

# “Oh and how things just don’t change, the more things stay the same”: Reflections on SenseCam images 18 months after capture

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## Abstract

This paper presents an exploration of how images captured by a wearable camera, SenseCam, might foster reflection on everyday experiences. SenseCams were provided to multiple members of four households who wore them simultaneously and reviewed the images after one week, and then again after a period of 18 months. The findings reveal how images captured by different family members led to new insights around normally unremarkable routines, and provided new perspectives on how children experienced the world, while the 18 month interval prompted some reinterpretation of the past and made participants aware of incremental changes in their everyday lives. Implications for the design of tools to support reflection on personal experience are suggested and remarks about the concept of memory collection devices made.

### Research Highlights:

- Families and couples reviewed SenseCam photos captured 18 months previously.
- New meanings were constructed in the production of personal and family narratives.
- An emphasis on routine made incremental changes clear; sameness was also apparent.
- Insights were gained into the lives of others, including of children by parents.
- Implications for designing tools to support reflection are discussed.

Keywords: routine, mundane, lifelog, wearable, photography

## 1 Introduction

Devices that capture and record everyday life, with the aim of creating some kind of lifelog, are often thought of as an aid to memory, with the potential to enable ‘total recall’ (e.g. Bell and Gemmell, 2009). Perhaps unsurprisingly, such grand claims have not gone without critique. Sellen and Whittaker (2010), for example, note that the values such systems provide to users are rarely made explicit. They note that lifelogs do not in fact capture the *experiences* of people, but instead record *cues* that can facilitate the revisiting of those experiences. Further, they suggest that in addition to revisitation, or reliving the past, reflection is one of the values that such systems could be designed to enable. Such a view finds some support from various studies of SenseCam, a wearable, passive, automatic camera, which has previously been shown to foster reflection in the short term (e.g., Harper et al., 2008, Fleck and Fitzpatrick, 2009). In this paper, we explore this argument further, in a study of how these reflections might alter over time. We will suggest, based on a longer-term treatment of SenseCam images, that such reflections can be thought of as narrative-like in experience and form, and in their explication by the users themselves. This accords with larger arguments about the relation between the past and its construction in the mind, such as in Rubin’s collection, *Remembering our Past* (1995), and Ricoeur’s more recent analysis of reflection in *Memory, History and Forgetting* (2004). Without wanting to venture too far from the HCI concerns, however, our argument will be that lifelogging is more usefully thought of as a means for people to construct personal histories or biographies, than it is as an aid to memory. One important feature of such biography, noted by others long before, is the role of ‘significant others’ (Sullivan, 1953); but another, and one that strongly comes out of this research, is how the prosaic and the inconsequential in daily affairs can become significant measures when viewed in narrative of a life seen in hindsight.

In this light, we present findings from a field trial that aims to extend previous findings in two ways. Firstly, we consider the circumstance in which entire households, rather than individuals, are loaned multiple cameras that might be worn simultaneously. This allows us to examine the ways in which the provision of multiple cameras enables insight into the lives of others, as well as encouraging reflections on oneself. Secondly, we interviewed participants twice, shortly after wearing the cameras and then again after an 18 month interval. This permits an exploration of how media relating to mundane elements in the past might evoke reflection on and in the present through the structuring agency of narrative.

We will show that reflection was invited by the juxtaposition of image streams captured by oneself and by others, and also by the comparison of current as against prior routines. However, before we explain the details of the study, or illustrate the ways in which reflection was fostered, we will consider in more depth what reflection is, and how it might be supported.

### 1.1 Defining Reflection

The term ‘reflection’ is used in a variety of ways in everyday life (Ricoeur, 2004). It is hardly surprising, therefore, that definitions of the term, the processes that it involves and the outcomes that it might engender, show a similar degree of variation within the academic literature. Reflection might be thought of as an important skill in one’s profession, a personality characteristic, a mental process that is engaged so as to solve a specific problem, or something that is undertaken more generally as a means of increasing self-awareness and making sense of personal experience.

For the purposes of this paper, we will follow Moon's (1999) definition of reflection. She highlights the difficulties of characterising this concept and, in order to do so, pulls together work from disciplines including psychology, philosophy, sociology and education, as well as that which crosses such boundaries, such as the literature on reflective practice (Schön's (1991) work is notable here) and experiential learning. In this treatment, she describes reflection is a process that involves manipulation of meaning and that is applied to relatively complicated or unstructured ideas, possibly being triggered by the need to resolve or clarify some issue. Accordingly, reflection can be summarised as a means of transcending more usual patterns of thought, so that a critical stance or overview can be taken. In this paper, our focus will be on reflection not as a tool for professional practice or as a means of changing the outcome of an ongoing situation (in contrast to Schön's emphasis on reflection-*in-action*), but instead as a means of learning from or retrospectively making sense of personal experience (or reflection-*on-action*). Moon suggests that reflection geared towards self-development involves the review of past events and the formulation of new meanings pertaining to them. This might be achieved by integrating and reshaping knowledge about the past, or it might be transformative, involving meta-cognitive processes that allow one to gain a critical overview of oneself or one's knowledge, how one typically orients to it and how this might be altered. Such an outcome can then feed further reflection.

## 1.2 Reflection as a Dialogue

While this account moves away from the idea of reflecting on raw unfolding experience, it shares with Schön's (1991) account of reflection-*in-action* the idea of a dialogue between material and the reflections that that material triggers. Central to Schön's account of what it means to be a reflective practitioner is the notion of the reflective conversation; ways of approaching a situation are continually reframed so that new understandings can be reached and tested. In testing these new understandings the situation provides 'back-talk', which then leads to further evaluations and actions; in other words, doing extends thinking, and vice versa. This idea of reflection as a dialogue can also be seen in studies within HCI. For example, Johnston et al.'s (2005) visualisation of a musician's aural output provides feedback that becomes part of a dialogue, and Johnson and Carruther (2006) also aim to support back-talk in their application to support creativity. In the case of reflection-*on-action*, new understandings are gained retrospectively, which then feed back into further reflective processes.

