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Increasing Anticipated and Anticipatory Pleasure through Episodic Thinking

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Abstract

Episodic future thinking for positive future events is known to evoke positive affect. We aimed to assess whether it specifically evokes *anticipated* and *anticipatory* pleasure for future events, and behavioural intention. As a secondary aim, we examined if this differed compared to a condition of thinking of positive past events. In two studies, participants nominated five upcoming positive events, and five positive past events. They then completed guided episodic thinking of past events and guided episodic thinking of future events. After guided episodic thinking they rated the nominated future events on detail/vividness, mental imagery, anticipated and anticipatory pleasure, and behavioural intention. In Study 1 (*N*=32, *M* age=37.0, *SD*=19.7), increases on all variables were found relative to baseline, although expected pleasure was at trend level. There were no significant differences between future and past conditions. In Study 2 (*N*=29, *M* age=38.4, *SD*=16.3), participants were asked to nominate future events that were not already planned, and perceived control was also assessed. Again, increases in detail/vividness, mental imagery, and anticipated and anticipatory pleasure were found, this time with stronger effects for the future condition. No change was found for perceived control or intention. In both studies, increases in detail/vividness, mental imagery, and anticipated and anticipatory pleasure were generally positively correlated with increases in behavioural intention. This study provides evidence that guided episodic thinking increases anticipated and anticipatory pleasure for positive future events. Clinical implications, particularly in depression and schizophrenia-spectrum disorders, are discussed.

Keywords: episodic future thinking; episodic memory; anticipated pleasure; anticipatory pleasure; behavioural intention; mental imagery

Episodic future thinking refers to mentally-simulating specific, possible future experiences that one might be personally involved in (Szpunar, Spreng, & Schacter, 2014). Imagining the context and details of future events can be an adaptive process for a range of purposes, such as planning, problem-solving, and spatial navigation (Schacter, Benoit, & Szpunar, 2017). Effortful simulations of future events can increase their vividness (Boland, Riggs, & Anderson, 2018; Madore, Jing, & Schacter, 2018), and the plausibility of them occurring in one's life (Boland et al., 2018; Gregory, Cialdini, & Carpenter, 1982; Szpunar & Schacter, 2013). Indeed, episodic future thinking can increase the availability of information about future experiences with which to make decisions and form intentions (Altgassen et al., 2015; Tversky & Kahnemann, 1974).

One particular form of information which influences behavioural intention is future-oriented emotions (Bagozzi & Pieters, 1998; Brown, MacLeod, Tata, & Goddard, 2002; Ortony, Clore, & Collins, 1988; Perugini & Bagozzi, 2001; Taylor & Schneider, 1989). Here, we focus in particular on anticipated and anticipatory pleasure. These represent two distinct dimensions, 1) anticipated pleasure being the expectation of experiencing pleasure in the future, and 2) anticipatory pleasure being the in-the-moment feeling of pleasure of thinking about a positive future experience. Although conceptually distinct (Baumgartner, Pieters, & Bagozzi, 2008), these dimensions are intimately linked, whereby the prediction of pleasure from a future event is a prerequisite to having a related affective response. Research has shown some divergent findings regarding these dimensions, for example, Barsics, Van der Linden and D'Argembeau (2016) observed a positivity bias for emotional future-oriented thoughts for emotions that were expected to occur, but not for emotions experienced in the present. Both higher anticipated and anticipatory pleasure are known to be strong motivating

factors in decision-making (Mellers, Schwartz & Ritov, 1999), behavioural intention (e.g., Bagozzi & Pieters, 1998; Baumgartner et al., 2008), and actual engagement in rewarding behaviours (Engel et al., 2013; Sherdell et al., 2012). Some research has shown that anticipated emotions are a stronger factor in intentions to perform a behaviour, but anticipatory emotions are a stronger factor in our self-predictions that the behavior will actually be performed (Carrera, Caballero & Muñoz, 2012), again pointing to possible differences in these dimensions.

To the authors' knowledge, no study has assessed whether engaging in guided episodic future thinking for positive events can cause increases in anticipated and anticipatory pleasure, although studies have investigated the effect on related variables such as happiness (Quoidbach, Wood, & Hansenne, 2009) and positive affect (Holmes, Coughtrey, & Connor, 2008). The current study aimed to assess whether episodic future thinking would increase anticipated and anticipatory pleasure. According to the simulation heuristic (Kahnemann & Tversky, 1988), more realistic and easier to imagine events will be perceived as more likely to occur. Given this, it was thought that increasing detail/vividness and mental imagery for positive future events should increase their plausibility (Szpunar & Schacter, 2013) and give rise to stronger anticipatory pleasure, and behavioural intention. Knowledge of whether anticipated and anticipatory pleasure can be manipulated has particular relevance in specifying interventions for those with schizophrenia-spectrum disorders and clinical depression, given they have impairments in episodic detail and specificity (Hallford, Austin, Takano, & Raes, 2018) that appear to be related to anhedonia, and specifically to the ability to anticipate pleasure (Hallford et al., 2020; Hallford & Sharma, 2019; Wu et al., 2017). Deficits in anticipatory pleasure are related to lower motivation (Foussias & Remington,

2008; Treadway & Zald, 2011) and impaired psychosocial functioning (Buck & Lysaker, 2013; Foussias et al., 2011), which maintain disorder. Therefore, more insight into the methods and mechanisms related to the enhancement of anticipated and anticipatory pleasure would be useful in translational research in clinical mental health settings.

On a related note, research has shown that recalling past experiences can prime an episodic thinking style, and subsequently increase detail/vividness when thinking of future events (e.g., Madore, Jing, & Schacter, 2018; Madore & Schacter, 2014; Madore & Schacter, 2016). This is thought to be because mentally simulating past and future events involves a similar process of generating and maintaining a mental scene populated with details (Madore et al., 2018). Indeed, activating an episodic thinking style, whether through past or future thinking, increases detail in future thinking (Madore et al., 2018). Regarding anticipatory pleasure, research has also indicated that thinking of positive past events might prime the prediction of positive emotions, and lead to a stronger sense of pleasure from thinking of future events (Painter & Kring, 2016). A second aim of the study, therefore, was to assess whether guided episodic thinking for past events would also significantly increase detail/vividness and mental imagery for positive future events, and anticipated and anticipatory pleasure and intention to engage in these events.

