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# Blended Memory: The Changing Balance of Technologically-Mediated Semantic and Episodic Memory

*Tim Fawns*

## **Abstract**

Ubiquitous technologies are leading us to be less selective when encoding, reviewing, and sharing details of the events in our lives. Reviewing digital photos has been shown to help the reinforcement of autobiographical memory. However, we need to know more about the type of memory experience these practices lead to. Accessing too much recorded detail about past events could lead our minds to engage less fully in the construction of memory, avoiding episodic experience by short-cutting to semantic knowledge. External memory has always been crucial to our memory process and our growing digital memories bring with them great potential advantages. Technology should, however, be designed to complement our minds rather than to replace them. Increased distance from our own experience through a failure to invoke episodic memory may lead to detachment from our own memories and, consequently, from our sense of self and from others. This paper introduces the term ‘blended memory’ to conceptualise the balance of internal (biological) and external (physical, digital or communal) memory, then speculates on how changes to this balance might impact on the way we view our past, present and future.

**Key Words:** Memory, technology, episodic, semantic, selectivity, digital photos.

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## **1. Introduction**

Digital technology is changing the way we capture, store, organise, review and share details of the events in our lives. Digital cameras, for example, allow us to take hundreds, or even thousands, of photos at minimal cost. They allow us to review photos immediately and retake imperfect ones. We are printing fewer photos, viewing them instead on computer screens, mobile phones and other devices. Websites such as Flickr and Facebook allow us to instantly send our photos to large groups of people. Add to this the ease of recording video and the rate at which personal information is expanding in our email accounts, social-networking sites and mobile devices and a picture begins to form of a social memory similar to what Jung called our ‘collective unconscious.’<sup>1</sup>

Our growing digital memory stores bring with them great potential advantages. We can bridge the gap between remote family members and friends by showing them the changes in us, our children and our surroundings. We can access details about our lives that would have been lost in the pre-digital age. We can access large banks of global knowledge. Alongside these benefits, however, is a concern

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that we are becoming less selective about capturing, storing or sharing information. In the case of photos, where we used to shoot 24 or 36 photos before taking the roll to the chemist for development, we can now shoot hundreds of photos before further action is required. We sometimes take multiple shots of the same thing in an attempt to get the photo just right. We are also being less effortful in our organisation, review and sharing practices.<sup>2</sup> Instead of organising printed photos into physical albums, we are more likely to copy digital photos to a computer, perhaps without even looking at them, particularly if there are more than seems manageable.<sup>3</sup> Sharing memory artefacts (such as photos or videos) via the Internet or email reduces our engagement in the co-construction of memory narratives compared to when we talked through our photos or home videos face-to-face.<sup>4</sup>

All of this points to a reduction in selectivity, effort and engagement when encoding and consolidating memory. This paper argues that, through a lack of criticality in our use of digital technologies, we may be reducing the depth of our engagement with memory practices while retaining too much detail about our lives that would otherwise be forgotten. There are two important consequences of this. Firstly, we are spreading ourselves too thinly across too many cues to our memory, thereby changing the balance of memory away from rich experience and toward surface knowledge of ourselves. Secondly, it may be more difficult to effectively develop our identity if we are less selective about what we choose to assimilate and what we discard. The following section discusses the relationship between memory and identity, highlighting the importance of selectivity in the construction of our sense of self.

## **2. Episodic vs Semantic Memory and Connection to the Self**

In 1972, Endel Tulving characterised two distinct systems relating to declarative memory (i.e. facts and experiences).<sup>5</sup> Episodic memory, characterised by the subjective re-experience of an event, includes an awareness of the sense that it is you remembering your personal experience (or auto-noetic awareness), as well as a sense of the time and space in which the event originally happened.<sup>6</sup> To achieve this, one must be auto-noetically aware at both the time of encoding and retrieval. This awareness depends on auto-noetic consciousness: the capacity for self-awareness and the feeling of being present within the moment as an entity separate from the environment.<sup>7</sup> This is different from semantic memory of your experience where you know what happened but you do not feel personally connected to it.<sup>8</sup> To illustrate this difference, picturing (mentally re-experiencing) a visit to a restaurant in Paris would require accessing episodic memory, whereas thinking of the name of the street it was on might only require semantic memory.