## 1.3 Conditions that Favour Reflection

It is important to note however, that reflection will not occur simply through the fostering of dialogue. Moon (1999) suggests that reflective processes require time and space, and might be more likely to unfold in an emotionally-supportive environment where expectations, norms and relationships will not serve as inhibiting factors. She further highlights the use of messy or ill-structured materials as a means of fostering reflective thought processes.

Again, similar ideas have also had an impact in HCI. Gaver (2003) suggests that by providing inconclusive foundations, reflection can be cultivated, and further suggests that design can be used to draw attention to overlooked aspects of the environment, thus encouraging reflection on their significance. Bell et al. (2005) extend these ideas in their emphasis on the use of defamiliarisation as creating a space for critical reflection, and Rogers and Muller (2006) draw on Gaver's ideas in their design of a sensor-based game, the 'Hunting of the Snark'. Here, interactions with the Snark are

predicated on uncertainty and unexpectedness, with the aim of encouraging children to stop and think about what is happening while they play the game.

#### 1.4 Reflection on Everyday Experience

Systems like these are not designed to support reflection on everyday experience, but it seems probable that technologies which encompass ways of recording and revisiting the past might enable such experiences. Van House (2009) notes that photos can provide anchors for storytelling (citing Frolich et al., 2002 and Crabtree et al., 2004, amongst others), and follows Linde (1993) in noting that one's story may change over time, with events that have been unremarkable in the past taking on new meanings when revisited. However, Van House also acknowledges that photos tend to be viewed when they depict the very recent past, making such revisitations atypical. Technologies for blogging and otherwise recording experience are also often cast in terms of reflection on recent events, with some designs specifically aiming to cater for such analyses in particular contexts, such as in the classroom (e.g., Zagal and Bruckman, 2007), while others focus more broadly on general everyday experience. The Affective Diary (Ståhl et al., 2008) is an example of the latter, incorporating affective bodily memorabilia and visualising it so as to represent levels of movement and arousal throughout a person's day. Echoing the notion of reflection as a dialogue, Ståhl et al. report a tension between representations of self in the diary and the participants' remembered subjective experience. This tension, combined with a design that allows visualisations to remain open to interpretation, was central to encouraging reflective thought and enabling the crafting of meaningful accounts. In addition to these technologies, it is worth highlighting a system that was designed specifically to provoke reminiscence on the more distant past. Pensieve (Peesapati et al., 2010) emails memory triggers to users, drawing on social media content that they have previously created.

Further to these designs, reflection has also been associated with lifelogging technologies, including SenseCam. Harper et al. (2008) suggest that certain visual features of SenseCam images were key to triggering reflective thought in a week-long deployment of the device; in particular, the unusual prominence of the prosaic in the images, the possibility of gaining an insight into the lives of others, and the 'strangeness' of the photos themselves, influenced by the camera's fish-eye lens and placement at chest height, were all identified as contributing factors. Furthermore, and in a finding that resonates with those reported by Ståhl et al. (2008), tensions surrounding representation were also noted, with participants identifying images that represented days that they perhaps wished had not occurred, or that had taken a different form. Their argument suggests that the past is a place that must be ventured into delicately.

#### 1.5 SenseCam as a Tool for Social Reflection

Findings such as these are complemented by studies in which SenseCam is placed in situations devised specifically for the purpose of social reflection. Fleck and Fitzpatrick (2009) report how SenseCam was used by trainee teachers in reflecting with others on recent lessons. In this case, the images were found to support a return to experience, to prompt discussion of thoughts and the sharing of background information, and to ground and illustrate conversation. Again, certain aspects of behaviour were particularly prominent; for example, the camera highlighted the teacher's position within the classroom and the amount of time spent on different activities. Fleck and Fitzpatrick also suggest that the incompleteness of the record (in terms of both visual and auditory aspects) allowed for multiple interpretations, while also allowing teachers to 'see more'; it became a

means through which assumptions and interpretations could be questioned, and alternative ideas and explanations offered.

## 1.6 Motivation for the Present Study

This prior work suggests that SenseCam has various attributes that make it an effective trigger for reflection. However, there are features of both of the above studies that may have encouraged reflective thought. The process of selecting images for presentation may, in itself, have encouraged reflection in the study conducted by Harper et al. (2008), and the use of SenseCam by trainee teachers reported by Fleck and Fitzpatrick (2009) was undertaken in a situation where reflection was expected to occur. Nevertheless, findings from these studies indicate that various features of SenseCam images resonate with characteristics thought to foster reflection, such as messy materials, ambiguity, and tensions, whilst also permitting insights into the lives of others.

In this study, we build on these previous observations to explore whether providing families with multiple SenseCams, so that they might wear one each and review each other's image streams, would encourage reflection. We aimed to explore whether users would reflect on the lives of one another, how they might consider their own experiences when juxtaposed with those of their fellow householders, and whether automatically generated photos would indeed prove successful sources of new insights into everyday life. Additionally, we draw a distinction between the recent and the more distant past. Participants were interviewed immediately after wearing the SenseCams, and then again 18 months later. While other prior work has examined the extent to which SenseCam images are able to trigger remembering and knowing about the past after an extended period of time (that of four months, for example: see Sellen et al., 2007), such a study has not been undertaken in the context of photo-viewing for the purposes of reflection. Thus in addition to the questions highlighted above, we hope to investigate how reflection might be undertaken differently when reflecting on materials that pertain to an earlier period of time.

