


Cognitive Psychology

Discrete Emotions Caused by Episodic Future Thinking: A Systematic Review With Narrative Synthesis

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Engaging in episodic future thinking, where a person imagines a specific, personal future, influences decisions partly through evoking affective experiences. While there is a growing literature on how future thinking influences affect, few studies have assessed this effect on discrete emotions. In this systematic review, we examined studies assessing the effects of episodic future thinking on discrete emotions. The aim was to provide an overview of which emotions have been studied, the evidence for an effect of future thinking on emotions, and the characteristics of emotional, episodic future thoughts. We identified 12 experimental studies ($N = 2825$) and synthesized these narratively. Findings suggest that episodic future thinking has some influence on several different emotions, including happiness, anxiety, and sadness. While the effects for most emotions were inconsistent, consistent effects were found for enjoyment and compassion. Imagining positive, personal future events can evoke enjoyment. Similarly, imagining instances of helping others in the future can elicit compassion. We suggest possible explanations for why future thinking only consistently influences some discrete emotions, emphasizing the cognitive appraisals and behavioral functions associated with different discrete emotions. We provide suggestions for empirically assessing effects of episodic future thinking on discrete emotions in future research.

We spend considerable time contemplating our own future (Barsics et al., 2016; D'Argembeau et al., 2011). Thinking about the future, or engaging in *prospection*, can be partitioned into *episodic* and *semantic* future thinking. This reflects Tulving's original distinction in memory research (Suddendorf & Corballis, 2007; Szpunar et al., 2014; Tulving, 1972). Future thoughts may thus be more episodic, connected to specific, personal episodes, or more semantic, connected to a general, abstract future. For example, a person can have an episodic intention of attending an upcoming dinner party or a semantic intention of generally attending social events in the future.

The terms episodic and semantic can be applied to four recognized modes of future thinking: intention, planning, prediction, and simulation (Szpunar et al., 2014). When applied to *simulation*, *episodic future thinking* describes the ability to imagine or pre-experience specific, personal episodes that may occur in the future (Atance & O'Neill, 2001; Szpunar, 2010). The subjective experience or *phenomenology* of episodic future thinking is vital in separating it from other modes of future thinking (Miloyan & McFarlane, 2019). Specifically, episodic future thinking is defined through the experience that people have when they engage

in it: People *experience* their future thoughts as vivid, detailed, personally relevant, and as "pre-living" something that may occur in the future (Miloyan & McFarlane, 2019; Tulving, 1985).

This review concerns itself with how these specific thoughts about the future impact *discrete emotions*, such as fear, anger, enjoyment, and compassion. The aim of the review is to examine the extent of existing research on the effects of episodic future thinking on discrete emotions and give an overview of this research. Such an overview will help bridge the gap between research in two areas connected to thoughts about the future: 1) research on episodic future thinking and decision making and 2) research on emotions and decision making. In the following, we provide a brief overview of the research on the effects of future thinking on decisions and affect. We also show how this relates to research on cognitive appraisals and discrete emotions.

Episodic Future Thinking and Decision Making

Simulating specific episodes in the future allows us to gather information about possible futures, and this information is intimately connected with our choices. Future

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thoughts often center around our decisions, plans, and goals (Barsics et al., 2016; D'Argembeau et al., 2011). Visualizing what may occur helps us decide between the present and the future. It aids our understanding of the steps necessary to reach our goals and may also give us a glimpse of what we will feel if we achieve them (Bulley & Schacter, 2020; Szpunar et al., 2014). Through providing information about the future, future thinking is assumed to allow us to overcome a tendency to prioritize that which is immediately certain or present. This tendency is described as *probability discounting*, the tendency to discount rewards which are more uncertain, and *delay discounting*, the tendency to discount rewards which are delayed in time (Bulley et al., 2016; McKechar & Renda, 2012).

Hence, episodic future thinking is paramount to *intertemporal decision making*, where we choose between smaller rewards which are immediately available or larger rewards which have not yet manifested (Bulley et al., 2016). This effect has been demonstrated in meta-analyses showing that episodic future thinking reduces delay discounting (Rung & Madden, 2018; Scholten et al., 2019). Generally, imagining personal future scenarios strengthens intentions to prioritize long-term outcomes and enhances actual long-term behavior. A behavioral example is prioritizing long-term health by smoking less (Rung & Madden, 2018). While some studies suggest that only positive future thinking reduces delay discounting, other studies have shown that future thinking can reduce delay discounting irrespective of the affective valence of the future thoughts (Bulley et al., 2019; Liu et al., 2013).

The affective valence of episodic future thoughts is important in understanding our decisions about the future (Bulley et al., 2016). By simulating a future event, we can gather information about the probable emotional consequences of the event and the probability that it will occur. If the future is perceived as affectively bleak and the probability of positive outcomes as low, then it would be more beneficial to prioritize what is immediately accessible. Correspondingly, a brighter future with more probable rewards would motivate us to exercise patience. Thus, rather than creating a general tendency to prioritize the future, episodic future thinking affords flexibility in choosing between the present and the future (Bulley et al., 2016). It seems clear that to fully understand how future thinking impacts our choices, we need to consider the information that is to be gained from estimations of affective value. This approach is reflected in research on how episodic future thinking impacts currently experienced affect.

Episodic Future Thinking and Affect

The affective value of a future outcome is featured in several research fields focusing on episodic future thinking. It is used to explain how future thinking impacts our decisions and why future thinking may increase prosocial behavior (Bulley et al., 2016; Gaesser, DiBiase, et al., 2017). Additionally, it is paramount in the clinical implications of future thinking and central in connecting future thinking to motivation (Gilbert & Wilson, 2007; Rung & Epstein, 2020; Schubert et al., 2020). While perceptions of likelihood are important for assessing whether future events will oc-

cur, perceptions of affective value are decisive for judging whether the future is something to work toward.

Affective responses to a potential future can be divided into two kinds: *anticipated affect* and *anticipatory affect* (Loewenstein et al., 2001). When people imagine a specific, future event, the mere act of imagination may give rise to *anticipatory* feelings experienced here and now. For example, a person imagining a tense social situation in the future may experience anxiety or nervousness in the present. When thinking about the future, people can also *anticipate*, or predict, the feelings they may experience. These predictions are often based on the immediate, anticipatory feelings, but may also be based on prior experience (Baumeister et al., 2007; Gilbert & Wilson, 2007). Thus, episodic future thinking gives us the ability to self-initiate affective responses. These responses are then used as information when deciding whether to pursue or avoid future outcomes. Anticipatory feelings are clearly integral in explaining how episodic future thinking affects decision making.

The impact of personal, future thinking on affective states was explored in a recent meta-analysis (Schubert et al., 2020). Schubert and colleagues assessed studies that experimentally manipulated imaginations of a personal future. In addition to episodic future thinking, this also included worry manipulations and contemplations of a best possible self in the future. As the outcome measure, they included all measures of affect, including affective states and life satisfaction. Generally, the meta-analysis showed that simulations of a personal future increased both positive and negative affect in the short term. Personal future thinking also increased affect to a greater degree than personal past thinking. Thus, there is ample evidence showing that episodic future thinking can impact positive and negative affect, and that future thinking is more emotionally evocative than memories.

Despite the importance of affective states in explaining why future thinking impacts our decisions, affect is very coarsely defined in the research literature. Authors generally refer to positive or negative valence when describing affect (Bulley et al., 2016; Gaesser, DiBiase, et al., 2017; Schubert et al., 2020). This focus on valence helps connect future thinking to the general motivational tendencies of approaching pleasure and avoiding pain. Similar efforts have been made at connecting other modes of future thinking to these motivational tendencies (Bø et al., 2021).

Notwithstanding the benefits of emphasizing valence, it may have resulted in a reduced focus on other, vital dimensions of affective experiences. Such dimensions include the cognitive appraisals and behavioral tendencies associated with a particular emotion (Lazarus, 2001; Roseman, 2001; Smith & Ellsworth, 1985). These dimensions matter greatly for how affect influences decision making and may exert influence on our choices independently of affective valence (Lerner et al., 2015). For example, both anger and fear share a negative valence. However, anger is strongly associated with approach behavior, whereas fear is strongly associated with avoidance behavior (Harmon-Jones, 2003). If we are to understand the role of affect in decisions about the future, it seems prudent to examine dimensions beyond affective valence more closely.

