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Moustafa, Ahmed A.; Morris, Alejandro N.; ElHaj, Mohamad

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Ahmed A. Moustafa<sup>a,\*</sup>, Alejandro N. Morris<sup>a</sup> and Mohamad ElHaj

# A review on future episodic thinking in mood and anxiety disorders

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**Abstract:** Future episodic thinking refers to the ability to imagine oneself in the future and project oneself into specific future events. This cognitive process is related to decision making and planning for the future. Although healthy populations commonly project themselves into the future (e.g. while planning a trip or career), patients with mood disorders show impairment in this ability. In this review article, we discuss the similarities and differences in future thinking among the following populations: major depressive disorder, dysphoria, anxiety, and post-traumatic stress disorder (PTSD). Importantly, we highlight the methodological variations in future episodic memory tasks in the literature that may explain the differences in the existing results.

**Keywords:** anxiety; depression; dysphoria; emotional valence; future thinking; phenomenology; PTSD.

## Introduction

Episodic memory and episodic future thinking are two constructs that have been used in psychology to, respectively, assess individuals' ability to imagine their subjective self at two points in time: the past and future. Episodic memory is a category within autobiographical

memory (AM) proposed by Tulving and colleagues (Tulving, 1984, 2002; Wheeler et al., 1997) as a memory system that allows individuals to re-experience events in a specific time and place (Prebble et al., 2013). Episodic future thinking is the ability to pre-experience and project oneself into specific future events (Atance and O'Neill, 2001). Both processes form part of auto-noetic consciousness, which is defined by Wheeler et al. (1997) as the capacity to 'mentally represent and to become aware of one's protracted existence across a subjective time and to focus directly on one's own subjective experience' (p. 335). Auto-noeticity underpins important human social behaviors such as self-awareness of autonomy and responsibility for past and present behavior, as well as planning for and behaving in congruence with future goals (Sani, 2008).

Until now, research has focused on measuring the ability of patients with various psychiatric disorders to remember and imagine future episodic events in an attempt to understand their etiology and maintenance factors. Compiling and assessing the current literature on future-oriented research in mood and anxiety disorders will improve the conceptualization, measurement, and possible treatment of these disorders. Specifically, the rationale of this review is to investigate the similarities and differences in future thinking in patients with negative mood states. It is hypothesized that patients with anxiety and PTSD will show more details of future details than patients with depression and dysphoria. In this paper, we review the literature relevant to future thinking research in major psychiatric disorders in adult populations, including major depressive disorder, dysphoria, anxiety, and post-traumatic stress disorder (PTSD).

## Types of future thinking tasks used in the literature

Future thinking is usually assessed by asking participants to imagine events that may reasonably happen in the future. Participants are typically asked to be precise and specific, that is, events are to last no more than a day. Participants are also invited to provide details such as time and

<sup>a</sup>Ahmed A. Moustafa and Alejandro N. Morris: These authors contributed equally to this work.

\*Corresponding author: Ahmed A. Moustafa, School of Social Sciences and Psychology, Western Sydney University, 2 Bullecourt Road, Milperra 2214, New South Wales, Australia; and Marcs Institute for Brain, Behaviour, and Development, Western Sydney University, Locked Bag 1797, Sydney 2751, New South Wales, Australia, e-mail: a.moustafa@westernsydney.edu.au

Alejandro N. Morris: School of Social Sciences and Psychology, Western Sydney University, 2 Bullecourt Road, Milperra 2214, New South Wales, Australia; and Institute of Psychology, Leiden University, Wassenaarseweg 52, P.O. Box 9555, 2300 RB Leiden, The Netherlands

Mohamad ElHaj: Sciences Cognitives et Sciences Affectives (SCALab), Université Lille, CNRS, CHU Lille, UMR 9193, F-59000 Lille, France; and Unité de Gériatrie, Centre Hospitalier de Tourcoing, F-59000 Tourcoing, France

place at which events will occur, as well as to describe their feelings and emotions during those events. These instructions have been used in most of the research reviewed in this paper. Other research has, however, used tasks probing semantic representations, to evaluate whether semantic memory is essential for imagining of the future. These research studies have provided an expansion to the prevailing view to which the role of episodic memory has focused primarily on (Klein, 2013) leading to the semantic scaffolding hypothesis (Irish and Piguet, 2013). According to this hypothesis, semantic representations support the construction of novel events as these representations provide undifferentiated conceptual information that can be harnessed and generalized to many different contexts.

