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Psychopathology and Episodic Future Thinking:

A Systematic Review and Meta-Analysis of Specificity and Episodic Detail

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Abstract

Episodic future thinking (EFT) refers to the mental simulation of possible future events; a crucial mental process in adaptation. Psychiatric disorders are associated with deficits in recalling episodic memory, however, no study has reviewed the empirical literature to assess for similar deficits in EFT. A systematic review comparing psychiatric groups with control groups on the specificity and episodic detail of EFT returned 19 eligible studies. An overall effect of $g = -0.84$ (95% CI = -1.06, - 0.62, $p < .001$) indicated individuals with a psychiatric diagnosis have significantly less specific and detailed EFT. Publication bias was not detected, but heterogeneity was. No methodological characteristics were significant moderators. Subgroup analyses showed significant effects for depression ($g = -0.79$, $p < .001$, $k = 7$), bipolar disorder ($g = -1.00$, $p < .001$, $k = 2$), and schizophrenia ($g = -1.06$, $p < .001$, $k = 6$), but not posttraumatic stress disorder ($g = -1.04$, $p = .260$, $k = 2$) or complicated grief ($g = -0.41$, $p = .08$, $k = 2$). Deficits in EFT are apparent in some psychiatric disorders. However, many clinical groups are understudied, and the causal mechanisms and remediation of these deficits require further research attention.

Keywords: Episodic Future Thinking; Psychopathology; Episodic Detail; Episodic Specificity; Autobiographical Memory Specificity

1. Introduction

Episodic future thinking (EFT) refers to thought processes that contribute to the mental construction, imagination or simulation of possible futures (Szpunar, 2010). These mental processes enable us to represent the self as extended over time in order to anticipate possible circumstances and the outcomes of action. This ability to simulate possible futures is believed to have evolved due to its conferral of adaptive advantages (Suddendorf & Corballis, 1997), and plays a role in a range of important processes, such as planning, problem-solving and coping (Brown MacLeod, Tata, & Goddard, 2002; Taylor Pham, Rivkin, & Armor, 1988), the regulation of emotional states (Taylor Schnieder, 1989), and goal-motivated behaviour (D'Argembeau & Mathy, 2011). Indeed, engaging in detailed and elaborated EFT is associated with more positive expectations of future events (Brown et al., 2002), and can influence motivations and behavioural outcomes in adaptive ways, such as delaying immediate gratification in the context of poor health behaviours (Daniels, Stanton, & Epstein, 2013; Snider, LaConte, & Bickel, 2016). In the context of psychological treatment, EFT is implicated in a range of processes central to cognitive and behavioural interventions, such as planning and predicting events and outcomes, producing mental imagery (for example, in imaginal exposure or behavioural experiments), and prospective memory for completing between-session tasks or assignments (Altgassen et al., 2015). Given the range of cognitive, emotional, and behavioural processes that EFT may influence, the ability to effectively simulate EFT may be an important transdiagnostic factor in the aetiology or maintenance of mental health disorders, and their treatment.

Current research indicates that the ability to simulate EFT is dependent on the episodic memory system (Schachter, Addis & Buckner, 2008). In their constructive episodic simulation hypothesis, Schachter et al. (2008) suggest that EFT requires the flexible

recombination of the contents of memories of experienced events in order to mentally simulate novel events. The notion that future thinking and remembering are intimately linked is supported by findings from neuroimaging studies showing common neural substrates such as the left hippocampus and posterior visuospatial regions (e.g. Addis, Wong, & Schacter, 2007), and neuropsychological and cognitive research (for reviews see Schacter et al., 2008 and Szpunar, 2010). Despite this overlap, EFT does differ from episodic memory, with contrasting phenomenological features such as being less vivid and more goal-oriented (D'Argembeau, Lardi, & Van der Linden, 2010; D'Argembeau & Van der Linden, 2004, 2006), more positively-valenced (D'Argembeau & Van der Linden, 2006; MacLeod & Byrne, 1996), and more likely to be simulated in third-person rather than first-person perspective (D'Argembeau & Van der Linden, 2004, 2006).

The level of detail and specificity with which possible futures are simulated are related, but not mutually dependent, factors that are relevant to its adaptive function. Episodic detail refers to the number of contextual details about a possible event, as opposed to general factual information. Specificity refers to the simulation of events that occur in a defined place and time (typically in the space of one day) rather than abstracted across various locations and time-frames. To assess the specificity of EFT, studies have typically used a cue word paradigm whereby individuals are presented with a word (e.g., "beach"), and asked to imagine and express a related event that could happen to them in their future (Williams et al., 1996). Specific future thoughts are characterised by possible events that are located in a particular time and place, and involve the generation of vivid information about that particular event. To illustrate this, one might be prompted by the cue word 'beach' and think about the possibility of a vacation at some point in the future. The generation of a specific EFT would necessarily involve constructing a mental representation of oneself in a particular location at a particular time (e.g., a familiar beach during sunset, with accompanying

contextual details such as palm trees lining the shore, and the sound of waves crashing). This ability to simulate more specific and detailed possible futures appears to be a significant resource in the service of adaptive processes such as planning and problem-solving (Brown, Dorfman, Marmar, & Bryant, 2012), decision-making (Peters, & Büchel, 2010), and regulating emotions (Jing, Madore, & Schacter, 2016).

