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The ethics of forgetting in an age of pervasive computing

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Abstract

In this paper, we examine the potential of pervasive computing to create widespread sousveillance, that will complement surveillance, through the development of life-logs; *socio-spatial* archives that document every action, every event, every conversation, and every material expression of an individual's life. Examining life-log projects and artistic critiques of sousveillance we detail the projected mechanics of life-logging and explore their potential implications. We suggest, given that life-logs have the potential to convert exterior generated oligopticons to an interior panopticon, that an ethics of forgetting needs to be developed and built into the development of life-logging technologies. Rather than seeing forgetting as a weakness or a fallibility we argue that it is an emancipatory process that will free pervasive computing from burdensome and pernicious disciplinary effects.

1. Introduction

“In the course of human (and non human) history, it is rare enough for a significant new regime of recording the past to develop” (Bowker, 2003, 28).

Bowker points to the invention of writing and the printing press as the only two new regimes of recording the past in the last millennium; we posit here that pervasive computing and the concept of life-logs are set to become the third. Pervasive computing, as defined by Galloway (2004, 384-5), “seeks to embed computers into our everyday lives in such ways as to render them invisible and allow them to be taken for granted.” A life-log is conceived as a form of pervasive computing consisting of a unified, digital record of the *totality* of an individual’s experiences, captured multi-modally through digital sensors and stored permanently as a personal multi-media archive. It will provide a record of the past that includes every action, every event, every conversation, every material expression of an individual’s life; all events will be accessible at a future date because a life-log will be a searchable and recallable archive. Such a life-log will constitute a new, pervasive *socio-spatial* archive as inherent in its construction will be a locational record; it will detail everywhere an individual has been.

Such a conception is fuelled by the roll-out and adoption of technologies that systematically measure many aspects of social and economic life (e.g. electronic payment, utility usage, material and information traffic flows, surveillance, etc.), the recognition that digital storage capacity is growing exponentially at the same time that cost and physical size is falling, digital sensors are becoming smaller and more autonomous, and contemporary experiments that seek to integrate captured data within proto-type life-logging systems is firing developers’ imaginations (e.g. Johnson, 2003; Schofield, 2004). As such, the present ability to capture and store vast amounts of information is inspiring a vision of pervasive computing that generates *ubiquitous* information of the present, that is kept to become a *continuous* record of the past. Such information constitutes *capta* (Dodge and Kitchin, 2005). *Capta* (derived from the Latin *capere*, meaning ‘to take’) are units of data that have been selected and harvested from the sum of all potential data (derived from the Latin *dare*,

meaning ‘to give’) (Jensen, cited in Becker, 1952)¹. To date, recording regimes have generated *capta* from an ‘exterior’ position generally through one-dimension and is held by an organisation external to an individual and which they do not control (e.g. it constitutes surveillance). A life-log will generate *capta* from an ‘interior’ (or first-person) perspective where the individual watches themselves through intimate technologies (i.e., technologies in service to the individual - e.g., phones, car, wearable computing) with the *capta* pooled into a unified, multi-media archive which they control (e.g., it constitutes *sousveillance*).

In this paper, we examine the potential shift from exterior (surveillance) to interior (*sousveillance*) recording through the development of pervasive computing, and in particular the notion of life-logging. In the following section we outline existing forms of exterior *capta* and its uses. We then examine the potential of life-logs to perform sophisticated *socio-spatial* *sousveillance* and the forms of interior *capta* it is anticipated they will capture. The fourth section explores the nature of memory within a life-log and raises ethical questions concerning their use and development. In the penultimate section we make the case for an ethics of forgetting and illustrate how such an ethics would be mobilised, before drawing some conclusions. Our analytical perspective is speculative to a necessary extent, but drawing on current empirical materials we follow Thrift’s (2004, 583) recent lead in trying “to capture the outlines of a world just coming into existence, one which is based on continuous calculation at each and every point along each and every line of movement.”

2. Surveillance: Generating exterior *capta*

Many everyday activities in public spaces, individual mobilities and personal interactions are now being *routinely* and *automatically* captured and recorded. Such capture is the outcome of processes and practices of surveillance, with the growth in surveillant technologies resulting in a daily deluge of *capta* that are increasingly being kept, processed, re-worked, circulated and *systematically* exploited by range of institutions and corporations, ostensibly with the goal of better management of their operations (making them more efficient, more profitable, more secure, safer, and so). Such surveillance is being directed at all aspects of daily life including working, consuming, communicating, and play, to create a powerful ‘*capta shadow*’ (Dodge and Kitchin, 2005).