## 2 Method

The study was conducted in two phases. The first phase involved the participants wearing SenseCam and immediately reviewing the photos that were captured; the second entailed revisiting a selection of these images 18 months later. We will now describe the methods associated with these different stages of the research.

### 2.1 Phase 1

Phase 1 of this project was conducted in early 2008, and was an exploration of how SenseCams, pedometers and energy meters were used in an everyday context for a week. At the beginning of this phase, researchers visited the participants at home to conduct an initial interview and demonstrate SenseCam, along with its associated software and the other technologies provided. Each household was also loaned a laptop, which was installed with software to support the download and viewing of SenseCam images, and each participant was provided with a diary in which they could write about their experiences with the technology. At the end of this phase, the researchers returned to conduct semi-structured interviews with the householders on how they had used the technology provided. Following the study, each household was given a copy of the photos that they had captured on a CD. Various aspects of this work have previously been published, for example Lindley et al. (2009a) highlight how different participants oriented towards their images in

different ways; couples, as a case in point, being more playful in their interpretation of the camera than families, for whom household routines were strongly apparent. We will show here how routine was a strong theme for all participants in Phase 2, including the couples, and how retrospective viewing allowed issues such as progress vs. sameness to be analysed. Reflection was not the focus of analysis in our earlier papers, although this theme has been considered in an earlier workshop paper (Lindley et al., 2009b), in relation to Phase 1. In this paper, we present data exclusively from Phase 2, which has not previously been reported.

To give a few extra details about the design of SenseCam, it is a lifelogging camera that can be worn around one's neck using a lanyard (see Figure 1). It has a wide-angle lens and, when turned on, automatically takes photos at regular intervals, capturing around 3000 images in a day in its default mode. The form factor of the device also permits it to be stood up and positioned so as to capture images from a fixed vantage point. SenseCam itself does not have any means of displaying images back to the user; these must instead be downloaded onto a computer. On being imported, images are saved in a specially created folder and can be viewed using a dedicated piece of software, which allows them to be played back at varying speeds and enables the viewer to bookmark and label sequences of interest (see Hodges et al., 2006, for further details).

*[Figure 1. The SenseCam device used in this study.]*

## 2.2 Phase 2

The second phase of the study was conducted in late 2009, 18 months after the first phase was concluded. The first author revisited four (out of seven<sup>1</sup>) of the households that had taken part in the initial phase to review their SenseCam photos with them. Details of these households are given in Table 1.

*[Table 1. Household composition and codes used in the remainder of the paper. All codes indicate the household number and relationship to other household members (e.g. mother, daughter, girlfriend, individual).]*

Each household was visited individually. The sessions were a combination of semi-structured interview and observation of the participants looking through their photos, with the discussion often unfolding naturally around this activity. Householders were able to select which images to view from a laptop that had all of their images from the first phase of the study saved on it, and to use the folder labels and bookmarks that they had created to help them navigate these data. They were told that they could look at as many (or as few) photos as they wished. The situation was not set up to encourage reflection per se; instead questions were aimed at understanding the general experience of reviewing the SenseCam images. An audio recording of the discussion was taken.

The sessions were transcribed and emergent themes identified using grounded theory methods described by Strauss and Corbin (2008), so as to allow findings to emerge, bottom-up, from the data. That is to say, themes were distinguished through open coding and then relationships between them identified through axial coding. This process was iterated until a comprehensive set of themes, justified by the evidence, had emerged. The themes that were derived include how the experience of looking over SenseCam images engendered reflection (or did not, as was the case for some

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<sup>1</sup> Of the remaining three, one had since moved house, one did not respond to our communications, and one was comprised of grandparents located in the north and their extended family located in the south of England, making it unfeasible for us to gather them together for interview.

participants), and how this was affected by the provision of multiple cameras and the longitudinal element of the study. However, before we discuss these in any depth, we will briefly describe how the process of photo review was undertaken in the different households, in order to put such findings into context.

### 3 Findings

#### 3.1 The Circumstances of Photo Review

The context in which SenseCam photos were viewed and the photo-talk (cf. Frohlich et al., 2002) that developed around them was noticeably different across the four households, being affected by household composition, level of interest in looking at photos in general, and how circumstances had changed since the first phase of the study. In H2, for example, much of the photo-talk was directed towards creating a narrative to accompany the sequence of images. This was chiefly constructed by the mother, who filled in gaps left by the images and delivered family jokes in order to keep her two young daughters entertained. Other strategies to engage them included allowing them to take turns in choosing which folder of photos to look at and giving them control of image playback. As such, much of the discussion in this household was about the children and how they were depicted within the image streams.

In contrast, in H1, the children quickly disappeared, leaving the parents to watch and discuss the photos together. The context of their discussion sat somewhere between that of the parents in H2, in that their photos featured family life and offered the opportunity to consider the running of a family home, and the couple in H3, in that the discussion was largely between adults and not overly influenced by the need to involve children. For both of these couples, the photos offered an opportunity for teasing and mock telling-offs, as well as for gaining an insight into differences in daily routines, and for contemplating how these had shifted (or not) since the beginning of the study. For the young couple in particular, the photos were also noted as being a potential source of embarrassment and as triggering feelings of self-consciousness, being seen to offer *“a real insight into you on your own”* (G3). Mannerisms and habits were brought to the fore, and this was not always seen as a good thing:

B3 *it's funny, it's funny though like cos even though we know each other so well, seeing each other, seeing yourself at work and [G3], and think oh that's a bit embarrassing kind of thing*

Unsurprisingly, the experience of review was quite different for I4, who was looking at images of and captured by her ex-boyfriend, and who was doing so with only the first author for company. In this case, there were instances in which the photos raised questions, and even opportunities for teasing similar to those that emerged in the couples' conversations, but that obviously could not be followed up on. Implied conversations were not a route this person wanted to go down. Indeed, this resistance to 'discussion', as it were, seemed one reason (of many) as to why I4 was much less engaged in the process of photo review than the other participants.

