RECALL Scenarios Booklet

Overview

RECALL aims to re-think and re-define the notion of memory augmentation. Recent developments in capture technology and information retrieval allow for continuous and automated recordings of many aspects of our everyday lives. RECALL will harness these trends and develop a new paradigm for memory augmentation technologies that are technically feasible, desired by users, and beneficial to society. By combining technological interventions with basic research questions in memory psychology, we plan to elevate memory augmentation technologies from a clinical niche application to a mainstream technology, initiating a major change in the way we use technology to remember and to externalize memory.

Scenarios allow us to envisage the future use of memory augmentation systems, providing rich illustrations that capture motivation, use cases, business models and social and ethical concerns. In this document we provide a rich set of scenarios that span a range of problem domains and act as motivation and evaluation criteria for the concepts and techniques developed as part of RECALL. These scenarios cover a variety of aspects of the problem space including data capture, retrieval, memory presentation, and social and ethical issues.

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Supporting Failing Memories

A year after his dementia diagnosis, Max has become familiar with the process of using his memory archive to support him in his everyday tasks. This morning, Max begins the day as usual by making himself a cup of coffee and preparing breakfast. As he waits for the kettle to boil, he hears the sound of the newspaper being posted through his letterbox; he goes to collect the paper and is reading through the front page when an alert shown in his heads-up display reminds him that he has yet to finish making his coffee. Max returns to the kitchen, makes his coffee and then sits down with to enjoy the paper over breakfast.

When Max' grandson John visits later that day, the TV in the living room shows pictures of Max and John, together with John's name and their relationship. While Max likes to pretend in front of John that he doesn't need the screens, John is relieved to have this little help that avoids the painful experience of not being recognized by his Grandfather.

Application	**Memory Type**	**Stakeholder**	**Technology**	**Purpose**	**Capture Landscape**	**Sharing**
Supporting failing memories	Prospective; Semantic; Episodic	Memory owner	Presentation: - in-home - wearables	Illustrate potential application	<not specified>	Memories for individual use

Research has shown that as we age, our ability to perform both prospective memory and uncued recall are particularly vulnerable to age-related decline. In this scenario we provide an example of the use of RECALL technologies to support failing memories by providing time-relevant and context-appropriate memory cues. In this way, older individuals and those with memory difficulties could enjoy greater self-confidence and greater independence by being reminded of moment-by-moment situated details of where they are and what they were intending to do. For example, in this scenario, when Max fails to return to his kitchen after picking up the newspaper, he is given a simple prompt to remind him of his previous task.

Beyond simply helping with completion of everyday tasks, technology interventions have the potential for far-reaching impact in supporting those with failing memories. Memory augmentation systems could help individuals maintain a sense of self-identity by providing access to experiences that might otherwise have been lost. They can ease family relationships by reducing the caring burden and, more importantly, by helping maintain an individual's awareness of autobiographical details of their loved ones and shared family experiences (e.g. a recent special occasion or other family gathering).

This scenario has little to say about memory capture but instead focuses on the mechanisms by which Max's memory cues are selected and presented back to him in order to support his failing memory. The scenario provides a clear illustration of how in-home devices such as TVs, or picture frames could be used as a target for memory presentation, and also demonstrates use of wearable devices such as a heads-up display. In-home digital displays are already numerous with many homes containing a variety of devices including computers, tablets, TVs, picture frames, and small LCDs on a significant proportion of appliances. Furthermore, a variety of home surfaces offer significant potential for the addition of additional information -- for example, refrigerators are already common targets for the placement of notices and mementos. Surfaces such as clocks, mirrors, doors, wardrobes and walls are readily found in most homes and provide the potential for in-context information display regardless of location in the home.