A range of psychiatric disorders have been linked with deficits in the specificity of autobiographical memories. Meta-analytic reviews have demonstrated these impairments in disorders such as depression (Liu, Li, Xiao, Yang, & Jiang, 2013; Williams et al., 2007), post-traumatic stress disorder (Moore & Zoellner, 2007; Ono, Devilly, & Shum, 2015), and schizophrenia-spectrum disorders (Berna et al., 2015). Given the established relationship between past and future thinking (e.g., Williams et al., 1996), it might be hypothesised that impairments in autobiographical memory found in psychiatric illness will also result in impairments in EFT. Indeed, some studies have shown that individuals with diagnosed psychiatric disorders have deficits in generating detailed and specific episodic future thoughts (e.g., Addis, Hach, & Tippett, 2016; Huddy, Drake, & Wykes, 2016), however, other studies have shown no effect (e.g., Kleim, Graham, Fihosy, Stott, & Ehlers, 2014; Raffard et al., 2016). Such differences in findings may be attributable to the different diagnostic groups under consideration, or methodological variation. Although the last decade has seen a dramatic increase in research on EFT, to date no systematic review has been conducted on the extant literature to assess if, and to what magnitude, the detail and specificity of EFT might be impaired in psychiatric samples.

The aim of the current study was to systematically review the available empirical literature for studies that have compared psychiatric and control samples on detail and/or specificity in EFT, and synthesise these findings using meta-analytical techniques. This

review focused on objective assessments of the ability to generate specific EFT or the quantifiable episodic detail in future simulations. Although some previous studies have examined the subjective sense of vividness in EFT (e.g., Holmes et al., 2011; Wu, Szpunar, Godovich, Schacter, & Hofmann, 2015) we chose to exclude these assessments as subjective ratings of vividness may be confounded by thoughts that evoke strong feelings, but might not involve many or any contextual details. Further, objective assessments of specificity and detail in EFT have been shown to be correlated with relevant clinical variables and outcomes such as apathy (Raffard, Esposito, Boulenger, & Van der Linden, 2013), dysphoria (King et al., 2011) and attempted suicide (Williams et al., 1996). The secondary aims of the study were to examine whether any effects differ dependent on psychiatric diagnosis, and whether the assessment methodology of EFT might also affect outcomes. We were interested in this latter question as previous reviews have found that methodological differences in studies moderate the effect of psychiatric diagnosis on autobiographical memory specificity (e.g., van Vreeswijk & de Wilde, 2004).

2. Method

The review was conducted in accordance with the evidence-based guidelines for systematic reviews described in the PRISMA statement (Liberati et al., 2009).

2.1. Data Sources and Search Strategy

On June 2nd 2017, electronic literature searches were conducted using the following databases: MEDLINE Complete, Academic OneFile, CINAHL. The search included all peer-reviewed articles written in English published up to the time the search was conducted. The following terms were searched for in the abstract of articles “Future think*” OR “episodic future*” OR “future sim*” OR “future imageability” OR “imagined future” OR “imagining the future” OR “future directed thinking” OR “mental time travel” OR “future event*” OR

“episodic specificity” AND “mental*” OR “symptom*” OR “diagnos*” OR “psychiatr*” OR “disorder”. This large number of search terms was used due to the heterogeneity with which episodic future thinking is referred to. As indicated in Figure 1, the databases were searched using the terms above. After duplicates were removed, the abstracts of the remaining studies were screened, and then full-text articles were assessed for eligibility. Reference lists from the identified articles were also searched for other eligible studies.

2.2. Study Selection

The following criteria were used to identify eligible articles:

- The article presented original quantitative data;
- was written in English;
- included an objectively-rated assessment of future thinking specificity or detail;
- compared a group of patients with psychiatric disorders with a control group;
- excluded patient groups characterised by neurological disorders, pervasive developmental disorders, or brain injuries;
- presented sufficient information so that the methodology of the study and the results could be extracted for meta-analysis, or this could be obtained from the authors; and,
- the study was not a duplicate of another eligible study.

2.3. Data Extraction

The following information was extracted from the articles selected for full review if possible, or authors were contacted for the information: authors, year of publication, characteristics of the sample used in analyses (age, diagnosis, percentage female), the assessment method for the disorder, the sampling method, and the assessment method for EFT and related variables: number of cues, emotional-valence of cues, timeframe in which future events would take place, scoring method, whether practice cues were given, time given

for response, and the method of recording responses. Means and standard deviations of the variables of interest were extracted from each study in order to calculate effect sizes: EFT specificity (typically presented as the proportion of EFT that were specific from a set of responses) or amount of episodic detail. Although initially it was planned to extract data on subcategories of EFT that were non-specific (e.g., events that recur over time, or extended events lasting longer than a day), this was abandoned due to only 3 studies reporting such information and the heterogeneity of how non-specific EFT were categorised across the studies.

