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# Exploring the Use of Experience Sampling to Assess Episodic Thought

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Summary: Mental time travel is the ability to mentally relive events in one's own past (episodic recall) and pre-live potential personal future events (episodic foresight). Recent research has used experience sampling to reveal when and how often we think about the past and future in everyday life; however, it remains unclear how much of thought is episodic, involving the sense of self that underpins mental time travel. In this study, we investigate the use of experience sampling to assess the frequency of episodic past and future thought in everyday life. Participants (n = 214) were exposed to 20 short message service prompts over 1 or 2 days. Half of thoughts were sited in the present; of the remainder, future-oriented thoughts were more frequent than past-oriented thoughts. Participants reported 20% of thoughts as episodic. This study suggests that experience sampling methodology can provide a means of assessing episodic thought during everyday activities. Copyright © 2016 John Wiley & Sons, Ltd.

Mental time travel (MTT) is the ability to travel mentally in time, constructing and reliving events from one's own past (episodic recall) or pre-living prospective future events (episodic foresight; Suddendorf & Corballis, 2007; Tulving, 2002; Wheeler, Stuss & Tulving, 1997). Research has established that both past and future episodic thinking depend on similar cognitive and neural processes, with both emerging at similar points developmentally (Busby Grant & Suddendorf, 2009, 2011; Busby & Suddendorf, 2005) and showing similar patterns of impairment in patients with schizophrenia (Argembeau, Raffard & Van Der Linden, 2008), amnesia (Hassabis, Kumaran, Vann & Maguire, 2007) and mild Alzheimer's disease (Addis, Sacchetti, Ally, Budson & Schacter, 2009), and neuroimaging studies have shown that a core network of brain regions is involved in both episodic remembering and episodic planning (Addis, Wong & Schacter, 2007). MTT occurs both deliberately and spontaneously (Berntsen & Jacobsen, 2008). Despite substantial debate as to the use and adaptive function of MTT (e.g. Buckner & Carroll, 2006; Schacter, Addis & Buckner, 2008; Suddendorf & Corballis, 2007), the majority of research to date has examined MTT in controlled lab-based settings (Addis et al., 2007; Szpunar, Watson & McDermott, 2007). Only a handful of studies provide insight into how, when and why MTT is deployed in everyday life.

Experience sampling is a methodology in which participants are prompted at intervals to provide real-time responses about a particular experience. Such techniques can be used to assess the content and temporal nature of people's thoughts as they go about daily life. Several studies have used experience sampling to examine the extent to which 'mind wandering', defined as thinking about something other than what they were currently doing, occurs in everyday life. Killingsworth and Gilbert (2010) found thoughts were categorised as mind wandering in 46.9% of the responses provided by participants; Kane et al. (2007) reported a lower 30% of the time their participants were 'not on task'. More recently, Song and Wang (2012) found a rate of mind wandering at 24.4%. In terms of content of non-present thought, there is a clear bias towards future-oriented thought in general, with the Song and Wang (2012) study reporting future-oriented thinking about twice as common as that sited in the past. This is consistent with lab-based experience sampling of thoughts (Smallwood, Nind & O'Connor, 2009; Stawarczyk, Majerus, Maj, Van der Linden & D'Argembeau, 2011) and other sources such as self-estimates of thoughts (Jason, Schade, Furo, Reichler & Brickman, 1989). D'Argembeau, Renaud and Van der Linden (2011) also found evidence of a high frequency of future-oriented thoughts using a diary study.

These studies demonstrate that large-scale experience sampling of thought content in daily life is possible (e.g. Killingsworth & Gilbert, 2010), and existing research suggests that up to half of thought in everyday life is not focused on the present. There is evidence of a future-oriented bias, such that of this non-present thinking, people are more likely to be thinking about the future than the past. However, to make inferences about MTT specifically, which involves the episodic construction and experiencing of a particular event, a more detailed picture of the nature of the thoughts occurring needs to be built.