Learning

Jacques is a biology student in his final year of study. As his exams get closer he spends increasing amounts of time reading his textbooks and reviewing the lecture notes he took on his laptop. The weekend before his exam Jacques must travel home for a visit to celebrate his sister's 18th birthday. Although he is looking forward to seeing his family, he is worried about the time the trip will take up and has warned his parents that he will need to do some studying over the weekend. On the train travelling from University to his hometown Jacques sets his mobile device up to help him revise his lecture material. The revision application presents Jacques with a mixture of flashcards and quiz questions to help him develop his knowledge. A concentrated burst of time on the train is complemented by short but frequent sessions during quieter moments over course of the weekend. Notifications from Jacques' phone remind him to check the device for revision cues -- although Jacques ignores the occasional one or two, they can usually be reviewed in a quiet moment as he helps his parents by putting up balloons or getting drinks for a guest. Jacques enjoys his weekend and is pleased not to have missed an important occasion, when his exam comes round on Monday afternoon his is confident that he has done enough revision to be familiar with the material.

Application	**Memory Type**	**Stakeholder**	**Technology**	**Purpose**	**Capture Landscape**	**Sharing**
Learning	Semantic	Memory owner;	Presentation: - Personal mobile device	Illustrate potential application	Instrumented world	Memories for individual use

This scenario provides an illustration of how technologies can be used to support the process of forming memory traces in order to facilitate or reinforce learning. In the scenario, Jacques actively reviews data captured by a memory management system in order to help understand and memorise important information.

Active study and learning dominates our early years but continues throughout our lives. Within popular culture much of the attention given to human memory is centred on the processes of memorising and learning new information, and how to improve these. While RECALL focuses primarily on using ambient display technologies to help general recall, such technologies can also be used as part of a learning environment. In particular, through the use of ambient displays and mobile devices it is possible to cue recall, and hence reinforce learning of a wide range of skills. For example, the acquisition of a new language could be supported by providing appropriate cues to facilitate recall of vocabulary. Similarly, a class teacher could be encouraged to remember the names of their pupils, and a study abroad student could learn culturally-significant facts as they explore a new city.

Although the mechanism of data capture is not described in this scenario, there are a number of approaches to capture that would support the described behaviour. For example, when capturing lecture materials, an instrumented world could provide feeds that include the video, audio and presentation materials associated with a lecture. Jacques individual notes taken during a lecture may also be mined for information, however, it is equally possible that Jacques and has peers have agreed to the sharing of memories related to this course allowing them to build a more complete dataset.

From the perspective of data selection and presentation, in this scenario Jacques actively seeks out the material he wishes to recall, using his mobile devices as a presentation medium. This is distinct from ambient approaches in which learning could take place serendipitously and becomes a natural part of interacting with the environment.

Finally, whilst this scenario (and other learning examples) is focused on learning the development of semantic memory (knowledge, facts, understanding), technology also has the potential to help with learning that develops our procedural memory [4] -- for example, helping Jacques to learn the practical medical skills related to his course.

Learning II

Craig is a teacher in a primary school. Over the last two weeks his class of nine- and ten-year-olds have been finding out about volcanos. The group have just a few more sessions before they move on to another topic. Today Craig wants to put a selection of materials onto the school's public display in the dining room in order to help his pupils remember the activities they have completed and some of the facts they have learnt. Craig reviews the material he has available from his lessons and selects a mixture of content for the display including photographs from the afternoon in which the class made a volcano and some quiz material based around the parts of a volcano.

After a morning talking about Pompeii, Vesuvius and the Romans, Craig's pupils go to lunch in the dining hall. Seeing the photographs of their erupting volcano triggers a lot of excited conversations as the children talk about what they did that day. The conversations about volcanos continue off and on throughout the lunch break and when the pupils return to class for the afternoon Craig is pleased to hear that they are still discussing the material.