Cognitive Appraisals, Emotions, and Future Thinking

The importance of a multidimensional understanding of emotions has long been recognized in the literature on cognitive appraisals (Lazarus, 2001; Roseman, 2001; Smith & Ellsworth, 1985). The appraisal theories attempt to explain which cognitive evaluations are involved in the activation of different discrete emotions (Lerner et al., 2015; Roseman, 2001; Smith & Ellsworth, 1985). The underlying idea is that organisms evaluate their environments for adaptive significance, and that the cognitive appraisals reflect that significance (Smith & Ellsworth, 1985). Emotions are understood as coordinated response strategies to different situations. The cognitive appraisals help identify which response is the most adaptive.

Some theorists distinguish between different phases of appraisal, such as *primary* and *secondary* appraisals (Lazarus, 2001). *Primary appraisal* concerns whether a situation is relevant to wellbeing (*goal relevance*), whether the situation is favorable or unfavorable for goal progress (*goal congruence*), and to what extent the self is involved in the goals (*type of ego-involvement*). *Secondary appraisal* concerns who is to *blame* or *credit* for the situation, the *coping potential* a person has in the situation, and whether *future expectations* about the situation are positive or negative (Lazarus, 2001). The primary appraisal determines valence. A situation that is favorable for goal progress gives rise to positive emotions just as an unfavorable situation gives rise to negative emotions. Secondary appraisals determine which emotion is evoked. Both anger and fear can result from a goal-incongruent situation. However, anger also requires a perception of high coping potential and that someone else is to blame, whereas fear requires a perception of low coping potential.

The other suggested appraisal dimensions concern whether the event is noticed (*attention*), expected (*unexpectedness* or *novelty*), positive or negative for goals (*situational state*), related to something positive or negative (*motivational state* or *pleasantness*), how the obstacle in an event is perceived (*perceived obstacle*), whether aspects of the event are merely possible or definitely present (*probability* or *certainty*), who caused the event (*agency* or *responsibility*), to which degree the event can be controlled (*control* or *control potential*), whether the outcome is deserved (*legitimacy*), of what kind the situation is (*problem type*), and the degree of effort expended (*anticipated effort*; Roseman, 2001; Smith & Ellsworth, 1985). Levels on these dimensions characterize different emotions. Happiness, for example, is characterized by high pleasantness and low expected effort, which is also the case for surprise. Surprise is additionally characterized by a high degree of uncertainty and attention (Smith & Ellsworth, 1985). Thus, cognitive appraisals can help distinguish between different emotions.

The appraisal framework outlines important dimensions beyond positive and negative affective valence. It also suggests that the effects of emotions on decisions can be understood through the cognitive evaluations associated with each particular emotion. Different cognitive evaluations evoke distinct emotions, which have correspondingly different effects on decisions (Lerner et al., 2015; Zeelenberg

et al., 2008). While both anger and fear have a negative valence, they are different as to whether the situation is appraised as predictable, comprehensible, and under individual control (anger), or unpredictable, incomprehensible, and characterized by situational agency (fear). This has clear implications for decision making: Whereas anger should make people less risk-averse, fear should do the opposite. This is also what has been found in empirical tests (Lerner & Keltner, 2001).

The appraisal approach is relevant in understanding how future thoughts impact affect and decision making. Importantly, appraisals are assumed to operate both unconsciously and consciously (Lazarus, 2001). Conscious appraisals may possibly be linked to the phenomenological experience of episodic future thinking. Mental simulations about the future may activate the same cognitive processes as experienced situations (Kappes & Morewedge, 2016). For example, imagining something happening in the future can make it seem more likely that it actually will happen. Future thoughts about different, upcoming situations could thus activate different cognitive evaluations in the same manner as experienced situations. If this is the case, then they should also evoke different anticipatory emotions. These emotions should then have correspondingly different effects on decisions about the future, independent of the emotions' affective valence. Based on this theoretical framework, we can expect episodic future thinking to influence decisions through evoking different discrete emotions. This approach is relatively neglected in the research literature.

Episodic Future Thinking and Discrete Emotions

Preliminary evidence for an effect of future thinking on emotions comes from a study assessing facial expressions when imagining the future (El Haj et al., 2018). In this study, participants were asked to remember an episodic memory and engage in episodic future thinking. Their facial expressions were measured and coded according to the basic emotions defined by Ekman (happiness, fear, anger, disgust, surprise, and sadness; Ekman & Cordaro, 2011). Results showed that emotional facial expressions were more frequent when thinking about the future than when thinking about the past (El Haj et al., 2018). For future thinking, participants displayed all six basic emotions, with happiness and surprise being most frequent. This suggests that when people imagine the future, they imagine scenarios which may evoke different discrete emotions. Further evidence supporting an effect of future thinking on discrete emotions comes from studies on happiness and enjoyment.

Episodic future thinking may be a source of motivation, happiness, and meaning in life (Hallford, Yeow, et al., 2020; Quoidbach et al., 2009; Vess et al., 2018). One study showed that participants assigned to engage in positive, episodic future thinking for two weeks showed an increase in trait-level happiness (Quoidbach et al., 2009). Another study tested the effects of a training program designed to make it easier to imagine specific events in the future. The authors predicted that being able to imagine more detailed futures would increase anticipatory enjoyment/pleasure (Hallford, Yeow, et al., 2020). Results showed that participants who

engaged in the training program experienced an increase in anticipatory enjoyment when their future thinking was assessed some weeks after participation. Studies on happiness and enjoyment thus suggest that episodic future thinking may increase the tendency to experience discrete, positive emotions in the present.

As shown in the overview of appraisal theory in the previous section, there are meaningful theoretical arguments for assuming that future thoughts may evoke different discrete emotions. The empirical examples also show that there is some evidence to support this notion. Despite this, affective valence is the dimension that has generally been emphasized when connecting episodic future thinking to decision making. An overview of the current evidence on discrete emotions may shed some light on which emotions are affected by future thinking. Additionally, it may illuminate whether distinct features of the experimental instructions or phenomenology of the future thoughts determine which discrete emotions people experience when contemplating the future. This overview may increase our understanding of the importance of affect as a mechanism in decisions about the future. Additionally, it may serve as a foundation for future, empirical research.

Aim of the Current Review

This review is the first systematic, comprehensive assessment of the effects of episodic future thinking on discrete emotions. The aim of the review is to connect research on episodic future thinking and decision making with research on emotions and decision making. This will be done by providing an overview of existing research on the effects of *episodic future thinking*, i.e., imagining specific, personal episodes that may occur in the future, on discrete emotions. Even if discrete emotions have not been focal in studies on future thinking, many studies have included measures of specific emotions in addition to their main outcomes. This review will help establish a foothold for empirical research in the intersection between two research areas by outlining which emotions have been assessed. Additionally, the review aims to assess whether these emotions appear selectively stronger after future thinking, as well as the association between the content and phenomenological quality of episodic future thoughts and their emotional effects. Thus, we aim to provide answers to the following research questions using studies assessing personal, future thinking in humans:

1. Which discrete emotions have been assessed in experimental studies on episodic future thinking?
2. Are there differences in discrete emotions between episodic future thinking-conditions and other episodic conditions, semantic conditions, or control conditions?
3. What characterizes the content and phenomenological quality of episodic future thoughts that impact different discrete emotions, and what characterizes their associated experimental instructions?

There are several major differences between the current systematic review and the previously mentioned meta-analysis on the effects of episodic future thinking on affect

by Schubert and colleagues (2020). In the current review, we will only include manipulations where participants were asked to imagine specific, personal episodes in the future, and not interventions where participants were asked to think about their *best possible selves* or *future worry*. Additionally, whereas Schubert and colleagues focused on affective states in general, the current review emphasizes discrete emotions. Although this review uses different inclusion criteria than the previous meta-analysis, some studies included by Schubert and colleagues targeted some specific mood/emotion states (i.e., Caruso, 2010; Van Boven & Ashworth, 2007). However, the search words in their review did not pertain to discrete emotions. This suggests that while the previous meta-analysis gives a good overview of the effects of personal, future thinking on affective states, it does not provide a sufficient overview of studies that are relevant to assessing the effects of episodic future thinking on discrete emotions.

