

INTERFACE FOCUS

Memory, Mental Time Travel and The Moustachio Quartet

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Memory, Mental Time Travel and The Moustachio Quartet

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Abstract

Mental time travel allows us to re-visit our memories and imagine future scenarios, and this is why memories are not only about the past, they are also prospective. These episodic memories are not a fixed store of what happened, however; they are reassessed each time they are revisited and depend on the sequence in which events unfold. In this paper we shall explore the complex relationships between memory and human experience, including through a series of novels 'The Moustachio Quartet' that can be read in any order. To do so we shall integrate evidences from science and the arts to explore the subjective nature of memory and mental time travel, and argue that it has evolved primarily for prospection as opposed to retrospection. Furthermore we shall question the notion that mental time travel is a uniquely human construct, and argue that some of the best evidence for the evolution of mental time travel comes from our distantly related cousins, the corvids, that cache food for the future and rely on long-lasting and highly accurate memories of what, where and when they stored their stashes of food.

Keywords

Memory, mental time travel, The Moustachio Quartet, convergence, comparative analysis, corvids

Introduction

Our ways of seeing (e.g. Berger, 1972) are based on memory and the anticipation of what comes next. There are those that argue this is all there is. Memory is a foreign land that only exists in the present, the space where all life exists. Would the world's archives make sense if there were no one there to access the meanings of all that went before? It could be argued that time, and the way in which we use it, is a uniquely human concept, and not one that is replicated in the wider universe. The concept of mental time travel, that ability to travel backwards and forwards in the mind's eye in order to contextualise the present, is well known. However we are probably out of step with the universe by assuming that time can move backwards and forwards, at least physical time. If we look for evidence of time in the wider universe all we have been able to detect are a series of unfolding events that move remorselessly in one direction. This is the process of entropy, which goes so far as to suggest that there is no way to unbreak an egg. The thesis that follows comes out of such observations.

The anomalies that occur in our thinking are fascinating, and outside of science can be observed in the art and writing of our cultures across millennia, an analysis of which suggests that memories are curious things and are central to our every day lives and make us who we are, and cause us to question the very nature of reality. We shall argue that memories are made for the future not the past, and reconstructed each time they are revisited. Facts about the past are preserved although the complexion of how they are remembered changes; in consequence of which none of these things are an accurate record of what happened, despite our own underlying prejudice. That is because what we remember becomes what happened: the re-visiting of memories results in the re-contextualising of thoughts, and the

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6 updating of perceived knowledge.
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10 This ability to project the self in time allows us to imagine events that have never
11 happened and to travel to places to which we have never been, other than in the
12 mind's eye. We swim in a subjective sea of time, which changes from moment to
13 moment, surrounded by an ever-present awareness that what once was the future
14 will soon become the past and that the real future will never be quite the one we
15 imagined. Without memory thought would have no anchor. Memory allows us to
16 use the past to create the future, it is the trigger to inspire new ideas, and generates
17 the flexibility in our imagination that allows us to do so, all be it embedded within
18 the scaffold of what we already know. We contextualize the present and the future:
19 in such ways we embody mental time travel as a primary resource for making sense
20 of our subjective experience. Our personal memories of the past are intimately
21 entwined with our thoughts about the future. We rely on our episodic cognition, our
22 mental time travel system, to reminisce, this being one reason why our memories
23 need to travel forwards as well as backwards in time¹. In this paper we shall explore
24 notions of memory and mental time travel. In so doing we will examine convergent
25 evidence, adopting a comparative analysis that interweaves science with the arts,
26 investigating both human and non-human animals.
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44 **What are the core features of Mental Time Travel?**