Application	**Memory Type**	**Stakeholder**	**Technology**	**Purpose**	**Capture Landscape**	**Sharing**
Learning	Semantic; Episodic		Capture: - Images Presentation: - Public display	Illustrate potential application	<not specified>	

As well as providing a valuable tool for independent study, use of future memory technologies could form a valuable part of more formal education. This scenario illustrates the use of memory review in order to help children learn in school. By reviewing captured material, a teacher can select items that they feel will be most useful as memory cues for the children. Each of the possible items available comes from the set of shared memories that each pupil has experienced (e.g. images and video from an experiment completed in the lesson). Showing appropriate cues on the display then helps the pupils to recall associated memories, reinforcing their learning.

A distinctive feature of this scenario when compared with the earlier learning example is the selection of material not only from the set of facts/knowledge to be learnt, but also the deliberate inclusion of cues designed to prompt episodic memory -- encouraging the children to remember the activities they experienced. For example, in the scenario it is looking back at the photographs from the lesson in which they made a volcano that prompts discussion in the children. These photographs represent the pupils memory of the event -- the actual mechanism of capture for these images is not specified, but what is important is that photographs accurately reflect the memories of the children so that they can be used as reliable cues.

Sharing and Privacy

Jan loves to share information with his friends and family about where he's been and what he's been doing. Sharing images and videos with his travel companions at the end of each day of his holiday helps provide an upbeat "editorial" on the positive and humorous things that have happened in the day, a process that Jan has found to greatly improve the dynamic between his travel companions and leads to greater satisfaction when later reflecting upon his holiday. In addition, sharing images, video and maps of his travels, and reading items shared by friends all help Jan feel connected to people he has not seen recently. When Jan meets up with friends that he has not seen in a while, the group often find themselves retelling significant events that have happened in their lives since they last met and Jan finds that being able to look back at his memory traces helps him remember the details and regain his excitement about the things he has experienced.

To help him generate data to share, Jan uses a variety of wearable mobile devices. Jan's devices generate thousands of pictures, sound bites, video clips each day. Although he likes to flick through some of the items each evening, Jan has been experimenting with automatic techniques for selecting out the highlights so that his friends can see what he has been doing even when he is too busy to review his day. One evening as he looks through the material the system has posted on his behalf this last week, he realises that there is an audio clip from a business pitch he delivered. Listening back, he is relieved to know that no confidential details were included in the clip but he uses this experience as a prompt to review his privacy settings and vows to be more careful about using his devices when at work.

Application	**Memory Type**	**Stakeholder**	**Technology**	**Purpose**	**Capture Landscape**	**Sharing**
Summarising memories; storytelling.	Semantic; Episodic	Memory owner; corporate entity;	Capture: - Video / images - Audio - GPS / location Data summarisation.	Illustrate potential application; Highlight privacy concern.	Personal memory capture devices	Memories for sharing

The practice of sharing personal stories with others is considered to be culturally universal [5]. Recently, social networking sites have emerged as an important mechanism for sharing experiences and photographs. In this scenario, we highlight the potential for memory capture as a mechanism for supporting the sharing of personal experiences and recent memories. In addition, the scenario describes how Jan uses his captured memories to help him relive historic events, an important feature of episodic memory.

There are numerous use cases for sharing memories with others. In particular, comparing life experiences allows individuals to find common ground and frames of reference upon which they build relationships and find their place in a community/society. Sharing similar experiences also allows a group of individuals to reflect and gain additional knowledge or insights that could not

otherwise have been found given only one individual's experience. In this scenario we see one illustration of how this communication of memory events could be augmented through use of RECALL technologies.

This scenario also portrays Jan's use of his memory system not for the completion of a specific task or goal (e.g. Where did I leave my keys? What is the history of my relationship with this individual?), but instead as a pleasurable activity in itself. Jan's review of his memory streams allows him to re-experience captured events and to regain positive feelings associated with those events. Our personal memories are important for self-identity, personality and mood regulation -- actively recalling a positive event has been shown to improve mood, and equally difficulties in bringing to mind positive experiences appears to be common for those suffering with depression. Using RECALL technologies to support episodic memory therefore has the potential to improve mental wellbeing by affirming self-identity and enhancing mood.