Method

Synthesis

This systematic literature review employs *narrative synthesis*. This means that existing literature is summarized with narrative or descriptive summaries (Popay et al., 2006). The methods used for identifying and evaluating relevant literature are the same as in a traditional meta-analysis. The key difference is that narration is used instead of aggregated effect sizes. The purpose of this systematic review is to give a descriptive summary of existing research which can answer the research questions. Additionally, we aim to provide an integrative narrative synthesis of this research, by comparing results from different studies and considering their respective and aggregated risk of bias.

Protocol and Pre-Registration

A protocol for this systematic review was registered in the Open Science Framework prior to commencing the final literature search and screening articles against eligibility criteria (<https://osf.io/yp96k>). The protocol followed the PRISMA-P checklist for systematic reviews (Moher et al., 2015). A longer description of deviations from the pre-registered protocol can be found in Appendix A. Briefly, the main deviations are as follows: 1) We used the ROBINS-I assessment tool for assessing the risk of bias for within-subjects studies as opposed to our pre-registered choice of the “revised risk of bias tool for cross-over studies”; 2) We presented general results prior to synthesizing results for each discrete emotion and 3) We deviated from the use of Web of Science for backward and forward reference search for one article that was not indexed in Web of Science.

Eligibility Criteria

Experimental studies (either within- or between-subjects) which included at least one condition where participants were asked to actively imagine or simulate one or more specific, personal episodes that may occur in the future were included. Moreover, studies had to include either an additional episodic condition (i.e., episodic memory),

a semantic condition, or a control condition. We also included studies where participants practiced active personal imagination, if participants practiced simulating one or more specific, personal episodes that may occur in the future. To distinguish between studies that assessed episodic future thoughts and studies that assessed future thinking without simulation, experimental studies were scanned for imaginative cue words (i.e., “simulate” or “contemplate”) while screening. The presence of these cue words would suggest that participants engaged in personal simulations (Schubert et al., 2020).

Additionally, studies had to include at least one measure of a discrete emotion. A measure was considered a measure of a discrete emotion if it measured any of the discrete emotions in the list of keywords used in the literature search. This is similar to a previous meta-analysis on specific emotions (Kranzbühler et al., 2020). This does not pertain to the keywords affect, emotion, and feeling. We also included studies with multi-dimensional measures that include specific, discrete emotions (i.e., Positive and Negative Affect Scales; Watson et al., 1988). If the information concerning specific items in these measures could not be extracted from the published material, the corresponding author of the article was contacted to acquire a copy of the data set. We included studies using both self-report measures and other measures of emotional experience (i.e., facial expressions). If measures of emotions included a keyword term which was specified in some manner (i.e., anxious affect or fright of partner abandonment), it was still considered a measure of a discrete emotion. We only included state measures of emotions like anxiety (i.e., STAI-S and not STAI-T from the Spielberger State-Trait Anxiety Inventory; Spielberger et al., 1970). The exception was if the study explicitly aimed to assess the effect of prolonged episodic future thinking on a trait measure of a discrete emotion (i.e., dispositional happiness or trait anxiety).

To summarize, experimental studies were included if they had at least two conditions, if participants were asked to actively simulate specific, personal episodes in the future, and if they included at least one measure of a discrete emotion. Studies which were either not published in peer-reviewed journals, not written in Danish, English, German, Norwegian, or Swedish, not experimental, or did not include an episodic future thinking-condition and an episodic/semantic/control-condition were excluded. Additionally, we excluded duplicate studies and studies which assessed general affect, affective valence, or arousal (i.e., positive/negative mood). Apart from restricting the population to humans, there were no restrictions for participant population or type of setting.

Outcomes

The primary outcome was discrete emotional states measured with any instrument, defined in accordance with the eligibility criteria. Additional outcomes include phenomenological aspects of the imagined future events and other outcome measures that were collected in addition to emotions. A full list of both pre-registered and unregistered additional outcomes is reported in [Table 1](#).

Table 1. List of Additional Outcomes.

Phenomenological aspects
Temporal distance, vividness, concreteness, sensorial clarity, clarity of spatial temporal context, frequency of experiencing the event in the past, frequency of imagining a similar event in the past, emotional valence, degree of mental imagery, perceived likelihood, visual perspective, personal importance, internal details, external details, or other measures explicitly marked as assessing either the phenomenology of future thoughts, quality of future thoughts or as manipulation checks of a future thinking-manipulation
Other additional outcome measures
Attentional bias, behavioral intentions, cognitive interpretations, executive functioning, delay discounting, outgroup attitudes, anticipated emotions, substance use, <i>schizophrenia symptoms, depressive symptoms, life satisfaction, social phobia, anxiety symptoms, stress, negative self-portrayal, perspective taking, emotional concern, perceived control, category of events, trait anticipatory pleasure, participant responses, participant attitudes, remembered emotions</i>

Note: For additional outcomes, outcomes in italics were not part of the pre-registered protocol.

Literature Search and Study Selection

The search was conducted in the databases MEDLINE (Complete Ovid), PsycINFO, Web of Science, and the ProQuest Psychology Database on the 25th of September 2020. Searches in MEDLINE and PsycINFO were conducted using the OVID interface. Although we are not able to share the database search record, we specify the number of records identified in the databases in our PRISMA Flowchart in the Results section. Additionally, the preregistration includes the full search strategy.

We searched the included databases for published articles without any time restriction, limited to Danish, English, German, Norwegian, or Swedish articles. The search terms are detailed in [Table 2](#). Database searches were supplemented by backward and forward reference search, using the articles included after full-text review. The reference lists and citing articles of these included articles were assessed using Web of Science and its citing function. Relevant additional articles were screened for inclusion in the same manner as detailed in the selection process below.

Two independent researchers (SB and IS) screened all titles and abstracts of retrieved references to identify relevant studies to include. After the title- and abstract-screening, the full text of potential studies was retrieved, and the same two researchers independently reviewed the full texts of these articles for inclusion. Disagreements in the screening process were solved through discussion. Any unresolved disagreements were solved by a senior author. The procedure for extracting data from included studies was pilot tested before the review. EndNote was used as the bibliographic software for sorting studies and for removing duplicates. Microsoft Excel was used for screening articles. If there were missing descriptions of key elements in the study, authors were contacted to attempt to include the studies with insufficient information. Specifically, the corresponding author was contacted by e-mail. If the requested information was not available, or we could not reach the

Table 2. Literature Search Terms.

Future thinking	Emotion
episodic foresight, prospection, mental time travel, mental time-travel, episodic simulation*, episodic construction*, future episodic th*, future thought*, future thinking, future-oriented cognition, self-projection, auto-noetic consciousness, projecting oneself, future envisioning, prospective cognition, future-directed th*, future-oriented th*, future-directed cognition, future simulation*, future image*, future imagination, future imagined, future imagining*, future imageability, future imagination*, constructive daydream*, imagined future, imagining the future, episodic specificity, future mental simulation, imagining new experiences, affective forecast*, affective misforecast*	emotion*, affect*, feeling*, happy, happiness, enjoy, enjoyment, joy, contentment, sadness, fear, anxious, anxiety, fright, distress, anger, angry, rage, frustrated, frustration, contempt, disgust, dislike, interest, seeking, play, panic, grief, love, lust, care, surprise, guilt, shame, envy, envious, regret, jealousy, pride, relief, hope, gratitude, compassion, aesthetic experience, boredom, challenge

authors of the original studies, studies with insufficient information were excluded. Interrater reliability was calculated using Cohen's kappa. For the risk of bias-assessment, we calculated interrater reliability using a weighted Cohen's kappa. Interrater reliability was calculated after screening, but prior to discussion, for screening of titles and abstracts, full-text review, and risk of bias-assessment.