Current research has also considered emotional aspects of future thinking by asking patients to imagine neutral, positive, or negative events. For instance, MacLeod and Cropley (1995) asked patients with dysphoria to imagine positive and negative events, and found that negative events were related with depression, while positive events were related with hopelessness. Emotional valence was also assessed by MacLeod et al. (1997) who found that participants with anxiety gave more negative responses than controls.

Besides the assessment of emotional valence, in this review, the phenomenological characteristics of future thinking are also discussed. Future thinking is believed to trigger a state of auto-noetic consciousness by which the phenomenological (i.e. subjective) experience of the future is relived due to mental time travel (Tulving, 2002). In the reviewed literature (e.g. Raffard et al., 2010, 2013), the assessment of the phenomenological experience of future thinking has been conducted by asking patients to complete scales in which they rate the reliving of their experience. On these scales, participants were asked to rate the amount of phenomenological characteristics such as visual details, amount of sounds, and amount of smell/taste sensations that might characterize their future thinking, as well as the clarity of the location, clarity of the spatial arrangement of objects and people, and clarity of the time of day in their projection. Self-referential information was also assessed with items about the representation of the patients' behavior, representation of what she/he would say, and representation of what she/he would think. Participants were also invited to report the visual perspective they took in their future thinking, that is, whether they saw themselves in their memory or saw the scene from their own perspective. Based on these studies, it has been observed that future thinking is less vivid in dysphoria (Anderson and Evans, 2014) and depression (Morina et al., 2011).

## Method

A computer search in PsychINFO was carried out, beginning with the introduction of the term future thinking. A search containing the terms future episodic thinking in dysphoria, major depression disorder, anxiety, and PTSD was carried out. This search was also performed in PubMed Central. Finally, the reference lists of all the research reports used in papers and meta-analysis was examined.

## Summary of earlier future episodic thinking in mood and anxiety disorders

Below, we review existing studies on future episodic thinking in the following psychiatric disorders: dysphoria, major depressive disorder and related disorders, anxiety, and PTSD.

### Major depressive and related disorders

Table 1 shows a summary of the studies investigating future thinking in patients with major depressive and related disorders. In one early study, MacLeod et al. (1997) examined the memory for past experiences and anticipation of future experiences within panic disorder patients ( $N=17$ ), patients with depression ( $N=16$ ), and controls ( $N=17$ ). Participants were asked to generate future and past, positive and negative experiences in response to various time-frame cues. It was found that participants with anxiety gave more negative responses but not fewer positive responses than controls; participants with depression gave fewer positive responses, although, against prediction, they did not generate more negative responses than the controls. Subsequently, Stöber (2000) provided a replication and methodological extension of the MacLeod et al. (1997) study with a nonclinical sample, using future-directed imagery to assess prospective cognitions. The results showed that the severity of anxiety, and not depression, was related to enhanced imagery for future negative events. Both anxiety and depression showed significant zero-order correlations with reduced imagery for future positive events.

In one recent study, Addis et al. (2016) investigated whether the specificity of future events was reduced in depression and what the role of executive functions played