Because of these different settings, opportunities for reflection and the topics to which it related differed markedly across the four households. Unlike in Fleck and Fitzpatrick's (2009) study, in which reflection was expected or aspired to, in this study its emergence was largely unsolicited and unprompted (although of course, the interviewer's questions will have influenced the conversation).



The child-centric conversation in H2 led to reflective behaviours centring specifically on children and parenting, whereas in H1 and H3 these tended to be more focused on general daily routines; for I4, reflection was almost entirely lacking. Nevertheless, there were various common themes that emerged from the data as a whole. In the following sections, we will consider in turn how reflection was influenced by the provision of multiple cameras, the effects of longevity, and the potential for SenseCam to be used as a tool specifically for reflection.

## 3.2 Provision of Multiple Cameras

### 3.2.1 Making the unremarkable a talking point

Previous studies of SenseCam (e.g. Harper et al., 2008, Lindley et al., 2009a), have emphasised how the nature of its images bring certain aspects of daily life, which are not usually noticed or remarked upon (cf. Tolmie et al., 2002), to the fore. While the mundane is increasingly a feature of digital photography (for example, Khalid and Dix (2010) report that photologged images serve as a form of ‘mundane memoir’), SenseCam was noted as capturing subjects that would not normally be photographed, such as babies crying and feeding (H1), and placing a particular emphasis on routine and one’s everyday surroundings. In this way, it was felt to offer a “*realistic portrait*” of “*what is normal*” (M1a):

- G3 *I think it makes you realise how much life’s a routine, do you?*
- B3 *oh yeah definitely*
- G3 *oh you do that again, oh [disappointed tone]*
- B3 *it’s just like on mine you know like the same image like the sink in the morning and the blind in the kitchen and so on and, yeah it does*
- G3 *really brings it home how actually, I dunno it depends on what kind of job you do I think, because we both get up and go to work at a certain time and come home at a certain time there is that, I don’t know that mundane side of life really coming out I think...*

Routine in particular was a central theme in discussions within H3 and H1:

- M1b *I mean I think one of the big things that we noticed was the difference in our day to day*
- M1a *hmm*
- M1b *cos at the time I was doing, I was studying*
- M1a *yeah*
- M1b *and I was spending a lot of time travelling, and I was a lot of the time on my own, and that was a big contrast between our day to day, whereas yours is just people people people, and not sitting, and not sitting was the other thing...*

In contrast in H2, this “*the real life stuff, the stuff you normally delete*” (M1b) was not focused on as much, especially when that ‘real life stuff’ did not feature the children. This can be seen in its most extreme form in the following extract, in which the decision is made to bypass images captured by the father:

- M2 *[opens a folder of F2’s pictures] oh, do you mind if we don’t?*
- F2 *no*

So while the mother's daily routine, which featured the children, was up for discussion, the father's was not. Images captured by children were also treated differently. The notion of routine as being an aspect of children's lives was not discussed by either family; this was in disregard to whether those children had routines. Indeed, it would seem reasonable to say that like most children they would have had routines, ones which were probably more severe and constraining than those imposed upon adults. Children typically have bedtimes, for example, just as they have school and nursery; the absence of interest in such properties indicating that the moral valence of routine is different for these groups. So while adults can look at routine and complain about a life unchanging, the routines of children are not commented on. Where children were concerned, other features, with their own implications for narrative topic and relevance, were brought to bear. The most obvious of these was the height from which images were captured.

### 3.2.2 Experiencing a different perspective

The height of the wearer, as depicted in SenseCam images, was used as a resource by both sets of parents to comprehend how their children might perceive the world:

*M1b it's interesting for me when [D1] had it on, and seeing it, what we look like from her angle, and erm what it, what her world is like, just as much just a size thing cos it, you know it's*

*M1a and the same with [S1], when he wore it*

*M1b yeah, cos he, did he have it on?*

*M1a he had it on for a bit, and that was [the dog's] height, and I remember thinking that that was the dog's height, that was what he saw...*

Such insights also allowed parents to draw new understandings regarding how a child's world is tailored to them (for example, ice cream posters were noted as being "right at the right height" for them (M2)), and even to make sense of more recent events such as a bout of travel sickness:

*M2 see all that bright sunshine coming in [F2], look, [to the Interviewer] we had a bit of an incident of er, erm being ill in the car last week, and I can see the sunshine flooding in here...*

In this instance, SenseCam images were used to help explain the recent past. However, the data also show how photos were used to trigger memories, elicit reinterpretations of or raise questions about the more distant period during which the images were captured. As such, issues that draw on the longitudinal aspect of the research will now be explored.

## 3.3 Effects of Longevity

### 3.3.1 Remembering, working out and reinterpreting the past

Previous studies have shown how SenseCam images can be confusing, and have pointed to the lack of audio as contributing to the lack of connection between events as remembered and as depicted (e.g. Harper et al., 2008, Fleck et al., 2009, Lindley et al., 2009b). Longitudinal work by Sellen et al. (2007) has demonstrated further how the experience of reviewing images is often one of knowing that something has happened, rather than directly remembering it. In the present study, when participants felt that they were really remembering something, those events were normally unusual. For example, B3 recalled how a woman had walked into a door in a cafe he had visited on a day out, and M2 noted how the more mundane features of her holiday cottage prompted clear memories:

M2 ...it is looking at the lock of the door for example, and that door lock was always a pain in the neck because it was too stiff, but, and that was...