Data Extraction and Quality Assessment

One of the authors (SB) extracted the data items from all the articles included after full-text review. 50% of the articles were also examined, and data extracted from these, by an independent research assistant (IS). Disagreements were resolved through discussion. The data included all the data items specified in the "Data items"-section below, and information concerning all the primary and additional outcomes specified in the systematic review protocol. Both the original, pre-registered sheet for collecting data and the revised, completed sheet is included as Appendices B and C.

The following information was extracted: authors, title, year of publication, journal, type of experimental design, whether the experiment was single-session or prolonged, number of conditions, population, country of data collection, demographic information, and sample size. Additionally, information was extracted about methodological aspects of the future thinking-manipulations, including type of future thinking-task, experimental instructions for the future thinking-task, total duration of the experimental session, duration of future thinking-task, duration of participation period for prolonged studies, domain of the future thought, category of future thinking-measurement, type of future thinking-measurement, specific instruments used in the study (for example the Adapted Autobiographical Interview), type of other episodic condition, type of semantic condition, and type of control condition. For the category, type, and specific instruments used for measuring future thinking, the classification reported by Miloyan & McFarlane (2019) for different measurement instruments was used.

For the outcome measures, the following information was extracted: number of discrete emotions assessed, name of discrete emotions assessed, and other outcome measures than discrete emotions, categorized by 1) type of outcome measure and 2) the specific measurement procedure. Finally, statistical information was extracted, such as means and standard deviations for discrete emotions in the different conditions in the experiments, and statistical test infor-

mation for tests of differences (p-value, statistical test type, statistical test value, degrees of freedom, number of observations, confidence interval type, confidence interval value, effect size type, and effect size value). In cases where new analyses had to be conducted with the original data sets, statistical test information for these analyses is reported. We extracted the same statistical information for all outcomes included from the articles.

If sufficient information concerning the data items for the main outcome variable was not reported in the published article, an attempt was made to obtain the original data set. If the data set was available as a supplement to the article, this data was used to calculate necessary statistical information. If it was not, the corresponding author for the article was contacted with a request to access the original data file. If there was insufficient information for the main outcome, the article was excluded from the synthesis.

Risk of Bias Assessment

A *risk of bias assessment* is used to assess the methodological quality of studies included in a review (Sterne et al., 2019). For assessing the risk of bias, the main tool for the between-subjects experiments was the "Risk of Bias" assessment tool developed by the Cochrane Collaboration (RoB 2; Sterne et al., 2019). The main tool for the within-subjects experiments was the ROBINS-I assessment tool, also developed by the Cochrane Collaboration (Sterne et al., 2016). These tools target domains in which experimental studies may be at risk of bias, which facilitates an understanding of how methodological weaknesses influence the quality of the available evidence. One of the authors (SB) assessed risk of bias in all the included articles after full-text review. 50% of the articles were also examined, and risk of bias assessed in these, by an independent research assistant (IES). Disagreements were resolved through discussion. To solve potential unresolved disagreements, the assessments were discussed with a senior author who made the final decision.

Additionally, the quality of the future thinking task-procedure and the assessment of discrete emotions was assessed with a quality assessment scale used in a previous meta-analysis (Schubert et al., 2020). The future thinking task-procedure was rated according to the quality of its description, whereas the measures of discrete emotions were rated according to the quality of the measure and whether it reported psychometric properties. Both were rated on a scale from 0 to 2. For the future thinking-task, a score of

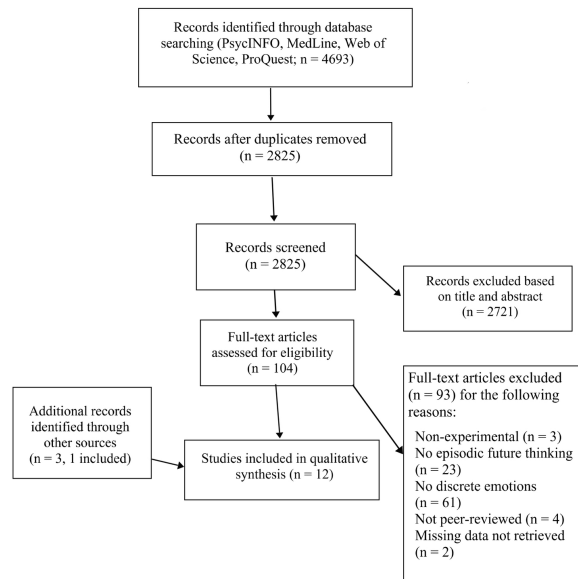


Figure 1. PRISMA Flow Chart.

0 means the task was named but not described, a score of 1 means the task was poorly described, and a score of 2 means the task was described in detail regarding duration and verbal instructions to participants. For the measure of discrete emotions, a score of 0 means the emotion was measured with one item, a score of 1 means the emotion was measured with more than one item, and a score of 2 means the emotion was measured with more than one item and at least one psychometric property was reported from the study sample.

Synthesis Plan

A narrative synthesis was conducted. We retained studies with any level of risk of bias for the narrative synthesis. Tables are used to give descriptive summaries of all included studies. The synthesis opens with summaries of the characteristics of the included studies, including samples and number of conditions. Thereafter, experimental manipulations of episodic future thinking and measures of discrete emotions are synthesized. Subsequently, the results for the effect of episodic future thinking on discrete emotions is structured in accordance with the pre-registration. The final section of the synthesis is an overall assessment of the strength of the evidence, taking risk of bias of the individual studies into consideration.

Results

Selection and Inclusion of Studies

Searches in included databases yielded a total of 2825 citations after removal of duplicates (See [Figure 1](#) for PRISMA Flowchart). After the screening of titles and abstracts, 2721 citations were excluded, resulting in 104 articles remaining for full-text screening. Disagreements between the two re-

searchers occurred for 8 studies, and the interrater reliability was high (Cohen's kappa of 0.96). Of the 104 articles extracted for full-text screening, 91 did not meet our inclusion criteria and were excluded. 13 studies met the inclusion criteria. For the full-text screening, disagreements between the two researchers occurred for 2 articles, and the interrater reliability was high (Cohen's kappa of 0.92). The additional reference searches yielded an additional three articles, resulting in a sample of 16 articles for the systematic review. Of these, we could not obtain the data set required to assess results for the main outcome for 4 articles, resulting in a final sample of 12 articles included for synthesis. A full description of "near-misses", articles that passed most inclusion criteria but were still excluded (Page et al., 2020), can be found in Appendix D. Briefly, one study measured emotions but did not manipulate episodic future thinking (Huynh et al., 2016); one study did not include conditions other than episodic future thinking-conditions (Sjåstad et al., 2021), and one study did not measure discrete emotions (Fernandez-Duque & Landers, 2008).

Study Characteristics

[Table 3](#) shows the characteristics of the included studies. [Table 4](#) shows an overview of future thinking-manipulations and assessed emotions. [Table 5](#) shows an overview of results for different studies on future thinking-measures. [Table 6](#) shows an overview of results for additional outcomes (a full description of these results can be found in Appendix E). Most studies had 'healthy', adult participants, either adults in general or students in particular. Mean age varied from 19 to 74, and the percentage of female participants varied from 0%–87%. Sample sizes ranged from 7 to 106. Three studies included clinical populations ([Table 3](#)). Participants were recruited in the United States, Canada,

the United Kingdom, Belgium, Australia, France, India, and China. For one study, it was not possible to determine the country of data collection. Six of the studies used a between-subjects or factorial design, and six studies used a within-subjects design. The total number of conditions across experiments varied from two to five, with two conditions being the most common.

Experimental Manipulations of Episodic Future Thinking

The experimental manipulations used in the included studies can be divided into two clusters: One cluster of studies in which researchers used experimental manipulations of future thinking in single sessions and one in which participants practiced future thinking over a period. Both clusters include studies which assessed episodic future thinking in isolation and the inclusion of future thinking in already-existing interventions (i.e., cognitive bias modification with future thinking).