It was hypothesised that engaging in guided episodic thinking, in conditions of either past or future positive events, would increase the detail and mental imagery of personally-relevant upcoming positive future events, and increase anticipated and anticipatory pleasure and intention to engage in them. It was hypothesised that there would be no significant differences between the future and past episodic thinking conditions.

Method

Design

The study used a within-subjects design with a repeated measures factor of condition (baseline; episodic past thinking; episodic future thinking). The main dependent variables were detail/vividness, the use of mental imagery, anticipated and anticipatory pleasure and behavioural intention, which was assessed for nominated future events. See Figure 1 for the study design.

Participants

The sample consisted of 32 participants (*M* age = 37.0, *SD* = 19.7, 64.5% female). They were recruited through advertisements on a university campus and social media, and snowballing whereby participants were asked to distribute an invitation among their personal networks. The inclusion criteria were that participants were 18 years or over and English-speaking. As their highest educational attainment, the majority reported having a bachelor (36.7%) or postgraduate degree (23.3%), and the remaining had a diploma or certificate (20%), or finished high school (20%). The majority were Caucasian (96.7%) and reported being in paid employment (74.2%), and almost half were currently students (41.9%).

An a priori power analysis was conducted using G*Power 3.1.9.2 (Faul, Erdfelder, Lang, & Buchner, 2007). Drawing on effect sizes from previous studies that showed changes in vividness for positive future events in community samples following episodic simulations (Cohen's d_z ranging from 0.43 to 0.73; Boland et al., 2018), we powered the study to detect a moderately-sized (d_z = .60) within-group effect using paired samples *t*-tests, with a power of .80 and alpha level of .05. To detect this effect, we required a total sample size of 24. We oversampled, recruiting a total of 34 participants, with two being excluded due to large

amounts of missing responses in the baseline measurements which was not detected until subsequent conditions had been completed.

Materials

After completing demographic questions in the online baseline survey, participants were asked to nominate five possible upcoming future events that were plausible and would be positive experiences for them, and then five positive events that had already occurred for them. Participants were told that they could nominate any type of event or activity, and were given a range of categories as prompts to nominate: work/school/study related activities, conversations, socializing, errands/chores, a hobby/interest, physical activity/sport, and TV/internet/games/media, and 'other'. It was specified that the nominated events were to occur on a particular day and in a specific place, and some examples were given (e.g. going for lunch with a friend at a particular restaurant, going shopping at a local shopping mall). They were instructed that the future events were to plausibly occur between 4 and 14 days after completing the survey, and that past events were to have occurred between 4 and 14 days before completing the survey. We used this lower bound to give experimenters and participants the time to complete the two episodic thinking conditions before any nominated future events might occur. We used the upper bound timeframe to control for the temporal distance of the event/activity, and to focus on events in the foreseeable future for which realistic judgments about behavioural intention could be made. Participants were asked to state how many days in the future or past the event had occurred/would occur.

Participants were asked to rate the detail/vividness of each of the nominated events, *"How vivid and detailed is your thought of doing this activity?",* and how much they had thought about it in pictures/mental imagery, "*How much did you find yourself thinking in*

pictures/mental pictures about this?" using a 1 (*not at all*) to 9 (*very much so*) self-report scale. The same scale was used to rate anticipated and anticipatory pleasure using two items which addressed the expectation and experience of pleasure relating to each of the events: '*How pleasant/enjoyable do you think it will be to do this activity?*', and '*How pleasant/enjoyable is it to just think about doing this activity?*'. The same items were administered at baseline for the nominated past events (which changes made to the tense for the pleasure items) in order to assess for differences between the past and future events which might introduce a confound when assessing the effects of the episodic thinking conditions. Lastly, to assess the intention to engage in the future positive events, participants were asked "*How likely is it that you will do this activity*?", and again gave their response on a 1 (*not at all*) to 9 (*very much so*) self-report scale. The scores for all of the aforementioned items were averaged across the respective past or future events (with the exception of intention which was only assessed for future events), with acceptable internal reliability across the scales (Cronbach's alpha range .63 - .84, M = .71)

To help describe the sample, measures of depressive symptoms and trait anticipatory pleasure were also administered.

Depression, Anxiety, and Stress Scale (DASS; Lovibond & Lovibond, 1995). Baseline levels of depressive symptoms were assessed using the depression subscale from the DASS 21-item short-form. The 7-item self-report short-form of the DASS depression subscale assesses core features of depression (e.g., *low mood, loss of interest, self-worth, and motivation*). It has excellent psychometric properties (Antony, Bieling, Cox, Enns, & Swinson, 1998). The items are responded to using a scale from 0 (*did not apply to me ever*) to 4 (*Applied to me very much, or most of the* time). Items are summed, and higher scores

represent higher elevations of depressive symptoms. Internal reliability in the current sample was good (Cronbach's α = .94)

Temporal Experience of Pleasure Scale (TEPS; Gard et al., 2006). The anticipatory pleasure subscale of the TEPS was used to assess trait levels of anticipatory pleasure. This subscale assesses the general ability to experience anticipatory pleasure using 10 self-report items. Responses were given on a 6-point scale (1 = *Very false for me*, 6 = *Very true for me*), and items were summed so that higher scores indicated a stronger tendency to anticipate pleasure. Internal reliability in the current sample was acceptable (Cronbach's α = .73)

Episodic past and future thinking conditions. Participants were asked to think about each of the nominated events that had occurred (past condition) or would occur (future condition). They were instructed to imagine them from a first-person perspective, describe them as if they were actually happening, and to use mental imagery. They were asked to think only about this particular event that took place in a specific location, and not about experiences occurring before or after this. A semi-structured interview was used to guide participants through to think about each of the events (see Supplementary Materials). Prompts were used to elicit details about the event/activity, the environment, other people involved, the highlight of the event/activity, and related positive emotions. These prompts were used flexibly dependent on what details the participants gave, but emphasis was placed on eliciting the positively-valenced aspects of the event (e.g., how friendly someone was, how good something tasted). Two minutes were given for each episodic simulation. Experimenters were trained on the simulation protocol over a series of sessions, and piloting was conducted with two participants prior to recruiting the main sample.