**Table 1:** A summary of future existing future thinking tasks in major depressive disorders and related disorders.

	Clinical group	Future thinking task
Addis et al. (2016)	Major depressive disorder	Cue words for past and future – AI paradigm
Morina et al. (2011)	Major depressive disorder	Prospective imagery task
Sarkohi et al. (2011)	Major depressive disorder	Future thinking task (no cue words)
Andersen and Limpert (2001)	Major depressive disorder	Positive and negative events
Thimm et al. (2013)	Major depressive disorder	Unrealistic optimism scale
Ji et al. (2017)	Major depressive disorder	Prospective imagery task
Belcher and Kangas (2013)	Major depressive disorder	AMT and Future Imagining Test (FIT)
Dickson et al. (2011)	Major depressive disorder	Goal task
Crane et al. (2012)	Major depressive disorder	Goal task and AMT (Williams and Broadbent, 1986)
Vihauer et al. (2012)	Major depressive disorder treatment	FDT
Hach et al. (2014)	Major depressive disorder-neural substrates	Past and future events are cued
MacLeod et al. (1997)	Major depressive disorder and panic disorder	Adapted verbal fluency paradigm
Stöber (2000)	Anxiety and depression	MacLeod's (1996) subjective probability items
Miles et al. (2004)	Anxiety and depression	The memory/future thinking task (MacLeod et al., 1997)
MacLeod and Byrne (1996)	Anxiety and depression	Personal future task
Eysenck et al. (2006)	Anxiety and depression	Questionnaire measuring anxious and depressive events
Vincent et al. (2004)	Parasuicide	Measure to elicit positive future goals and plans (MEPGAP)
Thomsen et al. (2011)	Rumination	Generating positive and negative events
Lavender and Watkins (2004)	Rumination in depression	Imagine positive and negative future events
Maccallum and Bryant (2011)	Complicated grief	Respond to future and past event based on cue words
Robinaugh and McNally (2013)	Complicated grief	Autobiographical memory and future event tasks
King et al. (2011)	Bipolar disorder	Galton-Crovitz 9 cue words – positive, negative, and neutral

in episodic specificity. They reported that the group with depression is more ruminative and avoidant than the controls, but did not exhibit deficits in executive functions. The depression group was significantly less specific in future events than the controls. The findings suggested that future simulation is susceptible to current or past experience of depressive symptoms, consistent with the notion that simulation is more cognitively demanding than autobiographical memory retrieval. Using functional magnetic resonance imaging (fMRI), Hach et al. (2014) investigated whether neural changes during the construction of autobiographical events were evident in depression. They reported that there was reduced activity in regions associated with episodic richness and imagery, including the hippocampus, precuneus, and cuneus.

Unlike prior studies, Morina et al. (2011) explored the relationship between positive and negative prospective mental imagery in patients with major depressive disorder (MDD) and patients with anxiety disorders in comparison to healthy participants. The prospective imagery task (PIT) was used to measure imagery for 10 positive and 10 negative prospective events. Subjects were then asked to rate the vividness of prospective positive events (e.g. you will have lots of energy and enthusiasm) or negative events (e.g. someone close will reject you). In addition, the PIT was modified to include arousal associated with prospective images and estimated likelihood

that prospective images would occur in the future. The Positive and Negative Affect Schedule (PANAS) was used to measure the positive and negative affect following the PIT. The Impact of Future Event Scale (IFES) was used to assess the impact of intrusive prospective, personally relevant imagery. The study found that depressed patients had, compared to controls, impoverished imagery vividness when asked to think about positive future events. Both patients with anxiety and depression reported higher impact of intrusive, involuntary prospective images of personal events than the control group.

In another study, Sarkohi et al. (2011) examined the relationship between future-oriented thinking and autobiographical memory in a sample of individuals with depression. In the future thinking task (FTT), participants were asked to think of potential future events across three time periods: next week, next year, and the next 5–10 years. They were given 1 min for each temporal condition. Autobiographical Memory Test (AMT): two groups of 18 words (six neutral, six positive, and six negative) used to cue memories. Participants were given 1 min to remember an event. A small but statistically significant positive correlation was found between positive future thinking and (1) negative future thinking and (2) positive autobiographical memory, but not with negative autobiographical memory. Similarly, Belcher and Kangas (2013) tested whether autobiographical memory and future

event specificity were associated with avoidance goals in depressed and non-depressed adults. They reported that individuals diagnosed with MDD and remembered fewer past memories set fewer specific long-term goals than the other group. However, it was also stipulated that individuals with depression did not have fewer future goals, but rather poorly defined goals that they perceived as unable to achieve.

To understand the mechanism of future thinking, Andersen and Limpert (2001) examined the hypothesis that individuals with major depression make predictions about future events relatively automatically and pessimistically, reflecting the use of a future event schema, while they also ruminate about the future. Individuals with depression showed a smaller increase in response latency due to the introduction of the attentional load compared to individuals without depression, suggesting relatively greater processing efficiency. They also predicted reliably fewer positive events.