2.4. Statistical Analyses

Meta-analytic calculations were performed using Review Manager 5.3 (Review Manager [RevMan] Version 10.11.6, 2014). Random effects models were used to estimate all effects in the event that there was heterogeneity between the effects sizes of the individual studies. The assumption underlying a random-effects model is that studies represent a random sample of studies that are distributed around the mean effect size for a population. All effect sizes were calculated using the standardised mean difference, represented with Hedge's g , which provides a corrected estimate to reduce the upward bias that typically occurs in small sample sizes. The magnitude of the effect sizes was interpreted approximately as small = 0.2, medium = 0.5, and large = .08 (Egger, Smith, & Altman, 2001).

The heterogeneity of effect sizes was assessed using the Q statistic and the I^2 statistic. The Q statistic estimates whether differences between the effect sizes are larger than we might expect to occur by chance, and is distributed as a chi-square statistic with accompanying p value ($< .05$ indicates a significant difference). The I^2 statistic shows the size of heterogeneity amongst effect sizes, where 50% or higher typically indicates notable variance between effect sizes (Higgins, Thompson, Deeks, & Altman, 2003). A file drawer

statistic was also calculated to account for the possibility of publication bias (i.e., the overrepresentation of positive findings over null findings). A fail-safe N was computed for each of the analyses (Orwin, 1983), which represented the number of additional studies with that would be required to make the effect size non-significant at the $p < .05$ level. We also inspected the funnel plot to assess for publication bias (Duval & Tweedie, 2000). The funnel plot shows studies distributed around the point estimate by the effect size (standard mean difference) and precision (standard error), with asymmetry in the distribution of studies indicative of publication bias. We then used the trim and fill procedure (Duval & Tweedie, 2000), whereby studies are removed from the asymmetrical side of the funnel plot and then re-imputed along with studies on the opposite side of the funnel that might be hypothesised to be missing due to publication bias. This procedure provides an adjusted effect size estimate after accounting for this trim and fill procedure.

3. Results

Figure 1 presents a flowchart of the study selection process. The initial search returned 1401 articles. The search engine removed 194 duplicates. This left 1207 articles. Of these, 110 were identified by their abstract as potentially meeting criteria for inclusion in the study. After examining the full text of the articles, 19 studies met the criteria for inclusion. Two studies were found that used the same clinical sample in assessing EFT (Brown et al., 2013; Brown et al., 2014), but differed in their method of assessment. Only one of these studies reported data sufficient to calculate effect sizes and so this study was included in the analysis (Brown et al., 2013), and the other excluded. One more eligible study was also found through cross-referencing, making a total of 19 studies included in the meta-analysis. Adequate data was provided in all 19 studies to calculate an effect size, although authors from four papers were contacted for additional information about methodology. A researcher otherwise not

associated with the review extracted data from five of the studies included in the meta-analysis using a coding guide developed for the study. Inter-rater reliability with the first author was found to be good for dichotomous variables (Cohen's kappa's of 1) and continuous variables (intraclass correlation coefficients $\geq .91$).

➔ *Insert Figure 1 about here.*

3.1. Study Characteristics

Table 1 presents details of the 19 studies included in the meta-analysis. The majority of the included studies ($n = 18$; 95%) were published in the past 10 years. A total of 854 participants were included, with the sample size ranging from 28 to 65. Most of the samples were of participants, on average, in their 20's and 30's, with no samples of older adults. Seven of the studies focused on individuals with diagnosed depressive disorders, six on schizophrenia, two on bipolar disorder, two on posttraumatic stress disorder, and two on complicated grief. Seventeen of the studies reported using DSM criteria to diagnose the psychiatric disorders of interest, predominantly with structured interviews, but four of these did not report diagnostic methodology. The remaining two studies stated that they used advice from participants that they had received a diagnosis from a health professional. All studies appeared to use non-probability sampling, with five reporting that participants were self-selected from advertisements, and the remaining 14 not clearly stating how participants were approached and recruited. There was variation across studies in the measurement of EFT detail and specificity that was used. Eleven used a modified version of the Autobiographical Memory Test (AMT; Williams & Broadbent, 1986), which involves the presentation of a series of cue words or sentences of different emotional-valence (e.g., *happy*, *imagine a time in the future when you will feel sad*) to which participants are asked to provide a related possible future event. Responses are coded based on their level of specificity. One