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46 It was Endel Tulving (1983) who coined the term episodic memory to clarify that
47 our ability to remember the past is a psychologically distinct process from other
48 forms of memory such as body memory (procedural memory) and knowing facts
49 about the world (semantic memory). Tulving identified two key phenomenological
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55 ¹ A second reason is that we also have prospective memories, namely the ability to remember to do something in the future e.g.
56 making a mental note in the morning to buy a bottle of wine on the way home from work for a dinner party that evening.
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6 features of memory and mental time travel, namely auto-noesis and chronesthesia
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8 (Tulving, 2002, 2005). Auto-noesis refers to a special kind of self-consciousness that
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10 allows us to reflect upon our memories, knowing that we are the authors and owners
11
12 of those thoughts. So what we have done in the past becomes a part of our self and
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14 the ability to reflect upon this influences our behaviours in the present (see also
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16 Wheeler, 2000). “It’s no use going back to yesterday, because I was a different
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18 person then” said Alice in Lewis Carroll’s (1865) clever tale *Alice’s Adventures in*
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20 *Wonderland*. Memory is the door to identity: it shapes who we are (Clayton &
21
22 Wilkins, in press) although it does not destroy it (see Craver et al. 2014 for example).
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24 Chronesthesia refers to another kind of consciousness that lies at the heart of
25
26 memory, namely our awareness of the passage of time, of being able to travel
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28 backwards and forwards in the mind’s eye to revisit the past in order to anticipate
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30 how we might position ourselves in the future.

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33 These phenomenological features of episodic memory have been impossible to access
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35 in non-human animals to date, due to the lack of agreed behavioural markers of
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37 consciousness in non-linguistic creatures. There are accompanying behavioural
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39 features of memory and mental time travel that Tulving originally referred to as the
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41 spatio-temporal relations between events (Tulving, 1972). In essence this is the
42
43 ability to form integrated episodic-like memories of what happened where and when
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45 (Clayton & Dickinson, 1998), which allows the subject to discriminate between
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47 similar episodes that occurred at different times and/ or locations (Griffiths et al.
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49 1999). This information can be deployed flexibly not only for memories of the past
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51 but also to imagine and plan for future events (Clayton et al., 2003a, Clayton, in
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53 press). It is these behavioural criteria of mental time travel that can be assessed in
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55 non-human animals, a point to which we shall return later.
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8 Tulving (1972) was also the first to make the distinction between remembering and
9 knowing. Knowing requires the use of semantic cognition, the ability to acquire and
10 store facts about the world, but such knowledge of the past and future does not
11 necessarily require an awareness of either the projection of the self or time, and
12 largely consists of a series of selfless, timeless labels (the obvious exception being the
13 semantic knowledge of one's birth date, which is not accompanied by any episodic
14 remembrance of the actual birth). By contrast, remembering requires a separate, all
15 be it embedded system, namely that of episodic cognition, the ability to project the
16 self in space and time to imagine the future and recall the past. As William James so
17 eloquently remarked (James, 1890, p. 6509), "Memory requires more than the mere
18 dating of a fact in the past, it must be dated in my past. In other words I must think
19 that I directly experienced its occurrence". This is not to say that the semantic
20 system plays no role however. Indeed semantic scaffolding hypothesis argues that
21 semantic memory provides a crucial scaffold in which to embed the subjective
22 experiences, a framework with which to evaluate and contextualise the episodic
23 contribution to past and future (Irish et al 2012, Irish & Piquet 2013, see also
24 Michaelian et al 2016 for a current review).

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42 As we alluded to in the introduction, remembering is subjective and the
43 interpretation of one's thoughts are open to conjecture and review whenever it
44 becomes necessary to recall them. The process is beautifully described in the
45 following: "You don't remember what happened. What you remember becomes what
46 happened" as Green (2006) expressed in his amusing novel, *An Abundance of*
47 *Katherines*. As in life, stories rely heavily on the sequence in which events unfold and
48 this colours the way in which we interpret our perceptions and our memories. The
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6 reconstructive nature of memory has its scientific origins in the work of Sir Frederic
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8 Bartlett (1932). In his book *Remembering*, he describes a study in which participants
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10 read and then retell a North American Indian folktale *The War of the Ghosts*
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12 involving a battle between ghostly warriors. The participants distorted the story to
13
14 fit in with their pre-existing knowledge structures, omitting the sections that
15
16 seemed irrelevant, and changed the emphasis and structure of the story to match
17
18 their own experience of how the world works.
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21 It is now well established that our episodic memories of past events can change each
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23 time we revisit them, depending on our mood and point of view. This causes us to
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25 frequently question the authenticity of memory, pondering the validity and meaning
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27 of experience~ What was real, what was imagined; what, if any of it at all, will be
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29 real tomorrow? Our thoughts and perceptions of the past and future are transformed
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31 through time. Sometimes the alterations that ensue create a false memory that never
32
33 actually happened. The seminal studies of Elizabeth Loftus have revealed how easily
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35 memory recall can be manipulated through language, overriding the perceptual
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37 feedback of the event itself (Loftus 1974, 1975, 2005). For example, when
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39 participants were asked to view videos of a car accident with collisions at 20, 30 and
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41 40 miles an hour respectively, and then asked to judge how fast the cars were going
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43 when the accident occurred, their responses were primarily influenced not by the
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45 perceived speed at which the cars were actually going, but by the choice of words,
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47 such as “smashed” as opposed to “bumped”, that were used to phrase the question.
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49 When asked additional details about the event such as whether or not they had seen
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51 any broken glass at the scene, participants were much more likely to report the
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53 presence of broken glass if the word “smashed” had been used to pose the question
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55 (Loftus, 1974). Our memories are so malleable that they are not only reconstructed
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6 but in some cases, misconstrued (Loftus et al., 1978). A case in point is the way in
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8 which magic effects work in the mind successfully disorientating and obscuring our
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10 perception and ability to remember what happened.