F2 to the cottage

M2 ...to the cottage, and that was one of life's, you know it is a very mundane thing seeing that door and that lock, but that that was, there was, there was a sort of frustration attached to it which makes, which has prompted a very very real memory of it

While the experience of struggling with the lock is not clearly depicted in the images, it is brought to mind by a picture of the lock. In contrast, when viewing image streams of more routine activities, images of the mundane were too generic to trigger memory:

G3 erm, it brings back memory of [that] week, but the minute details of you know, like going out for your lunch and stuff I wouldn't say they're memories they're more just, I wouldn't have known, d'you know what I mean, I wouldn't have known that I'd done that on that day...

Occasionally SenseCam images also contradicted the participants' memories. These contradictions were often fairly straightforward; for example, the parents in H2 believed that they had carried a tired child during a walk, but the photos showed otherwise, and G3 was surprised to see how much driving she did, believing she normally left this to her boyfriend. In other instances though, a richer reinterpretation of the past was realised. M2 in particular used the images captured on holiday to reassess what her experience had been like:

M2 and I think your natural memory is often different from the reality, and this is quite good to erm, prompt that natural, prompt that, that realness, this is a typical holiday, it's cold, we're trying to make the most of it

F2 everyone's got hats and scarves on

M2 yeah yeah everyone, so we were talking about going on holiday at Christmas time, and I've said to Stuart I just, I don't want to do that again, but actually I'm remembering that actually we had quite a nice time...

In this case, the experience of viewing the images was described as a "mood enhancer", demonstrating that, in spite of everything, "we did make the most of it", and leading M2 to reconsider future holiday possibilities. The extent to which SenseCam images were seen as providing an accurate record in these instances is interesting when considering their ambiguity. Participants frequently had to work out what was happening in the image streams, drawing contextual information from bookmarks, folder names, knowledge of who was wearing the camera, and time of image capture. This ambiguity was noted by some as having the potential to increase engagement with the images:

M1b who's that?

M1a erm, is that [c] and [k], I don't know, no that's our house, is it our house? Is it?

M1b no

M1a that's mum and dad's house

M1b yeah

Int so do you feel quite connected with what's going on in these or does it feel like you're trying to work it out?

M1b *erm for me at the minute I'm trying to work out*

M1a *but I quite like that, because it makes you think, you know if you're just flicking through photos you can just kind of go ner ner [mimes flicking through photos], without actually engaging, whereas if you actually engage with it at a slightly deeper level I quite like that...*

However, it should be noted that for other participants engagement was much shallower. For I4 in particular, the image streams were occasionally noted as being funny, more frequently as being boring, and generally as “*not stirring up much*”. This might seem surprising given the facts about her emotional life having parted company with partner since the images were taken (as we noted earlier). Indeed, she was startled at how unemotional the experience was. It seems then that if one doesn't want to engage with the images (as may well be the case when they feature an ex-boyfriend), the lack of clarity and absence of notable events can make for an experience characterised by indifference.

### 3.3.2 Making incremental changes evident

Another theme highlighted by the longitudinal aspect of the study was participants' reflections on how circumstances had changed since Phase 1. Many of the changes made evident by the images related to the mundane aspects of life already discussed; for example, shifts in daily routines:

M1a *...cos you forget, and I think particularly because of the time period of how old the children were, you forget what the minutiae of your life is like at that point, it's dull, it's really dull, you know, most of it is just, this [points to laptop screen], but you like, it's like having a baby or any horrible event, or building an extension you know, you forget all that nasty bit and you just like the next bit, cos you're just living in the next bit*

Int *so why's it good to look back at those nasty bits then*

M1a *cos you can look at them from a distance and enjoy them from a distance [laughs] do you know what I mean, you don't actually have to relive them you can just go oh thank god that's over...*

Similarly, M2 noted how simple changes in the breakfast routine denoted how her daughters had grown since the first phase:

M2 *you make your own breakfast now, look at me I'm pouring everything for you*

The changes highlighted in these sessions tended to be implemented gradually and not usually attended to or discussed in depth; M2 highlighted the experience of reviewing such changes as being quite emotional. Her youngest daughter in particular, who was described as appearing “*needy*” and “*like a titsy little shrew*” in the photos, led her to reflect on how she had felt as a parent at that time:

M2 *you know this coldness, I mean she was bitterly cold and erm, just the sense of responsibility as a parent, I don't, I don't feel quite that much [now]*

Reviewing the images also led her to consider how “*life can become very mediocre*” while “*these children [are] slipping through our fingers*”, the emotional quality of her conversation being largely related to the children and the impact of their growing older. In contrast, for the younger couple, changes were not associated with this depth of feeling: “*got less grey hairs there*” (B3); “*my jumper's a bit cleaner as well, same jumper, just with less goo on*” (B3); “*that's [...] my boss when I actually spoke to him*” (G3).

### 3.3.3 Demonstrating sameness

Nevertheless, for all participants the photos also illustrated a good deal of continuity between the first and second phases of the study:

- F2      *you're going to pick up [the children from school] now*
- M2      *oh ok*
- D2a     *going to school*
- M2      *oh and how times just don't change, the more things stay the same, I'm still doing this and still standing [waiting for the children]...*

Indeed, for the younger adults in the study, the most striking aspect of the image streams was the lack of shift in their daily lives. For the young couple in particular, this gave rise to a sense that progress was decidedly lacking:

- G3      *I just still feel, I've got to be honest with my job and stuff, I just hate being on that treadmill, and it just brings that home really, that in a year and a half down the line I'm still doing it, and it kind of makes you think I really need to pull my finger out*
- B3      *yeah*
- [...]
- Int     *why do you think that didn't hit you last time then?*
- G3      *erm, I don't know, I don't think last time that I actually you know like tonight I've sat and watched them one after the other, and I don't think we really, I don't think I watched them so intense, you know intensely last time I think it were just you download your day and then play a bit of it, and I don't know I think there's an element of looking at something retrospectively that makes you think about it on a bit of a, you're a bit more whimsical about the past aren't you, you know you're looking at things that have gone on before, I think you're a bit more, you start, you're more reflective about it...*