Single-Session Experiments. In eight studies, participants were either randomly assigned to (between-subjects) or completed in succession (within-subjects) episodic future thinking and at least one other condition. In four of these studies, episodic future thinking was contrasted with episodic memory; in seven of the studies, with active controls, and in only one of the studies with a semantic condition (Table 4). The simplest type of control condition involved simply considering events or activities without engaging in active imagination. A more complex control condition involved engaging in more specific activities, such as considering the writing style of a story. Participants were asked to imagine everyday events (El Haj et al., 2018), positive everyday events (Hallford, Farrell, et al., 2020), helping a person in need (Gaesser, Dodds, et al., 2017; Gaesser & Schacter, 2014; Sawczak et al., 2019), resolutions to ambiguous situations (J. S. Lee et al., 2015) and specific, negative future situations (Chiupka et al., 2012; Van Boven & Ashworth, 2007). See Table 4 for a more detailed description of the experimental interventions in all included studies.

Prolonged Practice in Future Thinking. In four studies, participants were engaged in prolonged practice in episodic future thinking. In one of these studies, there was one positively valenced condition and one negatively valenced condition (Quoidbach et al., 2009). Additionally, one study combined imaginations with discussions of future events (Hallford, Yeow, et al., 2020), and one study combined imaginations with remembering specific events (Chen et al., 2020). In one of these studies, episodic future thinking was contrasted with episodic memory; in another study with an active control, and in two studies, with passive controls (Table 4). There was no semantic condition in any of the studies. In all four studies, participants were asked to imagine everyday events. In two of them, the instructions emphasized positive events (Hallford, Sharma, et al., 2020; Hallford, Yeow, et al., 2020). The duration of the prolonged studies was considerably longer than the single-session

studies, with two studies lasting for 14 days, one study for 15 days and one study for 30 days (Appendix C).

As seen in Table 4, participants in different studies were asked to imagine quite different future scenarios. There is, for example, a considerable difference between imagining helping someone in need and listening to an annoying noise (Gaesser & Schacter, 2014; Van Boven & Ashworth, 2007). This is important to take note of when interpreting the results. While it may be reasonable to expect that imagining helping someone would evoke emotions such as compassion or distress, it may not be equally reasonable to expect that imagining listening to an annoying noise would evoke happiness (see Table 4).

Measures of Discrete Emotions

Measures of discrete emotions can be divided into two categories: State measures, corresponding with the experience of discrete emotions in the moment, and trait measures, corresponding with the general tendency to experience discrete emotions. A description of all the discrete emotions can be found in Appendix F.

Of the eight studies with single-session experimental manipulations, researchers assessed happiness, anger, fear, compassion, enjoyment, sadness, distress, guilt, interest, pride, disgust, and surprise (Table 4). Seven of these studies included self-report measures, and the final study measured emotions using analyzed facial expressions (El Haj et al., 2018). The emotion measures were frequently included as part of an index of emotions or affective experiences in general. For example, six experiments measured compassion/distress as part of an index of *emotional concern*, reflecting the degree to which others' needs evoke emotional reactions in oneself (Gaesser, Dodds, et al., 2017; Gaesser & Schacter, 2014; Sawczak et al., 2019). Another example is a study measuring distress, fear, guilt, interest, and pride included as part of a measure of state anxiety (PANAS; Chiupka et al., 2012). One of the studies included a measure of anticipatory enjoyment, where participants were asked to indicate the enjoyment/pleasure they experienced when contemplating future activities (Hallford, Farrell, et al., 2020). This is included as a measure of anticipatory enjoyment.

Of the four studies with prolonged practice with episodic future thinking, researchers measured anxiety, happiness, and enjoyment (Table 4). All studies used self-report measures, but these were more standardized than in the single-session experiments. For happiness, the *Subjective Happiness Scale* was used in one study (Quoidbach et al., 2009). For anxiety, the *State Trait Anxiety Inventory – Trait* (STAI-T) was used in two studies (Hallford, Sharma, et al., 2020; Hallford, Yeow, et al., 2020). Two of the studies included a measure of anticipatory enjoyment/pleasure, which was included as a measure of anticipatory enjoyment. See Table 4 for a complete overview of different emotions assessed in each of the included studies.

Table 3. Characteristics of Studies Included in the Review.

Publication	N	Experimental design	Population	Country of data collection	Mean age (SD)	Female %	Male %	Other %
Chen et al. (2020)	100	Between	Schizophrenia patients	China	34.80 (9.15), 34.50 (9.76), 35.35 (9.96), 35.10 (10.82)	17.6%, 25%	82.4%, 75%	Unknown
Chiupka et al. (2012)	85	Between	Undergraduate students	Canada	19.71 (3.29), 19.38 (1.85)	76.2%, 74.4%	23.8%, 25.6%	Unknown
El Haj et al. (2018)	33	Within	Graduate/undergraduate students	France	24.48 (5.95)	54.5%	Unknown	Unknown
Gasser & Schacter (2014) Experiment 1	15	Within	College students	United States	21.6 (3.0)	86.7%	Unknown	Unknown
Gasser & Schacter (2014) Experiment 2	30	Within	College students	United States	21.8 (2.9)	80%	Unknown	Unknown
Gaesser & Schacter (2014) Experiment 3	30	Within	College students	United States	20.3 (2.4)	70%	Unknown	Unknown
Gaesser, Dodds et al. (2017)	61	Within	Young and old adults	United States	21.97 (2.51), 74.00 (6.58)	Unknown	Unknown	Unknown
Hallford, Farrell et al. (2020) Experiment 1	32	Within	Adults	Australia	37 (19.7)	64.5%	Unknown	Unknown
Hallford, Farrell et al. (2020) Experiment 2	29	Within	Adults	Australia	38.4 (16.3)	62.1%	Unknown	Unknown
Hallford, Sharma et al. (2020)	7	Within	Depressive patients	India	24 (4.7)	0%	100%	0%
Hallford, Yeow et al. (2020)	60	Between	English-speaking participants	Unknown	31 (13.2)	60%	38.4%	1.6%
Lee et al. (2015)	80	Between	Adults from King's College	United Kingdom	25 (7.89)	61.3%	38.8%	0%
Quoidbach et al. (2009)	106	Between	Local university workers	Belgium	31.2 (10.76), 35.03 (14.8)	65.1%	34.9%	0%
Sawczak et al. (2019) Experiment 1	62	Within	Young and old adults	Canada	19.0 (3.32), 73.2 (4.73)	71.4%, 67.6%	Unknown	Unknown
Sawczak et al. (2019) Experiment 2	32	Within	Patients at epilepsy clinic and healthy controls	Canada	37.6 (11.7), 37.1 (11.7)	68.8%	Unknown	Unknown
Van Boven & Ashworth (2007)	83	Between	Undergraduate students	United States	Unknown	Unknown	Unknown	Unknown

Note: For some studies, it was not possible to determine mean age (and SD) for the whole sample, but only for individual conditions. Individual conditions and their order are reported in the excel sheet for data extraction (Appendix C).

Table 4. Experimental Manipulations and Assessed Emotions.

