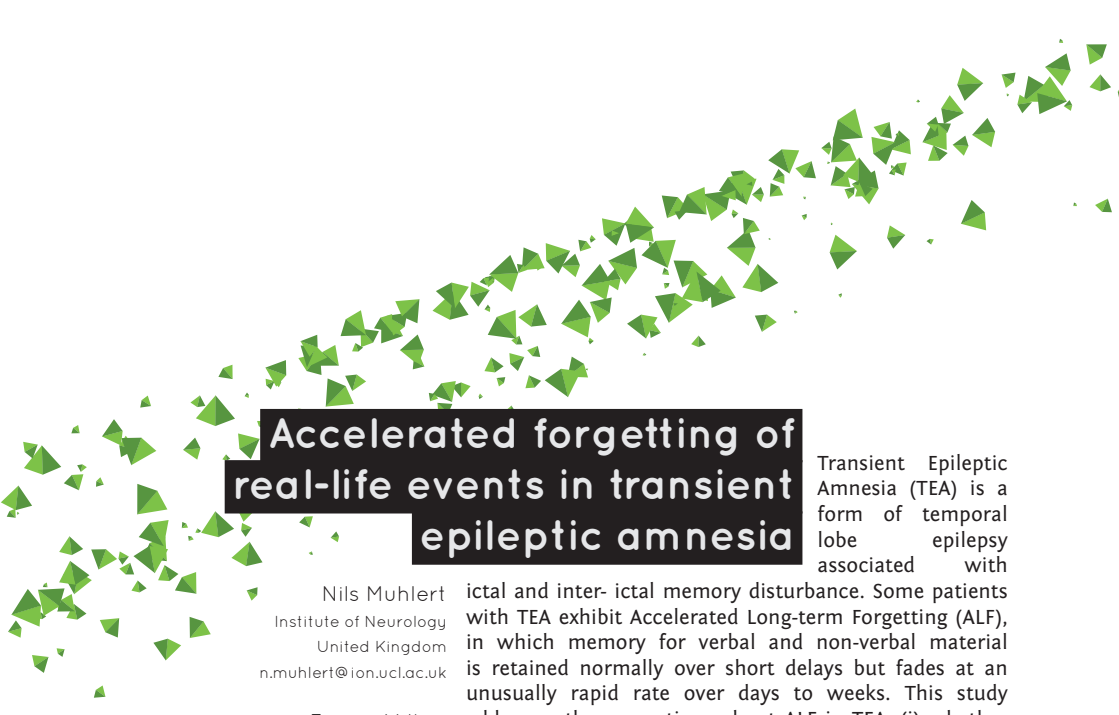
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out past experiences, but also to determine the best way to behave in future encounters. Typical experimental paradigms used to investigate recognition memory involve presenting participants with a series of novel stimuli (i.e. pictures or words) during a 'study phase', and then asking them to recognise them in a later 'test phase', a series of stimuli comprising a mixture of previously presented (old) and new items. Successful recognition memory can then be measured by comparing items correctly identified as old with those correctly identified as new. Whilst these typical laboratory based paradigms allow researchers to have strict control over stimuli content, ensuring consistency across studied and unstudied conditions, they are often criticised for their lack of external validity. In contrast to our memory for personal events and encounters these types of paradigms limit the level of personal engagement and significance of the 'to be remembered' information. This raises the question as to whether the findings from laboratory memory studies generalise to our everyday autobiographical memories. The research proposed here aims to address this question, using SenseCam to generate a stimuli set that is unique to each participant, documenting an event experienced by the individual. These personalised stimuli sets will be used, in the laboratory, to test participant's memory for the event. The results from this personalised study will then be compared with those of a task using more generic stimuli to try and understand memory for personal

experiences and how it compares to the type of memory typically being tested in the laboratory. Comparing this type of targeted task with those typically used in memory research will not only provide a contrast between memories for personally significant and insignificant material, but will also help to understand the degree to which laboratory based studies can be generalised to the day-to-day memories of experiences that are so important.





## Accelerated forgetting of real-life events in transient epileptic amnesia

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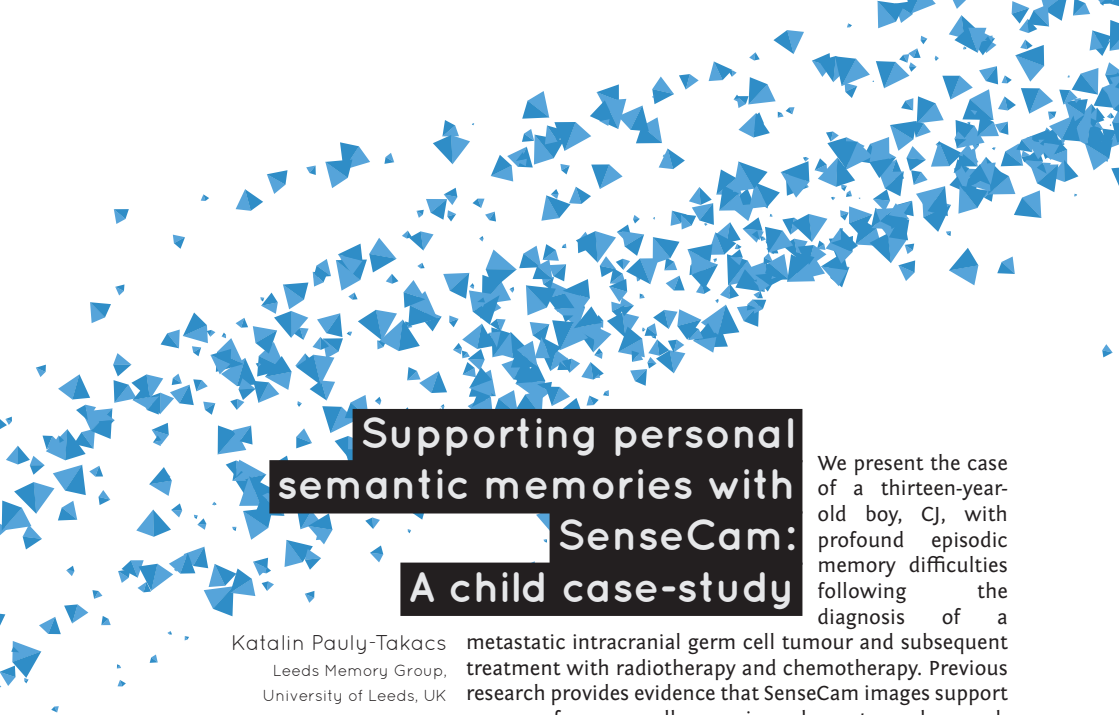
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Transient Epileptic Amnesia (TEA) is a form of temporal lobe epilepsy associated with ictal and inter-ictal memory disturbance. Some patients with TEA exhibit Accelerated Long-term Forgetting (ALF), in which memory for verbal and non-verbal material is retained normally over short delays but fades at an unusually rapid rate over days to weeks. This study addresses three questions about ALF in TEA: (i) whether real-life events undergo ALF in a similar fashion to laboratory-based stimuli; (ii) whether ALF can be detected within 24 h; (iii) whether procedural memories are susceptible to ALF. Eleven patients with TEA and eleven matched healthy controls wore a novel, automatic camera, SenseCam, while visiting a local attraction. Memory for images of events was assessed on the same day and after delays of one day, one week, and three weeks. Forgetting of real-life events was compared with forgetting of a word list and with performance on a procedural memory task. On the day of their excursion, patients and controls recalled similar numbers of primary events, associated secondary details (contiguous events, thoughts and sensory information) and items from the word list. In contrast, patients showed ALF for primary events over three weeks, with ALF for contiguous events, thoughts and words over the first day. Retention on the procedural memory task was normal over three weeks. The results indicate that accelerated forgetting in TEA: (i) affects memory for real-life events as well as laboratory stimuli; (ii) is maximal over the first day; and (iii) is specific to declarative memories.