### 3.3.4 A lack of reflection in the face of change

Worth mentioning also is the fact that the larger life shifts experienced by I4 since the first phase of the study were not cause for reflection in her interview. Given the attention paid by other participants to changes in their lives, it might have been expected that I4 would reflect at least in part on the way in which her life was different following the end of the relationship with her boyfriend. In contrast, and despite questions on the topic, the notion of change was not a significant feature of the discussion, and where it was noted, the changes were superficial, relating to hairstyles, clothing and a few new items of furniture:

- I4      *not that big a shift no, cos I'm still here, and like I say still doing my PhD, things have moved on with it and I'm nearly at the end of it and stuff, I feel more positive about stuff, but not that much really has changed, got a cat two rabbits and a fish tank, but that's it...*

This lack of reflection may have been due to reluctance on her part to engage more deeply with the photos, and it would not be particularly surprising if this were the case. However, there is also a sense that despite her shift in circumstances, much of the activities that characterise her time remain the same. A final speculative point relates to the magnitude of this shift; while SenseCam photos may foreground changes that are incremental and subtle, larger changes, such as a split with a boyfriend, presumably need no reminder.

### 3.3.5 A change in terms of what is valued

A final point to be made is that topics that had not been considered of interest during Phase 1 became so in retrospect. Participants reported less inclination to look at the images when they depicted the recent past, but over time, and because they portrayed events that would not be thought about otherwise, the photos had become “*memory worthy*” (M2). Participants generally found images depicting the mundane to be of greater interest retrospectively, and expected that this would increase over time.

Counter to this though, some participants also noted that if they actually owned a SenseCam, they would be more selective in what they captured and which photos they reviewed. The younger participants in particular envisaged using SenseCam at special events, or as low effort cameras that negate the need for someone to play the role of the photographer. This type of use for the camera would not support the reflective behaviours described above. In contrast, full-time mothers said that they would use the cameras to capture more ordinary activities, with M1a saying that she would try to capture snippets of her children, and M2 observing that “*the mundane [now] might not be mundane later*”. Notably, both of these women also saw the potential to use SenseCam specifically as a tool for reflection.

## 3.4 SenseCam as a Tool for Reflection

### 3.4.1 Analysis of unfolding scenes

In this final set of results, we will consider the ways in which participants felt SenseCam might be appropriated as a tool for reflection. The photos were noted as capturing a “*spread of activity and relationship in space and time*”, featuring behaviour that is “*normal*” as opposed to “*self-conscious*” (M1a). This was particularly the case when the camera was located so as to capture an unfolding scene, with M2 describing this usage as providing a “*study*” of one’s activities. During the interview, she used such images to examine her interactions with her two daughters, noting “*how I’m splitting my time between the two of them [...] I’m showing myself that I have split myself between them and how I’ve done it*”:

M2     *and here I come back again, everyone’s back, [D2b’s] got work, there’s [D2a], oh look we’re doing some homework now then, you’ve got wild hair that morning, [D2b’s] gone*

D2b     *to the toilet*

M2     *no you’re back again, you’ve gone to get your pencil tin, gosh, look I’m spending a lot of time with you [D2a] and your book work and [D2b’s] playing around with her pencil tin*

M2     *you must feel lucky, oh look no, now I’m dealing with [D2b] now I’ve left you to get going...*

M2 stated that this type of use could be “*potentially quite instructional*”; in H1 also the discussion touched on how using a SenseCam once a year might allow the “*progression*” (M1b) of the children to be observed. The images were noted as being evocative of a particular point in time:

M1a     *we’ve seen what their view of the world was at that particular time, let’s see how their view of the world is now different a year later, you know, just to see, how their eye line’s changed or whether their interests have changed, what they’re doing when we’re not there, I think will have changed in the space of a year [...] I think I’d use it like that*

More straightforwardly, the couple in H3 felt that SenseCam could be used to analyse aspects of their days that were cause for concern. B3, for example, could envisage using the camera to keep

track of how much a colleague smoked in the van that they shared, in order to explore the potential health consequences.

#### 3.4.2 An opportunity for reflection

The above examples show how SenseCam images could engender reflection, and that householders could foresee how they might undertake this deliberately. However, the fact remains that only H1 and H2 had looked at their photos since Phase 1, and neither had done so recently. Furthermore, in both cases, photo viewing had been triggered simply by someone finding the disc and, in the case of H1, wondering what was on it. So while all participants (including I4) were happy to keep the photos stored on a disc, the practicalities of viewing them seemed too large a barrier for this to be readily undertaken.

#### 3.4.3 Converting reflection to action

Of the participants who had viewed the images independently of the study, reflections that were evoked had led to some interesting changes. Most notably, M1a reported that *“the thing that struck me again was how much time I spent in the car”*, and went on to describe how this had led her to take a rather significant decision:

M1a *we’re moving [house], and one of the reasons we’re moving is cos I’ve had enough of driving*

[...]

M1a *it’s just, that was when I noticed it, how much time, how often I got in and out of the car and it was really noticeable [in the photos]*

M1b *was it?*

M1a *yeah, how I, how much of the time was just shoving them [the children] in and out of the car all the time, and erm, and since then I think I have become more and more [irritated tone] phrrrw...*

While this was somewhat unexpected, other smaller but equally enduring adjustments had also come about in response to the first phase of the study. For example, G3 had placed a fruit bowl on her desk at work, in order to cut down on the snacking that she had become conscious of during Phase 1.