study deviated from this format and presented pictures as cues instead of words or sentences (Raffard et al., 2013). Three studies used a future thinking version of the Autobiographical Interview (AI; Levine, Svoboda, Hay, Winocur, Moscovitch, 2002). The AI involves presenting cue words and eliciting possible events in a manner consistent with the AMT, but responses are coded in terms of the total number of episodic details that are provided by the respondent (for example, about time, place, perceptions, actions of the respondent or others), with higher scores indicating more detailed EFT. The remaining five studies used different forms of assessing EFT detail or specificity: one asked participants to generate future goals and then assessed which proportion were specific in nature (Dickson et al., 2013), one asked participants to solve possible future problems and rated the episodic detail in the answers (Huddy et al., 2016), one asked participants to simulate future events that would be self-defining and provided specific parameters around this, such as the need for it be very familiar and evoke strong feelings (Raffard et al., 2016), one used a sentence completion task (Chen et al., 2016), and another involved participants generating plans about the future and related specific future events. Across the sample, the studies varied in terms of how many cues they provided to participants to elicit EFT, the valence of the cues, how far into the future the possible events were to take place, whether practice cues were administered, the time given to respond, the scoring methods, and the method of recording the responses.

➔ *Insert Table 2 about here.*

3.2. Overall effect size analysis

A weighted, random effects meta-analysis tested for differences between the psychiatric and control group on EFT specificity and detail across the 19 included studies. A significant overall effect size was found of $g = -0.84$ (95%CI = -1.06, - 0.62, $p < .001$). This indicated that detail and specificity of EFT was significantly reduced in the psychiatric group relative

to the control group, with a large effect for psychopathology. The heterogeneity statistics indicated there was a moderate amount of between-study variance in the full sample of studies, $Q = 41.3$, $I^2 = 56\%$, $p = .001$. Inspection of the funnel plot indicated some asymmetry (see Figure 3), with two studies to the left of the plot with relatively large effect sizes and large standard errors (Brown et al., 2013; D'Argembeau et al., 2008). The trim and fill procedure removed these two studies, and the adjusted effect size was only trivially different, $g = -0.76$ (95% CI = -1.01, - 0.52). The fail-safe N for the overall effect size was 665, indicating that a minimum of 665 studies would have to be added to the included studies before the average effect became non-significant. Given this, we can surmise that the findings are not likely to be an artefact of publication bias, and are robust to the effect of unpublished or future studies with null effects.

➔ *Insert Figure 2 about here.*

3.3. Subgroup and Moderation Analysis

Subgroup and moderation analyses were conducted to assess for differences in effect sizes across the different diagnostic groups that were represented, as well as characteristics of the studies that may moderate the effect of psychopathology on EFT. Fail-safe N 's were also calculated for all subgroup analyses. Again, random-effects models were used. The Q and I^2 statistic were used to assess whether there were differences in the effects between the subgroups, and therefore whether that variable moderated effect sizes. Heterogeneity was also assessed within each subgroup. The studies were grouped based on the diagnosis of the psychiatric group, the assessment method, cue valence, whether practice cues were administered, the time given for responses, the response format, and the temporal frame for the future event. For the continuous variables of the mean age of the sample, percentage of

women in the sample, and number of cues used to elicit EFT, meta-regression analyses were conducted using random effects models in Comprehensive Meta-Analysis (Version 3.3.070).

Table 2 presents the results of the subgroup analyses. As indicated, the effect size did not significantly vary between the diagnostic groups. Within the diagnostic groups, there were large, homogeneous effect sizes for depression and bipolar disorder, and a large but heterogeneous effect for schizophrenia. Only one study in the schizophrenia subgroup did not show significant differences between clinical and control groups (Raffard et al., 2016). Notably, this study used an assessment of EFT that involved choosing familiar, self-defining possible future events, and was distinct from other studies. Nevertheless, the effect sizes in the schizophrenia subgroup were still significantly heterogeneous after removing this study ($Q = 12.2, p = .02, I^2 = 67\%$). The overall effect sizes for PTSD and complicated grief were non-significant, although marginally so in the instance of complicated grief.

No difference in effect size was found across the different types of EFT assessment. Only the effect size for studies using the Autobiographical Interview were homogenous, whilst those for the Modified AMT and other assessment types were heterogeneous in their effect sizes. No significant difference between cue valences was found. Large effect sizes were observed for positive and neutral cues, and a moderate effect for negative cues. Each was homogenous in its effect size. No significant differences were found on EFT detail or specificity on the basis of whether practice cues were administered, whether time for the response was limited or not, or the requested time frame for the future events. With respect to the timeframe for the future events, one study was excluded from this analysis as it employed a sentence completion task which prescribed the time frame on some items while leaving it non-specific on others (Chen et al., 2016).

The results of the meta-regressions indicated that the mean age of the sample was not a significant moderator, unstandardized regression coefficient = $-.012$ (95%CI = $-.03 - .01$), $SE = .01$, $z = -1.35$, $p = .178$, nor was the percentage of women, unstandardized regression coefficient = $.004$ (95%CI = $-.01 - .01$), $SE = .01$, $z = 0.82$, $p = .413$, or number of cues used, unstandardized regression coefficient = $-.003$ (95%CI = $-.04 - .03$), $SE = .02$, $z = -0.15$, $p = .880$.