## Supporting personal semantic memories with SenseCam: A child case-study

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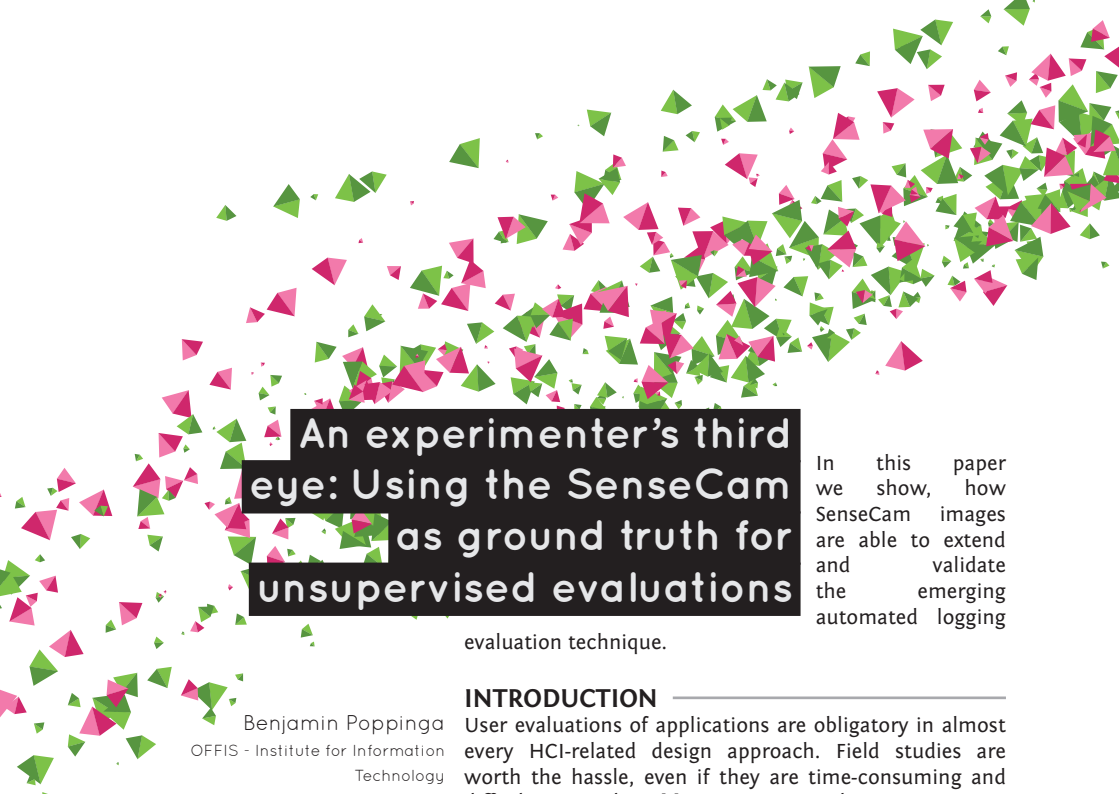
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We present the case of a thirteen-year-old boy, CJ, with profound episodic memory difficulties following the diagnosis of a metastatic intracranial germ cell tumour and subsequent treatment with radiotherapy and chemotherapy. Previous research provides evidence that SenseCam images support memory for personally experienced events, and as such the device can serve as a powerful memory aid for people with severe memory difficulties (e.g. Berry et al., 2007). At the core of this study is the first application of SenseCam to a child with severe memory impairment. CJ was taken for a walk while he was wearing SenseCam. This included visiting four different locations. We manipulated the number of locations he could review on SenseCam 'films' and then tested recognition memory (forced choice) for both reviewed and non-reviewed locations. We also collected his justifications for the choices he made. Our results indicate that repeated viewings of SenseCam images support the formation of personal semantic memories. Overall our results suggest that the use of SenseCam in memory rehabilitation extends beyond supporting episodic memory and recollection, and supports the feasibility of its use with children who have marked memory difficulties.





# An experimenter's third eye: Using the SenseCam as ground truth for unsupervised evaluations

In this paper we show, how SenseCam images are able to extend and validate the emerging automated logging

evaluation technique.

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## INTRODUCTION

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User evaluations of applications are obligatory in almost every HCI-related design approach. Field studies are worth the hassle, even if they are time-consuming and difficult to conduct [1]. To overcome these issues, new observation techniques are developed. One of them is automated logging, which uses sensors to capture the users' interactions. In this paper we describe how the SenseCam extends the logging and helps to validate the logging methodology in a user study. The final goal is to allow completely unsupervised evaluations.

## CONCEPT

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A common smart phone contains several sensors: GPS positioning, speed, and heading, an accelerometer, a compass, a proximity sensor, a light level sensor, a microphone, and a camera. Additionally, the timestamp and duration of possible touch screen usage can be detected. All these sensors can be used to automatically determine and log a user's behaviour in an evaluation setting. To investigate logging as a feasible evaluation technique we conducted a field study with 15 participants. As scenario we selected a mobile personal navigation application we developed, where we have some serious interest in the evaluation. The map-based application is called PocketNavigator (<http://www.pocketnavigator.org/>) and has tactile feedback integrated [2]. This is intended to guide a user without the need to look on the display. We have the hypothesis that the tactile feedback would lead to less

navigation errors, less disorientation events, and a reduced need to watch on the visual display.