The process by which episodic thought occurs remains a subject of considerable discussion; it is clearly complex, and interrelated with other processes and forms of information such as working memory and semantic recall (Addis et al., 2009; Buckner & Carroll, 2006; Schacter et al., 2012), and it differs in key ways between episodic recall and episodic projection (D'Argembeau & Van der Linden, 2004). However, lab-based studies have been able to reliably generate and assess both episodic recall and projection, by focusing on pre-living or reliving of a specific personal past or future event (Addis et al., 2007; Szpunar et al., 2007). On this basis, it should be possible to have people differentiate thoughts that involve this re-experiencing/pre-experiencing component from those that do not while they go about their daily lives. If so, the relative frequency of such thoughts can be assessed, and relationships between these cognitions, context and behaviours can be examined. No experience sampling studies have yet attempted this, although small diary studies provide suggestive data. Finnbogadóttir and Berntsen (2013) found that participants recorded an equal number of episodic memories and

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episodic projections in a live diary study. This is consistent with an earlier self-reporting retrospective diary study by Berntsen and Jacobsen (2008), in which participants reported similar frequency of past and future episodic events.

This study sought to establish whether an experience sampling methodology could be used to elicit reports of episodic past and episodic future thoughts of participants in their daily lives. Short message service (SMS) prompts were sent to participants throughout the day to trigger reporting of their thoughts and accompanying factors. By using mobile technology to both elicit attention and record responses, the aim was to minimise disruption to the participant in order to best gain an accurate picture of how thoughts are distributed in terms of whether they were episodic or non-episodic in nature, and whether they were sited in the past or the future. The content and valence of the thoughts, as well as context and resulting behaviour, were also briefly assessed. Two small pilot studies were conducted to test and revise logistical and technical elements of the study design. Based on previous research, a substantial proportion of thoughts were expected to be non-present in direction (up to half has been reported), with consistent evidence for a bias towards future-oriented thought in general. It is unknown what proportion of thoughts are likely to be episodic in nature, the target of MTT discussions, although recent theoretical emphasis has been placed on their importance to everyday functioning.

## METHOD

### Participants

Two hundred and fourteen undergraduate students, aged 17–55 ($M = 21$, $SD = 7$) participated in return for course credit. Seventy per cent of the sample were female.

### Design

The study was repeated measures, with participants responding to the survey questions every time they received an SMS prompt. The majority of the participants ($n = 179$) were sent 10 prompts per day over the 2 days of the study (total number of prompts = 20). To investigate the effect of increasing the frequency of prompts, a subset of the participants ($n = 35$) were sent 20 prompts over a single day. Frequency of thoughts reported as falling into each of the categories was the primary outcome measure.

### Materials

*Thought survey*

Participants responded either using a dedicated survey application (iSurvey) or via SMS managed by online service SMSBroadcast. Those responding via app had each of the six questions presented serially. Those responding via SMS received the thought survey questions in an initial SMS and replied to that SMS with answers with questions delineated by number (i.e. 1.present 2.work). The six-item questionnaire was as follows. 'What were you thinking about in the seconds before you received the SMS alert?' (possible responses: present, remembering, knowing, imagining, future or other); 'Please give more information about what you were thinking about' (text response). They were also asked how they were feeling when they responded (measured on a 5-point scale for the app and a 7-point scale for the SMS response, for both the endpoints sad/negative and happy/positive; responses were converted into percentages for all analyses). Actions associated with the thoughts were also elicited, with participants asked if they would do anything in particular on the basis of what they were thinking about (text response). Participants were also asked where they were when they received the alert and whether they were alone or with others, and if so, whether they were or were not engaging with others.

*Briefing information*

At the initial in-person meeting, detailed descriptions of each temporal thought category were provided to participants, along with examples of each (refer to Supporting Information). The aim was primarily to identify past and future thoughts involving episodic recall/projection (reliving or pre-living an experience) from thoughts located in the past and future but did not involve the episodic component, with additional categories for present thought and other thought. The key phrases were as follows: in the present (if you were absorbed in what you were doing at the time and just thinking about that activity, then select this answer), remembering (if you were remembering and reliving an event from your past, then select this answer), knowing (if you were thinking about something you learned in the past but you were not actually reliving an event or experience, then select this answer), imagining (if you were imagining and pre-living an event in your future, you should select this answer), future thought (if you were thinking about or planning something you will do in the future but you were not actually picturing you experiencing an event in your mind, then select this answer), or other (if what you were thinking about does not fit into any of the previously mentioned categories, such as being asleep, then select this answer).

*Comprehension measure*

To provide a measure of participants' ability to categorise their thoughts according to the provided scheme, participants were presented with 17 brief scenarios and asked to select the temporal category to which they believed each belonged. Responses were assessed, and the percentage correct for each temporal category and overall for each participant was calculated.