Publication	Episodic future thinking-conditions	List of additional conditions	Type of intervention	Single-session or prolonged	Duration of future thinking-task	Discrete emotions assessed	Results for discrete emotions
Chen et al. (2020)	1) Episodic future thinking training, 2) episodic future thinking & memory training	Episodic memory	Practice imagining events or setting specific goals that may happen in the future in 1 week, 1 year, 5 years, or more than 5 years.	Prolonged	16 hours	Anxiety	Neither practice in remembering specific events, imagining specific events, or both remembering and imagining events influenced trait anxiety.
Chiupka et al. (2012)	Only one condition	Episodic memory	Imagine holding a three-minute speech on why someone would want to be friends with you.	Single-session	60 seconds	Distress, fear, guilt, interest, pride	Imagining an upcoming speech evoked greater distress and fear, but not greater guilt, interest, or pride, than remembering holding the same speech.
El Haj et al. (2018)	Only one condition	Episodic memory	Imagine one specific future event that could reasonably happen to you in the future.	Single-session	2 minutes	Happiness, sadness, anger, surprise, fear, disgust	Facial expressions associated with happiness and surprise were more frequent during future thinking than facial expressions associated with sadness, anger, fear, and disgust. Happy facial expressions were more frequent during episodic future thinking than when thinking about episodic memories.
Gasser & Schacter (2014) Experiment 1	Only one condition	Active control	Imagine an episode of helping a person in an everyday situation in which they require help.	Single-session	30 minutes	Distress, compassion	Episodic future thinking increased compassion, but not distress, compared to solving math problems.
Gasser & Schacter (2014) Experiment 2	Only one condition	Two active controls	Imagine an episode of helping a person in an everyday situation in which they require help.	Single-session	30 minutes	Distress, compassion	Episodic future thinking increased compassion, but not distress, compared to identifying journalistic techniques used in a story, and increased neither compassion nor distress compared to estimating ways in which the person in need could be helped.
Gaesser & Schacter (2014) Experiment 3	Only one condition	Episodic memory, active control	Imagine an episode of helping a person in an everyday situation in which they require help.	Single-session	30 minutes	Distress, compassion	Episodic future thinking increased compassion, but not distress, compared to identifying journalistic techniques used in the study, and increased neither compassion nor distress compared to remembering a specific episode of helping someone under similar circumstances.
Gaesser, Dodds et al. (2017)	Only one condition	Passive control, active control	Imagine an episode of helping a person in an everyday situation in which they require help.	Single-session	3 minutes	Distress, compassion	Participants reported greater compassion and distress when engaged in episodic future thinking than when identifying journalistic techniques or writing about ways in which the person could be helped.

Publication	Episodic future thinking-conditions	List of additional conditions	Type of intervention	Single-session or prolonged	Duration of future thinking-task	Discrete emotions assessed	Results for discrete emotions
Hallford, Farrell et al. (2020) Experiment 1	Only one condition	Episodic memory, passive control	Imagine five positive events that could reasonably occur between 4 and 14 days after completing the survey.	Single-session	10 minutes	Enjoyment	Both engaging in episodic future thinking and engaging in episodic memory increased anticipatory enjoyment.
Hallford, Farrell et al. (2020) Experiment 2	Only one condition	Episodic memory, passive control	Imagine five positive events that you have not already planned to do that could reasonably occur between 4 and 14 days after completing the survey.	Single-session	10 minutes	Enjoyment	Episodic future thinking increased anticipatory enjoyment more than episodic memory.
Hallford, Sharma et al. (2020)	Only one condition	Active control	Imagine an event that you are looking forward to or could possibly do over the next two hours that would be enjoyable or give a sense of achievement.	Prolonged	Unknown	Sadness, happiness, enjoyment	When engaging in episodic future thinking, participants reported reduced daily sadness, but not greater daily happiness, compared to simply thinking about upcoming activities. Episodic future thinking also increased anticipatory enjoyment.
Hallford, Yeow et al. (2020)	Only one condition	Passive control	Receive psychoeducation about future thinking, practice imagining positive and negative future events, receive psychoeducation about future thinking with emphasis on anticipating positive emotions, practice generating neutral and positive episodic future thoughts.	Prolonged	Unknown	Enjoyment	Participants receiving episodic future thinking-training reported greater enjoyment when asked to imagine future events at a follow-up after the training, compared to participants in the wait-list control.
Lee et al. (2015)	1) Positive episodic future thinking, 2) negative episodic future thinking	Two active controls	Imagine an event related to an emotionally ambiguous text passage, either something positive (enhanced positive condition) or something negative (enhanced negative condition).	Single-session	6 minutes 40 seconds	Happiness, sadness	The inclusion of episodic future thinking, either positive or negative, with cognitive bias modification did not induce greater state happiness or sadness than standard cognitive bias modification.
Quoidbach et al. (2009)	1) Positive episodic future thinking, 2) negative episodic future thinking, 3) neutral episodic future thinking	Passive control	Daily practice in imagining specific, positive events/negative events/neutral events that could reasonably happen to you tomorrow.	Prolonged	Unknown	Anxiety, happiness	Neutral episodic future thinking reduced trait anxiety, compared to positive and negative future thinking. Positive episodic future thinking increased trait happiness, compared to negative and neutral future thinking.

Publication	Episodic future thinking-conditions	List of additional conditions	Type of intervention	Single-session or prolonged	Duration of future thinking-task	Discrete emotions assessed	Results for discrete emotions
Sawczak et al. (2019) Experiment 1	Only one condition	Active control	Imagine an episode of helping a person in an everyday situation in which they require help.	Single-session	60 seconds	Distress, compassion	Episodic future thinking increased compassion, but not distress, compared to a control condition in which participants tried to think of as many words as possible.
Sawczak et al. (2019) Experiment 2	Only one condition	Active control	Imagine an episode of helping a person in an everyday situation in which they require help.	Single-session	60 seconds	Distress, compassion	Episodic future thinking increased neither compassion nor distress for the whole sample, compared to an active control condition in which participants tried to think of as many words as possible. For the healthy controls, episodic future thinking increased compassion, but not distress.
Van Boven & Ashworth (2007)	Only one condition	Semantic future thinking, active control	Imagine listening to a longer version of an annoying noise in 20 minutes.	Single-session	30 seconds	Anger, happiness, sadness	Participants asked to imagine an upcoming, annoying noise did not report greater anger or happiness than participants anticipating the upcoming noise or remembering a specific episode of listening to the noise in the past. Participants imagining the noise reported greater sadness than participants remembering the noise, but not greater sadness than participants anticipating the noise.

Table 5. Overview of Future Thinking-Measurement and Phenomenological Results.

Publication	Emotions assessed	Category of future thinking-measurement	Type of future thinking-measurement	Specific instruments used in the study	Results for phenomenological measures
Chen et al. (2020)	<i>Anxiety</i>	Content measures	Phenomenology, examinations	Mental Time Travel Test	Four participants from all three active groups, but not the control group, experienced an increase in observer-rated specificity of future thoughts from baseline. For visual perspective, participants in the active groups did not experience an increase from baseline to post-training.
Chiupka et al. (2012)	Distress, fear, guilt, interest, pride	Content measures	Phenomenology	Image Events, Event Items, NSPS-Images	A greater number of participants endorsed mental images in the future thinking condition than in the past condition; however, participants in the past condition rated their mental images as more influential on their views of self and others than participants in the future condition.
El Haj et al. (2018)	Happiness, sadness, anger, surprise, fear, disgust	Content measures	Phenomenology	N/A	Participants experienced future thoughts as more positive than memories.
Gasser & Schacter (2014) Experiment 1	<i>Distress, compassion</i>	Content measures	Phenomenology	N/A	Participants reported a higher level of detail and greater coherence of thoughts when engaged in episodic future thinking than when solving math problems.
Gasser & Schacter (2014) Experiment 2	<i>Distress, compassion</i>	Content measures	Phenomenology	N/A	Participants reported a higher level of detail, greater clarity of thought, and a greater experience of pre-living when engaged in episodic future thinking compared to estimating ways in which a person in need could be helped or considering the journalistic style of the story.
Gasser & Schacter (2014) Experiment 3	<i>Distress, compassion</i>	Content measures	Phenomenology	N/A	Participants reported a higher level of detail and greater coherence of thought when engaged in episodic future thinking compared to episodic memory. Participants reported a greater experience of pre-living when engaged in episodic future thinking, both compared to episodic memory and to identifying journalistic techniques used in the story. Episodic future thinking increased the perceived similarity of stories with past experiences compared to episodic memory, but not compared to identifying journalistic techniques used in the story.
Gaesser, Dodds et al. (2017)	Distress, compassion	Content measures	Phenomenology	N/A	Participants in the episodic future thinking-condition reported greater detail, but not greater coherence, of their thoughts compared to when thinking about ways in which a person in need could be helped.
Hallford, Farrell, et al., 2020) Experiment 1	Enjoyment	Content measures	Phenomenology	N/A	When engaging in episodic future thinking, participants reported a greater degree of mental imagery and vividness/level of detail compared to baseline, but not compared to episodic memory. Imagined events were perceived as temporally closer in time than remembered events.