Procedure

Ethical approval for the study was obtained from the university human ethics advisory group prior to commencing the study. Interested parties responded to the advertisements and were followed up by a researcher with no prior relationship with the participant. A description of the study was given, and times were arranged to complete the two episodic conditions over the telephone. A link to the online baseline survey was then provided. The participant was contacted by telephone at the agreed times by one of two authors (H.F. or E.L.). Prior to commencing guided episodic thinking in either condition, the experimenter checked with the participant to ensure that the nominated positive events were the ones they listed at baseline and were still relevant and plausible (all were). They then guided the participants to think of either the past or future nominated events, dependent on the condition, with the order of conditions counterbalanced across the sample. Once each of the five episodic thinking activities were completed, participants were asked them to rate the detail/vividness, mental/imagery, anticipated and anticipatory pleasure, and intention for the five nominated positive future events. Therefore, in the past condition participants had guided episodic thinking of past events and then answered questions about the future events, and in the future condition they had guided episodic thinking of these future events and then answered questions about the same future events. The participants completed their first condition an average of 1.0 day (*SD* = 0.8) after completing the baseline survey, and the second condition an average of 1.6 days (*SD* = 0.6) after the first. Following completion of the study, participants were offered a $15 shopping voucher to compensate them for their time. No-one declined.

Data Analysis Strategy

Mean scores and standard deviations were calculated for all study variables. Spearman rank correlation coefficients were used to test associations between all of the measured variables at baseline. To assess for changes in EFT characteristics of detail/vividness and mental imagery, anticipated and anticipatory pleasure, and intention, one-way repeated measures ANOVAs were conducted, with planned paired samples *t*-tests, in accordance with the hypotheses, to compare differences between conditions where an omnibus effect was found. Cohens' d_z was used to indicate the magnitude of effect between conditions. To assess if any changes in EFT characteristics and anticipated and anticipatory pleasure were associated with changes in behavioural intention, residualized changes scores were generated by regressing the post-induction scores onto the pre-induction scores. These change scores were then correlated using Spearman rank correlations.

Results

On comparing differences between past and future events on the number of events chosen from each of the suggested categories, no differences were found except for on work/school/study whereby a higher number of events in this category were chosen for past events (M = 0.80, SD = 0.66) compared to future events (M = 0.36, SD = 0.55; M difference = -0.43, 95%CI: -0.70, -0.16; $t(29) = -3.26$, $p = .003$, $d_z = 0.61$. Full descriptive statistics and results of tests reported in the Supplementary Material. Prior to the main analyses, a series of paired sample *t*-tests were conducted to assess whether there were differences between the past and future events on the dependent variables at baseline. This was done to assess whether any differences between the past or future events at baseline might account for differences in ratings after each of the episodic thinking conditions. For example, if the past events were found to elicit significantly more pleasure from thinking about them than the

future events, then this might disproportionately influence the effects of that guided episodic thinking. There was a significant, small-to-moderate difference in terms of the average temporal distance of the event in days, with past events occurring further away from the present (M = 6.14, SD = 1.36) compared to future events (M = 6.62, SD = 1.13; M difference = -0.47, 95%CI: -0.90, 0.05; $t(31) = -2.28$, $p = .030$, $d_z = 0.41$). However, there was no significant difference between the past and future events on how enjoyable/pleasurable they were experienced as being/predicted to be (M difference = -0.18, 95%CI: -0.55, 0.19; $t(31) = -0.99$, $p = .329$, $d_z = 0.17$), or how enjoyable/pleasurable it was to think about them (M difference = 0.34, 95%CI: -0.10, 0.80; $t(31) = -1.55$, $p = .130$, $d_z = 0.26$), nor in how much mental imagery was used (M difference = 0.16, 95%CI: -0.18, 0.50; $t(31) = 0.96$, $p = .344$, $d_z = 0.17$). Detail/vividness was found to be significantly higher for the past events, (M difference = 0.54, 95%CI: -0.02, 1.06; $t(31) = 2.14$, $p = .040$, $d_z = 0.38$). Given this, the difference between vividness scores for past and future events at baseline was calculated, and used as a covariate in the analyses of change over conditions. One-way, between-group ANOVAs, using counterbalancing condition as the IV, were conducted to assess for any effect of the order of presentation of the episodic thinking conditions on the dependent variables in both episodic thinking conditions. All results were non-significant (all F's < 1.06, all p-value's > .312; full results reported in the Supplementary Material).

Table 1 shows all means and standard deviations of the study variables. Table 2 shows the correlations for future event ratings at baseline. As shown, depressive symptoms did not significantly correlate with any variables at baseline. Trait anticipatory pleasure correlated significantly with expected pleasure for the future event and behavioural intention, and at trend level with pleasure from thinking about the future event. This indicated that the

general tendency to anticipate pleasure was associated with event-specific anticipated and anticipatory pleasure and event-specific behavioural intention. The detail/vividness, mental imagery, anticipated and anticipatory pleasure, and behavioural intention measures had moderate to strong correlations with one another. The correlations between baseline measures and past event ratings are provided in the Supplementary Material and were consistent in direction and magnitude with future event ratings.