The workplace, with its unequal power relations, has long been a site where peoples' activities are intensely watched and recorded. The increasing use of software in many working practices has meant that more and more capta on workers is being generated. Such capta is often being used to monitor and evaluate staff performance and to provide differential rewards and punishments for individual workers (e.g. Ball, 2003; Marx, 1999). Typical means of capta generation include the use of codes or swipe cards to track employee movement through a workplace and the logging of the use of computer systems (e.g., keystroke counts) and telephones. Workplace monitoring is widespread and growing; "in 2001, according to the American Management Association survey, 77.7 percent of major U.S. corporations electronically monitored their employees, and that statistic had more than doubled since 1997" (Farmer and Mann, 2003, 38).

Everyday mobilities are similarly being monitored and recorded into capta shadows. Travellers, on a variety of modes of transport, are rendered identifiable and trackable across their journeys by smartcard ticketing systems (e.g. the Oyster card on the London Underground), subjected to verification at security screening points, and often observed by blanket CCTV coverage at the terminus and increasing onboard (e.g. buses in London). Air travel is the archetypal example, where the possibility for anonymous mobility has been effectively eliminated (see Dodge and Kitchin, 2004). However, it is not just mass transportation that are surveyed; roads are increasingly zones of personalised capta generation through the identification and tracking of vehicles. This is enabled through onboard locational devices (e.g. in-car navigation systems) and also roadside sensor systems (such as London's congestion charging scheme that tracks all vehicles entering and leaving the centre of city using a network of cameras with automatic number plate recognition capability). Under pretexts of efficiency and congestion reduction, safety and security, and revenue recovery, it has been hypothesised that in a few years it will not be possible to legally drive without the full journey being registered into a capta shadow.

Competition, and the drive for ever greater efficiency and profitability, in the provision retail goods and services by large corporation has also meant ever more capta generated on domestic consumption activities. Shopping patterns are now easily

folded into individuals' capta shadows by retailers eager to extract maximum spend from existing customers, as well as pinpointing likely new 'prospects'. This is facilitated by the identification and tracking of shoppers over time through loyalty cards, frequent customer codes, and electronic payment, to remove, as far as possible, the potential for anonymous purchases. Transactional capta on items purchased, in combination with customer geodemographic typologies based on residence, and lifestyle codes based on socio-demographic characteristics and attitudes, enable the calculation of increasingly sophisticated models of customer's behaviour and, therefore, the prediction of future wants and needs. This knowledge enables retailers to attempt to cater to, and in some senses channel, demand in ways that are most profitable to them. Some of most sophisticated classification and simulation of customer behaviour is in provision of financial services, through calculation such as credit scoring (see Leyshon and Thrift, 1999), which has brought benefits to many 'good' consumers (instant credit decisions, cheaper rates, and so on; see McCullagh, 2004), but also impacts unequally on 'sub-optimal' consumers who pay much more or are automatically determined to be too risky and are excluded. Capta on consumption transactions is also being calculated 'as it happens' as banks watch out for potentially fraudulent events. Here, the detection of fraud is premised on algorithms that watch for transactions out-of-keeping with a model of the person's 'normal' behaviour determined by the capta shadow. Geographic 'normality' - are you shopping in places that fit your model - is one of the key criteria, along with retailer type, time of day, cost of item, frequency and sequence of purchases (e.g. Till and Hand, 2003).

It is not only the raw size and extent of surveillance that has changed in the last few years, but also the emergence of new calculative practices. Capta shadows are increasingly being linked together, processed, 'mined' and analysed in combination, often in real-time, with goal of identifying predictive patterns at the individual level in terms how people are working, travelling, consuming, communicating and so on. Capta shadows are being used to make *automated* judgements about individuals, enacting increasing sophisticated rankings and classifications along axes of power that meet the needs and agenda of the institution controlling the shadow rather than the individual (see Graham and Wood, 2003; Lianos and Douglas, 2000). Exterior capta then is the 'fuel' for fine-grained differentiation and social sorting (Lyon, 2003). Such sorting is often not 'felt' directly or is perceived as a benefit (e.g. faster, easier

service from a company; being offered a perk such as discounts or upgrades) and thus welcomed.