Publication	Emotions assessed	Category of future thinking-measurement	Type of future thinking-measurement	Specific instruments used in the study	Results for phenomenological measures
Hallford, Farrell et al. (2020) Experiment 2	Enjoyment	Content measures	Phenomenology	N/A	When engaging in episodic future thinking, participants reported a greater degree of mental imagery and vividness/level of detail compared to baseline and episodic memory. Imagined events were not perceived as temporally closer in time than remembered events.
Hallford, Sharma et al. (2020)	Sadness, happiness, enjoyment	Content measures	Phenomenology	N/A	Participants in the study experienced greater vividness and mental imagery in the episodic future thinking-phase than in the control phase.
Hallford, Yeow et al. (2020)	Enjoyment	Content measures	Phenomenology, examinations	Episodic Future Thinking Test	When engaging in episodic future thinking, participants who had received a future thinking-training reported a greater degree of mental imagery, vividness/level of detail and specificity. Participants reported that imagined events were temporally closer in time, and perceived these as more likely to occur, in the episodic future thinking-condition than in the wait-list control condition.
Lee et al. (2015)	<i>Happiness, sadness</i>	Content measures	Phenomenology	N/A	Participants in the future thinking-conditions experienced a greater vividness of scenarios than participants in the standard cognitive bias modification conditions.
Quoidbach et al. (2009)	Anxiety, happiness	N/A	N/A	N/A	N/A
Sawczak et al. (2019) Experiment 1	<i>Distress, compassion</i>	Content measures	Phenomenology, examinations	Adapted Autobiographical Interview (AI)	When engaging in episodic future thinking, participants reported greater vividness and greater coherence of thought than when reading words aloud. Participants reported a greater number of internal details than external details.
Sawczak et al. (2019) Experiment 2	<i>Distress, compassion</i>	Content measures	Phenomenology, examinations	Adapted Autobiographical Interview (AI)	When engaging in episodic future thinking, participants reported greater vividness, but not greater coherence of thoughts, than when reading words aloud. Participants reported a greater number of internal details than external details.
Van Boven & Ashworth (2007)	<i>Anger, happiness, sadness</i>	Content measures	Phenomenology	N/A	Participants engaged in more mental simulation when they were asked to imagine an upcoming, annoying noise (episodic future thinking) than when they remembered the noise (episodic memory), but not compared to when they were simply told about the noise that was forthcoming (semantic future thinking).

Note: For emotions in bold text, there was a significant effect of future thinking; for emotions in italics, there was no significant effect.

Table 6. Effects of Episodic Future Thinking on Additional Outcomes in Included Studies.

Publication	Emotions assessed	Additional outcomes assessed	Results for aspects of future thoughts	Results for anticipated affect and other affective outcomes	Results for behavioral intentions	Results for clinical outcomes
Chen et al. (2020)	Anxiety	Schizophrenia symptoms, depressive symptoms (HAMD), medication side effects, depressive symptoms (BDI), life satisfaction, verbal memory, visual memory, verbal fluency	N/A	No effect of episodic future thinking on life satisfaction.	N/A	Results showed an inconsistent reduction in depressive symptoms and schizophrenia symptoms after engaging in either memory training, imagination training or a combination training, as compared to a control schizophrenia condition. Verbal memory and visual memory improved in all three active groups. However, this was not the case for the delayed measure of verbal memory or the measure of verbal fluency.
Chiupka et al. (2012)	Distress, fear, guilt, interest, pride	Social phobia, depression, anxiety, stress, negative self-portrayal	N/A	N/A	N/A	No effect of future thinking on depressive symptoms, social phobia, stress, negative self-portrayal, or anxiety.
El Haj et al. (2018)	Happiness, sadness, anger, surprise, fear, disgust	N/A	N/A	N/A	N/A	N/A
Gasser & Schacter (2014) Experiment 1	Distress, compassion	Willingness to help, emotional concern	N/A	Episodic future thinking did not increase emotional concern for people in need compared to solving math problems.	Episodic future thinking enhanced willingness to help compared to solving math problems.	N/A
Gasser & Schacter (2014) Experiment 2	Distress, compassion	Willingness to help, emotional concern, perspective taking	Episodic future thinking increased perspective taking compared to estimating ways in which the person in need could be helped.	Episodic future thinking increased emotional concern compared to identifying journalistic techniques used in the story, but not compared to estimating ways in which the person in the story could be helped.	Episodic future thinking enhanced willingness to help compared to identifying the journalistic style of the story and estimating ways in which the person could be helped.	N/A

Publication	Emotions assessed	Additional outcomes assessed	Results for aspects of future thoughts	Results for anticipated affect and other affective outcomes	Results for behavioral intentions	Results for clinical outcomes
Gasser & Schacter (2014) Experiment 3	<i>Distress, compassion</i>	Willingness to help, emotional concern, perspective taking	Episodic future thinking increased perspective taking compared to episodic memory.	Episodic future thinking increased emotional concern compared to identifying journalistic techniques used in the story, but not compared to episodic memory.	Episodic future thinking increased willingness to help compared to identifying journalistic techniques used in the story, but not compared to episodic memory.	N/A
Gaesser, Dodds et al. (2017)	Distress, compassion	Willingness to help, emotional concern, perspective taking	Episodic future thinking increased perspective taking for people in need compared to writing down how they could be helped.	Episodic future thinking increased emotional concern for people in need, but not significantly more than engaging in episodic memory about similar instances of helping people.	Episodic future thinking enhanced willingness to help, but not significantly more than remembering episodic memories.	N/A
Hallford, Farrell et al. (2020) Experiment 1	Enjoyment	Category of events, anticipated enjoyment, behavioral intention	Results showed no differences between the conditions for category of events, except that participants in the future thinking-condition chose work/school/study events less frequently than participants in the memory condition.	Episodic future thinking did not increase anticipated pleasure relative to baseline, and there was no difference between future thinking and memory.	Episodic future thinking enhanced behavioral intentions for imagined future activities compared to baseline, but not compared to episodic memory.	N/A
Hallford, Farrell et al. (2020) Experiment 2	Enjoyment	Category of events, anticipated enjoyment, behavioral intention, perceived control	No differences between the conditions for category of events. Episodic future thinking did not increase perceived control over events.	Episodic future thinking and episodic memory increased anticipated pleasure relative to baseline, but there was no difference between future thinking and memory.	Episodic future thinking did not enhance behavioral intentions.	N/A
Hallford, Sharma et al. (2020)	Sadness, happiness, enjoyment	Category of events, completion of activity, anticipated enjoyment, depressive symptoms, trait anticipatory pleasure, behavioral activation for depression	Results showed that the most frequently endorsed category of future thought was work/school/study, and that events connected to TV/internet/games/media and conversation/socializing evoked more anticipatory pleasure than events connected to work/school/study, eating/drinking and other activities.	Participants reported greater anticipated pleasure in the episodic future thinking-phase compared to the control phase. No effect of episodic future thinking on trait anticipatory pleasure.	N/A	No effect of engaging in episodic future thinking on depressive symptoms. Participants experienced an increase in behavioral activation (goal-directed activity and completion of scheduled activities) at the end of the episodic future thinking-phase compared to baseline.