Main Analyses

Firstly, effects of the episodic thinking were assessed on detail/vividness and mental imagery. A repeated measures ANOVA for vividness showed a main effect for condition, $F(2, 60) = 8.5$, $p = .001$, $\eta_p^2 = .22$. Participants reported higher detail/vividness in the past condition relative to baseline (*M* difference = 0.81, 95%CI: 0.38, 1.23; $t(31) = 3.92$, $p < .001$, $d_z = 0.69$), and in the future condition relative to baseline (*M* difference = 0.97, 95%CI: 0.51, 1.44; $t(31) = 4.26$, $p < .001$, $d_z = 0.75$), but the difference between future and past was not significant (*M* difference = 0.16, 95%CI: -0.09, 0.42; $t(31) = 1.30$, $p = .202$, $d_z = 0.22$). A main effect was also found for mental imagery, $F(2, 62) = 19.6$, $p < .001$, $\eta_p^2 = .38$. Participants reported more use of mental imagery for future events in the past condition relative to baseline (*M* difference = 1.27, 95%CI: 0.74, 1.81; $t(31) = 4.87$, $p < .001$, $d_z = 0.87$), and in the future condition relative to baseline (*M* difference = 1.28, 95%CI: 0.71, 1.85; $t(31) = 4.62$, $p < .001$, $d_z = 0.81$). There was almost no difference between future and past conditions (*M* difference = -0.01, 95%CI: -0.29, -0.30; $t(31) = 0.04$, $p = .966$, $d_z = 0.01$).

Next, the anticipated and anticipatory pleasure items were assessed for change over the conditions. A repeated measures ANOVA showed a trend for a main effect on expectation of pleasure from the future events, $F(2, 62) = 2.79$, $p = .069$, $\eta_p^2 = .08$. Trends

were also found for higher expectation of pleasure after the past condition relative to baseline (*M* difference = 0.22, 95%CI: -0.01, 0.47; $t(31) = 1.87$, $p = .070$, $d_z = 0.31$), and in the future condition relative to baseline (*M* difference = 0.21, 95%CI: 0.02, 0.45; $t(31) = 1.86$, $p = .072$, $d_z = 0.32$). There was no evidence for a difference between future and past (*M* difference = -0.01, 95%CI: -0.18, 0.15; $t(31) = 0.15$, $p = .878$, $d_z = 0.02$). A main effect was found for pleasure from thinking about the future positive events, $F(2, 62) = 12.8$, $p < .001$, $\eta_p^2 = .29$. Higher levels of pleasure were experienced from thinking about the future events after the past condition relative to baseline (*M* difference = 0.72, 95%CI: 0.37, 1.07; $t(31) = 4.20$, $p < .001$, $d_z = 0.74$), and in the future condition relative to baseline (*M* difference = 0.67, 95%CI: 0.27, 1.07; $t(31) = 4.62$, $p < .001$, $d_z = 0.61$), but there was no evidence for a difference between future and past conditions (*M* difference = -0.04, 95%CI: -0.24, 0.14; $t(31) = 0.49$, $p = .624$, $d_z = 0.07$).

Lastly, a main effect was found for intention, $F(2, 62) = 3.77$, $p = .028$, $\eta_p^2 = .11$. Higher levels of intention to engage in the future events were reported following the past condition relative to baseline (*M* difference = 0.24, 95%CI: 0.01, 0.48; $t(31) = 2.08$, $p = .045$, $d_z = 0.36$), and in the future condition relative to baseline (*M* difference = 0.27, 95%CI: 0.01, 0.53; $t(31) = 2.17$, $p = .037$, $d_z = 0.38$), but there was no evidence for a difference between future and past conditions (*M* difference = -.03, 95%CI: -0.13, 0.19; $t(31) = 0.39$, $p = .696$, $d_z = 0.06$).

Regarding correlations between residualized change scores from baseline to the past condition (see Table 3), the only correlation to reach statistical significance was increases in pleasure from thinking about the future events correlating with increases in intention to engage in them. From baseline to the future condition, increases in detail/vividness, mental

imagery, and pleasure from thinking about the event were found to correlate significantly with increases in intention to engage in the future events, while expected pleasure missed reaching statistical significance at the $p < .05$ level. Using Fisher's z-transformation and tests, it was ascertained that the strength of correlations of change did not significantly differ between the conditions (all z's < 1.20, all p-values > .233), however, the low statistical power to detect differences is noted.

Discussion

The results supported the prediction that detail/vividness and mental imagery would increase for the positive future events after guided episodic thinking, and to a similar degree whether this was for the future events themselves, or other past positive events. These findings are consistent with prevous studies showing increases in detail/vividness (Boland et al., 2018; Szpunar & Schacter, 2013) and mental imagery (Blackwell et al., 2015) for future events after effortful simulations, and that activating specificity in episodic thinking increases detail/vividness (Madore et al., 2018) and the use of mental imagery. Support was found for the hypothesis that the guided episodic thinking would increase anticipatory pleasure, with participants reporting a stronger experience of pleasure from thinking about the future events in both conditions, with no difference between the groups. However, only small to moderate, trend-level changes were found for the expectation of pleasure. The hypothesis that guided episodic thinking would increase behavioural intention, relative to baseline, was supported. The correlations of changes in variables and behaviour intention were all in the expected directions, although their magnitude varied, with increases in pleasure from thinking about the events the strongest and most consistent factor related to change in intention.

These findings extend on those of the positive emotional effects of simulating positively-valenced future events (Boland et al., 2018, Holmes et al., 2008, 2009; Quoidbach, Wood, & Hansenne, 2009) by demonstrating increases in the specific prospect-based emotions of anticipated and anticipatory pleasure, and that these increases are predictive of changes in behavioural intention. The findings of small effects for behavioural intention, and only a trend for the expectation of pleasure, may be related to the fact that the future events chosen by participants were already reasonably certain to be experienced at baseline. The participants may have already considered these future events to the degree that their expectation of pleasure and intention to engage in that behaviour were already well established, and potentially less amenable. Indeed, high scores at baseline for both variables, and in particular for intention, suggested a ceiling effect.