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13 Our awareness of these notions is explored in the following extract from The
14
15 Moustachio Quartet (Wilkins, 2015a, p. 48)

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17 *“Xavier had launched himself, before midnight, into the darkened city, to follow his*
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19 *idiosyncratic and nocturnal inclinations, to take note of the confusing world he found himself*
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21 *in and to wonder. In the gloom, he had followed the lines of the streets with his thoughts and*
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23 *had eventually found himself at the tango by the river. The dancing was glorious and he had*
24
25 *lost himself to moments that opened up for him. The release, as ever, had been joyous; he felt*
26
27 *he was outside of time. The spirit of the experience flashes before him; he observes it, remotely*
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29 *quantifying the sensations, checking and wondering if his observations still matched his*
30
31 *earlier recollection. Even in this short time, Xavier recognised that his sense of recall, his*
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33 *remembrance and his emotional responses had become altered in some way beyond his control.*
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35 *What had been missed or forgotten? What had altered?”*
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40 This begs the question why episodic memories and perceptions are so labile and not
41
42 simply a fixed repository of the past. The answer lies in the fact that our memories
43
44 are as much about what will happen next, as about what has already occurred, and
45
46 indeed it is thought that the episodic memory system evolved for thinking about the
47
48 future rather than the past, the so-called Constructive Episodic Simulation
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50 hypothesis developed by Dan Schacter and colleagues (Schacter et al., 2007, 2008,
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52 2012). This hypothesis posits that a crucial function of the brain is to use
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54 information gleaned from past experience to simulate a series of future scenarios and
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6 in so doing allow us not only to juxtapose a number of alternatives, but crucially to
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8 predict and plan for those possible eventualities.
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11 This flexibility in our ability to simulate multiple points of view is great for
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13 creativity, allowing us to move our thoughts seamlessly between the past, the
14
15 present and the future, and to reflect upon our thoughts and those of others,
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17 enabling us to juggle multiple perspectives involving other selves and other times~
18
19 all simultaneously in the mind's eye. As we have argued previously (Clayton &
20
21 Wilkins, 2012), we have an internal compass that we use to orient ourselves in space
22
23 and time, to project ourselves into times past and future and even into other people's
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25 lives, capturing a landscape that contains past, present and future, all of which can be
26
27 accessed simultaneously. This *Creative Navigator's Compass* comes at a cost in terms
28
29 of accuracy~ our attention, our perception and our memories are selective and
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31 subjective: the brain anticipates what it expects to see and makes associations
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33 accordingly. Sometimes it can deceive itself.
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37 A source of such deception is the obsession of the self in the current moment~ we
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39 had a tendency to think that the future will be more like the present than it actually
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41 will be. Dan Gilbert (2006) describes this temporal myopia, or short sightedness,
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43 when it comes to envisioning futures, in his wonderfully entertaining book *Stumbling*