*Other measures*

Gender and age were recorded. Questions assessing aspects of technology ownership and use were asked, specifically what type of mobile phone (cell/web/smart phone) and normal usage. Whether participants were using their own or a borrowed phone or SIM was recorded.

### Procedure

During an initial in-person session, participants were provided with an information page that detailed the requirements of the study, a consent form and an iPhone use waiver form (if the participant was borrowing an iPhone for the duration

of the study). The requirements were also explained verbally and questions answered. The iPhones (either participants' own phones or borrowed from the researcher) were then set up to download the iSurvey app and the app linked to an appropriate identifier for each participant. Participants were then provided with the briefing information (refer to the Supporting Information) describing the questions involved in the survey, and how to answer it using the app. The different categories of thought and examples were explained in detail, and participants were 'walked through' the use of the app to answer each question. An additional series of six real-life examples (thoughts in particular scenarios, with appropriate responses) was also provided during the initial in-person meeting. Participants completed the Comprehension Measure to assess their understanding of the thought categories and provided demographic and general phone use information.

Upon receiving a prompt, participants responding via SMS were told to reply to the thought survey text with their answers. Participants were asked to respond as soon as feasible, on the understanding that some commitments (such as lecture or work attendance) would prevent them from responding. It was stressed that participants not respond while driving. It was emphasised that it was better to respond late than not at all. To avoid recall bias, participants were told that all responses should be of the state of mind *at the time of responding*, not when the prompt was sent. Response delays were dealt with by linking a response to the most recent SMS prompt. Accordingly, in analyses, responses are operationalised in terms of times of receipt, not time of prompt.

Those responding via app were asked to open the app in order to complete the comprehension measure. If using an experimenter phone or SIM, they borrowed/installed it during this session. During the next 1 or 2 days (depending on condition) following the session, participants received 20 prompts prompting them to answer the thought survey. SMS responses were automatically received in real time. All participants attended a second debriefing meeting, at which point app responses were downloaded from iSurvey, and any borrowed iPhones and SIM cards were returned.

Prompts were sent on a criterion of 10× per day. A high-quality random schedule for each participant was generated *a priori* using the program 'Psrta'. Psrta parameters include the closest acceptable intervals (15 minutes), the interval for prompts (regular waking hours) and the number of prompts (10). Over 400 random schedules were generated before data collection began. Participants were assigned a random schedule in the order in which they were recruited. Once assigned, the SMS were sent in advance according to the random schedule.

## RESULTS

### Mode of responding

A logistic multilevel model revealed no difference in the categorisation of thoughts depending on the number of SMS prompts received per day, whether they responded using SMS or the app, or whether the phone/SIM was owned or borrowed. All groups were combined for subsequent analysis.

### Task comprehension

Task comprehension was assessed through the percentage of items participants were able to categorise into the 'thought' categories correctly. Averaging scores within, then across participants, participants scored an average of 72% ($SD = 17$). If both past-oriented categories and future-oriented categories were collapsed, the average score increased to 83% ($SD = 19$). This suggests some confusion about the finer points of the episodic/non-episodic categories, but general understanding of basic temporal distinction (past, present, future and other). Those who scored poorly on the comprehension task were significantly less likely to respond during the repeated measures phase of data collection ($\chi^2 = 27$, $p < 0.01$; Table 1). The possibly confounding effects of comprehension score and poor response behaviour were explored by comparing results if participants with a score below 70% and/or who responded on fewer than 10 occasions were removed from analysis. Comprehension and low response frequency were not significantly associated with self-reported thought orientations, suggesting that poorer comprehension scores did not systematically bias the repeated-measures data, so all participants were retained in analysis.

### Response delay

Participants responded to an average of 14 of the 20 prompts ($SD = 6$). The response delay (number of minutes between the prompt being sent and the response receipt) was extremely skewed, ranging from 0 to 603 minutes, with over half (52%) being received in the 4 minutes after the prompt was sent. The vast majority (92%) of responses were recorded within the hour. A series of multilevel models with responses nested by participant revealed no significant relationship between number of prompt, or response delay (either as a continuous variable, or binned into categories of less or more than 10 minutes), and temporal orientation of thought. This supports the decision to leave all responses, regardless of delay, in subsequent analyses.