Given this, a second study was conducted wherein participants were asked to generate future events that were not already planned to occur. It was thought that this might mitigate against this ceiling effect, at least for behavioural intention. Increasing anticipated and anticipatory pleasure for unplanned events may be of particular interest in the context of treatments for depression, such as behavioural activation (Hopko, Lejuez, Ruggiero, & Eifert, 2003) that aim to improve behavioural functioning by identifying and scheduling new activities.

Study 2 also included the additional variable of perceived control, that is, the perceived ease with which behaviours can be performed. This was included as another variable that might be increased through episodic thinking, and that might be associated with changes in behavioural intention. Studies have indicated that perceived control fluctuates in relation to the level of episodic detail in which future events are thought of (Brown,

MacLeod, Tata, & Goddard, 2002; Jing, Madore, & Schacter, 2016), and in the context of simulations of positive future events (Boland et al., 2018). As with anticipated and anticipatory pleasure, this may be, in part, explained by the simulation heuristic (Kahnemann & Tversky, 1988), whereby future events that are mentally-simulated in high detail are perceived as realistic and as plausibly occurring (Gregory, Cialdini, & Carpenter, 1982). It was predicted that perceived control would increase in both episodic thinking conditions and, congruent with the theory of planned behaviour (Ajzen, 1991) and related empirical findings (Armitage & Conner, 2000), increases in perceived control would be related to increases in behavioural intention.

Study 2

Method

The methodology used in Study 1 was replicated for Study 2, with two key changes. Firstly, when participants nominated the future positive events at baseline, they were instructed that they needed to provide five different events that they *were not already planning to do.* This was in addition to the previous instructions asking that they be plausible, positive experiences, occurring within a 4 –14-day timeframe. Secondly, they answered an additional question after guided episodic thinking for each event relating to perceived control using the same using a 1 (*not at all*) to 9 (*very much so*) self-report scale: '*How easy do you think it will be to do this activity?*'. Again, there was acceptable internal reliability across the past and future scales (Cronbach's alpha range .59 - .86, *M* = .79).

In total, 29 participants were recruited (*M* age = 38.4, *SD* = 16.3, 62.1% female) and included in analyses. For highest educational attainment, the majority reported having a bachelor (31%) or postgraduate degree (24.1%), and the remaining had a diploma or

certificate (17.2%), or had finished high school (27.6%). The majority were Caucasian (86.2%) and reported being in paid employment (93.1%), and almost half were currently students (41.4%). The demographics of this sample were very similar to that of Study 1.

Results

On comparing differences between past and future events on the number of events chosen from each of the suggested categories, no differences were found except (see Supplementary Materials for descriptive statistics and test results). Again, paired sample *t*-tests were conducted to assess differences between the past and future events on the dependent variables at baseline. No difference was found in relation to the temporal distance in days between past (M = 6.30, SD = 1.73) and future events (M = 6.23, SD = 2.21; M difference = -0.06, 95%CI: -0.90, 0.76; $t(31) = -0.16$, $p = .874$, $d_z = 0.03$. The participants rated the past events higher on how detailed/vivid they were (M difference = 0.63, 95%CI: 0.23, 1.02; $t(29) = 3.29$, $p = .003$, $d_z = 0.60$), how enjoyable/pleasurable they were experienced as being/predicted to be (M difference = 0.39, 95%CI: 0.02, 0.76; $t(29) = 2.20$, $p = .035$, $d_z = 0.41$), and how enjoyable/pleasurable it was to think about them (M difference = 0.59, 95%CI: -0.14, 1.05; $t(29) = 2.68$, $p = .012$, $d_z = 0.46$). No significant difference was found for mental imagery (M difference = -0.17, 95%CI: -0.62, 0.28; $t(29) = -0.77$, $p = .448$, $d_z = 0.14$). Again, scores were used as covariates in the respective analyses.s

One-way, between-group ANOVAs were conducted to assess for an effect of counterbalancing on the dependent variables in both of the episodic thinking conditions. All results were non-significant (all F's < 1.38, all p-value's > .250; full results reported in the Supplementary Material), with the exception of perceived control for the nominated future events, $F(27) = 6.1$, $p = .020$, $\eta_p^2 = .18$), whereby this was rated as higher by participants in

the past condition when it was the second condition engaged in by participants (M = 7.4, SD = 1.04) relative to the first (M = 6.4, SD = 1.06). Given this, counterbalancing was used in this analysis as a covariate.

Table 1 shows the descriptive statistics, and Table 2 shows correlations at baseline. Although they correlated in the expected direction, depressive symptoms was not significantly correlated with any variables at baseline. Moderate to strong correlations were found between trait anticipatory pleasure and expected pleasure for the event and pleasure from thinking about the event. The detail/vividness, mental imagery, and anticipated and anticipatory variables had moderate to strong correlations with one another, however, only expected pleasure and perceived control correlated significantly with behavioural intention. The correlations with the past event ratings are again provided in the Supplementary Material, however, in this case there was evidence that higher depressive symptoms were related to reduced remembered pleasure at the time of the event and pleasure thinking about the past event, whereas trait anticipatory pleasure did not correlate with these variables.

Main Analyses

A main effect for condition was found on detail/vividness, $F(2, 54) = 5.48$, $p = .007$, $\eta_p^2 = .16$, whereby participants reported higher detail/vividness in the past condition relative to baseline (M difference = 0.63, 95%CI: 0.15, 1.1; $t(28) = 2.70$, $p = .012$, $d_z = 0.50$), and in the future condition relative to baseline (M difference = 1.10, 95%CI: 0.53, 1.49; $t(28) = 4.33$, $p < .001$, $d_z = 0.80$). Reported vividness/detail was also significantly higher in the future condition than the past condition (M difference = 0.37, 95%CI: 0.15, 0.60; $t(28) = 3.40$, $p = .002$, $d_z = 0.63$). A main effect was also found for mental imagery, $F(2, 56) = 14.4$, $p < .001$, $\eta_p^2 = .34$, whereby participants reported more use of mental imagery for future

events in the past condition relative to baseline (*M* difference = 0.72, 95%CI: 0.25, 1.19; $t(28) = 3.13$, $p = .004$, $d_z = 0.58$), and in the future condition relative to baseline (*M* difference = 1.01, 95%CI: 0.58, 1.44; $t(28) = 4.83$, $p < .001$, $d_z = 0.89$). The participants reported more use of mental imagery in the future condition compared to the past condition (*M* difference = 0.29, 95%CI: 0.03, 0.54; $t(28) = 2.31$, $p = .028$, $d_z = 0.41$).