That said, many activities and spaces still escape the reach of this regime of recording. As Amin and Thrift (2002, 128, our emphasis) remind us, “the networks of control that snake their way through cities are necessarily *oligoptic*, not panoptic: they do not fit together. They will produce various spaces and times, but they cannot fill out the whole space of the city – in part because they cannot reach everywhere, in part because they therefore cannot know all spaces and times, and in part because many new spaces and times remain to be invented”. The next question, then is how far pervasive computing operating an ‘interior’ perspective will produce a very different way of knowing the history of individuals and cities by taking an opposite vantage of viewing: not top-down, but from the inside, looking out.

3. Sousveillance: Generating interior capta through life-logs

“The MyLifeBits system is designed to store and manage a lifetime’s worth of *everything* – at least everything that can be digitised” (Gemmell *et al.*, 2003, no pagination, original emphasis).

Exterior capta that render people’s lives transparent to *outside* organisations are now partially being complemented by interior capta, personal documentation of lives as they unfold, an internally *self-produced* autobiographical sousveillance. Here, capta is *automatically* being generated by material objects used on an every day basis by an individual, such as a phone, computer, television, car, etc., on individual usage (when, where, how long used, but also on content – what was done, was chosen, was said, etc). In addition, the application of pervasive computing to ‘dumb’ objects (like fitness equipment, fridges, and other household appliances) seeks to make them ‘self-aware’ to some degree, able to monitor and communicate their usage. These technologies constitute ‘history-enriched’ digital objects in that they produce autobiographical capta. Moreover, some are supplemented with profiling programmes that adapts the technology to personal preferences (e.g., automatic interface customisation, driver settings in the car, predictive texting on mobile phones,

etc). These automated forms of sousveillance are being complemented by scopophilic technologies – the conscious self-creation and public sharing of sousveillance, for example, through blogging and webcams.

At present, however, this capta is patchy in nature (in terms of what is actually captured), is not-continuously collected (rather capta is only generated during use), and individual streams of capta are not being amalgamated into a single, unified life-log. Moreover, some present capture technologies are generally still externally controlled and monitored objects and infrastructures – they are third-person technologies (that create biographies) that have first person potential (to create autobiographies); the cameras are pointed at the person rather than being pointed by the person.

One of the aims of some pervasive computing enthusiasts is to create a unified, autobiographical (first person) life-log for each individual through digital technologies that are always-on, communicate with each other without human instruction or intervention, and are so pervasive that they cover all aspects of human activity and become so banal as to be seemingly invisible – to create a means to personally store all of one’s activities throughout a lifetime within a single archive (CARPE, 2004). The prospect is of capturing and storing *everything* we see and hear – “the totality of information that flows through a human life” (Johnson, 2003, 85), with the ultimate goal being the simultaneous digitisation of *all* cognitive ‘inputs’ experienced by the brain (all five human senses), such that the life-log would be a digital *parallel* ‘memory’ of the lived experiences of a person. Much of this just involves taking a separate digital copy for the life-log of all media that the person interacts (such as songs heard on the radio, email messages, television programs watched, webpages viewed). This is summarized in Figure 1 from one of the leading life-logging projects. The life-log at this point might be seen as a realization of Vannevar Bush’s (1945, no pagination) celebrated *Memex*, “a device in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory”

In addition, however, life-logs will go beyond Bush's *Memex* vision because they will be supplemented through wearable computing (including passive, continuous voice and visual recording) and complete home management systems that coordinate all domestic appliances and services (that are themselves interactive, digitally-aware and capable of recording use through software and sensors). This additional capta is likely to be augmented with capta not directly experienced but held unconsciously as biological 'memories' such as physiological conditions inside the body (blood pressure, heart rate, etc) and external conditions (e.g., orientation, temperature, levels of pollution). A person's life-log, therefore, will not be just an enormous digital archive, it will be "... a kind of universal prosthetic memory" which "... creates profound differences in our consciousness and in our work practices: all which had been fleeting or consigned to a folder itself consigned to dust is now, should we wish, active and present in our lives" (Bowker, 2003, 30).