#### 3.4.4 Reflection-in-action

As a final observation, and one that relates to reflection-in-action, M2 commented that SenseCam made her more aware of her behaviour while she was wearing the camera:

M2 *it’s that public, what we were going to see again what we were going to keep on record, and what you were going to be observing from us, I mean it didn’t stop us videoing the girls, or taking photos of the girls’ bedroom in an absolute pit wasn’t it [..] I mean it was, it was truthful and it was honest but there was still a performance I felt to it, erm and that didn’t cease during the course of the week...*

Such a sense of heightened performance would probably shift with the passing of novelty and the lack of involvement from researchers. However, this finding echoes arguments regarding how ongoing experience is partly characterised by reflections on how unfolding events might later be presented to others (McCarthy and Wright, 2004; Khalid and Dix 2010); in this instance, this aspect of experience seems to have been heightened by the lack of control over image capture.

## 4 Discussion

The findings presented above illustrate a number of ways in which the attributes of SenseCam image streams resonate with conditions that foster reflection, as highlighted in the introduction. The photos themselves can be complex and surprising, ambiguous and defamiliarising, and as such demand a degree of engagement from the viewer. Furthermore, the material was inevitably retrospective, facilitating the making of new meanings in relation to existing knowledge and beliefs. This study makes clear how these meanings are identified, constructed and elaborated around the narrative production of personal and family biographies. As such, these narratives are thoroughly entangled with the social, emotional and practical lives of family endeavour: its routines and samenesses, its differences and dynamics, as well as its differences in bodily perspectives. Images captured by children were different to those captured by parents, for example, which were different again to those captured from shelves and other fixed points.

There are then two features to this study that differentiate it from existing work on SenseCam. On the one hand there are methodological differences: in this study, multiple cameras were provided to members of households, and these same individuals were asked to consider or to 'revisit' the images thus collected some 18 months after their capture. But the second relates to the findings that emerged. These findings encourage one to think that devices like SenseCam lead 'users' to matters of life-narrative, drawing rather less on the idea of 'lifelogging'.

Following Harper et al.'s (2008) observations of an interest in the lives of others, and Fleck and Fitzpatrick's (2009) remarks on the use of SenseCam to gain different perspectives, this study confirms the potential for insight when viewing image streams captured by loved ones. This seemed most notable when SenseCam was worn by children, although the contrasting routines of adults also prompted reflection, highlighting points of difference and emphasising features of one's own life that were normally taken for granted. Additional ramifications of the provision of multiple SenseCams included the possibility of misrepresentation. As noted by Lindley et al. (2009a), participants raised such concerns during Phase 1; the lack of much discernible activity while at work or the apparent calm of the house for stay-at-home mothers gave rise to a tension between how one might like to be perceived and how one's everyday life was depicted. Khalid and Dix (2010) note similar issues in their study of the use of photologs by expatriates, when viewed remotely by family and friends at home. In Phase 1 of the present study, some participants had taken the decision to turn their cameras off to avoid such problems (see Lindley et al., 2009b). Such actions could limit the use of SenseCam not only for one's own reflection, but also for that of others; if image streams of different behaviours have not been captured, they cannot be juxtaposed or contrasted.

On the other hand, this tension has the potential to serve as a trigger for reflection in itself, by highlighting to family members how they want to present themselves, and by contrasting features of their felt-lives as remembered with those depicted. Van House (2009) highlights the performative aspects of photo sharing, drawing on Goffman's (1959) notion of self-presentation. This concept is also relevant here, and can be applied both to the experience of wearing the camera, in terms of deciding to turn it on or off, and afterwards, when viewing the images and tailoring narratives accordingly. For some participants, SenseCam was also conceived of as a tool that might be appropriated specifically for purposes of reflection, for example, in analysing interactions with one's children.



The distinction between events as remembered and events as depicted via SenseCam was also an important feature in prompting reflection on the shift from past to present. In some cases, the images led participants to question their recollections, highlighting alternative accounts of what might have happened when on a family holiday, for example. In others, memories of tedious or dull routines resurfaced and the fact that they were now over celebrated. Furthermore, the defamiliarisation of daily routines led some participants to reflect that progress in their lives was not occurring at a sufficient pace. Here, the patterns made evident by watching several days' worth of images back-to-back led to reflections on how everyday life might be improved.

Finally, while the above highlights the ways in which various aspects of SenseCam images might foster reflection, it is also important to consider the situation in which this reflection occurred. In this study, reflection was not particularly encouraged and was something that tended to unfold as the participants reviewed their photos. However, as the session with I4 highlights, reflection does not necessarily entail the explicit rehearsing of an emotional life. For whatever reason, this interviewee did not treat images of her ex-boyfriend in an obviously dramatic or emotional way, but merely observed that in many ways some things had stayed the same. What this indicates, we suggest, is the way in which reflection involves some kind of trade-off between the routine and the significant; between what one wants to reflect upon and what one wishes to forget because reflection is too painful (Ricouer, 2004; see also Mayer-Schönberger for a consideration of the implications of digital content for forgetting).

#### 4.1 The Problem of Design

It is quite clear from the various studies of SenseCam usage that a passive device of this kind does produce different responses and different reflections from those we expect in a review of ordinary photographic images (see for example, Frohlich et al.'s analysis of photo-talk, 2002). These findings have implications for what technologies relating to lifelogging, photography and passive data capture might do for people. In this final section, we will adopt an analytic orientation regarding the construction of life-narratives in considering how we might design for these various uses.

First of all, the potential for misrepresentation needs to be considered if people are to adopt the idea of wearing an automatic camera. Automatic image capture has implications for the willingness of users to share and reflect on their data with others, particularly when that data is ambiguous. Importantly though, and in findings that resonate with those of the Affective Diary (Ståhl et al., 2008), elements of incongruity within SenseCam images were a factor in fostering reflection. An understanding needs to be reached on how to support a level of uncertainty in the content that is captured, whilst guarding against users being wary of making it available to their family members in a way that might lead to misunderstandings. If SenseCam images are sources of narrative production, then even when some of those images are primarily used for aesthetic ornament, the meaning of those images is an important matter. Images that are merely interesting must be distinguishable from those that attest to the sad routine of adults, for example.