Next, the anticipated and anticipatory pleasure items were assessed for change over the conditions. A main effect was found for expectation of pleasure from engaging in the future events, $F(2, 54) = 6.47$, $p = .003$, $\eta_p^2 = .19$. Expectation of pleasure from the events was higher after the past condition relative to baseline (*M* difference = 0.58, 95%CI: 0.18, 0.98; $t(28) = 3.01$, $p = .005$, $d_z = 0.56$), and in the future condition relative to baseline (*M* difference = 0.48, 95%CI: 0.23, 0.72; $t(28) = 4.01$, $p < .001$, $d_z = 0.73$), but there was no significant difference between future and past conditions (*M* difference = 0.10, 95%CI: -0.19, 0.39; $t(28) = 0.71$, $p = .480$, $d_z = 0.14$). A main effect was found for the experience of pleasure from thinking about the future positive events, $F(2, 54) = 8.8$, $p < .001$, $\eta_p^2 = .24$. Higher levels of pleasure were experienced from thinking about the future events after the past condition relative to baseline (*M* difference = 0.51, 95%CI: 0.26, 0.75; $t(28) = 4.26$, $p < .001$, $d_z = 0.77$), and in the future condition relative to baseline (*M* difference = 0.82, 95%CI: 0.47, 1.16; $t(28) = 4.62$, $p < .001$, $d_z = 0.89$). More pleasure from thinking about the future events was reported in the future condition compared to the past condition (*M* difference = 0.41, 95%CI: 0.06, 0.55; $t(28) = 2.62$, $p = .014$, $d_z = 0.47$).

Lastly, the main effect was not statistically significant for perceived control, $F(2, 56) = 1.87$, $p = .163$, $\eta_p^2 = .06$, or intention, $F(2, 56) = 2.07$, $p = .135$, $\eta_p^2 = .06$.

Regarding correlations between residualized changes scores, in the past condition, increases in vividness/detail, mental imagery, perceived control and pleasure from thinking about the future events were significantly correlated with increases in behavioural intention (see Table 3). In the future condition, increases in detail/vividness, perceived control, expectation of pleasure, and pleasure from thinking about the future events were associated with increases in behavioural intention. Using Fisher's z-transformation and tests, no significant differences were found (all z's < 1.42, all p-values > .157), however, again the low statistical power to detect differences is noted.

Discussion

The results from Study 2 replicated findings from Study 1 that engaging in episodic thinking would increase the detail/vividness and mental imagery of simulations of positive future events, and anticipated and anticipatory pleasure. However, these results also indicated that participants reported significantly more detail, use of mental imagery, and experience of pleasure from thinking about the future events after episodic thinking for these future events, relative to past positive events. Contrary to hypotheses, changes for perceived control and behavioural intention did not reach statistical significance.

General Discussion

These two studies aimed to examine whether guided episodic thinking of future events would cause increases in detail and use of mental imagery, anticipated and anticipatory pleasure, and behavioural intention for these events. A further aim was to compare this with the effects of guided episodic thinking for positive past events. Across both studies, and congruent with the hypotheses, increases were observed after both episodic thinking conditions, relative to baseline, on detail/vividness, mental imagery, and anticipated and anticipatory pleasure. This

is the first study to show that engaging in episodic thinking for positive past or future events can specifically increase anticipated and anticipatory pleasure.

The lack of difference in effects between the past and future episodic thinking conditions in Study 1 is consistent with previous research contrasting different temporal frames of episodic thinking (e.g., Madore et al, 2019; Schacter & Madore, 2016), and showing that engaging in past episodic thinking enhances future thinking also (Madore et al, 2014; Schacter & Madore, 2016). Episodic thinking in both conditions may have 'primed' scene construction, therefore leading to increased detail/vividness and imagery ratings for the positive future events. However, in Study 2, when it was specified that participants should nominate events that were not already planned, the effects on detail, imagery, and the experience of pleasure were stronger in the future condition relative to the past condition. The lack of differences in effects between past and future conditions in Study 1 may be because the events may have already been thought of and planned, therefore potentially diminishing the effects of prolonged guided episodic thinking in the future condition. Indeed, some research has found that frequency of prior thinking is a relevant variable when studying detail in positive simulations of future events as it likely inflates detail levels, such as when compared to negative simulations (Puig & Szpunar, 2017). Even so, this suggests that episodic thinking for past and future events are not equivalent in their effect on future thinking, and that stronger effects on detail, imagery, and experience of pleasure for the future might arise by focusing on the future event itself. It might be argued that it was the 'repeated' nature of episodic thinking in the future condition that caused these effects, i.e., in this condition they were guided to think in detail about the events, then also rated them giving rise to additional episodic thinking. However, this might be better characterised as prolonged

episodic thinking, rather than repeated efforts at thinking of the events, and contrasts with repeated episodic thinking in previous studies (Szpunar, & Schacter, 2013 Wu, Szpunar, Godovich, Schacter, & Hofmann, 2015) during which participants engaged in a series of sessions over a course of days.

The lack of significant effect for perceived control was unexpected, although it did increase in the predicted direction. Perceived control also correlated strongly with behavioural intention at baseline, and in terms of changes between conditions, which is congruent with previous research on the role of perceived control in predicting behavioural intention (Armitage & Conner, 2001). The lack of effect may be because the guided episodic thinking did not directly address the efforts required to engage in the event, or any barriers that might arise to enacting the behaviour (e.g., logistical constraints, preparation). Rather, it primarily focused on the positive aspects of the event. Adding content to guided episodic thinking to consider the behavioural steps leading up to the enactment of the positive event might be one way of producing increases in perceived control, and possibly behavioural intention.