Semantic memory is often used to approximate episodic memory.<sup>9</sup> For example, it is possible to construct episodic-like narratives using personalised semantic information. Such narratives may give the impression that the narrator can remember the experience even if he or she is simply accessing knowledge of

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what happened. If we have enough semantic details on hand to solve a problem, we may choose to avoid the extra effort of re-experiencing a memory.<sup>10</sup> In this way, semantic memory can act as a heuristic device for episodic memory content, increasing efficiency but decreasing emotional connection.<sup>11</sup> For example, if we see a lion, we know that it is dangerous before remembering the events that led us to this knowledge, allowing us react quickly to the situation. The activation of this semantic memory may cue a subsequent episodic memory with an associated emotional response but, without such re-living of the moment, the connection to our past experience is reduced.

To illustrate this point, we can look at patients with frontal lobe damage which is believed to be associated with impairments in autoegetic consciousness and episodic memory.<sup>12</sup> There is often a subsequent lack of self-reflection and, in some cases, despite awareness of their cognitive deficits, a lack of concern at their condition which is consistent with the inability to connect semantic knowledge (that they have a cognitive impairment) to their own, personal situation.<sup>13</sup> People with Autism Spectrum Disorder<sup>14</sup> or Alzheimer's Disease (see Addis et al.<sup>15</sup>) are also thought to have impaired capacity for episodic recall, leading to problems in social interaction and ability to anticipate future possibilities. In the same way, increased distance from our own experience through a failure to invoke episodic memory may lead to detachment from our own memories and, consequently, from our sense of self and from others. The following sections discuss the integration of internal memory with external memory and reflects on how shifting more details about our personal experiences out of our brains and into the world may lead to shallower processing of less personalised knowledge of ourselves.

### 3. Blended Memory

The term 'blended memory' is used here to conceptualise the balance of internal (biological) and external (physical, digital or communal) memory. External memory has always been crucial to our memory process. We have distributed our knowledge of ourselves and the world for centuries by speaking to other people or writing our thoughts on paper. Our capacities as humans acting in the world are dependent on our ability to manipulate our environment via tools and technologies. As Marshall McLuhan wrote, 'The wheel is an extension of the foot, the book is an extension of the eye; clothing, an extension of the skin, electric circuitry, an extension of the central nervous system.'<sup>16</sup> Our computers, cameras, phones, pens and paper are extensions of our person and digital memory is a legitimate part of our overall memory system. Blended memory is a natural progression from our inherent tendency to enter into what Clark calls 'deep and complex relationships with nonbiological constructs, props and aids.'<sup>17</sup>

Distributing aspects of our cognition to external artefacts frees up some of our cognitive load and allows us to engage in abstract thinking that would otherwise be impossible.<sup>18</sup> It also allows us access to a rapidly expanding collective memory

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which few would deny is an immensely valuable resource. In terms of memory, reviewing digital photos have been found to help reinforcement<sup>19</sup> and innovative recording technologies such as Sensecam (a wearable camera that automatically photographs daily movements) have been shown to help people with memory impairments.<sup>20</sup> However, the robust nature of digital memory brings with it a seemingly paradoxical potential for new types of memory bias which will be explored in the following sections.

#### **4. Forgetting**

Technology should be designed to complement our minds rather than to replace them. Key here is the constructive, rather than reproductive, nature of our memories.<sup>21</sup> Conway argues that to maintain a coherent sense of self, we need to align our past and our present identities by continuously reconstructing our memories.<sup>22</sup> As Loftus and Calvin write, 'The serious difference between computer and human memory is that we don't pop out a pristine copy of the original event ... We guess.'<sup>23</sup> Constructing our memories to suit our identity and view of the world allows us to forget those experiences that hinder our evolution as people. Having overly detailed records of our experience will change the way in which we are able to do this because our degrees of freedom will be reduced by having too many digital 'anchor points.' When Mayer-Schonberger wrote 'through perfect memory we may lose a fundamental human capacity - to live and act firmly in the present,' he described the potential for us to get stuck in redundant patterns of thinking due to exposure to evidence that we did, said or experienced something that would more usefully be forgotten.<sup>24</sup>

#### **5. Distortion**

Digital memory can seem incontrovertible. It is often perceived as more reliable than biological memory. A digital photo, for example, will look exactly the same in thirty years time as it does now. Because of this resilience, we may become reliant on digital memories to verify our biological ones in the same way that people have become reliant on calculators and spell-checkers.<sup>25</sup> Rather than focusing on any impending degradation of factual or episodic recall, however, this paper is concerned with a possible disruption of the constructive process when combining biological, episodic memory with an excess of digital cues.