Life-logs will thus provide new means of recording social memories, providing a *comprehensive* personal archive, intelligently indexed and available on-demand for later consultation. Given the range of capta archived, each life-log has the potential to record many significant aspects of daily life from every conversation had, every person met, every location visited, and every vista viewed. A life-log will therefore be significantly different from personal diaries in that it records, non-discriminatorily *all* personal events; it is an automatically recorded autobiography captured in a multi-media format, that is always up to date and stored in perpetuity.

Significantly, life-logs will be inherently *socio-spatial* archives as location will be a fundamental capta element of life-logging technologies, automatically built into the sensing systems. This location information will be generated at a fine spatial resolution, pin-pointed to (potentially) within a few millimeters through pattern recognition, wireless triangulation to fixed sensor nets, and GPS, and will be dynamically collected so that the precise path of an individual can be recalled. All manner of things will 'know' where they are at all times, while many other 'dumb' objects will be routinely 'chipped' using RFID technologies making them instantly locatable on-demand. Such rich capta will have the effect of opening up new time-space queries that were previously impossible. For example, it will possible to know every route ever taken, the location of every personal item within a sensor field and

the history of that object and its relations to other objects, and to recall every place in which an activity was undertaken. As noted below, it will also have the potential effect of creating a mobile panopticon (as opposed to a partial oligopticon).

The rationale for life-logging centres on the notion of change in the concept of computing. Rather than the concept of a computer for life, pervasive computing is premised on the idea of a 'memory for life' (Fitzgibbon and Reiter, 2003). In particular a life-log will: reduce physical clutter (there will be no need for photo albums, CDs, notepads, books, etc., because all will be stored in the life-log); allow the efficient managing of materialism and enhance domestic and individual productivity (it would be possible to know where all your possessions are and what conditions they are in); enhance productivity and enjoyment of life by allowing the searching for and recalling of events and actions; enhance the management and recalling of frail memories, particularly in an aging population where there might be significant memory loss; allow the self-monitoring of health conditions, stress levels, diet and fitness and other aspects of daily life (systematizing and significantly deepening bodily performance monitoring regimes common in today's society; see Schuurman, 2004).

Significant progress is presently being made within the computer science community in exploring life-logging². For example, Sunil Vemuri, a researcher at the MIT Media Lab is developing a personalized sound logging system called '*what was I thinking*' that archives all of individual's conversations and provides means to usefully search the verbatim transcripts via visual interfaces³. Researchers at Microsoft Research Lab in Cambridge are developing *SenseCam*, a device which automatically takes photographs of the person's environment in response to changing conditions (such as body motion, light levels, temperature) (Williams and Wood, 2004). The current prototype, "designed to act like a black box for the human body" (Twist, 2004, no pagination), is a custom-built digital camera worn like a necklace, with a ultra wide angle lens that captures a 132 degree view in front of the wearer. The results of *SenseCam* is a timeline of hundreds of photographs that log activities and spaces as they are encountered throughout the day, which can be interrogated along side the sensor logs (Figure 2). This potential is already being turned into a product. For example, Nokia aim to introduce *Lifelog* software that promises to

intelligently organise all mobile phone photographs and interactions into a browsable timeline. The *SenseCam* prototype is also being integrated as capture component of a larger Microsoft Research project called the *MyLifeBits* project. This is probably the most comprehensive life-logging project currently underway, with the aim to ‘cyberdize a life’, by digitizing all existing information of a single test subject (researcher, Gordon Bell) and capturing all their future material informational flows (Gemmell, *et al.*, 2003).

4. Digital memories

“A record if it is to be useful ... must be continuously extended, it must be stored, and above all it must be consulted” (Bush, 1945, no pagination).

“The Western tradition of memory since the Renaissance has been founded upon the assumption that material objects, whether natural or artificial, can *act as analogues* of human memory.” (Forty, 1999, 2, our emphasis).

As Forty details, artefacts have long been recognised as analogues or foils for memory. In the case of archives – such as diaries or photo albums – they record events, people and places as snapshots in time and space. For people who know the individuals in the archive, context provides emotional connections and further meaning, but for others the archive simply provides a factual account. Here, there is a distinction between what we would call thin memory and thick memory. Thin memory is factual and easily formalised within a media as textual/numeric records, sound, image, etc.; it is *capta* – selected facts captured from the sum of all material data. Thick memory is embedded, emotional, context rich, immaterial – it is remembrances that constitute who a person is and provides a sense of self.