Coming from the hypothesis we designed three dependent measures. Navigation errors are detected by calculating how far the user is from the shortest path between two waypoints (i.e., used sensor: GPS). Disorientation is detected by observing the user's heading towards the next waypoint (i.e., used sensors: GPS, compass). The device posture is measured by relying on the accelerometer and the values roll and pitch. To determine a ground truth, every participant was asked to wear a SenseCam. Additionally we shadowed the participants, taking written notes on the three determined dependent measures.

At this informal stage we find it sufficient to investigate the observation method through simple reviewing. Therefore we developed an application, which is able to display every recorded value in a meaningful way. In example the users position and heading is displayed on a map, the device posture is encoded as the user's icon colour, and disorientation is shown as two-coloured indicator (i.e., red means disoriented, grey means non-disoriented). Additionally the SenseCam image taken in this specific situation is shown.

## **RESULTS AND DISCUSSION** —

As result we can report, that the SenseCam serves well as ground truth and observation device. According to our informal results the logging performed well in practice. For navigation errors we found that a noisy GPS signal can result into false positive indications of the

logging framework. Through the SenseCam we observed that users tend to physically rotate the device to align the map to the environment (see Figure 1). This results in false positive detections for disorientations.



In our future work we plan to do another more formal validation of the logging methodology against the gold standard observation method in field studies: video recording. Beside this we plan to release our logging framework and the Context Player to the research community to foster the investigation of other scenarios and applications, e.g. travel reconstruction.



Figure 1: The observation of the participants through the SenseCam revealed that some tend to physically align the map shown on the device to the environment. This results into confusions for the automated detection of disorientations.

#### ACKNOWLEDGEMENTS

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## Towards privacy preserving lifelogging

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Lifelogging, even in its simplest form, is surrounded by privacy issues. If a lifelogger is collecting data only about herself, such as geolocation, activity, or medical data (e.g. heart rate, blood pressure) then she may wish to keep all of her data completely private, share some with a medical practitioner or continuously broadcast it to the world. In these cases, the technical challenges to controlling privacy and sharing access to data are relatively straightforward and have been well studied (e.g. [3,4]). However, when a lifelogger begins to capture data about others, complex privacy issues arise, both ethical and legal. Capturing low resolution still images (such as those from the current Vicon Revue) of people in a public place where there is no expectation of privacy and which are not published, are currently legal in North America and the UK. Most national and provincial Information Commissioners currently consider lifelogging to be recreational and therefore outside the remit of data protection laws.

Although capturing some data about strangers in public places is currently legal, capturing images of family, friends, and colleagues is on a different ethical and legal level. One may argue that a stranger in a public place is not an identifiable person and therefore exempt from fair information practices or data protection laws, but a lifelogger has an ethical (and sometimes legal) duty to inform those they know that their images may be captured and stored, possibly forever. Our initial work has shown that many individuals are concerned about their friends and colleagues capturing random still images of them in potentially unflattering poses (such as while eating or gesticulating). This concern has caused some to object to having a lifelogger in their presence.


While others have suggested blanket facial obscuring methods (e.g. [1,2]), we believe that this defeats many of the purposes of lifelogging. In this work we are exploring

methods for understanding the range of perceptions of privacy in lifelogging in order to develop appropriate tools to enable both the lifelogger and those around them to achieve their privacy goals. One proposed method allows people to register their objection to having their image captured with a central server. When lifelog images are uploaded directly to the server facial recognition will be used to obscure only those who do not wish to be recorded. Most data protection or fair information practices require the data collector to give data subjects a right to access their data. This method would also allow those who are captured in someone else's lifelog to have access to any data about them, perhaps to incorporate into their own lifelog. In this work we are exploring a number of methods to achieve both useful and socially acceptable lifelogging.

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## Capturing the moment: The cognitive and psychosocial impact of two SenseCam media formats on persons with cognitive impairments

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with early Alzheimer's disease (AD) or Mild Cognitive Impairment (MCI). SenseCam reexperience presents unprocessed SenseCam images replayed at 2 frames/second in the temporal sequence in which the experienced percepts might have been encoded. SenseCam remix is composed of a selection of 24 SenseCam images that have been edited and narrated by the cognitively impaired persons' caregiver resulting in a multimedia representation of the day's events that merges participant and caregiver perspectives.

Six participants with early AD or MCI wore SenseCam during three personal outings accompanied by a caregiver. Subsequent to each outing, participants were interviewed five times (over two-and-a-half weeks) about the event using a customized version of the Autobiographical Interview (AI) [1]. The AI scoring methodology enables the separation of autobiographical memory details that are specific to the event from semantic information and other details or commentary. During the interview sessions participants were shown either SenseCam re-experience, SenseCam remix, or a no media control. Three months after each event a long-term follow-up interview session was conducted.

In addition to the AI sessions the three conditions were compared along a broad set of measures including well being, ratings of the meaningfulness of the event and how clearly it can be visualized, general cognitive measures (pre-and post-intervention), and qualitative analysis of

We report on a study that evaluates the cognitive and psychosocial impacts of two types of SenseCam media formats (termed reexperience and remix) on persons

semi-structured interviews and video data of participants viewing the media with family members. An embedded visual recognition task was included to explore the associative effects of multimedia review for memory of outing stimuli that were not reviewed or even captured by SenseCam. Results will be reported from five participants across two constructs: cognitive and psychosocial. Results from AI data of 3 participants show they retained more details from their autobiographical memory of the events they review using the two SenseCam media formats as compared to the no media control. Preliminary qualitative results show some participants felt reexperience was better for recall but remix was more enjoyable to share with others. Some participants also found the study helped them gain insight into their cognitive impairment. We shall conclude with lessons learned from this study regarding: consideration of multiple stakeholders such as family members; use of psychosocial as well as memory measures to evaluate lifelogging technology; and the use of the AI for SenseCam research.