If we rely too heavily on digital artefacts, we will constrain our recollection largely to information that is stored in the system. We may add meta-data, such as tags or comments, to digital artefacts to help retain some of the context of an event but we will not be able to artificially retrieve associated memories or associated emotional information. These must be accessed via an episodic connection by reconstructing some part of the original experience. Instead, levelling and sharpening may occur where memories are distorted by certain details becoming exaggerated as other details fade.<sup>26</sup> Although digital photos or videos have been

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shown to aid recall of episodic memory,<sup>27</sup> they may distort the salience of particular aspects of an experience. This happens because only certain elements of the event are captured by our device, leaving out many elements which were picked up by our senses at the time. For example, reviewing photos of a dinner party may artificially increase the importance of the details that were in the camera frame at the time the button was pressed, potentially at the expense of those elements that were most important to us during the night. Additional issues arise if the angle of the camera was not the natural angle of our experience at the time or if people posed for the photo, thereby creating postures and expressions which do not reflect the norm during the event.

## 6. Detachment

Whilst blended memory brings with it many positive aspects (described previously), new practices of memory sharing are blurring the boundaries between individual and communal memory as we extract information from a variety of familiar or unknown sources. Unrestrained sharing of our personal memory artefacts (e.g., by making them publicly-accessible), could lead to detachment from our memories by reducing our ownership of them. Such detachment is illustrated by a quote from a featured student in *Class Pictures*, a book of portraits of US high school students: '[looking at my picture] feels strange because I am trying to extract a private memory from an image that is now public.'<sup>28</sup>

## 7. Balancing Blended Memory

We cannot be sure that the concerns outlined above are justified. Despite our long history of externalising memory, changes to these practices have always brought concerns. The advent of writing, argued Plato's character Socrates in the *Phaedrus* (274-7), weakened the mind by leading people to rely on external artefacts rather than maintaining internal thought.<sup>29</sup> Similarly, the printing press, according to scientist Conrad Gessner, heralded 'an unmanageable flood of information.'<sup>30</sup> While these technologies radically changed our memory practices, it would be difficult to argue that they decreased our quality of life. The same may be true of our expanding blended memories.

There are certainly convincing arguments that our lives will be enhanced by increased access to digital memory cues. There is, however, very limited research into the types of memory these innovations are supporting. There is a risk that what we are really doing with our abundance of memory cues is reinforcing semantic memory but impairing episodic memory. For example, Pauly-Takacs et al. claim that Sensecam helped a 13-year-old boy with profound memory impairment to support the formation of personal semantic memory but not episodic memory.<sup>31</sup> While digitally-retrieved media make it easier to cue certain associated memories, we need to explore the richness of this experience compared to when we expend greater effort in remembering.

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To avoid the problems described in this paper, we may need to be more selective and considered in our use of memory artefacts. Overexposure to digital memories without meaningful interaction threatens to devalue the artefacts we use to connect to our experience. This can be seen by the lower value attributed to digital photographs than printed photographs due to factors such as comparative rarity and tangibility.<sup>32</sup> Nunes et al found that people prefer to show printed rather than digital photos to others and also prefer to display printed photos around their home or office.<sup>33</sup> In recent times, the effort people have spent on arranging printed photos into physical albums, sitting in social spaces and comparing their related memory narratives has been an important part of the consolidation of personalised memory.<sup>34</sup> Perhaps we need to rediscover the value of our memory artefacts by being more selective about what we capture, store and share. This would increase our freedom to engage more fully in our selected artefacts, organising them, reflecting on their meaning and constructing narratives around them with friends and family.

## 8. Conclusion

Technology should be designed and used in a considered way that increases the value of our interaction with it, not just the quantity of its output. Digital memory stores, although bringing many significant advantages, demand effort, selectivity and engagement with their contents if they are to support strong connections to our sense of personal experience and identity. This is true for all stages of our memory process, including capture, storage, organisation, review and sharing. It is important that we explore the ways in which we can use digital artefacts to connect us more meaningfully to our episodic memory rather than to the semantic details of our lives. Those practices and technologies that currently remove us from active engagement with our experiences should be adapted to help us to reconnect with ourselves and the world around us.