On the flip side of this, the idea of one's behaviour having an element of 'performance' may well encourage reflection-in-action. Designers may need to choose whether to support one or the other of these possibilities, and also consider how such a feeling might be sustained beyond the confines of a short study. In this case, consciousness of wearing the camera may well have been a novelty effect, or prompted by the fact that researchers would later see the images. Nevertheless, such a

feeling might be facilitated through design, for example through the development of cameras that only function for short periods, so as to heighten the users' awareness of them. At the same time, the fact that SenseCam images can be treated as social objects begs the question of whose sources of images end up being used in narrative production. As we saw, fathers might find themselves removed from the narratives, and issues surrounding curatorial control may become more prominent as technologies become assimilated into family life (see also Durrant et al.'s (2009) account of such issues surrounding photo display).

In terms of image review, time demands associated with looking at lifelog content were highlighted in the first phase of the study. While researchers are working on ways of making such data sets more manageable (e.g., Lee et al., 2008), additional solutions relating to the viewing of multiple image streams are suggested here. Time would have been saved, for example, by allowing people to view SenseCam image streams taken during the same day, but by different cameras, simultaneously. This might also get round the difficulty of some participants being less interested in viewing the image streams of others, or indeed, of being more interested in viewing photos captured by others at the expense of looking at their own. Furthermore, it may also result in the juxtaposition of routines that was seen to foster reflection in our participants, or encourage joint reflections on how the day had unfolded. This might also offer solutions to the problem of narrative control mentioned above. Another alternative way of presenting data might be to present image streams captured recently alongside those captured some time ago. While prior work using SenseCam images and locational information has suggested that location was particularly useful for the reconstruction of habits (Kalnikaitė et al., 2010), this study highlights also the potential for routines as depicted through images to encourage reflection on progress, or a lack of it. Furthermore, automatic analysis might pick out patterns that are indicative of change (or not) and juxtapose appropriate image streams accordingly.

Finally, and importantly, there is the issue of motivating playback of images outside the context of a research study. Here, photo review was prompted by a visit by one of the researchers, and this also led to several image streams being viewed back to back. Both of these features are atypical; participants in Phase 1 did not watch image streams back to back, and it was unusual to take a considered decision to sit down and view the images. In this way, the images are much like other digital photos; studies have shown that these are rarely accessed, either when kept in personal archives (Whittaker et al., 2010) or when stored online using sites such as Flickr (Mislove et al., 2008). Therefore, designing to support reflection involves more than simply playing with the functionalities of the camera. It is necessary for the time and space that are needed for reflective processes to unfold to be provided, and this might be complemented by triggering photo review at a timely interval, or encouraging playback of multiple sets of data in a single session.

## 4.2 Conclusion

To conclude, this study has highlighted once again potential uses for SenseCam, the potential here being to foster reflection about the past. These reflections highlight often unremarked tensions between the routine and the novel, between the 'performative' and the inert or unappealing, between the manifest interest in the lives of significant others and the despondency that observation of images from one's own life can engender. But above all, and in various ways for each of the participants in this study, a sense of biography is entailed when SenseCams are worn and the images they collect revisited. Our findings highlight how wearable image capturing technologies

foster the production of narrative forms, forms that themselves link in various ways to the narrative histories of other people.

The developing literature on new forms of digital media and their various possibilities, including arguments pertaining to user-generated content and the sheer amount of available personal data, has not yet fully encompassed the 'sense of history' or the range of biographical detail that is rapidly becoming available for us, our friends and our families to make of what we will. Studies on topics such as the sharing of photo albums, including those that are shared online (e.g. Pauwels, 2008) have arguably pointed the way, but we have only begun in outline to explore the possibilities that new technologies for recording, storing, annotating and integrating data may provide. The vast amount of multimedia data that has become available in the last few years has not yet become a biographical and historical resource, and early trends suggest that sites such as Flickr actually enable a merging of images; people view pools of images comprising their own and those taken by others, with tags allowing the creation of a 'better' photo record (Van House, 2009), rather than highlighting individual accounts.

This study shows how future wearable technologies might instead support the framing of individual stories, and how these narratives are formed in the context of retrospective viewing of images. We have shown how, in embryonic form, the reinterpretation of previous impressions of experience and the assimilation of new accounts into existing schemes can be supported and personal experience reconsidered. Also apparent however, is the role of the viewer in engaging within a reflective dialogue, and the context in which the photos are played back. While these lifelog images have the potential to support a meaningful life-narrative of personal experience, it is left to the person viewing those images to craft it.

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## Figures and captions:

Figure 1. The SenseCam device used in this study.



Table 1. Household composition and codes used in the remainder of the paper. All codes indicate the household number and relationship to other household members (e.g. mother, daughter, girlfriend, individual).

| Household [and code] | Household members [and codes]   |
|----------------------|---|
| Household 1 [H1]     | A family living in Cambridgeshire, comprising a lesbian couple [M1a; M1b] and their two children, a girl aged 7 [D1] and a boy aged 3 [S1]. They were loaned 3 SenseCams between them in the initial phase. |
| Household 2 [H2]     | A family living in the same village as H1, comprising a mother [M2], father [F2] and their two girls, aged 8 [D2a] and 6 [D2b]. They were loaned 3 SenseCams between them in the initial phase.             |
| Household 3 [H3]     | A couple in their early 30s, who live together near Blackburn. The female is coded [G3] and the male [B3]. They were loaned a SenseCam each during the initial phase.                                       |
| Household 4 [H4]     | A single female [I4], also in her early 30s, who had participated in the initial study with her now ex-boyfriend. They were loaned a SenseCam each during the initial phase. She lives near Household 3.    |