➔ *Insert Table 2 about here.*

4. Discussion

The current study is the first to systematically review and meta-analyse findings from studies on the association between psychopathology and the specificity and detail of EFT. The results of the combined sample of 19 studies indicated that psychopathology is significantly related to the specificity and detail with which individuals can mentally simulate possible future events. Significant heterogeneity between effect sizes was found, which appeared to be accounted for by a minority of the studies. Removal of these studies resulted in an overall effect that was not significantly different in magnitude, but was homogenous. Further, we found little evidence of publication bias in the total effect size.

Sub-group analyses provided evidence of large and homogeneous effects for depression and bipolar disorder. For schizophrenia, the results showed that it is associated with impairments in the specificity and detail of EFT, however, variation in the effect sizes limits the accuracy of the point estimate. Only two studies were found examining PTSD, which varied largely in their effect size and when synthesized did not produce a significant overall effect. The effect size for complicated grief marginally missed statistical significance, although the homogeneity of the effects suggests that statistical power may not have been

high enough to detect what appears to be a small to moderate effect size. As with PTSD, further research within this population may clarify whether such effects are to be observed.

The subgroup and moderation analysis did not show any significant differences in effect sizes on the basis of methodological differences. There were small numbers of studies in many of these comparisons, and therefore the findings should be considered tentative given low statistical power to detect effects. Interactions between these methodological variations may account for some heterogeneity between and within diagnostic groups, however, the sample size was too small to allow for such analyses. Previous studies on autobiographical memory specificity have shown that the emotional valence of the cues used to prompt responses does not moderate the association with psychopathology (e.g., van Vreeswijk & de Wilde, 2004; Liu et al., 2013), and the current study replicates this finding. This suggests that the failure to generate specific and detailed EFT is not likely to be attributable simply to difficulty or avoidance of thinking about possible negative events. Rather, this impairment manifests in a more pervasive manner that is not wholly contingent on the emotional valence of thoughts.

A clear finding of our systematic review is that there are still a range of psychiatric groups for which the specificity and detail of EFT have not yet been examined (robustly), including those of which evidence of reduced AM specificity has been identified (e.g., eating disorders; Bomba et al., 2015; Huber et al., 2015). For PTSD, meta-analyses of AM specificity deficits show large effects for PTSD (Ono et al., 2015). Given this, it may be that the current null effect is attributable to the small number of studies and heterogeneity of effects. Future studies in EFT and PTSD may yield a significant overall effect size. It was noteworthy that no other studies were found that focused on anxiety disorders, aside from one that used a subjective measure of vividness of EFT (Wu et al., 2015). Future research might

examine EFT specificity and detail in the context of anxiety disorders, especially in light of recent evidence of effects of general anxiety symptoms on autobiographical memory specificity (Hallford & Mellor, 2017; Hallford et al., 2017).

Future studies may categorise and report non-specific EFT so as to assist in interpreting patterns in the types of non-specific EFTs that are simulated. Research into autobiographical specificity has shown, for example, that depressed individuals, relative to non-depressed, are more likely to retrieve memories about events that repeat over time, rather than extended memories of longer events (Barnhofer, de Jong-Meyer, Kleinpaß, & Nikesch, 2002). Such differences may exist in EFT, however, further data is needed to assess this. The lack of studies with older adult samples was also notable, especially given the observed deficits in memory specificity in this age group relative to working-age adults (Wilson & Gregory, 2017). With regards to the quality of the studies, the lack of probability sampling may possibly introduce bias into the sample characteristics. Further, there was heterogeneity across studies with respect to the definition of the control group, with some control groups defined as having no past or current psychiatric disorder, and others only excluding the disorder of interest. This may have affected the findings given that a range of psychopathologies may have effects on EFT, including those yet to be examined.

Simulating EFT is, to a large degree, contingent on access to episodic memory (Schacter, Benoit, & Szpunar, 2017). As such, the findings of the current study are not unexpected in light of deficits in accessing specific episodic memories in psychiatric groups. Research has indicated that episodic future thoughts are constructed in a generative manner consistent with episodic memories, beginning with more abstracted, semantic knowledge and progressing to specific episodic details (D'argembeau & Mathy, 2011). Therefore, the same processes that are proposed to disrupt the retrieval of specific episodic memories may also