## Notes

<sup>1</sup> R. K. Papadopoulos, *The Handbook of Jungian Psychology: Theory, Practice and Applications*, Psychology Press, New York, 2006, p. 63.

<sup>2</sup> M. Nunes, S. Greenberg, C. Neustaedter, 'Sharing Digital Photographs in the Home through Physical Mementos, Souvenirs, and Keepsakes', *Proceedings of the 7th ACM Conference on Designing Interactive Systems*, February 2008, p. 254.

<sup>3</sup> N. Van House, 'Collocated Photo Sharing, Story-telling, and the Performance of Self', *International Journal of Human-Computer Studies*, Vol. 67, No. 12, 2009, p. 1078.

<sup>4</sup> *Ibid.*, p. 1084.

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- <sup>5</sup> E. Tulving, 'Episodic and Semantic Memory', in *Organization of Memory*, E. Tulving and W. Donaldson (eds), Academic Press, New York, 1972, p. 385.
- <sup>6</sup> E. Tulving, 'Episodic Memory: From Mind to Brain', *Annual Review of Psychology*, Vol. 53, 2002, p. 5.
- <sup>7</sup> M. A. Conway, 'Memory and the Self', *Journal of Memory and Language*, Vol. 53, No. 4, 2005, pp. 602-603; M. A. Wheeler, D. T. Stuss, E. Tulving (eds), 'Toward a Theory of Episodic Memory', *Psychological Bulletin*, Vol. 121, No. 3, 1997, p. 345.
- <sup>8</sup> Conway, op. cit., p. 599.
- <sup>9</sup> Tulving, 'Episodic and Semantic Memory', p. 400.
- <sup>10</sup> E. Tulving, *Elements of Episodic Memory*, Oxford University Press, Oxford, 1983, p. 225.
- <sup>11</sup> Wheeler et al., p. 349.
- <sup>12</sup> Ibid., p. 346.
- <sup>13</sup> Conway, p. 599.
- <sup>14</sup> S. E. Lind and D. M. Bowler, 'Episodic Memory and Episodic Future Thinking in Adults with Autism', *Journal of Abnormal Psychology*, Vol. 119, No. 4, 2010, pp. 896-905.
- <sup>15</sup> D. R. Addis, D. C. Sacchetti, B. A. Ally, A. E. Budson, D. Schacter, 'Episodic Simulation of Future Events is Impaired in Mild Alzheimer's Disease', *Neuropsychologia*, Vol. 47, No. 12, 2009, pp. 2660-2671.
- <sup>16</sup> M. McLuhan and Q. Fiore, *The Medium is the Massage: An Inventory of Effects*, Bantam, New York, 1967, pp. 31-40.
- <sup>17</sup> A. Clark, *Natural-Born Cyborgs*, Oxford University Press, New York, 2003, p. 5.
- <sup>18</sup> D. Norman, *Things That Make Us Smart: Defending Human Attributes in the Age of the Machine*, Addison-Wesley Publishing, Reading, MA, 1993, p. 43.
- <sup>19</sup> D. West, A. Quigley, J. Kay, 'MEMENTO: A Digital-Physical Scrapbook for Memory Sharing', *Personal and Ubiquitous Computing*, Vol. 11, No. 4, 2006, p. 324.
- <sup>20</sup> E. Berry et al., 'The Use of a Wearable Camera, Sensecam, as a Pictorial Diary to Improve Autobiographical Memory in a Patient with Limbic Encephalitis: A Preliminary Report', *Neuropsychological Rehabilitation*, Vol. 17, No. 4-5, 2007, pp. 582-601.
- <sup>21</sup> D. Schacter and D. R. Addis, 'The Cognitive Neuroscience of Constructive Memory: Remembering the Past and Imagining the Future', *Philosophical Transactions of the Royal Society of London, Series B, Biological Sciences*, Vol. 362, No. 1481, 2007, p. 774.
- <sup>22</sup> Conway, op. cit., p. 595.