## ACKNOWLEDGMENTS

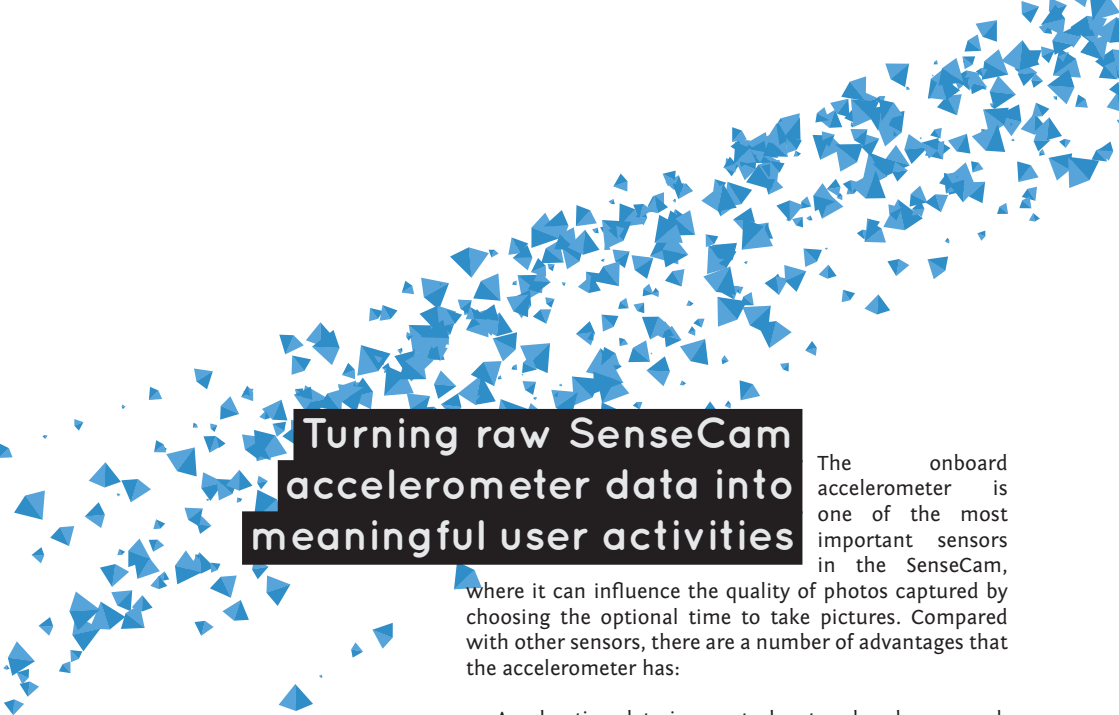
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## Turning raw SenseCam accelerometer data into meaningful user activities

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The onboard accelerometer is one of the most important sensors in the SenseCam,

where it can influence the quality of photos captured by choosing the optional time to take pictures. Compared with other sensors, there are a number of advantages that the accelerometer has:

- Acceleration data is easy to be stored and processed, especially in comparison to the average of 4,000 images taken every day by the SenseCam which consume an amount of disk space. Acceleration data takes little space, and can be processed by the SenseCam's on-board micro-processor in real-time.
- The most important information from SenseCam is image data, but it is difficult to take a clear photo when the user is moving very fast or is present in dark places, the accelerometer helps to avoid the problem of blurred image capture.
- No wireless signals are needed. While GPS techniques have been improved a lot in the past decade, determining location of the inside of buildings is limited by no clear line of sight to satellites in the sky.
- Low battery consumption. Compared with camera and GPS, it uses little battery. Now the battery is the key bottleneck for portable sensors. It is very inconvenient for users to constantly remember about charging battery all the time.
- The accelerometer can also act as an important source of evidence for automated content annotation, as described below.

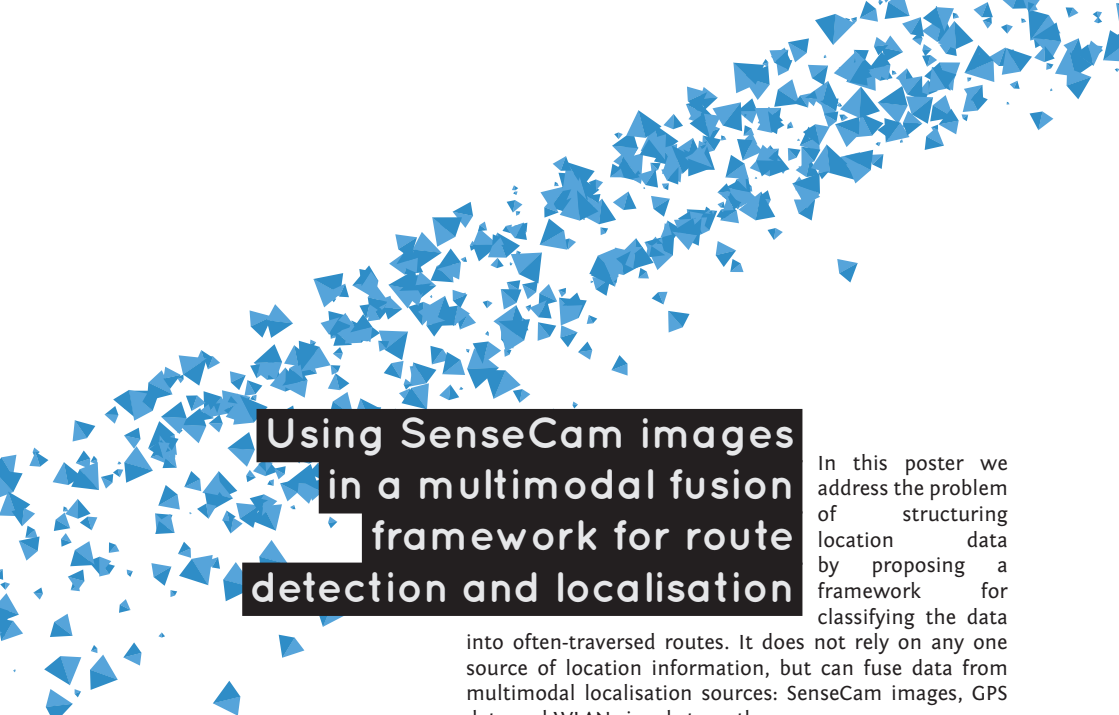
Given the above benefits of the accelerometer onboard the SenseCam, we now discuss the information which can be mined by analysing this raw acceleration data:

1. Activities detection: By analysing acceleration data, common daily activities can be recognised, such like sitting, walking, driving and lying. To recognise each different activity, we employ different binary-class SVM models for each activity, because different features from acceleration are used to recognise different activities. These activity recognition results can be used as an important resource for associating context with real-time lifelog information.
2. Calculate driving-related CO<sub>2</sub>: Environmental issues have been at the forefront of the public conscience of late. We believe it will be helpful if users can get real-time driving information and how much carbon they have produced by driving. To achieve this we have built SVM classifiers to identify driving related activity. Our driving detection can be improved by smoothing algorithms and also techniques to detect time spent at traffic lights. From this we can make an accurate estimation of driving related CO<sub>2</sub> emissions. Our presentation will provide details on how the above algorithms work, and their potential for future SenseCam related applications.