Diaries can provide some resonances of thick memories, but artefacts such as mobile telephones and emerging wearable computing can only at best provide hints as the material they record and store are largely one-dimensional and lack the interpretation, meaning, and emotive interconnections that a human mind would add. For example, a vista stored within a life-log is simply a view of a place – a collection of 1s and 0s

that constitute a picture. It is a thin memory composed purely of factual information (intensities of colour). It may have some metadata associated with but it lacks semantic and emotion meaning. For the person to whom the log relates the picture will prompt thick memories, for others it, at best, provides only hints of the wider emotional register and personal meaning. Integral meanings are not attached because they were not collected and are not collectable. Life-logs are therefore good for recording thin memory only – the factual details of everyday life, providing a living archive of the minutiae of interactions, transactions and mobilities.

That said, life-logs clearly have significant implications to the recording of the present and thus how the past is *recalled* as opposed to remembered. In terms of what is captured there is a qualitative shift in the granularity (space-time resolution of capta) and fidelity of recording media and thus quality of the capta held, and also in complementarities between media to create mutli-dimensional archives (the same events captured by different technologies and subsequently linked together). This is accompanied by a quantitative shift in terms of the volume of personal capta captured not simply as a function of resolution (a higher resolution picture requires more storage) but in terms of the frequency of capta generated (the number of frames per second, the number of activities recorded, using multiple medias, etc.) and the mobility of capture (capta is generated from devices carried or worn by the person, not fixed locations such as ATMs and surveillance cameras). In short, capta is becoming continuous across time and space, flowing into the life-log effortlessly as a natural part of performance of daily life (see Dodge and Kitchin, 2005).

While these technological shifts have the potential to provide rich autobiographical narratives that are of potential use and value to the individual life-loggee, allowing the replaying of life events (as superior diaries, interactive photograph albums and lifeline movies for example), they raise broader social and political questions. In particular there are questions concerning who owns life-logged capta, how it can be used, and the limits to what is captured.

In relation to ownership, while the capta within a life-log is autobiographical, and will be held by the individual, there are questions concerning access and control. For example, who has rights to access other than the creator? To what extent can the

material be sequestered for legal cases and what is the legal status of such material? Do *capta* take on the same status as biological memories? Or are they seen as *more* objective and true? What happens when there is a discrepancy between the statements of individuals and the life-log's *capta*? Are there any other third parties that can have access, such as government security agencies or employers? Would access by third parties (including legal use) be restrictive or non-restrictive (e.g., all *capta* will be available or only selected portions either by date or media)? Would other people captured by the life-log have claims to access to its contents (such as a partner or friends or work colleagues)? What happens to the life-log at death?⁴ Are their inheritance rights and so on? Who has control of a child's life-log? Will life-logs be voluntary or will pressure or mandatory measures by state and capital force people to adopt them?

If life-logs are accessible to third parties, in whatever form, then such access opens up potential for invasive profiling, social sorting and pernicious disciplining effects. (The life-log would be in many respects a marketers dream, enabling them to 'get inside the life' of consumer to a unprecedented degree.) For example, there is the opportunity to monitor lifestyle with the life-log providing base-line *capta* that underpins services such as health and car insurance (as envisaged in Sterling's novel *Holy Fire*). Life-log *capta* could extend social sorting practices allowing for preferential treatment of customers and clients that maximises profits and maintains the status quo, and penalises those that fit certain profiles. Moreover, there is the potential for indiscretions, perversions and minor infractions of the law to be identified and penalised thus encouraging more rigorous, self-disciplining behaviour, thus encouraging an ultra-conservative society (see also Blanchette and Johnson, 2002). When every action is recorded for in perpetuity, in a seemingly objective manner, and there is a likelihood that the consequences will be realised, then Bentham's panopticon becomes fully realised. This is particularly the case if life-logs are interlinked to create collective profiles.

The vision of life-logs are that they capture all possible *capta*, storing it forever. It is not clear, however, to what extent a life-log will be editable, if at all. Should a life-log be editable like a diary or photograph? Should portions be open to selective, permanent erasing? Or just deletion from view, but with prospect of recovery?