disrupt the simulation of episodic future events. Williams et al. (2006, 2007) have proposed three related processes that may impair this generative retrieval: capture and rumination, functional avoidance, and impaired executive functioning (CaR-FA-X). Capture refers to highly elaborated, intermediate-level schematic representations of the self or situations that might capture attention before more specific thoughts can be generated. Rumination can lead to more highly elaborated representations at this intermediate level. Functional avoidance refers to repeated suppression of negative thoughts that might result in a more pervasive difficulty in generating specific events, and impairments in executive functioning, such as working memory or cognitive control, might constrain the generation of detailed, specific thoughts. These processes may truncate retrieval of EFT in a similar manner to autobiographical memories. However, research examining this question has only recently begun to appear, and how differences in CaR-FA-X mechanisms might cause deficits in EFT across different disorders has yet to be investigated. Some findings indicate that a factor in the context of depression may be executive functioning deficits that affect the strategic retrieval of details from episodic memory necessary to construct episodic future thoughts (Addis et al., 2016). Another important point to clarify may be whether deficits in episodic detail and specificity are distinct from one another, or represent a common underlying difficulty in simulating future thoughts. Further, we might examine whether these cognitive processes are disrupted by similar or different causal mechanisms, such as in the CaR-FA-X model. Some research in a non-clinical sample has indicated that specificity and detail of autobiographical memory may be largely unrelated (Kyung, Yanes-Lukin, & Roberts, 2016), although further simultaneous measurement of these constructs is needed in clinical samples and in episodic future thoughts.

Currently, it is unclear how deficits in EFT might contribute to psychopathology, and whether this might be transdiagnostic in nature and/or through disorder-specific pathways. It

is reasonable to suspect that some cognitive processes that might be disrupted or impaired by difficulties in simulating specific or detailed EFT, such as problem-solving (Brown et al., 2002) and prospective memory (Altgassen et al., 2015), could contribute to poorer mental health regardless of the specific disorder. However, there may be other specific pathways too. For example, difficulty cognising positive future events is associated with lower perceived likelihood of them occurring (Brown et al., 2002), which may contribute to blunted anticipatory pleasure (Wu et al., 2017), increased hopelessness (MacLeod & Byrne, 1996; MacLeod et al., 2005) and reductions in positively reinforcing behaviours which maintain depressive psychopathology. In psychotic disorders, difficulties generating future self-representations might impair the formation of a coherent sense of self that is connected to personal goals (Lysaker & Lysaker, 2002), and contribute to apathy (Raffard et al., 2013). Future research may further elucidate the role of EFT in the development and maintenance of psychopathologies by testing these and other theories of the common and specific pathways of influence.

Given the important role that EFT plays in adaptation, there may a place for evaluating programs for remediation of this cognitive process in psychiatric groups. Interventions for deficits in autobiographical specificity (e.g., Memory Specificity Training, MEST; Raes et al., 2009) have already shown some success in improving the retrieval of specific memories in samples with diagnosed depression (Neshat-Doost et al., 2013) and PTSD (Moradi et al., 2014), with associated reductions in symptom severity. A series of studies in non-clinical samples have shown that improving episodic thinking can increase the detail of EFT and have subsequent effects on outcomes such as problem-solving and affect (e.g., Jing et al., 2016; Madore & Schacter, 2016). Enhancing EFT is also related to the ability to delay immediate gratification in favour of larger, longer-term rewards (Peters & Büchel, 2010), and more adaptive decision-making, such as less caloric consumption among

obese individuals (Daniels et al., 2013) and reduced demand for alcohol in alcohol dependence (Snider et al., 2016). These findings are suggestive of some mechanisms through which interventions for EFT deficits may be effective, such as improved capacity to solve problems, affect regulation, decreased temporal discounting, and reduced impulsivity. Recently, it has been argued that even within established psychotherapeutic frameworks, such as cognitive-behavioural therapy, a focus on mental representations of possible futures is lacking (Roepke & Seligman, 2016), and that integrating more techniques based on EFT may improve treatment and broaden the range of transdiagnostic treatment strategies. The current findings support the notion that such deficits in EFT are indeed transdiagnostic in nature, although the extent of this, and how effective treatments aimed at EFT might be, awaits further clarity.

4.1. Conclusion

This study represents that first meta-analysis on the mental simulation of possible future events in clinical samples. It provides evidence that psychiatric diagnosis, specifically depression, bipolar disorder and schizophrenia, are related to large, significant impairments in the ability to mentally simulate specific and detailed possible futures that are important in adaptive psychological functioning. Future research examining other diagnostic groups, the mechanisms through which these deficits occur, and the development or enhancement of treatments to remediate this deficit are indicated.

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Table 1.