Using a different task, Thimm et al. (2013) investigated prospective cognition with the Hope scale (Snyder et al., 1991) and the Unrealistic Optimism Scale (Weinstein, 1980) in clinically depressed (CD;  $N=61$ ), previously depressed (PD;  $N=42$ ), and never depressed controls (ND;  $N=46$ ). The CDs estimated their probability of experiencing positive events in the future as lower and their probability of experiencing negative events as higher than the two other groups. Along these lines, Ji et al. (2017) tested whether the ability to vividly imagine positive events in one's future was associated with dispositional optimism in a sample of adults with depression. Those individuals who were able to envision a brighter future were more optimistic, and regained optimism more quickly over time, than those less able to do so at baseline. Using a goal explanation task, Dickson et al. (2011) asked participants to write down goals that they think they would achieve at some point in the future. Surprisingly, it was found that depressed individuals did not create fewer future goals compared to healthy participants, but their goal appraisal is more pessimistic than non-depressed individuals.

Thomsen et al. (2011) made participants complete questionnaires on rumination and recalled and rated a positive and a negative memory. Participants also generated and rated a positive and a negative future scenario. Memories were rated on reliving and emotional valence, while future scenarios were rated on reliving, emotional valence, and how probable the scenario was. The results showed that a higher degree of rumination was related to more reliving of negative memories and future scenarios as well as more negative expectations for the future scenarios. Vincent et al. (2004) built on this finding to test

whether parasuicidal individuals had difficulty planning and setting long-term goals. Participants were asked to generate as many long-term goals as possible in a semi-structured interview. The results showed that parasuicidal patients provided as many goals as controls, but showed greater difficulty and were less specific at explaining how they would achieve those goals.

Lavender and Watkins (2004) tested the hypothesis that, in patients with depression, rumination would reduce the ability to imagine positive future events, while increasing the ability to imagine negative future events. In the depressed group, rumination increased both negative and positive future thinking. The study supported the view that rumination leads to greater negative future thinking. In a similar study, Crane et al. (2012) also tested patients diagnosed with depression. However, they were interested in analyzing the effect MBCT had on the specificity of life goals in a group diagnosed with MDD. They found that those receiving active treatment were more specific at describing future goals compared to a wait-list control group.

Using different scales, Maccallum and Bryant (2011) studied complicated grief, which is a syndrome characterized by an intense and prolonged yearning for the deceased and can feature marked difficulty accepting the death, a sense that life lacks meaning or purpose without the deceased, emotional numbness, bitterness, loss of trust, and a difficulty re-engaging in activities. Participants with complicated grief were less specific in their imagining of future positive events and were more likely to imagine future events relating to their loss. The extent to which individuals were able to imagine a specific future event was significantly correlated with recalling specific memories. Similarly, Robinaugh and McNally (2013) examined whether individuals with complicated grief could retrieve autobiographical memories and create future events using the autobiographical task (Williams and Broadbent, 1986). It was found that relative to participants without complicated grief, those with complicated grief were deficient at recalling specific autobiographical memories and imagining future episodic events.

Similar to prior studies, King et al. (2011) examined the ability of individuals diagnosed with bipolar disorder to imagine positive, negative, and neutral future events. The modified Crovitz's cue-word test was used: nine cue words (three positive, three negative, and three neutral) to elicit episodic future events. Patients with bipolar disorder generated significantly fewer episodic details for positive, negative, and neutral future events. Compared to controls, there was no difference in amount of episodic

details generated by patients across positive, negative, and neutral events.

As for therapy, Vihauer et al. (2012) examined a new manualized treatment designed to help people anticipate a more positive future. It was found that future-directed therapy (FDT) may have the potential of becoming an additional treatment option for patients with MDD.

Unlike most of the above-mentioned studies, a few studies have attempted to compare future thinking in depression and anxiety. MacLeod and Byrne (1996) examined the anticipation of future and positive and negative experiences in relation to anxiety and depression. It was predicted that both anxious and mixed individuals (anxious and depressed) would generate more negative future events than controls. They evaluated future capabilities by the personal-future task, which requires participants to think of future experiences occurring over three different time periods. The results indicated that both mixed and anxious participants show increased negative future thinking but not decreased positive future thinking. A limitation of the study was that they did not use a clinical sample, nor did they have an exclusive depressed group.