### **Acknowledgements**

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## Using SenseCam images in a multimodal fusion framework for route detection and localisation

In this poster we address the problem of structuring location data by proposing a framework for classifying the data

into often-traversed routes. It does not rely on any one source of location information, but can fuse data from multimodal localisation sources: SenseCam images, GPS data and WLAN signal strengths.

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The problem of route-matching is complicated by a number of factors including the need to track users seamlessly in both indoor and outdoor environments, the need for robustness to slight deviations in the path and the user's speed taken along a route. We investigate the combined use of GPS, wireless signal strength readings (WLAN) and SenseCam image-matching to provide reliable user route matching. Whilst GPS has become synonymous with user localisation, its robustness can be called into question. Indoors, GPS signals are weak and outdoors signals can be affected by obstacles, multipath propagation and tall buildings causing serious errors in localisation; in the case of WLAN, localisation indoors is generally good but variations in the environment, such as temporary changes to building layout or weather conditions, can affect signal strength. Using image matching from a wearable camera like SenseCam to determine location is an alternative technique to radio-frequency based approaches. Occlusion and changes in lighting are the main problems for this approach. It is now possible for users to regularly collect large amounts of different types of location data. This large collection of data is potentially useless without some means of structuring the data to make it understandable and searchable. Such applications of using large amounts of location data can be of benefit to a variety of users. For example, runners may wish to know how often they take a particular route whilst jogging. In caring for the

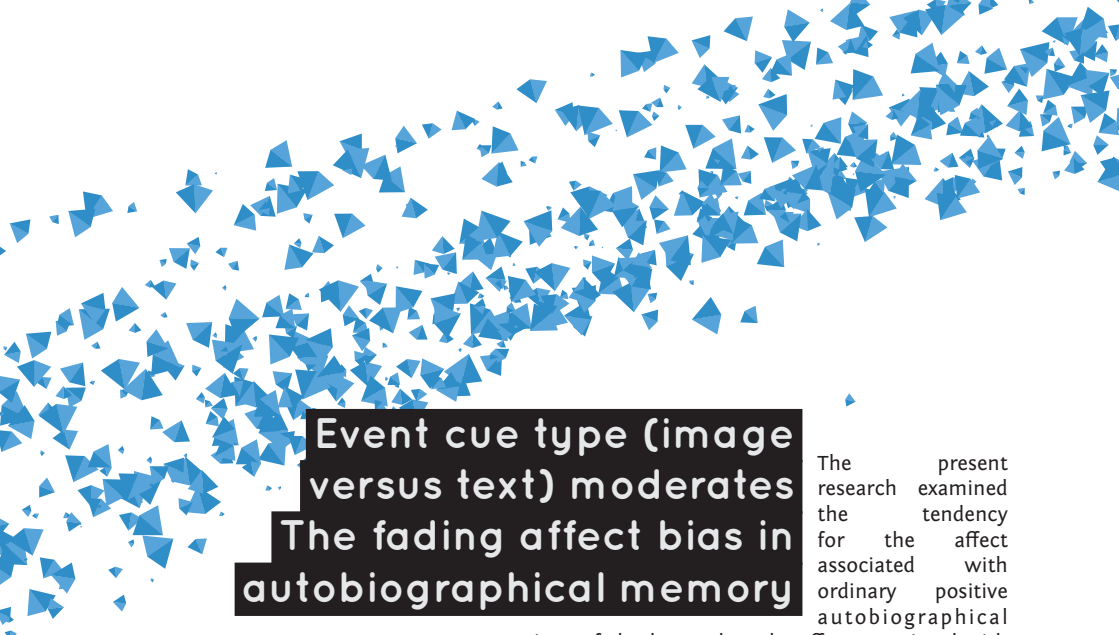
elderly, allowing a mobile device to automatically determine whether an elderly person has deviated from his/hers normal routine can trigger a notification to carers. In the life-logging community, route matching can add valuable structure to the months and years of recorded daily activities. A set of training data was collected simultaneously using a SenseCam , GPS device and Campaignr software installed on a N95 Nokia phone (for collecting signal strengths data). Measurements were taken on 6 selected routes within and around the Dublin City University (DCU) campus, ranging from 330m to 615m in length. The devices were synchronized and the data recording was collected at regular time intervals. Each route was traversed many times over a period of 6 weeks, yielding 30 testing and 24 training sets of data for overall. Signal strength information is considered to be 3-dimensional as the same 3 MAC addresses were discernible along each trip. GPS data is deemed to be 2-dimensional (consisting of longitude and latitude coordinates). On average, a trip consisted of approximately 30 images along the route. In order to find a similarity measure for data collected during different trips the Multidimensional Dynamic Time Warping Algorithm was employed. The algorithm uses a local distance measure to determine the similarity between two sequences. In order to classify a new trip into one of the known routes, we used a k-NN (nearest neighbour) classifier. This simple classifier can account for the large variability of the localisation sources, as well as being able to easily accommodate new trip examples for online training. To fuse the localisation data from our three sources, we computed a weighted linear combination of the distance matrices of the sources. These matrices were suitably weighted and then added. Using a training set of 24 trips we identified a set of optimal weights for each combination of sources using an exhaustive grid-search. The weights were selected such that sum is equal to 1 and the classification accuracy on the

training set was maximised. We evaluated the classification performance on 30 separate testing trips. Preliminary results of combining three complementary sources of data for classifying trips from localisation data are presented. By fusing GPS, wireless signal strength readings and image-based matching, we achieve better performance than any individual/combined modality.

#### **ACKNOWLEDGMENTS**

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# Event cue type (image versus text) moderates The fading affect bias in autobiographical memory

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memories to fade slower than the affect associated with such negative memories—the Fading Affect Bias (FAB)—and examined the extent to which the magnitude of the FAB varied according to event cue type (i.e., text descriptions vs. images).

The present research examined the tendency for the affect associated with ordinary positive autobiographical

## INTRODUCTION

Reminiscing about one's past often prompts emotions. Research has consistently shown that the positive emotions prompted by positive autobiographical events typically outlive the negative emotions prompted by negative autobiographical events [1, 2]. Evidence suggests that this occurs across emotions [3]. The effect has been formalized into a general principle that is expressed in terms of affect [4]: Pleasant affect associated with positive events tends to persist longer over time than unpleasant affect associated with negative events (the Fading Affect Bias; FAB).