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45 *on Happiness*: for example he convincingly demonstrates that peoples' choices of what
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47 they think they will want to eat tomorrow will be heavily influenced by their current
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49 motivational state, irrespective of whether or not those states will be experienced
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51 tomorrow (see also Cheke et al., 2016). For most of us this is a familiar experience:
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53 it's seldom a good idea to go supermarket shopping when hungry~ that's when we
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6 make ill-informed dietary choices because of our inability to dissociate current needs
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8 from possible future ones.
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11 Such temporal myopia constrains our memories of what happened. It could be
12 argued we fail to remember events because we are too busy reconstructing memories
13 to fit into our existing schema of how the world works, and in so doing override
14 what was actually perceived. Visual illusions and magic effects capitalize on these
15 aspects of perception too, as does art, literature, music and dance (Laland et al.,
16 2015). The errors that illusions and other visual effects induce in our perceptions are
17 systematic, revealing fundamental features of our perception. As Dan Gilbert (2006,
18 p. 46) so eloquently states “they are not silly mistakes but clever mistakes, ones that
19 allow those of us who understand them to glimpse the elegant design and inner
20 workings of the mind”. The mistakes we make when we try to imagine our personal
21 futures and reflect upon our treasured memories are also systematic and they too
22 have a pattern that tells us about the powers and limitations of using our creative
23 navigator’s compass to explore the world. We use our eyes to look into space, and
24 our creative compass to circumnavigate space and time~ just as our eyes sometimes
25 lead us into seeing things as they are not, our episodic cognition can lead us to
26 remember things falsely and foresee things as they will not be (Clayton & Wilkins,
27 in press). ‘Boundary extension’ is a classic case in point. This is the phenomenon
28 whereby people consistently perceive and imagine a greater expanse of a scene than
29 the one they were actually shown (Intraub & Richardson, 1989). In essence, it is an
30 error of commission in which people think they remember seeing a surrounding
31 region of a scene that was not visible in the original view. Interestingly, it does not
32 occur in response to all pictures, only those that convey scene structure, and
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6 furthermore it does not occur for all boundaries within a scene, but only those
7 boundaries that form the exterior to the view (Gottesman & Intraub, 2002, 2003).
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11 This is phenomenon long known to painters and photographers who work within a
12 picture plane that has a defined edge and limit. The art of composition and knowing
13 where to finish an image is crucial to the communication of an idea. In order to make
14 sense of an image the viewer most frequently will infer what went on moments
15 before and will conjecture what is coming next. In addition they infer what is beyond
16 the boundary. In so doing they invent more of the world and the story of that world
17 than they were originally shown. Indeed, in a similar vein the theatrical proscenium
18 arch allows the audience to suspend disbelief in the imaginative or artificial worlds
19 that they experience. In this instance the arch although it describes the edge of the
20 stage does not describe the edge of our imagination.
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33 Interestingly, not all minds are subject to boundary extension. Amnesiacs are not
34 only impaired in their ability to remember the past, but in addition cannot imagine
35 or reconstruct complex spatial scenes (Hassabis & Maguire, 2007, Hassabis et al.,
36 2007) and intriguingly they do not show the boundary extension phenomenon
37 (Mulally et al., 2012), presumably because they do not have access to what we have
38 referred to as the creative navigator's compass.
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46 **Convergent Evidence 1**