In another similar study, Miles et al. (2004) tested whether depression is related to a reduction in positive memories and expectancies while experiencing anxiety to increase anticipation of negative expectancies. Following MacLeod et al. (1997), participants were asked to remember and imagine future events in three time periods. The total score was the number of events written in 1 min. The results showed that adolescents with anxiety and other adolescents with depression recalled more negative memories and anticipated more negative future experiences. The group with depression did not show reduced positive cognitions compared to controls, either for past or future thinking. In another study, Eysenck et al. (2006) performed two studies. The first showed that healthy individuals associated anxiety-producing events to occur in the future, whereas depression was associated with

past events. The second study found that the levels of anxiety and depression experienced in response to negative events depended on the time (past vs. future) of those events. Future probable events produced more depression than future uncertain events. Anxiety was associated with future negative events and not past events.

To sum up, episodic foresight of future positive events was compromised in individuals with MDD. Having high levels of anxiety and depression made participants remember and anticipate more negative events than controls. Rumination increased positive and negative future thinking, while individuals with complicated grief showed a diminished ability to envision positive future events. In addition, individuals with bipolar disorder were similar to healthy controls in their ability to generate positive and negative future events. More research is required to support the validity of FDT in increasing positive future thinking and reducing the severity of depressive symptoms.

## Dysphoria

Table 2 shows a summary of studies investigating future thinking in individuals with dysphoria. Although not a disorder, dysphoria is interlinked to depressive disorders, and thus, individuals with dysphoria may show similar future thinking abilities as patients with depressive disorders. Dysphoria is defined as a state of dissatisfaction with life (Starcevic, 2007). In one early study, MacLeod and Cropley (1995) examined the anticipation of positive or negative experiences at a general or specific level in dysphoria. Individuals with dysphoria showed a greater belief in likelihood of negative events but did not significantly differ from controls in their estimates for positive events. Compared to controls, individuals with dysphoria were faster to provide specific examples of negative relative to positive events. Future thinking concerning negative events was related to their levels of depression, while future thinking

**Table 2:** A summary of future thinking tasks in dysphoria.

	Clinical group	Future thinking task
MacLeod and Cropley (1995)	Dysphoria	8 Future negative and positive sentences
Dickson and Bates (2006)	Dysphoria	Future event task (pleasant vs. unpleasant cue words)
Hoerger et al. (2012)	Dysphoria (anxiety and hypomania)	Predicted emotional states on Valentine's day
Anderson and Evans (2014)	Dysphoria	Future event task – imagine two events within the next month and two after 1 year
Holmes et al. (2008)	Dysphoria	PIT
Cropley and MacLeod (2003)	Dysphoria	Memory, attribution, and judgment task
Anderson et al. (2016)	Dysphoria	Sentence completion tasks

concerning positive events was related to levels of hopelessness. In a follow-up study, Cropley and McLeod (2003) investigated the relationship between attributional thinking and future expectations, in a group of control individuals and individuals with mild depression and dysphoria. Participants were asked to recall eight positive and eight negative cued autobiographical memories and, then, generate a short attributional statement giving the reason why they thought each event had happened. Individuals with dysphoria gave more internal, stable, and global attributions for negative events, but their attributions for positive events were more external, unstable, and specific. These findings suggest that individuals with dysphoria had the same ability to create future events as controls, but focused more on possible negative future events.

In a follow-up study, Dickson and Bates (2006) and Hoerger et al. (2012) investigated whether individuals with dysphoria were able to envision positive and negative future events. While Dickson and Bates (2006) used the autobiographical memory task to assess the participant's ability to retrieve and write down specific personal memory narrative based on six cue words, Hoerger et al. (2012) asked participants to predict their emotional reactions around Valentine's day ('How will you feel...') without the use of a cue words. In both cases, it was found that dysphoric individuals were less specific than controls in describing unpleasant and pleasant personal experiences. Hoerger et al. (2012) found that dysphoric individuals predicted more negative emotional reactions than controls. However, neither studies examined their phenomenological experience that could elucidate the lived experience of those participants.