## THE PRESENT RESEARCH

The present research examined the FAB with a method typical of FAB research (i.e., text-cued) and also with a novel method (i.e., image-cued). I examined the extent to which the magnitude of the FAB varied by cue type, and hypothesized that if event reconstruction tends to be self-protective and self-enhancing then the FAB will be large for events that are shielded from reality (i.e., no image cue) and it will be small for events cued by reality (i.e., image-cued).

## METHOD

### Participants & Procedure

Participants were six volunteers with an average of age 33 years ( $SD = 11.84$ ). Each wore a passive digital camera for 4-6 hours for one day. The researcher selected 5-20 images from each image pool ( $NI = 95$ ). On the same day, participants reviewed their images, typed a brief title for each and rated each for Affect Pleasantness, Affect Arousal, Rehearsal Frequency, Self-Importance and Detail. After one week, participants were first shown their brief titles then re-rated each event; they were next shown their titles and images and then re-rated each event.

## RESULTS

For text-cued events, unpleasantness faded ( $M = 0.34$ ) and pleasantness increased since the event ( $M = -0.11$ ): a FAB occurred,  $p < .05$  (see Table 1; positive mean suggests fading, the negative mean suggests that affect a week later was rated as more pleasant than it was at occurrence). For image-cued events, unpleasantness faded more ( $M = 0.32$ ) than pleasantness ( $M = 0.12$ ), however, this was not statistically significant: a FAB did not occur,  $p > .25$ . These findings occurred independently of Affect Arousal, Rehearsal Frequency, Self-Importance and Detail.

## DISCUSSION

In sum, published research on the FAB relied on diverse methodology; however, until now, no FAB study had kept a visual record of what occurred during people's events. Hence, it was unclear whether the FAB is a result of unaided event reconstruction. Although only a pilot study, the results suggest that for text-cued events, a FAB occurred; for imaged-cued events, a FAB did not occur. These findings implicate the self in autobiographical affect [4, 5], such that without visual cues, the self tends to avoid affective unpleasantness (protective) and tends to seek affective pleasantness (enhancing) in memory; the self does this less when given visual cues.

## ACKNOWLEDGMENTS

I thank my colleagues at the University of Limerick and in the UK for their help with collecting data for this study.

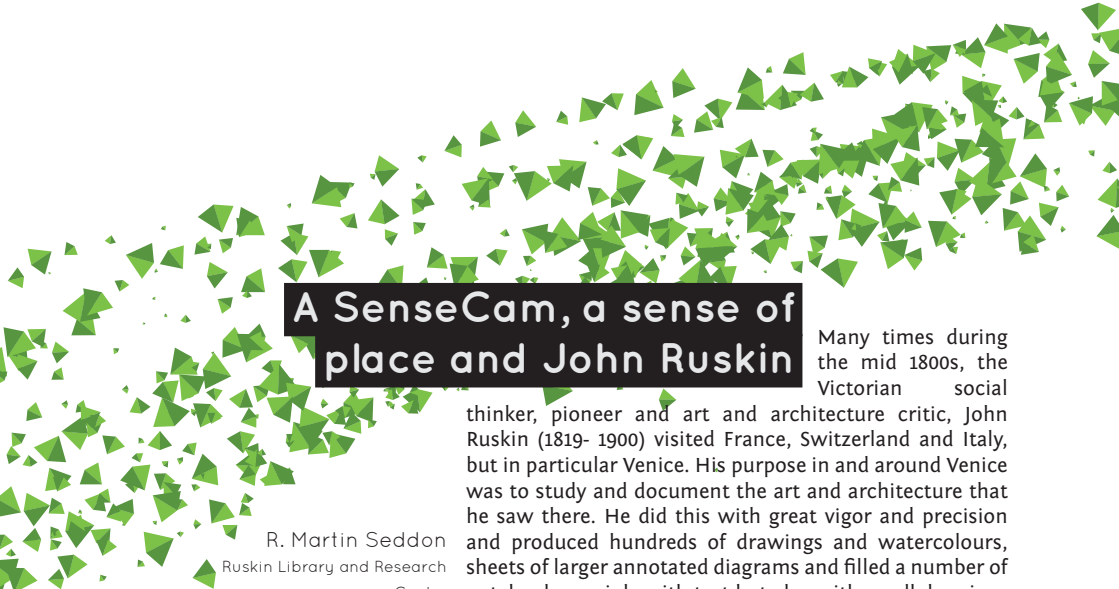
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Cue	Negative	Positive	<i>F</i>	$\Delta R^2$
Text	0.34	-0.11	4.12	.08
Image	0.32	0.12	1.26	.05

Table 1. Affect Fading Mean per Event Valence and Cue Type





## A SenseCam, a sense of place and John Ruskin

Many times during the mid 1800s, the Victorian social

thinker, pioneer and art and architecture critic, John Ruskin (1819- 1900) visited France, Switzerland and Italy, but in particular Venice. His purpose in and around Venice was to study and document the art and architecture that he saw there. He did this with great vigor and precision and produced hundreds of drawings and watercolours, sheets of larger annotated diagrams and filled a number of notebooks, mainly with text but also with small drawings of architectural features. The purpose of this combined output was to provide the public with a complete record and analysis of what he saw.

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However, the records that he made were not themselves generally intended to be seen by the public. Rather, they were Ruskin's own notes and aides memoire which enabled him to produce written volumes on his subject matter - volumes which themselves were sparsely illustrated.

One of the types of publication that Ruskin produced was a 'Traveller's Handbook' - what we would now call a Guide. However, unlike our guidebooks, his were, in the main, totally un-illustrated. They relied on the fact that the visitor was standing in front of the painting or building being described and thus described the items almost as a dialogue.

Reading the descriptions of the artefacts and the journeys between them provides a strikingly similar experience to that when viewing a SenseCam image stream, but using words. Many similarities can be drawn, not in the purpose behind their production, but in terms of their experience by the end user. The technique used to produce the SenseCam images may appear to be similar to a video but with the vital difference (and one which Ruskin seems to have appreciated, either consciously or not) that whilst a

video might provide a more detailed and literal version of events, this is not what enables the most effective use of memory. Part of my research has been to analyse Ruskin's explanatory watercolours to determine how he provided information through them. These pictures often have large areas with very little detail or colour. Combined with these areas are smaller sections in full detail and colour. Ruskin uses this as a means of telling the viewer what he considers they should be concentrating on. Thus the overall image provides a general impression of the overall site but without the distraction of unnecessary details while these are provided to the extent necessary to convey a full record.