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48 In the absence of the ability to engage in mental time travel the mind is left
49 stranded~ in a dark place. Without the ability to engage in mental time travel the
50 mind is equally left stranded, but in an unknown place. The hippocampus has a
51 critical role in the difference between the two states of mind for this in an area of the
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6 brain that plays a key role in memory and mental time travel.
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10 Henry Molaison is undoubtedly the most famous case study highlighting
11 hippocampal amnesia, but like many amnesiacs damage was not limited to only one
12 region of the brain (Corkin, 2013). Another less well-known case is that of the
13 British musicologist, conductor, tenor and keyboardist, Clive Wearing, known as
14 “the man with the seven-second memory”², who developed herpes simplex
15 encephalitis causing irrevocable memory loss. Perhaps the clearest evidence,
16 however, comes from the seminal studies of patients such as Kent Cochrane (KC;
17 Rosenbaum et al., 2004, Craver et al., 2014) and DB (Klein et al, 2002) who suffered
18 specific impairments in episodic cognition, both in terms of remembering the past
19 and imagining the future. KC and DB know facts about the past and can conjecture
20 information about the future, but they cannot directly experience it: when asked to
21 do so they report that their minds go blank and that they feel the same kind of
22 blankness when asked to remember the past or imagine the future. The striking
23 thing here is that neither can conjure a single event into their conscious awareness.
24 They have no subjective experiences about themselves. It is as though they were not
25 present when the events they are asked to describe actually happened but were
26 merely told the facts afterwards.
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44 In analysis of amnesiacs we see the debilitating effects of life and consciousness in
45 the absence of mental time travel. Primarily this results in the inability to
46 contextualize the present. Examples abound: How can I know how I am feeling
47 today without conscious access to a memory of how I was feeling yesterday, last
48 week, last year? How do I know if I feel full immediately after a meal? Despite the
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55 ² The Man With The Seven Second Memory (2005) directed by Jane Treays.
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6 role of auto-noesis and the claim that memory is the door to identity, memory loss
7 alone, by report, does not leave the individual without personality or individual
8 character traits (Wearing, 2005). This leaves one to conjecture whether aspects of
9 identity are carried in the way we use language and accessed by other non-episodic
10 forms of memory.
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17 Understanding aspects of what is lost in the absence of mental time travel makes any
18 analysis of the fully functioning mind seem particularly incredible. The ability to
19 marshal complex thought from a variety of viewpoints in analysis and formulate
20 flexible strategies for thinking that provide a narrative for the future may be our
21 greatest skill. Despite technologies that allow us to glimpse such gifts in action (e.g.
22 functional magnetic resonance imaging) it may be the case that the fully functioning
23 mind is still best observed in the artifacts we produce. The following extract taken
24 from *The Moustachio Quartet* (Wilkins, 2017, p. 23), although literature no doubt,
25 illustrates the manner in which mental time travel can be used to place the individual
26 in time and place, in our need to understand the miasma of being and the universe
27 writ large.
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38 *"It is mid-afternoon on another imagined day. Caruso Maelstrom stands on the steel deck, his*
39 *familiar, boyish gaze passing over the paint splattered, chipped railing of the P&O passenger*
40 *ferry; the far distant islands appearing as miniature outcrops of blue amidst the vast, cold,*
41 *glistening, shimmering sea; passing waves might roll and undulate, airborne surf pound hard*
42 *against the ships prow, delivering the smell of salt water and sea into this beautiful man's*
43 *flaring, open nostrils. He senses, from what he sees, that the ocean's surface is only marginally*
44 *warmer than what ~~lies~~ beneath, in some other realm beyond. As he looks, sunshine and the*
45 *crystal daylight radiate out across the oceanic vista, throwing the various hard territories and*
46 *islands into degrees of relief, the prevailing detail determined by his proximity to their*
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6 *majesty and magnitude. The nearest island, green-topped and brown-faced with igneous rock*
7 *weathered over millennia is known to be the nesting place for seabirds. Guillemots are there*
8 *flying still~ slicing through three dimensions~ gliding over the formidable and available*
9 *rocky landmass. Listen, the sound of their remote cries and calls can be heard even now,*
10 *passing silently through the air and travelling on discreet, secret, transient breezes, the noise*
11 *only briefly, temporarily deadened by miscellaneous activity that has, in truth, happened*
12 *since~ within the annals of human memory. All this occurred within space and time and has*
13 *become no more than a remote symphony. That clouds, light and beauty exist within his*
14 *consciousness in this re-imagined moment is a reality recognised to be too brief, ephemeral*
15 *and so easily lost~ all this can only be remembered as belonging to a once known and*
16 *impenetrably mislaid place, if it is remembered at all? Prompted by such airy thoughts the*
17 *man imagines and inwardly glimpses a breath-taking void stretching out before him into an*
18 *unknown and impossible distance.”*
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33 The flexibility of the written narrative makes it difficult for the reader to know
34 whether the description is happening in the present or the past or the future. Indeed
35 the narrator is deliberately engaged in the act of disorientating themselves in order
36 to find a way forward in their description of impossible questions, the answer to
37 which at the end of the short sequence remain unresolved. Nevertheless the process
38 of looking for clues and searching for answers without fully understanding the task
39 in hand is intrinsic to the creative process. In the absence of knowing what to do,
40 finding a way forward is paramount.
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51 **Convergent Evidence 2**