### Thought type and direction

Overall, present-oriented thoughts were the most frequently reported, followed by thoughts oriented towards the future and then towards the past, with 'other' thoughts being the least common (Figure 1). Averaging across participants, 'present' thoughts were reported on an average of 51% ($SD = 17\%$) of responses, future thoughts (non-episodic future) 18% ($SD = 14\%$), imagining (episodic future) 10% ($SD = 7\%$), remembering (episodic past) 10% ($SD = 5\%$) and knowing (non-episodic past) 7% ($SD = 8\%$).

The wide standard deviations indicate considerable between-subject differences in the temporal orientation of thoughts across measurement occasions, suggesting that some people may have a tendency towards future thought, and others past thought. To explore this further, the relative proportion of responses with a past focus ('remembering' and 'knowing') as opposed to a future focus ('imagining' and 'future thought') were calculated on a per-participant basis. Splitting the data into quintiles reflects the higher percentage of future-oriented than past-oriented thought: 16%

Table 1. Logistic multilevel model with task comprehension score as a predictor of responses during repeated measures phase, nested by participant

| Parameter | Model | |
|---|---|---|
| | Null | Full |
| | Fixed effects | |
| Intercept | 3.79 (SE = 0.017) | 3.75 (SE = 0.99) |
| Comprehension score | | 0.0011 (SE = 0.01) |
| | Random parameters | |
| Level 1 intercept ($e_{ij}$) | | 2.79 |
| AIC | 1178 | 1153 |

*Note*: Standard errors are in parentheses. $n = 165$, cases with missingness removed. AIC = Akaike information criterion, model fit measure where smaller is better.

Table 2. Logistic multilevel model coefficients for the relationship between company and thought orientation

| Parameters | Fixed effects |
|---|---|
| Intercept | 1.48 (SE = 0.086) |
| With others (engaging) | 0.25 (SE = 0.12)[1] |
| With others (not engaging) | 0.26 (SE = 0.14) |
| | Random parameters |
| Level 1 intercept ($e_{ij}$) | 0.27 (SE = 0.52) |
| AIC | 2546 |

*Note*. Standard errors are in parentheses. $n = 165$, cases with missingness removed. AIC = Akaike information criterion, model fit measure where smaller is better.
[1]Significance at $\alpha = 0.05$. Base group for comparison in model is 'alone'.

of participants thought more of the past than the future (proportion < 1), 14% thought slightly more of the past (proportion between 1 and 1.7) and 15% thought slightly more of the future (proportion between 1.7 and 4). Over half (55%) thought considerably more about the future than the past (proportion 4 and higher).

### Predictors of thought type

Multilevel models with responses nested by participant did not find a significant association between age, gender or current mood and temporal orientation of thought. However, having company was significantly associated with the temporal orientation of thoughts ($\chi^2(2) = 81$, $p < 0.01$, Table 2). Table 3 presents the frequencies of self-reported thought in each of the temporal categories by social engagement. Participants were significantly more likely to engage in present-focused thinking and remembering, when with friends, than when they were alone. Those who were alone were more likely to report thoughts in the other category. Physical location was significantly associated with the temporal orientation of thoughts, but only if they were collapsed into categories of past focus, future focus or other focus ($\chi^2(5) = 65$, $p < 0.01$, Table 4), with the tendency for more future-oriented thoughts less pronounced at university than other locations (Table 5). There was no significant interaction between company and physical location in predicting thought orientation.

Participants engaging in future thought were significantly more likely to report that they intended to do something