Experiments to date have attempted to use the SenseCam, in combination with a more 'standard' digital camera, to emulate architectural coverage of this type. The image stream provides information about the building in terms of its overall appearance, its place in its setting and the way it is approached and entered. The accompanying separate images provide the more detailed information required for accurate analysis of particular features. The actual method requires some refinement and to be most useful may require additional features which may or may not be able to be incorporated into future SenseCam models. This testing is ongoing, and for the conference I hope to have examples to show.



## The sensor web and the SenseCam

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Since its inception, the SenseCam has been used as a lifelogging device with support for memory recall being the primary intended application. However, as with the development of all good technologies, we tend to find new applications that we didn't think of in the first place and these unintended applications can sometimes outgrow the original ones. In the case of the SenseCam, we have been using the image and sensor data gathered in order to determine the activity profiles and characteristics of individuals and to compare them against the peers as well as to track changes in activities over time. We have also been using SenseCam data to help compute the wearer's individual carbon footprint by detecting driving and other transport mechanisms. When our use of SenseCam is coupled with a simple domestic electricity meter and the combined data forms part of the sensor web, then the calculation of carbon footprint information, and determining the activity profiles of individuals or groups, becomes even more accurate. The net result is that by using two simple sensor devices, the SenseCam and a domestic energy meter, we can characterise much of the activities and carbon footprints of individuals, a classic case of good technology (SenseCam) finding new and unforeseen applications.


### Acknowledgements

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# Use of SenseCam to complement traditional rehabilitation approaches for patients with mild Alzheimer's

Innovative research has been recently developed concerning the role of technology to serve human memory in a broad range of situations. However, some

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further research is needed in understanding how prosthetic memory devices such as SenseCam could provide support in the rehabilitation of neurodegenerative diseases, e.g. mild Alzheimer's disease (AD). We propose to integrate traditional rehabilitation programs with SenseCam, which do not force direct training of memory functioning in order to assess the impact and synergies between traditional approaches and the use of SenseCam.

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## INTRODUCTION

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Neuropsychologists intervene with AD patients frequently using exercises like remembering shopping lists, news, personal events, doing simple actions at some later time, mnemonic learning and repetition training. There is a relatively large body of evidence that suggests these techniques are effective tools to improve memory [2]. However, memory researchers are gradually becoming more aware of the excessive focus of these exercises on internal processes, and the need to increase their practical efficacy involving the use of external strategies [3].

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Recently, devices like SenseCam [4] overcome this problem, because there is no demand for active memory training. Other research has shown that Sensecam can stimulate different types of memory cues [4, 5, 6]. However, with a few exceptions [1] there has not been much research investigating how SenseCam could support AD interventions over prolonged periods of time. We address the following research questions, with the focus on AD rehabilitation:

- Can large streams of pictorial memory cues support

memory recall for patients with mild AD over prolonged periods?

- Does SenseCam indeed support autobiographical cueing and reflection for patients with mild AD and does this impact overall wellbeing?
- How could SenseCam complement traditional rehabilitation approaches for mild AD?

## OVERALL PURPOSE

To understand how simultaneous use of both internal memory exercises and the external memory aid - SenseCam could improve memory stimulation in patients with mild AD.

## METHOD

A cross-sectional experiment with three evaluation points (pre, post, and 6-month follow-up) will be developed. This will include three clinical groups (A, B and C) with 20 patients each, all with a clinical diagnosis of mild AD, according to the NINCDS-ADRDA criteria. There will be one comparative control group also with 20 individuals with mild AD.

After a comprehensive neuropsychological assessment comprising the assessment of memory performance in a wide range of domains, participants will be randomly assigned to the following groups.

1. Group A - will be instructed to follow a specific memory stimulation program composed by traditional memory training exercises, twice a week, for approximately seven weeks.
2. Group B - will wear SenseCam daily, for approximately seven weeks, and will see SenseCam pictures every two days (the caregiver will chose specific events to review).
3. Group C - will be instructed to follow a specific memory stimulation program while simultaneously wearing SenseCam on daily basis. Their SenseCam viewing practices will be the same as of Group B.
4. Control group - will be asked to keep a

detailed personal diary.

## ANTICIPATED OUTCOMES

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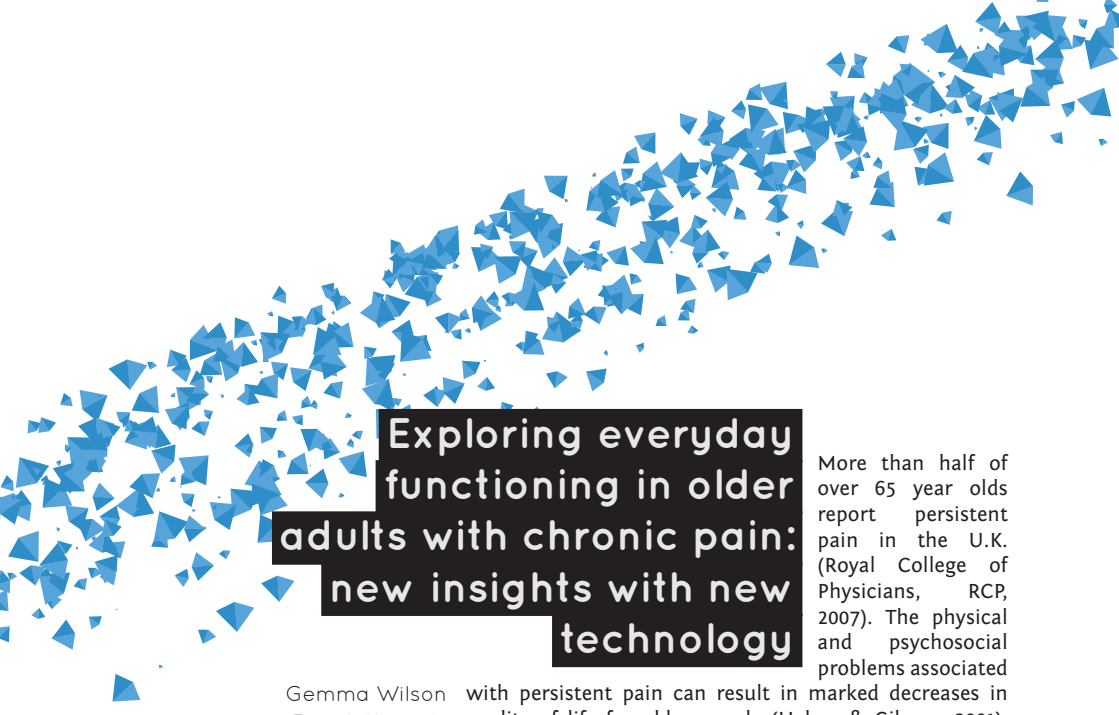
- Inline with previous research, we anticipate that SenseCam will indeed stimulate richer autobiographical recall in patients with mild AD, particularly over prolonged periods of time;
- We also anticipate that with SenseCam, AD patients will achieve greater experience and sense of overall wellbeing.
- Aim to build on the understanding of synergies between technologies such as SenseCam and traditional methods in the rehabilitation of mild AD.
- We suggest alternative designs and technology integration approaches to increase support in current rehabilitation practices in treating neurodegenerative diseases.