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53 So far our focus has been on human mental time travel, but are we unique in
54 the animal kingdom in having the ability to remember the past and plan for the
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6 future? There has been considerable debate as to whether mental time travel is
7 uniquely human (e.g. Suddendorf & Corballis, 1997), or whether we share this
8 cognitive ability with other animals (e.g. Clayton et al., 2003a; Corballis, 2013,
9 2014). The issue is not about whether animals can store, process and retrieve
10 information about the past, but rather whether they use episodic cognition, the
11 mental time travel system, to do so (Tulving, 1983). As we stated earlier, questions
12 concerning autoecesis and chronesthesia in animals are at least currently outside the
13 bounds of empirical enquiry, and it is open to conjecture whether animals experience
14 boundary extension; such tests are yet to be conducted. What we do know, however,
15 is that some animals can remember the what, where and when of past events and act
16 prospectively (for recent reviews see Clayton, 2014; Clayton, in press) and that like
17 humans, hippocampal activity plays a key role (for recent reviews see Moser et al,
18 2015; Thom & Clayton, 2016).

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33 Some of the best evidence comes from studies of corvids, members of the crow
34 family, whose cognitive abilities have earned them the title 'Feathered Apes' (Emery
35 & Clayton, 2004, 2005). These birds hide food for the future and have excellent
36 memories of specific past caching episodes~ of what they hid, where and how long
37 ago (Clayton & Dickinson, 1998; de Kort et al., 2005), as well as keeping track of
38 who was watching when they cached in a particular place (Dally et al., 2006). They
39 can also update and generalize across situations, thereby demonstrating that these
40 episodic-like memories can be flexibly deployed (Clayton et al., 2003b), and use this
41 information to learn where and when not to cache in the future (Clayton et al., 2005).
42 Furthermore, they can also plan for the future, knowing where to hide food for
43 tomorrow's breakfast (Raby et al., 2007), and when to protect their caches from
44 potential thieves (Emery & Clayton, 2001; Dally et al, 2006). The jays can ignore
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6 their current needs at the time of caching in order to choose to cache those items
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8 they have learned they will want in the future when they come to recover and eat
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10 their caches (Cheke & Clayton, 2012; Correia et al., 2007). Given the ill-informed
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12 dietary choices humans often make, as alluded to earlier, such ability seems no small
13
14 feat. Perhaps the reason the jays are able to dissociate current and future needs is
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16 precisely because they are not relying on episodic cognition, that subjective
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18 experience of thinking, which all too easily constrains our perception and our
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20 memories (Cheke et al., 2011).

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23 A number of other laboratories have subsequently investigated whether or not other
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25 animals have episodic-like cognition using paradigms analogous to those employed
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27 with the jays. There is now good evidence that a diverse range of animals can
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29 remember the what-where-and-when of past events, from cuttlefish to great apes,
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31 and that some primates are also capable of prospective cognition (see Clayton in
32
33 press for a recent review). It remains to be seen, however, whether such behavioural
34
35 criteria are sufficient to ascribe episodic cognition to these animals, but converging
36
37 evidence from the cognitive development literature suggests that episodic-like
38
39 memory (remembering what happened where and when) and the ability to plan for
40
41 the future emerge at around the same time in young children as other tests of mental
42
43 time travel (Clayton, 2014).

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45
46 Additional evidence comes from neurophysiological recordings of hippocampal
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48 activity. In humans, it is well known that the hippocampus is activated when
49
50 subjects consciously engage in remembering the past and imagining the future, and
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52 analogous explorations of ‘replay recordings’ of hippocampal activity in rodent
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54 models suggest that rats may also engage in such mental time travel (see Moser,
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6 Rowland & Moser, 2015 for a recent review).