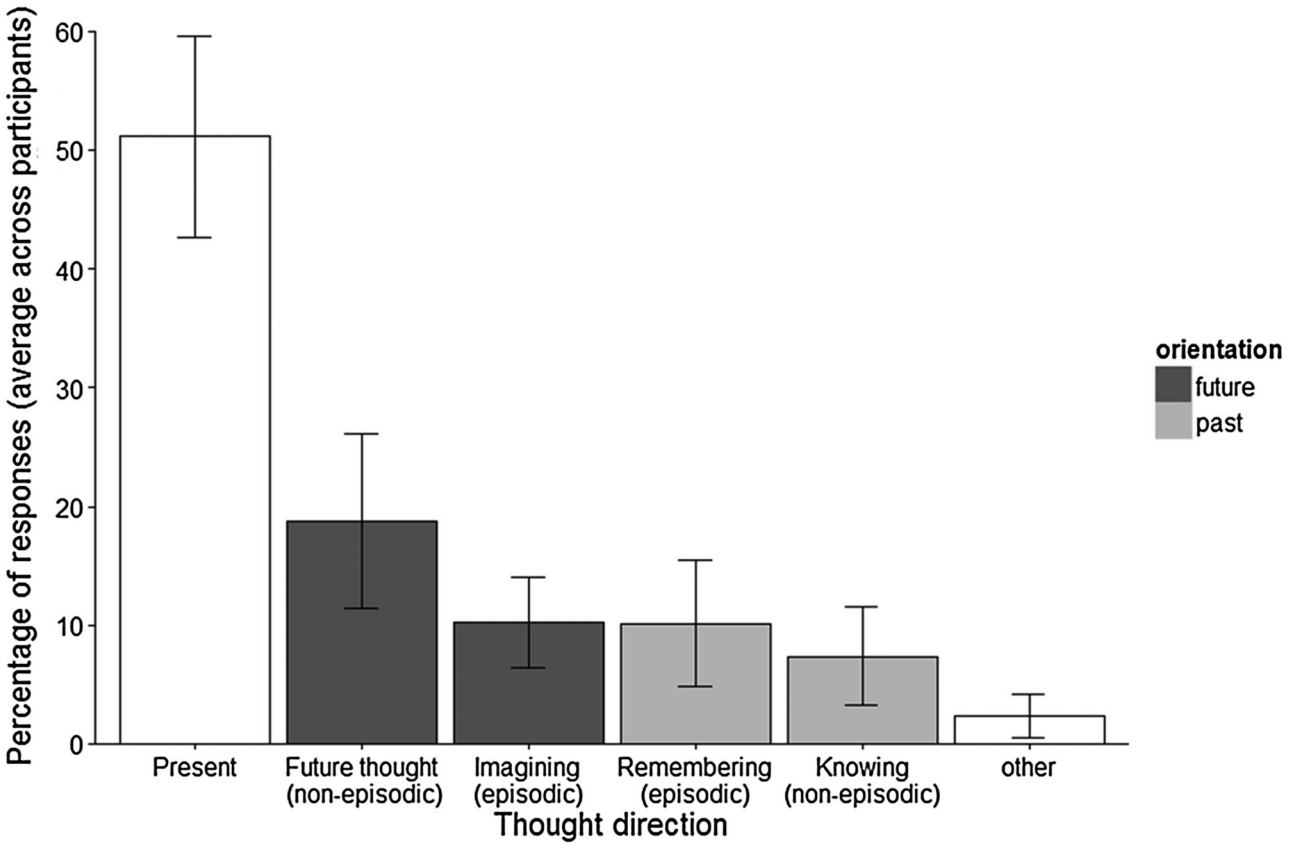


Figure 1. Temporal orientation of thoughts reported by participants, expressed as a percentage of response occasions (i.e. 10% reports in a participant who responded all 20 occasions would be 50%), and averaged across participants. Error bars denote the standard deviation across participants

Table 3. Absolute frequencies of self-reported thought orientation by social engagement

| | Present | Imagining (episodic) | Future thought (non-episodic) | Remembering (episodic) | Knowing (non-episodic) | Other |
|---|---|---|---|---|---|---|
| Alone | 520 | 121 | 172 | 96 | 70 | 36 |
| With others, engaging | 426 | 84 | 148 | 87 | 63 | 13 |
| With others, not engaging | 246 | 46 | 79 | 51 | 39 | 4 |
| Remotely engaging | 1 | 0 | 0 | 0 | 2 | 0 |

*Note*: This reflects counts pooled across all individuals and time points. Because 'alone' was used as a base group in multilevel analyses, small cell counts in other location categories did not unduly distort analyses.

Table 4. Logistic multilevel model coefficients for the relationship between location and thought orientation

| Parameters | Fixed effects |
|---|---|
| Intercept | −0.74 (SE = 0.09)[1] |
| Other | 0.42 (SE = 0.19)[1] |
| Restaurant | 0.35 (SE = 0.44) |
| Transportation | 0.11 (SE = 0.21) |
| University | 0.63 (SE = 0.16)[1] |
| Work | 0.30 (SE = 0.23) |
| | Random parameters |
| Level 1 intercept ($e_{ij}$) | 0.22 (SE = 0.47) |
| AIC | 1677 |

*Note*: Standard errors are in parentheses. $n = 165$, cases with missingness removed. AIC = Akaike information criterion, model fit measure where smaller is better.
[1]Significance at $\alpha = 0.05$. Base group for comparison in model is 'home'.