In a more recent study, Hoerger et al. (2012) examined whether dysphoria was associated with negatively biased affective forecasts or greater accuracy. Participants supplied predicted and actual emotional reactions for 3 days surrounding Valentine's day. There was a support for dysphoric forecasting bias, that is, the tendency of individuals in dysphoric states to overpredict negative emotional reactions to future events. Dysphoric symptoms were independently associated with biased forecasts in analysis controlling for anxiety symptoms and lifetime hypomanic symptoms.

Unlike the above-mentioned studies, Anderson and Evans (2014) investigated the content and phenomenological experience of past and future events in individuals with and without dysphoria. They found that individuals with dysphoria reported fewer positive events across both temporal directions. Furthermore, the ratings of phenomenological characteristics suggested that individuals with dysphoria saw future, but not past, events as less vivid, coherent, sensorially detailed, bodily experienced, emotionally intense, and important with respect to their story and identity. In another study, Holmes et al. (2008) examined the relationship between depressed mood and the subjective experience of emotion in imagined events, specifically, prospective imagery, and imagery in response to emotionally ambiguous stimuli. Compared to low dysphoria, high dysphoria was associated with poorer ability to vividly imagine positive (but not negative) future events (compare to findings by MacLeod and Cropley, 1995).

Unlike prior studies, Anderson et al. (2016) argued that overgeneral memory, in which individuals exhibit difficulties in retrieving specific episodes from autobiographical memory, is consistently linked with emotional disorders. In this study, overgeneral future thinking was only evident when the sentence stems included emotional words. These findings highlight the importance of investigating the overgenerality phenomenon using a variety of cueing techniques.

To sum up, the current research on future thinking in individuals with dysphoria indicates a tendency toward non-specificity of future thought. Research employed positive and negative cueing techniques to elicit future events. The results indicate that individuals with dysphoria show greater difficulty than controls at envisaging future positive events. Future research should focus on more neutral cueing methods that do not include emotional words/sentences in order to fully elucidate the conditions under which future thinking biases occur in this patient group.

## Anxiety disorders and PTSD

Table 3 shows a summary of studies investigating future thinking in patients with anxiety disorders and PTSD. An

**Table 3:** A summary of future existing future thinking tasks in anxiety and PTSD.

	Clinical group	Future thinking task
Butler and Mathews (1983)	Anxiety	3 Questionnaires
Wu et al. (2015)	Generalized anxiety disorder	Experimental recombination task based on Addis et al. (2010)
Brown et al. (2013)	PTSD	Neutral cues words for past and future events – tested episodic specificity
Kleim et al. (2014)	PTSD	Positive and negative cue words in AMT

initial study by Butler and Mathews (1983) analyzed how depressed and anxious individuals reacted to ambiguous material. The results indicated that both groups interpreted ambiguous information as threatening. It was suggested that anxiety increased access to dangerous past memories. This meant that individuals would display avoidance of future events due to the anticipated danger of these events.

Wu et al. (2015) investigated 21 patients with general anxiety disorder (GAD) and 19 healthy participants who simulated positive, neutral, and negative future events either once or repeatedly, and rated their phenomenological experience of episodic future thinking. The results showed that healthy controls spontaneously generated more detailed episodic future thoughts over repeated simulations. Both groups found episodic future thinking easier to generate after repeated simulations, except when GAD participants simulated positive events. They also perceived higher plausibility of negative-not positive or neutral-future events than did controls.

## PTSD

Kleim et al. (2014) examined the specificity of episodic future events generated by trauma survivors, who generated brief descriptions of imagined future experiences in response to positive and negative cues in future-based autobiographical memory test. Individuals with PTSD imagined fewer specific future events in response to positive, but not to negative, cues compared to healthy controls. The effect was found to be independent of comorbid major depression. Reduced memory specificity in response to positive cues was related to appraisals of foreshortened future and permanent change.

Using a modified autobiographical memory test, Brown et al. (2013) investigated the extent to which PTSD influenced the content of imagined future events. Individuals were asked to remember autobiographical memories or future simulations in response to neutral word cues. Individuals with PTSD were more likely to generate overgeneral autobiographical memories and future events than controls and were more likely to incorporate content associated with combat when remembering the past or thinking about the future.