Details of Studies Included in the Systematic Review

Author (Year)	Clinical Group	Age (% Female)	Assessment	Control Group	Age (% Female)	Assessment	EFT Assessment	Number of Cues	Cue Valence	Timeframe	Scoring Method	Practice Cues	Time for Response	Method of Recording
Addis et al., 2016	24 MDE	24.5 (16.6%)	Self-reported MDE diagnosis from a health professional	24	24.5 (12.5%)	No history of depressive symptoms. (semi-structured clinical interview)	Modified AMT	24	64% positive					
Belcher & Kangas, 2014	30 MDE	38.1 (70%)	SCID-IV	30	30.7 (83%)	No current or previous history of depression (SCID-IV)	Modified AMT	6	3 positive, 3 negative	Next few years	Proportion of specific responses	Yes	Unlimited	Audio
										Not specified	Proportion of specific responses	Yes	60s	Audio
Boulanger et al., 2013	19 Bipolar Disorder	45.2 (57.8%)	Clinical interview, met DSM-IV criteria	18	45.4 (57.8%)	Never experienced depressive, manic or hypomanic episodes (method not stated)	Modified AMT	10	5 positive, 5 negative	Not specified	Proportion of specific responses	Yes	60s	Written
										5 next month, 5 in next 5-20 years	Proportion of specific responses	Yes	Unlimited	Audio
Brown et al., 2013	12 PTSD	31 (8%)	CAPS	12	18 (18%)	Absence of PTSD (CAPS)	Modified AMT	10	10 neutral					
Chen et al., 2016	32 SCZ	28.9 (41%)	SCID-IV	33	34.7 (39%)	No personal history of psychiatric disease screened by non-structured interview	SCEFT	11	No valence	Not specified	Proportion of specific responses	No	Unlimited	Written
										Not specified	Proportion of specific responses	Not Stated	60s	Audio
D'Argembeau et al., 2008	16 SCZ	36 (56%)	Met DSM-IV criteria (method not stated)	16	30 (56%)	No history of psychiatric disorder (method not stated)	Modified AMT	10	5 positive, 5 negative	Not specified	Proportion of specific responses	Not Stated	60s	Audio

Dickson et al., 2013	21 MDE	37.9 (62%)	SCID-IV	24	31.2 (71%)	Absence of MDE (SCID-IV)	Generate future goals	1		No valence	Not specified	Proportion of specific responses	No	90s	Written
Hach et al., 2014	17 MDE	20.6 (88%)	Self-reported diagnosis from a health professional	16	23.5 (88%)	No self-reported history of depression and below cutoff on the BDI	Modified AMT	24		No valence	Next few years	Proportion of specific responses	Yes	Unlimited	Audio
Huddy et al., 2016	30 SCZ-Spectrum	36.5 (20%)	Met DSM-IV criteria (method not stated)	2	39.4 (29%)	Absence of psychiatric diagnosis (MINI)	Problem-solving task	5		No valence	Not specified	Rating of simulation coherence	Yes	Unlimited	Audio
King et al., 2011a	20 Bipolar	45.7 (60%)	SCID-IV	20	45.4 (60%)	No history of psychiatric illness (SCID-IV)	AI	9		3 positive, 3 neutral, 3 negative	Not specified	Number of Episodic Details	No	Unlimited	Audio
King et al., 2011b	22 MDE	48 (68%)	Met DSM-IV criteria (method not stated)	22	45.1 (63%)	Absence of MDE (method not stated). Low scores on HAM-D, YMRS, and GAF	AI	9		3 positive, 3 neutral, 3 negative	Not specified	Number of Episodic Details	No	Unlimited	Audio
Kleim et al., 2014	30 PTSD	42.3 (67%)	CAPS	20	37 (50%)	Trauma, but absence of PTSD (CAPS)	Modified AMT	12		6 positive, 6 negative	Not specified	Proportion of specific responses	Yes	60s	Audio
Maccallum & Bryant, 2011	24 CG	50.6 (92%)	Clinical Interview with the CG Assessment	21	50.7 (86%)	Bereaved but absence of CG (Clinical Interview with the CB Assessment), and absence of MDE (SCID-IV) and PTSD (CAPS)	Modified AMT	10		5 positive, 5 negative	Not specified	Ordinal Rating of Specificity	Yes	60s	Audio

Oliveira et al., 2009	25 SCZ	33.8 (16%)	Met DSM-IV criteria (method not stated)	23	34.3 (13%)	No SCZ (method not stated)	Future Event Questionnaire	12	No valence	3 next week, 3 next month, 3 next year and 3 in the next 5 years	Ordinal Rating of Specificity	No	Unlimited	Written
Parlar et al., 2016	21 MDE	41.3 (52%)	SCID-IV	20	36.5 (50%)	No history of psychiatric illness (SCID-IV) or trauma exposure	AI	9	3 positive, 3 neutral, 3 negative	Not specified	Number of Episodic Details	No	Unlimited	Audio
Raffard et al., 2013	25 SCZ	33.6 (36%)	SCID-IV	25	34.7 (36%)	No history of psychosis diagnosis (SCID-IV)	Modified AMT	6	3 positive, 3 negative	Not specified	Ordinal Rating of Specificity	No	Unlimited	Audio
Raffard et al., 2016	27 SCZ	31.4 (57%)	SCID-IV	26	28.2 (12%)	No history of psychosis of affective disorders (MINI)	SDFPT	3	No valence	at least one year	Proportion of specific responses	No	Unlimited	Written
Robinaugh & McNally, 2013	13 CG	48.5 (46%)	Semi-structured clinical interview for CG	20	52.1 (40%)	Bereaved, but absence of CG (semi-structured clinical interview for CG),	Modified AMT	8	4 positive, 4 negative	Not specified	Proportion of specific responses	Yes	60s	Audio
Williams et al., 1996	24 MDE	34 (66%)	Met Research Diagnostic Criteria for depression (Spitzer, et al. 1978),	24, 24 General Med Hospital	34 (66%)	Did not meet Research Diagnostic Criteria for depression (Spitzer, et al. 1978),	Modified AMT	15	5 positive, 5 neutral, 5 negative,	Not specified	Ordinal Rating of Specificity	No	Unlimited	Audio