Jan's personal memory data is sourced from a series of wearable mobile devices that capture location traces, images, video, and audio. This corresponds with current approaches to lifelogging in which data is gathered through the use of personal memory capture devices such as the Microsoft SenseCam [3], Narrative Clip [6], and smartphone applications such as UbiqLog [7]. Complementary data may also be sourced from Jan's environment although that is not described in this scenario. Significantly though, the scenario describes how data from multiple sensors is aggregated to create a single coherent feed that describes Jan's activity, and then filtered to generate a concise summary suitable for sharing. By comparison, existing lifelogging technologies are isolated entities with limited scope for summarisation -- our own recent experiments have illustrated the difficulties of working with such devices due to the sheer volume of data generated [1].

Finally, this scenario also highlights a privacy concern that emerges from that fact that Jan is continuously capturing and sharing his memories regardless (it seems) of the social context in which those memories are captured. Although there is value to Jan in capturing data for both work and social purposes, the use cases for that data are most likely very different. For example, whilst captured data from the business pitch may not be appropriate to share with friends, it may well have value for Jan and his colleagues when reviewing their performance or when planning further interactions with this client. In this business environment, the ownership and stakeholders associated with an individual's memories are more complex and provision of mechanisms for managing these relationships are important requirement for RECALL technologies. This scenario therefore provides a helpful illustration of the need for RECALL systems to provide support for multiple memory ownership models and to allow users to somehow specify privacy preferences based on a variety of attributes including context and media type.

Meeting Capture

Dorothee and her colleagues Luka, Tim and Amit are working together on an advertising campaign for a new product. The preparation is in the early stages and they agree to have a meeting to generate ideas.

Once all four of them have arrived in the meeting room, Dorothee prepares to start the discussion. So that none of their ideas are lost, the group decide to use the room's in-built capture system. Dorothee taps her work ID badge onto a small panel in the room and a confirmation message appears on the whiteboard. Dorothee checks that the others are ready to begin and taps on the confirmation message to start the capture system.

Throughout their meeting, the top corner of the whiteboard indicates that audio, video and whiteboard content are being captured. When the team pause for coffee they have the option of stopping the capture but they decide to leave the system running as they often find themselves drifting back into the discussion. After several hours of productive discussion, Dorothee thanks the others for their participation and stops the capture system. She agrees to send the other participants details of how to access the captured data when she gets back to her desk.

Application	**Memory Type**	**Stakeholder**	**Technology**	**Purpose**	**Capture Landscape**	**Sharing**
Meeting capture.	Semantic	Memory owner	Capture: - Video / images - Audio - Whiteboard	Illustrate potential application; highlight issue of group consent.	Instrumented world.	Memories with shared (group) ownership

Minuting meetings in order to remember what occurred is a common practice -- many meetings involve the taking of formal or informal notes that describe what has been discussed and what actions have been agreed. In this scenario we show how RECALL technologies can be used to support this practice by capturing a group discussion; the scenario also provides an example of a case in which memories can have group ownership, and the implications of this for capture, consent, storage and future access.

In this scenario, an instrumented meeting room allows the occupants to record their discussion generating a shared memory that each can access. Although in this case the meeting room itself offers explicit support for this kind of capture (e.g. by providing an interface for users to start and stop the capture, and by incorporating whiteboard content), cameras in cafes and other environments could be used to capture memories for discussions in more informal situations (e.g. a breakfast meeting, friends having a discussion over coffee). A key feature of each of these meetings is that the resulting memories have a shared ownership.

In order to ensure that each participant in the scenario was aware of the discussion capture, Dorothee was required to sign into the system, and consent was agreed between all colleagues. An indication of the captured data was provided as feedback to all those in the room, and a simple interface allowed them to pause the system. This scenario therefore provides a helpful illustration of a possible mechanism for interacting with capture systems within the environment, particularly for group situations.