- <sup>23</sup> E. F. Loftus and W. H. Calvin, *Memory's Future*, Psychology Today, 2001, viewed on 25<sup>th</sup> March 2008, <<http://williamcalvin.com/2001/PsychToday.htm>>.
- <sup>24</sup> V. Mayer-Schönberger, *Delete: The Virtue of Forgetting in the Digital Age*, Princeton University Press, New Jersey, 2009, p. 12.
- <sup>25</sup> S. Carmien and G. Fischer, 'Tools for Living and Tools for Learning', *Proceedings of the HCI International Conference (HCII)*, July 2005, viewed on 13<sup>th</sup> January 2011, <<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.126.2071>>.
- <sup>26</sup> A. Koriat, M. Goldsmith, A. Pansky, 'Toward a Psychology of Memory Accuracy'. *Annual Review of Psychology*, Vol. 51, p. 488.
- <sup>27</sup> Berry et al., 2007.
- <sup>28</sup> D. Bey, *Class Pictures: Photographs by Dawoud Bey*, Aperture, New York, 2007 cited in J. Yabroff, *Here's Looking At You, Kids*, *Newsweek*, 2008, viewed on 22<sup>nd</sup> March 2008, <<http://www.newsweek.com/id/123484>>.
- <sup>29</sup> W. Ong, *Orality and Literacy: The Technologizing of the Word*, Routledge, New York, 1982, p. 78.
- <sup>30</sup> V. Bell, 'Don't Touch That Dial! A History of Media Technology Scares, from the Printing Press to Facebook', in *Slate*, 2010, viewed on 2<sup>nd</sup> February 2011, <<http://www.slate.com/id/2244198/>>.
- <sup>31</sup> K. Pauly-Takacs, C. J. A. Moulin, E. J. Estlin. 'SenseCam as a Rehabilitation Tool in a Child with Anterograde Amnesia', in *Memory*, 2010, viewed on 5<sup>th</sup> February 20, <<http://www.ncbi.nlm.nih.gov/pubmed/20658434>>, p. 6.
- <sup>32</sup> D. Petrelli and S. Whittaker, 'Family Memories in the Home: Contrasting Physical and Digital Mementos', *Personal and Ubiquitous Computing*, Vol. 14, No. 2, 2010, p. 160.
- <sup>33</sup> Nunes et al., 2008, p. 254.
- <sup>34</sup> R. Fivush and K. Nelson, 'Culture and Language in the Emergence of Autobiographical Memory', *Psychological Science: A Journal of the American Psychological Society / APS*, Vol. 15, No. 9, 2004, pp. 576-577.

## Bibliography

Addis, D. R., Sacchetti, D. C., Ally, B. A., Budson, A. E., Schacter, D., 'Episodic Simulation of Future Events is Impaired in Mild Alzheimer's Disease'. *Neuropsychologia*, Vol. 47, No. 12, 2009, pp. 2660-2671.

Bell, V., 'Don't Touch That Dial! A History of Media Technology Scares, from the Printing Press to Facebook', in *Slate*. 2010, viewed on 2<sup>nd</sup> February 2011, <<http://www.slate.com/id/2244198/>>.

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Berry, E., Kapur N., Williams L., Hodges S., Watson P., Smyth G., Srinivasan J., Smith R., Wilson B., Wood K., 'The Use of a Wearable Camera, Sensecam, as a Pictorial Diary to Improve Autobiographical Memory in a Patient with Limbic Encephalitis: A Preliminary Report'. *Neuropsychological Rehabilitation*, Vol. 17, No. 4-5, 2007, pp. 582-601.

Bey, D., *Class Pictures: Photographs by Dawoud Bey*. Aperture, New York, 2007.

Carmien, S. and Fischer, G., 'Tools for Living and Tools for Learning', in *Proceedings of the HCI International Conference (HCII)*. July 2005, viewed on 13<sup>th</sup> January 2011, <<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.126.2071>>.

Clark, A., *Natural-Born Cyborgs*. Oxford University Press, New York, 2003.

Conway, M. A., 'Memory and the Self'. *Journal of Memory and Language*, Vol. 53, No. 4, 2005, pp. 594-628.

Fivush, R. and Nelson, K., 'Culture and Language in the Emergence of Autobiographical Memory'. *Psychological Science: A Journal of the American Psychological Society / APS*, Vol. 15, No. 9, 2004, pp. 573-577.