Table 6. Logistic multilevel model coefficients for the relationship between intention to act and thought orientation

| Parameters | Fixed effects |
|---|---|
| Intercept | 0.701 (SE = 0.15)[1] |
| Imagining | −0.5088 (SE = 0.17)[1] |
| Knowing | −0.9311 (SE = 0.19)[1] |
| Other | −1.86 (SE = 0.345)[1] |
| Present | −1.0570 (SE = 0.127)[1] |
| Remembering | −1.2169 (SE = 0.183)[1] |
| | Random parameters |
| Level 1 intercept ($e_{ij}$) | 1.859 (SE = 1.363) |
| AIC | 3245 |

*Note*: Standard errors are in parentheses. $n = 165$, cases with missingness removed. AIC = Akaike information criterion, model fit measure where smaller is better.
[1]Significance at $\alpha = 0.05$. Base group for comparison is 'future thought'.

based on what they were just thinking about than those engaging in past-oriented or present-oriented thoughts ($\chi^2 = 383$, $p < 0.001$, Table 6).

## DISCUSSION

This study extends previous experience sampling research examining the temporal location of thoughts by asking participants to identify episodic thoughts located in the past and future while they go about their daily lives. The overall findings are consistent with previous studies, with about half of thoughts reported located in the present, and of the remainder, a larger proportion was future oriented than past oriented. The key new finding is that thoughts identified by participants as episodic (involving pre-living or reliving a specific event) composed around 20% of all thoughts, with equal frequency of past and future episodic constructions. The similar frequency of past and future episodic experiences is in line with two previous retrospective diary studies. Taken as a whole, these data suggest that this methodology can be used to elicit from participants the episodic nature of their thoughts, not only the temporal direction, and thus opens an avenue for real-life, in-context assessment of episodic thought and associated factors.

This study focused on establishing 'proof of concept', as to whether participants could in a real-life setting rapidly identify past and future episodic thoughts, as defined to them at the beginning of the study, as part of an experience sampling methodology. In this light, the categories and associated descriptions used here should be considered a first attempt at delineating and describing these types of thought for such a methodology. Future research needs to explore first whether the categories used here represent the most appropriate delineations, and secondly how these categories can be effectively communicated to participants.

Assessing subjective experience by necessity involves simplification—in this case, classifying thoughts into one of series of specific categories. The current study used a grouping

Table 5. Absolute frequencies of self-reported thought orientation by location

| | Present | Imagining (episodic) | Future thought (non-episodic) | Remembering (episodic) | Knowing (non-episodic) | Other |
|---|---|---|---|---|---|---|
| Home | 524 | 124 | 191 | 98 | 87 | 34 |
| Other | 147 | 33 | 53 | 31 | 21 | 2 |
| Rest | 33 | 5 | 8 | 4 | 3 | 0 |
| Transport | 104 | 20 | 30 | 22 | 15 | 3 |
| Uni | 282 | 50 | 78 | 51 | 48 | 12 |
| Work | 94 | 25 | 32 | 23 | 5 | 3 |

*Note*: This reflects counts pooled across all individuals and time points. Because 'home' was used as a base group in multilevel analyses, small cell counts in other location categories did not unduly distort analyses.

process, in which thoughts were categorised as involving the sense of personal reliving or pre-living or not, in concert with the temporal orientation of the thought to define category membership. While focusing on the sense of personal experience in past or future as defining episodic thought is consistent with previous definitions (Suddendorf & Corballis, 2007; Tulving, 2002; Wheeler et al., 1997), there is much debate as to the nature of episodic thought, in particular whether it should be conceptualised more broadly. For example, it has been argued that the temporal nature of the episodic experience may not be a defining factor, as constructions such as counterfactuals may constitute an episodic experience without being temporally dependent (Buckner & Carroll, 2006; Schacter et al., 2012). Similarly challenging is theory of mind simulations, which could be argued to constitute an episodic construction but lack the sense of self often cited as central to (and used here to define) episodic experiences (Buckner & Carroll, 2006). Daydreaming was explicitly grouped in the current study with future episodic thought, but past-oriented daydreaming or fantasies may have been categorised differently by participants—future studies would need to consider how these phenomena should be interpreted and aligned. Clearly, further testing and refinement of these categories are required. We suspect that most future research will of necessity tailor the choice and definition of categories (or indeed use of a continuous versus categorical approach—refer to the discussion below) to suit the particular aims of a given study. Experiencing sampling methodology requires fast, in-context decision-making, and hence, fairly simple category judgments (and associated labelling) lend themselves easily to this context, and thus, a broad picture of when and where episodic thought occurs is likely to be built over a series of parallel studies examining different aspects and definitions of episodic and associated thought as suits a particular study aim, rather than designing a one-size-fits-all categorisation model.