Further, should these acts of erasing or deleting themselves be witnessed and remembered by the life-log? Are there events and actions that should be excluded from capture or at least should there be an option to suspend recording? Can you press pause on the life-log? Would an act of deletion or suspension itself be considered a sign of guilt if the life-log were to be used in law? Do the mundanities of life really need to be captured for in perpetuity, such as cleaning the house, walking the dog, or lying on a beach? As Oscar Wilde stated “One should absorb the colour of life, but one should never remember its details. Details are always vulgar” (1988, 80). In addition, to what extent will it be possible to dupe the log, to unsettle the authenticity of the record.

The degradation of biological memory or cognitive disorders are traumatic experiences as the evidence from forms of dementia and mental illness illustrate. So what would be the impact of accidental or deliberate damage or alteration through the planting of false ‘memories’ to the life-log? Moreover, could the life-log be stolen and used, perhaps in the same way as stolen passports or identity cards? What would be the consequences for the person whose life-log was stolen both emotionally and materially?

Some questions about the ‘reality’ of trying to live in a life-logged world are starting to be problematised through the work of digital artists. For example, Lucy Kimbell, through her website (www.lucykimbell.com) “I measure therefore I am” has undertaken a quantitative personal audit — which includes her stock market style evaluation called *LIX*, “..a weekly index that tracked [her] performance between 2002-03 by measuring financial, emotional, social and environmental factors”. Multimedia artist Ellie Harrison’s projects include *Gold Card Adventures*, a logging of all her public transport journeys for a year, and *Eat 22* project where everything she ate for the year after her 22nd birthday was photographed, logged and displayed online (www.ellieharrison.com) (Figure 3). A more generalised questioning of the excesses of consumerist culture was the focus of the *All-Con\$uming.com*, a ‘life-logging’ type project by artist Stephanie in which she comprehensively recorded all her purchases in 2001. A total of \$73,549.14 USD (excluding new home) for 2,586 different items/services was spent, all catalogued online with descriptions, photographs, date, time, location and amount. Lastly, Alberto Frigo’s work in ‘visual-statistics’ questions

human's banal dependence on technology through a very exacting type of logging. The project is "an ongoing experiment consisting of photographing each time my right hand uses an object in order to create my autobiography for self-reflection and enforcing my identity" (Frigo, 2004, 52).

5. The ethics of forgetting in an age of pervasive computing

"Much forgetting turns out to be more benefit than bereavement, a mercy rather than malady. To forget is as essential as to keep things in mind, for no individual or collectivity can afford to remember everything" (Lowenthal, 1999, xi).

With respect to the development of *sousveillant*, life-logging technologies, and the discourses used to support such development, the dilemmas we, and the artist projects described above, raise are strategically avoided because they highlight difficult ethical questions concerning events and actions that were previously either private or disparately captured across media and organisations and were subsequently difficult to stitch together into a coherent, unified whole. Rather than systematically examine the ethical dilemmas that life-logging raises, sketched in the previous section, here we wish to suggest that such dilemmas might be tackled through an ethics of forgetting. In so doing, we want play devil's advocate to the drive to create technologies that 'store and manage a lifetime's worth of everything' by suggesting that memory should always be complemented by forgetting. We thus posit that forgetting is not a weakness or a fallibility, but is an emancipatory process that will free life-logging from burdensome and pernicious disciplinary effects; as Nietzsche suggests, forgetting will save humans from history (Ramadanovic, 2001).

Human memory is fallible and does not constitute a perfect biological life-log. People forget. Schacter (2001) details six forms of forgetting, three concerned with loss and three with error⁵. Loss-based forgetting consists of transience (the loss of memory over time), absent-mindedness (the loss of memory due to distractedness at the time the memory relates to); and blocking (the temporary inability to remember – 'it's on the tip of my tongue'). Error-based forgetting consists of misattribution (assigning a