To sum up, research into individuals with anxiety revealed that they had greater difficulty at generating positive and negative future events. Individuals with PTSD were also more likely to be overgeneral in imagining future thought and remembering past events. Future research should aim to ascertain what protective factors

promote future simulation capacity. Furthermore, future studies should look at investigating future specificity pre-trauma and shortly after trauma, and its relationship with post-trauma adaptation.

## Discussion

Unlike other reviews, our review investigated the similarities and differences in episodic future thinking in various mood and anxiety disorders including dysphoria, major depressive and related disorders, anxiety, and PTSD.

Our review indicates that the difficulty to envisage future episodic events is a robust phenomenon in individuals suffering psychiatric disorders such as MDD, dysphoria, anxiety, and bipolar disorder, as most studies have yielded medium to large effect sizes. This was the case irrespective of the method used to elicit past and future episodic thoughts. Studies on MDD employed future imagery task (i.e. asked participants to imagine events without cue words), and it was found that they had more difficulty at generating past and future personal events compared to healthy controls. Similarly, the cue-word paradigm also showed that MDD patients had deficits at imagining positive and negative future events.

In one review study, Roepke and Seligman (2016) argued that faulty prospection is a core underlying process that drives depression. They differentiated between negative prospection as a representation of an undesirable future and faulty prospection, which is a pattern of negative content that leads to significant impairment. Individuals with depression might struggle to imagine a good future because they struggle to remember a good past. They propose a framework that outlines three faults that outline prospective depression: poor generation of future events, poor evaluation of future events, and negative attitudes and beliefs about the future. In a recent review study, Miloyan et al. (2016) investigated the adaptive significance of human anxiety. Consistent with evolutionary perspective, they identified episodic foresight as one of its key psychological features. Anxiety facilitates the detection and avoidance of threats to fitness, as well as enabling individuals to take more advanced precautionary measures. It is argued that episodic foresight represents an evolutionary achievement because it permits anticipatory preparation for maximizing opportunity and avoiding ruin over greater temporal distances than otherwise possible. It is proposed that episodic foresight enables humans to generate, manage, and infer threats to fitness, even in the absence of present cue threats.



## Neural studies

There has been a dearth of neural studies on future thinking processes. Many of the existing studies have been conducted on healthy populations. For example, it was found that episodic memory and foresight have common core brain networks, including the hippocampus, medial frontal and lateral temporal cortices (Addis et al., 2010). Okuda et al. (2003) found that while remembering the past and imagining future scenarios, participants showed similar activation in the temporal lobes, suggesting that remembering past episodes overlaps and contributes to imagining the future. Other studies have shown that amnesiac individuals with hippocampal lesions have exhibited deficits in episodic memory and a consequent difficulty imagining future scenarios (Hassabis et al., 2007), suggesting a key role for the hippocampus in these processes. Along these lines, research on episodic foresight in hippocampal-damaged patients revealed that the type of cue word used to elicit episodic events greatly impacted the level of specificity of episodic memory and foresight. It was found that providing personally meaningful cues such as ‘40th wedding anniversary’ elicited greater episodic detail compared to generic cue words such as ‘table’ (Kwan et al., 2016). It indicates that using non-descriptive nouns (e.g. lemon) hindered a participant’s ability to demonstrate episodic specificity. As for psychiatric disorders covered in this area, we are familiar with one fMRI study that investigated neural changes during the construction of autobiographical events that was evident in depression (Hach et al., 2014), which we discussed above. They also found that the hippocampus also plays a role in episodic imagery. However, it is unclear how the pre-cuneus and cuneus regions play a role in future thinking. Future neural studies should investigate neural changes associated with future thinking deficits in patients with anxiety and PTSD.