Note: AI = Autobiographical Interview, AMT = Autobiographical Memory Test, BDI = Beck Depression Inventory, CAPS = Clinician Administered PTSD Scale, CG = Complicated Grief, DSM-IV = Diagnostic and Statistical Manual of Mental Disorders-IV, GAF = Global Assessment of Functioning Scale, HAM-D = Hamilton Rating Scale for Depression, HC = Healthy Control, MDE = Major Depressive Episode, MINI = Mini International Neuropsychiatric Inventory, SCEFT = Sentence Completion for Events in the Future Test, SCID-IV = Structured Clinical Interview for the DSM-IV, SCZ = Schizophrenia, SDFPT = Self-Defining Future Projection, YMRS = Young Mania Rating Scale

Table 2.

Subgroup Analyses

Variable	<i>k</i>	Clinical <i>N</i>	Control <i>N</i>	Effect Size (<i>g</i>)	<i>p</i>	95% CI	<i>Q</i>	<i>I</i> ²	Failsafe <i>N</i>
<i>Diagnosis</i>					0.32		4.8	16%	
Depression	7	159	160	-0.79	< .001	-1.02, -0.56	2.9	0%	81
Schizophrenia	6	155	147	-1.00	< .001	-1.52, -0.48	22.5***	78%	90
Bipolar disorder	2	39	39	-1.06	< .001	-1.54, -0.58	0	0%	12
PTSD	2	39	38	-1.04	0.26	-2.85, 0.77	10.9***	91%	/
Complicated grief	2	37	40	-0.41	0.08	-.86, 0.05	0	0%	/
<i>Assessment</i>					0.90		0.2	0%	
Future AMT	11	259	265	-0.89	<.001	-1.17, -0.60	26.5**	59%	259
Autobiographical Interview	3	63	64	-0.81	<.001	-1.25, -0.38	2.7	28%	13
Other	5	144	130	-0.99	<.001	-1.59, -0.38	22***	82%	30
<i>Cue Valence</i>					0.18		3.5	42%	
Positive cue valence	10	228	220	-0.69	<.001	-0.88, -0.49	9.2	2%	124
Negative cue valence	10	228	220	-0.45	<.001	-0.69, -0.21	14.5	38%	64
Neutral cue valence	4	73	76	-0.92	.001	-1.48, -0.36	7.6	61%	26
<i>Practice Cues</i>					.39		0.7	0%	
Yes	9	199	189	-0.89	<.001	-1.26, -0.53	22.6**	65%	151
No	9	217	217	-0.71	<.001	-0.92, -0.49	9.9	19%	115
<i>Time given for Response</i>					.64		0.2	0%	
No specified limit	12	279	273	-0.88	<.001	-1.15, -0.62	24.8**	56%	296
< 90 seconds	7	152	149	-0.77	<.001	-1.16, -0.38	15.7*	62%	68
<i>Response Format</i>					.35		0.9	0%	
Oral	14	308	298	-0.90	<.001	-1.18, -0.63	32.7**	60%	389
Written	5	124	124	-0.69	<.001	-1.04, -0.34	7.2	45%	32
<i>Time Frame for Event</i>					.92		0.01	0%	
Not specified	13	295	284	-0.85	<.001	-1.11, -0.59	27**	56%	310
Specified	5	105	105	-0.88	.002	-1.43, -0.33	14**	72%	40

Note: * $p < .05$, ** $p < .01$, *** $p < .001$. The Q and I^2 statistics indicate whether differences between effect sizes across studies are significantly larger than expected by chance, and the magnitude of any heterogeneity, respectively.

Figure 1. Flowchart of the study selection process.

Figure 2. Forest plot of differences between psychiatric and control groups on specificity and detail in future thinking

Figure 3. Funnel plot of standard error by standard differences in means. Observed studies shown in white and imputed studies shown in black after using the trim and fill procedure.

Highlights

- First meta-analysis on the mental simulation of possible future events
- Psychiatric diagnosis was related to large, significant impairments
- Significant effects for depression, bipolar, and schizophrenia, but not PTSD or complicated grief
- No significant effects for methodological variables
- Further studies are warranted, and in other diagnostic groups