Organisational Memory

Martha has recently graduated as a teacher and is working as a supply teacher until she finds a permanent job; she is regularly asked to cover lessons at short notice at a number of schools in her local area. Today she has been called to a local secondary school where she will be teaching a set of history classes. Her first class begins in an hour and will be focussed on the industrial revolution. Martha sits down in the staff room to prepare -- she begins by starting the schools lesson review application on a large public display in the corner of the room and typing in details of the class. The system selects a range of results for her to review, including lesson plans and video clips from the usual teacher's most recent sessions with that group, extracts from lessons taught on the industrial revolution at this time last year, plus recent course assignment tasks from both the group Martha will be teaching and another class being taught the same material by another teacher. Martha navigates through the material and assembles her lesson plan.

Once the lesson is over, Martha returns to the staff room and looks back over the data captured during her own lesson. Looking at a mixture of videos captured by the classroom cameras and work completed by students on laptops during the class, Martha is able to reflect back on how effective her teaching was and takes some notes that will help her in her future sessions. She then approves the data to be kept by the school so that when the class's regular teacher returns they will be able to pick up where Martha left off.

Application	**Memory Type**	**Stakeholder**	**Technology**	**Purpose**	**Capture Landscape**	**Sharing**
Learning; workplace	Semantic; Episodic	Workplace/ organisation; memory owner	Capture: - Video - Electronic documents Presentation: - Shared display	Illustrate potential application	Instrumented world	Memories for sharing, Memories for self-reflection Corporate memory

Integrating into a new workplace or other organisation can be a significant challenge. Even organisations with a common goal will have significant differences in their work practices. In this scenario we illustrate how RECALL technologies can be used to help an individual absorb knowledge held in the memories of an organisation in order to quickly integrate themselves into that organisation. The scenario also also illustrates how access to captured memories can encourage the self-reflection that is important for personal development.

Collective memory, a shared pool of information held in the memories of group members, is constructed and shared by groups in a range of settings. Within an organisation, managing corporate memory effectively can be important for successful and efficient work practice. In this scenario, we illustrate how Martha can use digital memories collected by others in order to

quickly integrate herself into the teaching delivered by a particular school.

In addition to use of memories for collective use by an organisation, this scenario also illustrates the importance of memories in self-reflection and personal development. In many cases, reflecting back on our actions can help us gain insights that weren't obvious at the time, and can help to inform our beliefs and future behaviour.

Finally, this scenario also highlights the importance of consent for memory data collection -- Martha is able to look though captured data before approving it for contribution into the schools

Persuasive Memory

Serge is struggling with keeping up his exercise levels ever since he finished school and started working at his new job. To make his exercise fit his new schedule, he decided to take up running - all-afternoon football meetings with his friends from Uni are now just out of the question. However, the onset of fall with its lower light levels, foggy mornings, and frequent rains quickly saw Serge reduce the frequency of his workouts: from every other day, to every other week, to once a month.

Realizing his frequent lack of enthusiasm for his new sport, Serge decides to have the RECALL installation in his home focus on his workout experience. Shortly after, his morning newsfeed on the large display in the kitchen starts showing recordings captured by his smart glasses during his late summer workouts. Combined with the music from his usual workout playlist, the upbeat video forms a powerful reminder of the joy he felt back when he started his first runs. In addition, the system pulls in recently shared memories from other runners, convincing Serge that a run through the foggy woods does have something magical to it. Before long, Serge has put on his running shoes to fit in a quick morning run before he's off to work.

After keeping a better schedule for several weeks, Serge realizes that his mood during and after his runs - as tracked by his RECALL wrist band - is consistently higher for his evening runs than for those that he squeezes in in the morning before he leaves for work. After reviewing some of his recent morning and evening run experiences, Serge decides to regularly leave for work earlier so he can head home already late afternoon, with enough time to do all his runs in the evening.