memory to the wrong source), suggestibility (memories that are implanted either by accident or surreptitiously), and bias (the unknowing or unconscious editing or rewriting of experiences). Life-logging aims to overcome both problems of loss and error with respect to thin memories. A life-log will keep a perfect digital record of events and activities that does not decay or fade, technologies will record an exact record; distractedness will be minimised through cross-referencing of life-log sources; and blocking will be minimised by search and visualisation capabilities. A life-log will minimise errors because the technology will not be open to misattribution, suggestibility or bias – it will be an exact record of what the sensor ‘saw’ and will not open to re-interpretation and re-working. Moreover, the life-log will be augmented through the recording of detail beyond what an individual notices or knows. For example, each ‘memory’ will be augmented by exact time-space coordinates, and possibly other variables such as temperature, humidity, and physiological aspects such as heart-rate, etc. Moreover, it will add order, precision, completeness, multiple angles (taken from different technologies to provide a multimedia ‘memory’), instantaneous recall of the whole archive, searchability, filtering, and allow analysis (such as cross-referencing, charting of development, producing value-added, multimedia recollections, working out space-time envelopes of activities, and so on) to what human memory or existing memory technologies (such as photo album) can achieve. In other words, the life-log will not forget, but will also augment through added detail. And yet, forgetting is an inherent part of memory.

Perhaps, in the process of designing and implementing life-logging, forgetting should be an integral part of any system. This, we feel should happen from the bottom-up and be a core feature of the life-log, rather than from the top-down wherein legislation or organisational policy is used to regulate ‘perfect’ life-logs. So, rather than focus on the prescriptive needs for privacy protections, we envisage necessary processes of forgetting, following Schacter (2001) six forms, that should be in-built into the system ensuring a sufficient degree of imperfection, loss and error. The goal is to make the system humane and yet still useful. For example, in relation to a journey across a city. Transience could be achieved by ensuring the fading or loss of details over time proportional to the length of time lapsed between generation and present. Just as a person would simply start to forget parts of the journey, so the life-log would gradually degrade the precision of the record with time. Absent-mindedness could be

ensured though distractedness being in-built into the sensing technologies of capta generation. The log would record the whole journey, but miss out certain pieces of capta because a recording media was switched off or was directed at something else. Blocking would be incorporated at the time the life-log was being queried. At other times, the query would be answered with no problems. Misattribution could be achieved by the specific mis-recording of part of an event, but not the whole event. For example, part of a journey would be *randomly* misattributed (e.g., having a coffee in Starbucks rather than Caffè Nero), but the overall journey in terms of travelling from A to B is correct. In other words, misattribution is meaningful in relation of time, space and context. It is not the adding of false memories, but rather ‘tweaking’ of an past event. Suggestibility would consist of the plausible rescripting of *certain* events after a particular time. Here, part of the journey would take a subtly different, but believable, route (like taking street A rather than street B). Bias would be re-writing *all* events based on pattern recognition; it rescripts the capta in line with past behaviour, decisions and preferences to create a record that is consistent and plausible but subtly different. The journey would be an impression of the route rather than a perfect recording, highlighting the things seemingly more important; it becomes a ‘memory’ not a recording. Over time the extent of suggestibility or bias would increase, adding a degree of uncertainty into the capta. Overall, then, a range of algorithmic strategies could be envisioned such as erasing, blurring, aggregating, injecting noise, data perturbing, masking, and so on that would be used ‘upset’ the life-log records.

6. Final thoughts

But for those first affections,
Those shadowy recollections,
Which, be they what they may,
Are yet the fountain-light of all of our day,
Are yet a master-light of all of seeing.

(William Wordsworth, *Ode: Intimations of Immortality from Recollections of Early Childhood*, 1807)

In this paper we have described how the multiple exterior surveillant archives which render peoples lives transparent to outside organisations, are increasingly being complemented by interior, personal digital documentation of lives as they unfold.

This combination of exterior surveillance and interior, *sousveillant* ‘life-logging’ has the power to produce a society that never forgets; that has a permanent socio-spatial archive of trillions of events across a vast population, traceable through space and time, a detailed spatialisation of the history of everything, everywhere.

Such an archive has many potential implications with regards to the regulation of everyday life, changing the conditions through which life unfolds. To counter such implications we have suggested the development of an ethics of forgetting that is materialised through the ‘loss of memory’ in a life-log. While building fallibility into the system seemingly undermines life-logging, it is the only way to ensure that humans can forget, can re-work their past, can achieve a progressive politics based upon debate and negotiation, and can ensure that totalitarian disciplining does not occur. A fallible life-log, underpinned by an ethics of forgetting (an ethics that works at both micro (individual – being able to live with yourself) and macro (collective – being able to live in a society) scales)⁶ allows humans to be fallible, to evolve their social identities, to live with their conscience, to deal with ‘their demons’, to move on from their past and build new lives, to reconcile their own paradoxes and contradictions, and to be part of society. Life-logs are unforgiving of mistakes because of their ubiquitous and merciless memory (Galloway, 2003); forgetting allows forgiving. Without fallibility life-logs might never happen because people will oppose their development. In that sense, forgetting may be an essential ingredient to pervasive computing.