Koriat, A., Goldsmith, M., Pansky, A., 'Toward a Psychology of Memory Accuracy'. *Annual Review of Psychology*, Vol. 51, pp. 481-537.

Lind, S. E. and Bowler, D. M., 'Episodic Memory and Episodic Future Thinking in Adults with Autism'. *Journal of Abnormal Psychology*, Vol. 119, No. 4, 2010, pp. 896-905.

Lindley, S. E., Randall, D., Glancy, M., Smyth, N., Harper, R., 'Reflecting on Oneself and on Others : Multiple Perspectives via SenseCam'. *Presented at the CHI 2009 Workshop on Designing for Reflection on Experience*, April 2009, viewed on 10<sup>th</sup> January 2011, <<http://research.microsoft.com/apps/pubs/default.aspx?id=102058>>.

Loftus, E. F. and Calvin, W. H., *Memory's Future*. Psychology Today, 2001, retrieved 25 March 2008, <<http://williamcalvin.com/2001/PsychToday.htm>>.

Mayer-Schönberger, V., *Delete: The Virtue of Forgetting in the Digital Age*. Princeton University Press, New Jersey, 2009.

McLuhan, M. and Fiore, Q., *The Medium is the Massage: An Inventory of Effects*. Bantam, New York, 1967.

Norman, D., *Things That Make Us Smart: Defending Human Attributes in the Age of the Machine*. Reading, MA, Addison-Wesley Publishing, 1993.

Nunes, M., Greenberg, S., Neustaedter, C., 'Sharing Digital Photographs in the Home Through Physical Mementos, Souvenirs, and Keepsakes'. *Proceedings of the 7th ACM Conference on Designing Interactive Systems*, February 2008, pp. 250-260.

Ong, W., *Orality and Literacy: The Technologizing of the Word*. Routledge, New York, 1982.

Papadopoulos, R. K., *The Handbook of Jungian Psychology: Theory, Practice and Applications*. Psychology Press, New York, 2006.

Pauly-Takacs, K., Moulin, C. J. A. E., Estlin, J., 'SenseCam as a Rehabilitation Tool in a Child with Anterograde Amnesia', in *Memory*. 2010, viewed on 5<sup>th</sup> February 2011, <<http://www.ncbi.nlm.nih.gov/pubmed/20658434>>.

Petrelli, D. and Whittaker, S., 'Family Memories in the Home: Contrasting Physical and Digital Mementos'. *Personal and Ubiquitous Computing*, Vol. 14, No. 2, 2010, pp. 153-169.

Schachter, D., *The Seven Sins of Memory: How the Mind Forgets and Remembers*. Houghton Mifflin Books, Boston, 2001.

Schacter, D. and Addis, D. R., 'The Cognitive Neuroscience of Constructive Memory: Remembering the Past and Imagining the Future'. *Philosophical Transactions of the Royal Society of London, Series B, Biological Sciences*, Vol. 362, No. 1481, 2007, pp. 773-786.

Tulving, E., 'Episodic Memory: From Mind to Brain'. *Annual Review of Psychology*, Vol. 53, 2002, pp. 1-25.

——, 'Episodic and Semantic Memory', in *Organization of Memory*, E. Tulving and W. Donaldson (eds), Academic Press, New York, 1972, pp. 381-403.

——, *Elements of Episodic Memory*. Oxford University Press, Oxford, 1983.

---

Van House, N., 'Collocated Photo Sharing, Story-telling, and the Performance of Self'. *International Journal of Human-Computer Studies*, Vol. 67, No. 12, 2009, pp. 1073-1086.

West, D., Quigley, A., Kay, J., 'MEMENTO: A Digital-physical Scrapbook for Memory Sharing'. *Personal and Ubiquitous Computing*, Vol. 11, No. 4, 2006, pp. 313-328.

Wheeler, M. A., Stuss, D. T., Tulving, E., 'Toward a Theory of Episodic Memory'. *Psychological Bulletin*, Vol. 121, No. 3, 1997, pp. 331-354.

Yabroff, J., *Here's Looking At You, Kids*. *Newsweek*, 2008, viewed on 22<sup>nd</sup> March 2008, <<http://www.newsweek.com/id/123484>>.

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