9 10 **Convergent Evidence 3**

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12 The empirical testing so familiar to scientists is not the process that artists use in
13 their form of enquiry. That is not to say that they are oblivious to the scientific
14 method, but theirs is a process informed by an analysis of experiential concerns and
15 self-enquiry, almost as if to say the recognition of self in its conscious state is the
16 experiment that artists undertake. One's personal response to stimulus becomes the
17 focus for further artistic enquiry. Often this is exemplified or embraced by the
18 acceptance of the artist's artifacts within society and culture. The level at which such
19 conjecture can be accepted as true is part of that enquiry. In its broadest sense
20 activity that takes place across millennia has at least stood the test of time and
21 resonates in some way that must be significant. In this sense the construction of *The*
22 *Moustachio Quartet* (Wilkins 2015a, 2015b, 2015c, 2017) is interesting, especially in
23 terms of its collaborative nature as an arts-science project exploring memory and
24 mental time travel. Each of the books features one of four characters who move over
25 through and across the mythical city of Warcapest. In so doing they come across the
26 characters from other books by accident or design.
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43 Such structure and the ensuing matrix of unfolding ideas and events allows for
44 conjecture about how memory and mental time travel works. This is especially
45 significant for the reader since the books can be read in any order. The inquisitive
46 reader is able to understand the unfolding scenario in the order they read the books,
47 but in addition find themselves doing the mental conjuring that allows for conjecture
48 as to how understanding might be altered had the sequence been read differently, for
49 this lies at the heart of the reconstructive nature of memory. Furthermore, there are
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6 choices to be made about what has been discovered and thereafter what should be
7 remembered. The author has taken account of the reader's prior knowledge,
8 knowing that their current state of mind will cause them to automatically make
9 assumptions about the scenario and other associations that may exist outside of the
10 novels. It is implicit that the reader will reinterpret the scenario to suit their
11 purposes and in so doing build the story in a form they understand. A good author
12 recognizes that the story will be remembered not as they wish it to be but as the
13 reader wishes it to be~ the reader seldom remembers what happened but what they
14 remember becomes what happened. In this respect Warcapest, the city in which the
15 action takes place, is a metaphor for culture and the endemic baggage it carries with
16 it, the social history of a species as it were, replete with souvenirs and mementos and
17 signposts that preserve and promote the collective unconscious.
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31 In short, the narrative causes questions to be raised that lie at the heart of how
32 memory and mental time travel works. The artifice is so shallow as to entice the
33 reader to ask whether the main characters are similar, if not the same as one another.
34 Indeed, how could they be different given that the author has constructed them. All
35 these issues operating in tandem offer the opportunity to question identity and
36 perspective taking.
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45 **Integrating approaches**

46 The process of collaboration provides insight that can be found in no other way and
47 indeed this is a major strength of the comparative approach, of an analysis of the
48 converging evidences concerning memory and mental time travel. This approach
49 allows us to recognise the patterns we use to decipher the world (Berger, 1972).
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54 Integrating science and the arts allows us to focus on the common denominator of
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6 our expertise, the human mind, and a comparison with animals offers a perspective
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8 on what it is like to engage in memory and mental time travel with and without
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10 words (Clayton & Wilkins, 2016). We begin to build a lexicon of the mechanisms in
11
12 play and the patterns of thinking that are endemic across a variety of perceptual
13
14 abilities. The broader platform provides an opportunity for alternative kinds of
15
16 enquiry and thinking that may highlight the limitations of human thought (see
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18 Clayton & Wilkins, in press). Understanding what we cannot do and the
19
20 discrepancies in our thinking may be a way forward.
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22
23 In the final section we offer three observations. The first concerns time. As alluded
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25 to in the introduction physical time only appears to move in one direction, forwards.
26
27 Although mental time travel moves bidirectionally, the time travelling patterns are
28
29 different. When we reverse time in the mind's eye we do not play it backwards in a
30
31 continual fashion: we jump backwards and then play our imagining forwards again.
32
33 This is in contrast to the gradual unfolding of events as we mentally travel forwards
34
35 into a future that has not yet happened and may never happen in quite the way we
36
37 envisage. As the White Queen remarked to Alice in Lewis Carroll's poignant tale
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39 *Alice Through the Looking Glass*, "it's a poor sort of memory that only works
40
41 backwards" (Carroll, 1871).
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44 The second issue concerns the reconstructive nature of memory. We know that our
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46 memories shimmer and change each time we revisit them so why do we feel the need
47
48 to assume that what we remember encapsulates what actually happened? In recalling
49
50 events, we constantly make comparisons and in so doing make judgments about the
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52 present with regard to the past and our understanding of what has gone before.
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54 However our memory cannot be an accurate reflection of what happened due to the
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6 subjective nature of mental time travel. The very process of comparing the present
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8 with the past, both defines the present and changes the past, and the process is on-
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10 going~ like a train travelling a track it can never be in the same place twice. We are
11
12 aware of the continuity of time, but only have the capacity to sample its passing. We
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14 chunk the unfolding moments into a series of snap shots, of events~ it's the short
15
16 hand of our thinking process, and then we search for ways to connect them, to join
17
18 the missing dots. These ideas are poignantly expressed in the following quote from
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20 The Moustachio Quartet (Wilkins, 2015c, pp. 72-73), in which the main protagonist
21
22 is reflecting on how to make sense and reinterpret the series of unfolding events in
23
24 his memory.