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¹ Jensen (cited in Becker, 1952, page 278) states that "it is an unfortunate accident of history that the term datum ... rather than captum ... should have come to symbolize the unit-phenomenon in science. For science deals, not with 'that which has been given' by nature to the scientist, but with 'that which has been taken' or selected from nature by the scientist in accordance with his purpose ...".

² For overviews see Werkhoven, 2004; Nack, 2005. The proceedings of CARPE 2004 and Pervasive04 conferences provide a good sample of research in this area.

³ See <http://web.media.mit.edu/~vemuri/wwit/wwit-overview.html>

⁴ This issue of access and ownership personal digital records after death is already causing concern, see Selinger, 2004.

⁵ Schacter notes one other problem with memory – persistence, the recalling of events that would rather be forgotten.

⁶ See also Blanchette and Johnson's (2002) analysis on the importance of institutional forgetfulness to societal wellbeing.

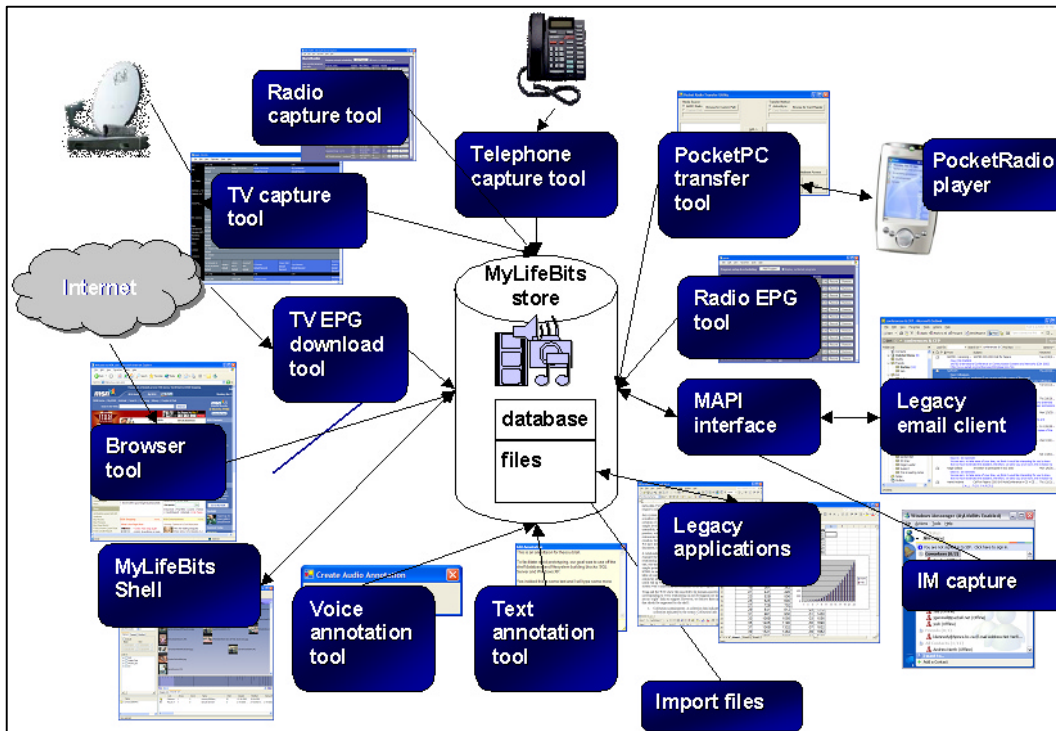


Figure 1: Conceptual model of media capture of the *MyLifeBits* systems (source: Gemmell *et al.* 2003).



Figure 2: The experimental interface to the photographic log produced by the *SenseCam* prototype (source: Williams and Wood, 2004).



Figure 3: A small part of Ellie Harrison's Eat 22 project, a year long dietary 'life-log' (source: <http://www.ellieharrison.com>).