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## Exploring everyday functioning in older adults with chronic pain: new insights with new technology

More than half of over 65 year olds report persistent pain in the U.K. (Royal College of Physicians, RCP, 2007). The physical and psychosocial problems associated

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with persistent pain can result in marked decreases in quality of life for older people (Helme & Gibson, 2001). In order to gain a fuller understanding of the impact of persistent pain on older people and then to develop some practical solutions to identified problems the joint UK Research Councils' Life-Long Health and Well-Being initiative have funded a £1.2 million four year project. This is led by the University of Aberdeen in collaboration with Teesside University and Glasgow Caledonian University. The research protocol outlined here is for a PhD study within that project. This study is focusing on the impact of pain on older people's function, specifically 'body function', 'activity' and 'participation' as explained within the WHO (the International Classification of Functioning Disability and Health, ICF, World Health Organisation, WHO, 2001).

Current self-report measures, such as questionnaires and diaries (e.g. Nielens & Plaghki, 2001 and Heneweer, Vanhees & Picavet, 2009) and ambulatory technologies, such as pedometers and accelerometers (de Bruin, Hartmann, Uebelhart, Murer, & Zijlstra, 2008) have so far failed to give sufficient insight into how day-to-day function is affected and what measures older people use to go about their daily business.

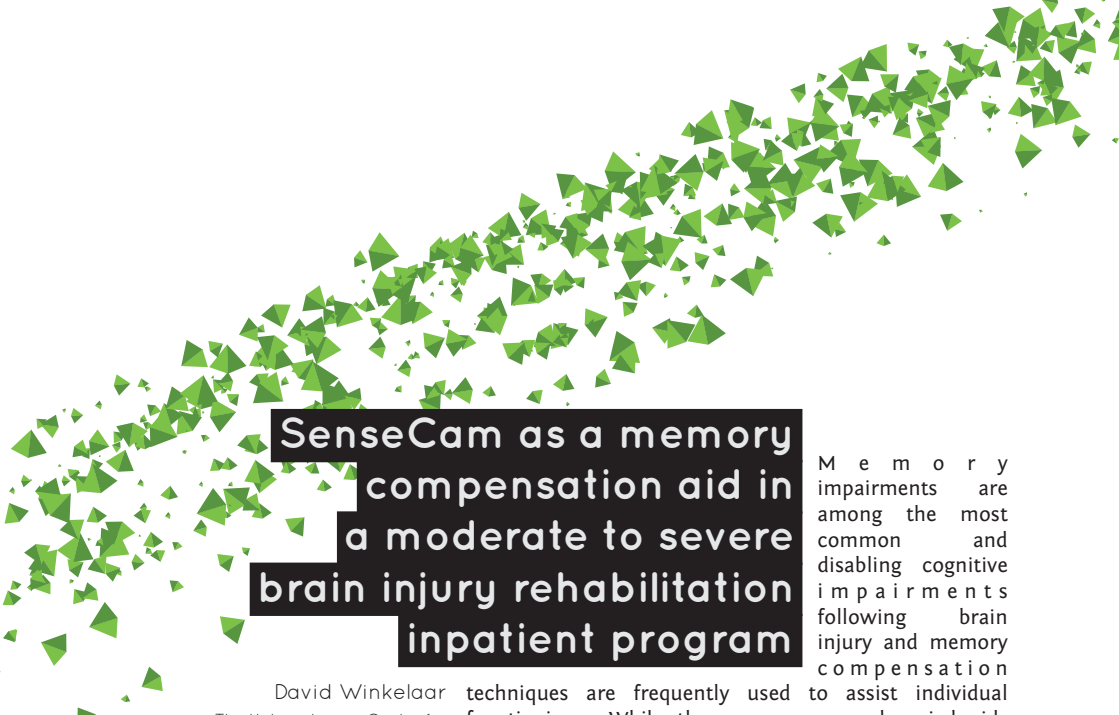
There are two main aims of the study:

1. To explore the day-to-day pattern of functioning in older adults suffering from chronic pain, and
2. To explore the usability, acceptance and experience of the technology used to measure levels of functioning.

There will be two parts of the study running in parallel. The first will be a mixed methods study that will explore the day-to-day experiences of older adults suffering from chronic pain. A qualitative, interpretive phenomenological analysis will be used to explore the lived experience of the participants. Purposively selected individuals will be asked to provide self-reports of their feelings of pain and their daily functioning by completing daily diaries using the framework of the Day Reconstruction Method (Kahneman, Krueger, Schkade, Schwarz & Stone, 2004). Semi-structured interviews will also be conducted at the end of the study, in order to gather more in-depth information from each participant. This data will be complemented by quantitative data on physical and psychological function, collected in real time using recording equipment and the Life Shirt (VivoMetrics, Inc). It is also intended to use the Sensecam (ViconRevue, Vicon Motion Systems Ltd), or similar technology, to record participants' environments and social interactions. In the second parallel part of the study the acceptance, questionnaires and interviews will be used to gather information on the usability and experience of the technology. The data gathered will be based on the theoretical model of the Unified Theory of Acceptance and Use of Technology (UTAUT, Venkatesh, Morris, Davis, & Davis, 2003). The same participants will be used in both parts of the study.

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## SenseCam as a memory compensation aid in a moderate to severe brain injury rehabilitation inpatient program

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techniques are frequently used to assist individual functioning. While there are many and varied aids available for prospective memory tasks, the availability of a variety of aids for retrospective memory is limited. The complex combinations of deficits that occur with moderate to severe brain injuries make all efforts at memory compensation challenging and the need for individualized memory compensation aids is apparent.

Memory impairments are among the most common and disabling cognitive impairments following brain injury and memory compensation

SenseCam has been trialed as a memory compensation aid for 5 patients. It has been used as a memory journal replacement and/or an event specific memory aid. Results of this research will be presented. Potential uses of the SenseCam in brain injury rehabilitation in areas other than memory compensation will be discussed.