25 *"Years pass by and experiences, myriad moments, and un-summoned influences in various*
26 *measures, impose themselves on the retina and in the memory of living persons. Memories, by*
27 *virtue of their nature, will seem significant and often support earlier remembrances beyond*
28 *themselves~ or may even support experiences of memories yet to come. Long forgotten*
29 *thoughts rise up again, when the need arises. What a rich tapestry of moments a person*
30 *becomes over a lifetime! If nothing else, life is poignant."*

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32
33 *"Memories are markers. They can be isolated, but should not be. Intervening times are the*
34 *real measure; they are stranger and more significant than the memories themselves. I tell*
35 *myself they are notable and have been important. I tell myself that maybe the intervening*
36 *times should become cherished more than the memories."*

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44 *"The space between two memories is where I remember real life to have taken place, where*
45 *life was lived unadorned, devoid of flourish, hubris and ostentation. The true complexion of*
46 *how times pass is to be found here~ between two such points within a living memory. The*
47 *measure can be quantified in easy stages~ this was my former self, when young, and then I*
48 *grew into this~ each ensuing year a stepping-stone to the next new self, all individually*
49 *recalled but seldom assessed, often forgotten and lost! A life is the space between one's earliest*
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6 *memory and where you find yourself now. That time that passes~ what does it all mean?*
7
8 *How does one quantify the significance, effect or complexion of so many years? Why does it*
9 *have to make sense? Why do I feel it has to make sense?"*
10
11 *"It becomes a kind of madness to think of such things~ and it is in any case impossible to*
12 *quantify a life in such a way. Who can make sense of everything, as if attempting to see the*
13 *thread and the line that time follows?"*
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19 There is a second point being made here. The brain is not only subjective in its
20 selectivity, it is also anticipatory: those imagined edges that belong to boundary
21 extension are where we build convergence into our worlds and engage in developing
22 responses to the ideas and treasured memories we see as pertinent. Such things are
23 signposts to our futures and lie at the heart of creativity, although of course
24 semantic memory plays a key role too in allowing prior knowledge to be abstracted
25 across many different experiences to structure and guide our current perceptions
26 and future thoughts (e.g. Bubic & Abraham 2014, Irish & Piquet, 2013)..
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36 Finally, our need to collect mementoes and souvenirs of our experiences is of
37 particular interest, an analysis of which may lead to some intriguing insights into
38 the process of mental time travel. We might be referring to the post cards and other
39 paraphernalia we select as 'aides de memoire', but more importantly the objects that
40 we use to define us, the cars we drive, the architecture and buildings we live in, and
41 the cities we create for ourselves. All these things become physical extensions to our
42 excursions into mental time travel, to the thinking process with which we project
43 ourselves in time. They anchor fleeting moments within our living memories, to
44 connect the missing dots, to convert the chunks into continuity, and they cannot be
45 forgotten or altered as easily as information that only exists as a memory. They take
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6 on the role of artifacts, evidence that can be viewed objectively, physical adjuncts to
7 the mechanism by which we explore possibilities, order information, and develop
8 ideas.
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13 So memory is more than just the projection of our self and other selves in space and
14 time. It also has to take account of the physical world, that is to say the manner in
15 which we interact and bond with naturally occurring and man-made materials.
16
17 These things are the architecture of our lives, and define the process by which we
18 share memories with others. It is for this reason that the city of Warcapest becomes
19 the living backdrop to the lives of the main protagonists in The Moustachio
20 Quartet~ much of what the characters think is defined by the environments in which
21 they live and through which they move, and the objects and living things with which
22 they associate.
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33 Everything leads one to conjecture that memories are made for the future.
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NC and CW contributed equally to the content of this paper, and they wrote the manuscript together.

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