## Clinical implications

Our review has several clinical implications. By gathering the theoretical knowledge on future thinking in mood and anxiety populations, our review demonstrates how future thinking extends comprehension of clinical symptomatology in these populations. For instance, patients with dysphoria, as observed in the study of MacLeod and Cropley (1995), show a greater belief in the likelihood of the occurrence of negative than positive events than in individuals without dysphoria. MacLeod and Cropley (1995) also demonstrated that individuals with dysphoria

are faster to provide specific negative events relative to positive ones. These findings are of interest as dysphoria is typically defined as a state of dissatisfaction with life and often reported in patients with mood and anxiety disorders. Therefore, this negative bias, as typically observed for past thinking, can also be extended to future thinking. In line with our assumption, future thinking concerning negative events in dysphoria seems to be related to depression, while future thinking concerning positive events seems to be related to levels of hopelessness. In a similar vein, Cropley and McLeod (2003) found that mildly depressed (dysphoric) patients provide stable attributions for negative events, but unstable attributions for positive ones. In addition, future thinking seems to be less vivid than past thinking (Anderson and Evans, 2014), probably due to hopelessness that characterizes future thinking in dysphoria.

As for depression, this clinical condition has been typically associated with overgenerality of past thinking. As demonstrated by our review, this overgenerality can be extended to future thinking. The literature, as reviewed here, demonstrates a reduction in the specificity of future thinking in depressive disorders (Addis et al., 2016). The literature also demonstrates that individuals with depression struggle to imagine positive future scenarios as they struggle to remember positive past events (Roepke and Seligman, 2016). In addition, as similar to their difficulty to retrieve high phenomenological experience of past scenarios, patients with depression tend to retrieve impoverished experience of future scenarios (Morina et al., 2011). We argue that the similarity between past and future thinking in depression can be attributed to rumination and pessimism. More specifically, owing to pessimism and preference for negative material in memory, patients with depression are likely to envision a gray and poor image of the future.

In our view, any evaluation of future thinking in clinical populations may provide a window into the subjective experience of patients. This issue is important because, thanks to the evaluation of future thinking, clinicians may understand whether patients are stuck in the ‘here and now’ or whether patients have the ability to mentally represent the future and/or to become aware of their protracted existence across the subjective time. A related, but fundamental, issue that may be explored is how the loss of a sense of future impacts the identity of patients. Deterioration of future thinking may result in a tendency of patients to focus on their ‘here and now’ identity, with little interest in the construction of future identity and future self-images. As we tend to suggest, impaired future thinking may lead to feelings of emptiness and/

or a present-focused subjective experience. Further, we suggest that it will be important for clinicians to take into account how an inability to imagine the future impacts both dimensions of self ('I': self-as-agent vs. 'Me': self-as-object). By evaluating both dimensions, clinicians may be able to understand whether patients are able to adopt an outward viewpoint of the future self (i.e. whether patients are able to pre-experience their 'I/agent' self) and/or whether patients are able to adopt an external viewpoint of the self (i.e. whether patients are able to pre-experience their 'Me/object' self). The subjective experience of the self is mainly characterized by a switch from actor (i.e. a first-person perspective allowing to view the world through our own eyes) to observer based (i.e. a third-person perspective allowing to see ourselves from an outside perspective). Clinicians may, therefore, ask patients to imagine a future event (e.g. a family dinner) and then probe the perspective from which the event is simulated. Accordingly, clinicians may be able to understand how patients process their sense of self.

## Limitations and future studies

The current studies have established the existence of a tendency to overgeneralize future episodic events in individuals diagnosed with mood and anxiety conditions such as MDD, anxiety, and PTSD. The current studies have limitations. First, only one study (Mercuri et al., 2016) sought to understand and explain what factors maintained an individuals' difficulty at envisaging future episodic events. Related to this idea, longitudinal studies are required to trace the development and associations between an individual's specific condition and their ability to imagine past and future episodic events.

The studies of future thinking do not only improve the comprehension of clinical symptomatology in psychiatry, but they also pave the way for rehabilitation therapy techniques. It is important that clinicians should consider future thinking as it may provide patients with alternative to confront some negative events. For instance, in social phobia, patients can be encouraged to imagine alternative scenarios rather than to confront memories about painful social situations. Thanks to this approach, patients may gain some control over their anxiety and fears. Although FDT has been used as a treatment option for patients with MDD (Vihauer et al., 2012), it was not used with other mood and anxiety disorders. Future work should investigate whether FDT can ameliorate not only future thinking deficits but also symptom severity in psychiatric patients.

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