Application	**Memory Type**	**Stakeholder**	**Technology**	**Purpose**	**Capture Landscape**	**Sharing**
Health; Persuasive tech.	Episodic	Memory owner; fellow runners	Capture: - Video - Audio/Playlists - Health data - Experience	Illustrate potential application; highlight use in health and well-being	Instrumented self	Anonymous sharing with other runners

This scenario highlights the potential for RECALL technologies to be used as part of behaviour change applications that encourage reflection during regular domestic activities.

Targeted Attenuation

Jeff works at the IT support desk of a large company. He thoroughly enjoys his work, as it allows him to pursue his passion for computers and help users who have a harder time understanding how computers work. Of course, his position means that most of his contacts are frustrated users who have had terrible experiences - sometimes due to problems generated by his colleagues from IT services, but more often due to their own carelessness or inability.

In order to keep in high spirits on such a stressful job, Jeff uses RECALL to keep track of positive customer services experiences - a voice messages that a happy employee left on his machine after he restored his deleted files to life, or an email that he received with praise for his swift action in upgrading an aging software installation. During breakfast in the morning, the system plays back parts of these testimonies - sometimes using audio that is interleaved with the radio stream Jeff listens to, but more often simply by inserting images or social media posts from his happy "customers" onto a nearby fridge display (the system gathers such secondary information from the company directory as well as available social media pages). These memory cues not only remind Jeff of the satisfaction he often feels while on the job, but also help him forget the more frustrating days, using a process known in psychology as "retrieval induced forgetting" - the more he remembers his "good" customers, the worse he gets at remembering those that complain.

Application	**Memory Type**	**Stakeholder**	**Technology**	**Purpose**	**Capture Landscape**	**Sharing**
Attenuation; workplace	Episodic	Workplace/ organisation; memory owner	Capture: - Audio - Social media Presentation: - Audio stream, web banners	Illustrate positive role of attenuation	Instrumented workplace	Corporate memory

In this scenario we illustrate the use of memory attenuation in a postive context. In many cases memory attenuation is portrayed as a potential source of problems for users. However, there may be many situations in which the same technique can be employed for a positive purpose.

End of day review

Andrew leads a busy life as an architect, but he can get so engrossed in his work that he sometimes wonders where the day has gone. He finds that he often thinks about the things he has to do on his journey to and from work, and when he gets home in the evening, his thoughts often return involuntarily to aspects of the day and future.

Recently, Andrew has started using RECALL. By spending a few minutes at the end of each day engaged with the RECALL app, Andrew is reminded of what he has done today: he is far more aware of where the time has gone, and is often surprised by the big (and little) achievements that make up a day's work. This process that highlights the important aspects of the day, provides Andrew with an important sense of closure, and by reviewing these highlights, Andrew enhances spontaneous future access to these highlights. Moreover, the review allows him to update the tasks that have been completed and allows clearer focus on those that are still "to do". Moreover, through the intelligent review system, important images can be re-presented in future reviews, further augmenting their future recall and decreasing accessibility to related but unreviewed items.

Sometimes, Andrew uses recall over a longer timescale, allowing reviews of weeks, months and even years. By reminding himself of what he used to be worrying about in the past, such reviews help Andrew to place his current work-related anxieties into perspective, helps Andrew remember how much has been achieved over these time periods, and help him to recalibrate his expectations about the timescales necessary for future targets.

Application	**Memory Type**	**Stakeholder**	**Technology**	**Purpose**	**Capture Landscape**	**Sharing**
Supporting failing memories	Prospective; Autobiographical Episodic	Memory owner	Presentation - in-home - wearables	Illustrate potential application	<not specified>	Memories for individual use

In this scenario we provide an example of the use of RECALL technologies to support "normal" everyday functioning. RECALL technology helps keep the demands and worries of life into perspective.

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