Despite a small to moderate effect for behavioural intention in Study 1 in both conditions, no significant effect was found in Study 2. The change in scores in the future condition was in the expected direction, albeit small in magnitude (d = 0.17). When considered along with Study 1, it may be that the effects of these brief episodic thinking activities on intention are simply quite small. Notably, asking participants to nominate events that were not planned did not remove the ceiling effect of intention at baseline. Across both studies, stronger effects may have been observed if participants were asked to choose events that they are unlikely to do. This would then assess whether intention can specifically be

increased when it is low. This might more realistically characterise the low motivation for engaging in activities observed in for those that are depressed. The change scores for variables provided relatively consistent support for the idea that higher detail, mental imagery, anticipated and anticipatory pleasure, and perceived control were associated with stronger intention to engage in behaviours that were predicted to be positive in nature. In relation to the novel findings in anticipated and anticipatory pleasure, this is consistent with correlational studies showing that stronger positive prospective emotions are related to behavioural intention (Bagozzi & Pieters, 1998; Baumgartner et al., 2008). Therefore, while the effects of the guided episodic thinking on intention was either small or non-significant, the findings indicate a mechanism for change, whereby targeting these aspects of episodic thinking may enhance behavioural intention further.

These findings build on previous research of the psychological effects of simulating positively-valenced future events (Boland et al., 2018, Holmes et al., 2008, 2009; Quoidbach et al., 2009), by isolating the specific prospect-based emotion of anticipated and anticipatory pleasure. Deficits are found in anticipatory pleasure in both depression and schizophrenia-spectrum disorders (Hallford & Sharma, 2019; Kring & Elis, 2013). Significantly then, higher anticipatory pleasure has been found to be related to more engagement in rewarding behaviours and increased psychosocial functioning in this clinical groups (Engel, Fritzsche, & Lincoln, 2013; Foussias & Remington, 2008; Foussias et al., 2011; Sherdell, Waugh, & Gotlib, 2012). Therefore, these findings suggest that mentally-simulating positive events may potentially increase rewarding behaviour through increases in anticipated and anticipatory pleasure. Indeed, recent findings indicate that detail and imagery for positive future events are independently related to anticipatory pleasure in major depression (Hallford et al., 2020).

Research has also indicated that sustained practice in positive mental imagery is related to increases in behavioural activation (Renner, Ji, Pictet, Holmes, Blackwell, 2017) and a reduction in depressive symptoms (Blackwell et al., 2015). However, anticipated and anticipatory pleasure were not assessed in these studies on mental imagery, nor were the mental imagery exercises necessarily of personally-relevant events. Further, in the present studies, behaviour itself was not assessed. Future research might explicitly measure all key aspects of this cognitive-affective-behavioural chain (i.e., episodic future thinking detail/vividness and imagery, anticipated and anticipatory pleasure, and behavioural enactment) in order to explain the link between episodic future thinking and rewarding behaviour. One potential implication of these findings is that short, but sustained, episodic thinking activities for future events that focus on detail and mental imagery might be useful for interventions that aim to increase rewarding behaviour (e.g., acceptance and commitment therapy; Hayes, Strosahl, & Wilson, 2009; behavioural activation components of cognitive-behavioral Therapy (Hopko et al., 2003). This specific technique to enhance the imagining and experiencing of pleasure in relation to upcoming events may be particularly useful in adding incremental effects to such treatments. Another consideration here is the degree of self-concordance of future events, that is, whether they relate to goals seen as something we to *have* to achieve versus those that we *want* to achieve. Positive emotions for future events have been found to be stronger when they concord with personal goals (Ernst, Phillipe, & D'Argembeau, 2018), and therefore establishing the personal significance of future events might be another factor in promoting anticipated and anticipatory pleasure and increasing intention and enactment of behaviours.

Regarding limitations, the ratings were directly to an experimenter, which may introduce a response bias or demand characteristics. While participants were encouraged to provide their ratings as honestly as possible, these possibilities cannot be discounted, and may have inflated their ratings of future events in the episodic thinking conditions. It is possible that writing down their responses may have mitigated against this somewhat. Participant's verbal accounts of their simulations were not recorded in this study. This precluded any opportunity to further assess their responses, such as through observer-rated coding for detail or the emotional-valence of content. This would have provided another means through which to understand other aspects of the simulations, as well as the concordance between the subjective ratings and content of the simulations. As above, reliance on subjective rating may have introduce bias. Conducting the episodic thinking sessions over the phone was chosen to maximise convenience to participants, whereas conducting these in-person may have increased the ecological validity in relation to using these techniques in a face-to-face clinical context. Within the design that was used, it is hard to disentangle whether it was qualities of the episodic simulations or simply the repeated thoughts of the events that caused changes in the outcome variables. However, even if it was simply repeated thinking of any kind that increased intention and anticipated and anticipatory pleasure, this may represent a novel finding akin to evidence that detail and plausibility increase with repeated episodic thinking (Szpunar et al., 2013). Regardless, a strict control condition where a separate group of participants rate the events on three occasions without a guided simulation would provide a strong test of this. A further consideration is that current study did not assess whether increases in anticipated and anticipatory pleasure for the events that were nominated might generalise to other possible future events that were not simulated. Boland et al. (2018) have demonstrated such generalisable effects on outcomes of vividness,

likelihood of occurrence, and perceived control. Future research may assess this generalisability in the context of anticipated and anticipatory pleasure. Future research may also assess anticipated negative affect for positive events, especially given that recent research indicates that individuals with schizophrenia anticipate more negative affect in relation to social interactions (Martin, Castro, Li, Urban & Moore, 2019) and can feel more negative affect, compared to healthy controls, after engaging in positive mental imagery exercises (Mote & Kring, 2019). It has been shown in healthy samples that higher detail when imagining prosocial episodes in can predict stronger behavioural intentions, even in the context of a negatively-valenced social encounter (Gaessar, DiBiase & Kensinger, 2017). This suggests a possible role of episodic simulations in countering negative expectations, possibly through increasing anticipated and anticipatory pleasure. Although examining negative future events and related negative affect was not in the scope of this study, it clearly warrants continued examination. It is noteworthy that trait anticipatory pleasure and episodic thinking variables did not correlate with depressive symptoms in either study, with the exception of pleasure from past events in Study 2. This may be an artefact of low variance in depressive symptoms in this community sample though, as previous meta-analytic research indicates a diagnosis of clinical depression is associated with large deficits in trait anticipatory pleasure (Hallford & Sharma, 2019) and specificity and detail in episodic thinking (Hallford et al., 2018).