The second issue of implementation of the chosen categories through communication with participants also needs to be examined carefully. The participants in the current sample were clearly able to use the technology and instructions to group their thoughts into a number of different categories, but it remains unclear how accurate they were in doing so. Although participants were trained by the researcher and completed a series of practice tasks, comprehension problems may have arisen because of unclear category descriptions or titles (in particular 'imagining' and 'future thought' could be altered in future to highlight to participants the difference between these categories). The extent to which this affected results is unclear in the current study. A comprehension measure was used with the aim of excluding data provided by participants who demonstrated a low understanding of the categorisation process. However, excluding these poorly performing participants did not result in a substantially different pattern of results. This may be because task comprehension was associated with response rate; thus, the exclusion of those with low understanding had marginal impact on overall findings. Alternatively, poor task comprehension may result in random (e.g. swapping between 'remembering' and 'knowing') rather than systematic (e.g. always responding 'imagining') responding. Another possible explanation is that measuring task comprehension during the initial appointment does not accurately reflect comprehension during the later sampling period. Subsequent studies should consider other means to assess the accuracy of categorisation of thought. One avenue is requiring more detailed content information be provided, hence allowing categorisation checking (in the current study when content responses were provided they were often not amenable to categorisation—e.g. 'another tattoo'). However, this would need to be balanced against the impact on the rapid experience sampling methodology through potential loss of responses. Incorporating this requirement for only a subset of responses and including a lab-based component of the methodology to allow for in-person feedback are alternatives.

A range of factors associated with episodic thought have only been lightly examined in this preliminary study, including implied mutual exclusivity of thoughts, the association between thought orientation and action, and the relationship between mood and thought. The relatively high response and completion rates in the current study suggest scope for longer repeated questionnaires. A particularly informative future direction would be to replace the single categorical temporal orientation question with a series of Likert-style questions for each category of thought (i.e. 'To what extent are you currently engaging in remembering?' 0—*not at all through* to 7—*very much*). Doing so would allow investigation of the co-occurrence of episodic and non-episodic thoughts and be an avenue to consider episodic constructions as a continuum rather than categorical approach. It would also allow more nuanced exploration of the association between thought content and intention to act, as action may be predicated on a combination of on past knowledge, current status and possible future outcomes. Finally, previous studies suggest that mind wandering in general (thinking about something other than what you are doing) is associated with lower levels of happiness (Killingsworth & Gilbert, 2010). The current study used only a rudimentary measure of mood, but future studies should focus on investigating further the link between thoughts and mood, as there are clear clinical implications for such findings.

This preliminary evidence that approximately one-fifth of thought in daily life can be categorised as episodic informs the ongoing debate about the adaptive value of MTT. It is now widely acknowledged that the mental construction of episodic future events allows prediction of potential threats, allowing for avoidance and/or mitigation behaviours that confer improved personal outcomes (Miloyan, Bulley & Suddendorf, 2015; Schacter et al., 2012; Suddendorf & Corballis, 2007). The current data support this claim for an important role for MTT in navigating daily life, by suggesting that we frequently engage in this mental construction of past and future events. The finding that both past and future episodic thoughts were frequently reported is interesting, given the recent focus on the adaptive function of future episodic thought. Perhaps, the role of past MTT in conferring evolutionary advantage, particularly motivation (Boyer, 2008), should be reconsidered.

This study piloted the use of real-time experience sampling of episodic thinking using smartphones. This approach provides unique insight into real-time thought, and in this study, the methodology was associated with impressive response rates, and short response delays; more than half of responses were received in the 4 minutes after the initial prompt was sent. This approach minimises bias associated with retrospective recall and also eliminates selective recall associated with diary studies. These factors add support to the further use of this approach in future research.

This study found that 20% of thoughts in daily life were categorised as either past episodic or future episodic by participants, suggesting a substantial role for MTT in everyday experience. While methodological and theoretical questions around the nature and categorisation of episodic constructions remain, this study represents a step forward in understanding when, how and why people use MTT in everyday life and informs ongoing debate surrounding the adaptive function of MTT.

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