In conclusion, these studies provided evidence that engaging in episodic thinking for positive future events, and for positive past events, enhances the detail, use of mental imagery, and anticipated and anticipatory pleasure for future events.

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Table 1.

Means and Standard Deviations of Study Variables

Measure	Baseline	Episodic Past Thinking Condition	Episodic Future Thinking Condition
Study 1			
DASS Depression	5.2 (5.5)	/	/
TEPS Anticipatory Pleasure	44.5 (7.1)	/	/
Detail/Vividness	6.1 (1.6)	7.0 (1.2)	7.1 (1.0)
Mental Imagery	5.7 (1.7)	7.0 (1.3)	7.0 (1.2)
Expected pleasure from events	7.3 (0.9)	7.5 (0.6)	7.5 (0.7)
Pleasure from thinking about the events	6.6 (1.3)	7.3 (0.7)	7.2 (0.7)
Behavioural Intention	7.7 (1.03)	8.0 (0.8)	8.0 (0.7)
Study 2			
DASS Depression	4.1 (3.6)	/	/
TEPS Anticipatory Pleasure	42.8 (7.4)	/	/
Detail/Vividness	6.0 (1.6)	6.6 (1.3)	7.0 (1.2)
Mental Imagery	5.7 (1.7)	7.0 (1.3)	7.0 (1.2)
Expected pleasure from events	7.0 (1.0)	7.6 (0.9)	7.5 (0.8)

Pleasure from thinking about the events	6.2 (1.3)	6.7 (1.2)	7.0 (1.0)
Perceived Control	6.8 (1.3)	6.9 (1.1)	7.2 (0.8)
Behavioural Intention	7.5 (1.0)	7.3 (1.0)	7.7 (0.8)

DASS = Depression, Anxiety and Stress Scale, TEPS = Temporal Experience of Pleasure Scale

Table 2. *Zero-order Correlations between Study Variables for Positive Future Events and the DASS and TEPS-A at Baseline (Study 1 correlations shown below the diagonal (N = 32) and Study 2 correlations shown above the diagonal (N = 29).*

	1.DASS Depression	2. TEPS-A	3. Detail/ vividness	4. Use of Mental imagery	5. Expected pleasure from future events	6. Pleasure from thinking about future events	7. Behavioural intention	8. Perceived control
1.DASS Depression	-	-.04	-.15	.01	-.28	-.23	-.27	-.20
2. TEPS-A	-.18	-	.29	.29	.51**	.52**	.27	.17
3. Detail/vividness	.08	.26	-	.86***	.47**	.59**	.21	.39*
4. Use of Mental imagery	.20	.14	.84***	-	.36*	.51**	.12	.43*
5. Expected pleasure from the events/activities	.02	.40*	.57**	.54**	-	.73***	.63***	.55*
6. Pleasure from thinking about the events/activities	.06	.32†	.76***	.73***	.80***	-	.28	.45*

7. Behavioural intention	-.02	.40*	.59***	.46**	.53**	.45*	-	.56**
8. Perceived control	-	-	-	-	-	-	-	-

†$p < .10$, *$p < .05$, **$p < .01$, *** $p < .001$. DASS = Depression, Anxiety, and Stress Scale, TEPS-A = Temporal Experience of Pleasure Scale – Anticipatory Subscale.

Table 3.

Correlations between Residualized Change Scores for the Study Variables with Behavioural Intention, and

Change Scores for EFT Characteristics and Behavioural Intention	Baseline to Past Episodic Simulation Condition	Baseline to Future Episodic Simulation Condition	Fisher's Test for Difference in Correlation Magnitude
Study 1			
Detail/Vividness	.22	.49**	$z = 1.19$, $p = .234$
Mental Imagery	.27	.39*	$z = 0.51$, $p = .610$
Expected pleasure from events	.22	.29†	$z = 0.29$, $p = .771$
Pleasure from thinking about the events	.52**	.58*	$z = 0.33$, $p = .741$
Study 2			
Detail/Vividness	.49**	.39*	$z = 0.45$, $p = .652$
Mental Imagery	.39*	.27	$z = 0.49$, $p = .624$
Perceived Control	.59**	.56***	$z = 0.16$, $p = .872$
Expected pleasure from events	.17	.51**	$z = 1.41$, $p = .158$
Pleasure from thinking about the events	.60***	.50**	$z = 0.52$, $p = .603$

Fisher's Tests of Correlations Magnitude

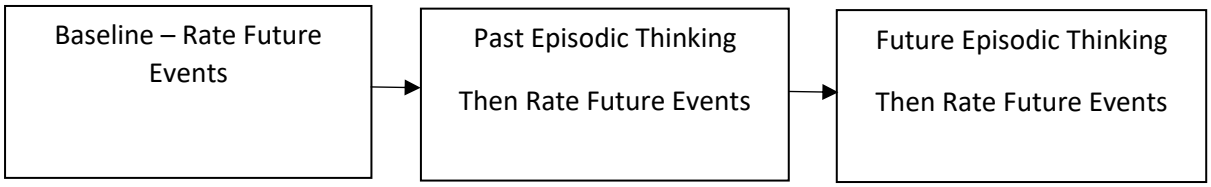

Figure 1. Study Design