Publication	Emotions assessed	Additional outcomes assessed	Results for aspects of future thoughts	Results for anticipated affect and other affective outcomes	Results for behavioral intentions	Results for clinical outcomes
Hallford, Yeow et al. (2020)	Enjoyment	Anticipated enjoyment, perceived control, generalized imagery detail, generalized imagery mental imagery, generalized imagery anticipated enjoyment, generalized imagery anticipatory enjoyment, generalized imagery perceived control, generalized imagery likelihood of occurrence of events	Practice in episodic future thinking increased perceived control over imagined events. Participants engaged in prolonged practice in episodic future thinking reported greater detail, anticipatory enjoyment, and anticipated enjoyment of generalized imagery at follow-up than participants in a passive control condition. However, there was no difference at post-test, and there was no difference at either post-test or follow-up on experienced imagery, perceived control, and likelihood of occurrence.	Anticipated pleasure was increased after engaging in specificity training compared to a wait-list control.	N/A	N/A
Lee et al. (2015)	Happiness, sadness	Interpretative bias	N/A	N/A	N/A	Engaging in positive episodic future thinking with bias modification, as compared with positive bias modification, reduced negative bias with one measure, but not another. There was no effect of either positive or negative episodic future thinking on positive bias.
Quoidbach et al. (2009)	Anxiety, happiness	Anticipated emotional valence	N/A	Practice in positive (negative) projection evoked positive (negative) anticipated emotion.	N/A	N/A
Sawczak et al. (2019) Experiment 1	Distress, compassion	Willingness to help, emotional concern, perspective taking, confidence in ability to help	Episodic future thinking increased perspective taking and confidence in one's own ability to help compared to reading words aloud.	Episodic future thinking increased emotional concern compared to reading words aloud.	Episodic future thinking increased willingness to help compared to reading words aloud.	N/A
Sawczak et al. (2019) Experiment 2	Distress, compassion	Willingness to help, emotional concern, perspective taking, confidence in ability to help	Episodic future thinking did not increase confidence in one's own ability to help or perspective taking for the whole sample. For healthy controls, episodic future thinking increased perspective taking, but not confidence in one's own ability to help.	Episodic future thinking did not increase emotional concern for the whole sample. For healthy controls, episodic future thinking increased emotional concern.	Episodic future thinking did not increase willingness to help for the whole sample. For healthy controls, episodic future thinking increased willingness to help.	N/A

Publication	Emotions assessed	Additional outcomes assessed	Results for aspects of future thoughts	Results for anticipated affect and other affective outcomes	Results for behavioral intentions	Results for clinical outcomes
Van Boven & Ashworth (2007)	<i>Anger</i> , happiness , sadness	Anticipated/remembered emotional intensity	N/A	No difference was found in anticipated emotional intensity between a condition in which participants were asked to think about the future without imagination (semantic future thinking) and a condition in which participants were asked to actively imagine the future (episodic future thinking). Participants thinking about or imagining an annoying noise reported more intense emotions than participants remembered that they had when they listened to it (episodic memory).	N/A	N/A

Note: For emotions in bold text, there was a significant effect of future thinking; for emotions in italics, there was no significant effect.

Results for the Effects of Episodic Future Thinking

Happiness. *Happiness* is used to describe all enjoyable feelings and is connected to experiencing goal progression (Ekman & Cordaro, 2011; Lazarus, 2001). Three single-session experiments assessed happiness. One study showed that happiness was the most frequently expressed emotion while engaging in episodic future thinking, and was more frequently expressed during future thinking than when recalling episodic memories (El Haj et al., 2018). Another study showed that episodic future thinking about either positive or negative resolutions to emotionally ambiguous situations did not influence happiness (J. S. Lee et al., 2015). The third study showed that happiness did not differ depending on whether participants engaged in episodic future thinking, semantic future thinking, or retrospection about an annoying noise (Van Boven & Ashworth, 2007).¹

There were also two experiments with prolonged practice in episodic future thinking. The first showed that engaging in practice in positive episodic future thinking, but not negative or neutral future thinking, increased trait happiness (Quoidbach et al., 2009). The second showed that engaging in future thinking about upcoming enjoyable activities did not increase state happiness (Hallford, Sharma, et al., 2020).

The current evidence suggests that while happiness may be frequently expressed when engaging in episodic future thinking, future thinking does not generally increase state happiness. For trait happiness, the only available study suggests that engaging in prolonged positive, episodic future thinking may have increased the general tendency to experience happiness (Quoidbach et al., 2009). This study, as well as the study on emotionally ambiguous situations, included conditions with positive and negative future thinking (Table 4). However, while the study measuring trait happiness as an outcome showed an effect of positive future thinking, the study with emotionally ambiguous situations showed no effect of either positive or negative future thinking on state happiness. This suggests that if an effect on happiness only occurs for positive episodic future thinking, this may be limited to trait rather than state happiness.

Of the five studies on happiness, four included phenomenological measures of future thinking (Table 5). For vividness and mental imagery, the available results suggest that participants in episodic future thinking-conditions experienced more vivid thoughts and a greater degree of mental imagery compared to other conditions. The exception was the study on the annoying noise: Participants in the episodic future thinking-condition of this study did not experience greater mental imagery than participants in the semantic future thinking-condition (Van Boven & Ashworth, 2007). Despite this exception, results for phenomenological measures generally support the idea that participants imagined specific episodes in the future.

To summarize, the studies generally showed an effect of episodic future thinking on the phenomenological measures, but only one study showed an effect on happiness.

Thus, there does not seem to be any connection between phenomenological qualities of thoughts and whether there is a significant effect on happiness. This may imply that episodic future thinking, in and of itself, is not sufficient to consistently evoke happiness. Another crucial point is that the study that showed an increase in trait happiness did not include measures of the phenomenological features of future thinking (Table 5). This makes it difficult to assess whether the increase in happiness was caused by episodic future thinking.

Enjoyment. *Enjoyment* is related to a behavioral tendency to play and is considered a narrower emotional state than happiness (Levenson, 2011; Panksepp & Watt, 2011). For enjoyment, two single-session experiments showed that both engaging in episodic future thinking and engaging in episodic memory increased enjoyment (Hallford, Farrell, et al., 2020). Episodic future thinking only increased enjoyment to a greater degree than episodic memory in the second experiment. Crucially, participants were asked to imagine events that they had not yet planned to do in the second experiment, but not the first (Table 4). Thus, one explanation for the difference is that participants relied more on memory while thinking about the future in the first than the second experiment. This would make the difference between conditions smaller. Nevertheless, results suggest that episodic future thinking can increase anticipatory enjoyment.

For the two studies that assessed the effect of extended practice in episodic future thinking, participants reported greater enjoyment after this practice (Hallford, Sharma, et al., 2020; Hallford, Yeow, et al., 2020). For the second study, this difference was not present at post-test, but only at follow-up. Results thus suggest that engaging in future thinking over time can enhance state enjoyment. See Table 4 for a descriptive overview of results for the individual studies.

Importantly, all these studies had instructions specifying that at least some future thoughts should be positive. This was done using positive cue words or through actively asking participants to think of events that they were looking forward to (Table 4). It may seem intuitive that imagining positive events in the future can increase enjoyment, and inconceivable that negative events may do the same. However, neutral future thinking has been shown to reduce negative emotions like anxiety (Quoidbach et al., 2009). Thus, an important question concerns whether the effects on enjoyment are limited to thoughts about positive events or may also occur when thinking about neutral events. Also, researchers asked participants to indicate their pleasure/enjoyment in the same question. As such, the effect may represent an effect on a combination of participants' experience of pleasure and enjoyment.

All studies on enjoyment included content measures of future thinking. Three of the experiments only used phenomenological measures (self-report), and one experiment additionally used *observer examinations* (see Table 5). For future thinking, observer examinations may involve transcribing participants' descriptions of their future thoughts.

¹ Analysis conducted by one of the review authors (SB).

These are then evaluated by independent raters with an emphasis on a specific dimension, such as specificity. Results from the enjoyment studies suggest that participants reported their thoughts as more vivid, and involving a greater degree of mental imagery, when engaged in episodic future thinking (Hallford, Farrell, et al., 2020; Hallford, Sharma, et al., 2020; Hallford, Yeow, et al., 2020). Crucially, this was only significantly different from episodic memory in one of the two single-session experiments: The one that also showed a significant difference in enjoyment (Table 5). These results are further supported by observer measures, showing that the content of participants' writing was rated as more specific after engaging in episodic future thinking. Episodic future thinking inconsistently decreased the perceived temporal distance of imagined events but increased their perceived likelihood of occurrence (Table 5). Together, these results strongly support the assumption that participants were engaged in episodic future thinking. This suggests that it may be sufficient to be engaged in episodic future thinking about upcoming, positive events to have an increased experience of anticipatory enjoyment.

Pride. *Pride* is strongly connected to one's own achievements. People experiencing pride perceive that these achievements have been brought on by themselves (Lazarus, 2001; Lerner et al., 2015). The one included study showed that thinking about holding an upcoming speech did not induce more pride than remembering the same event (See Footnote 1; Chiupka et al., 2012). In the study, a greater number of participants endorsed mental images in the future thinking-condition than the past condition (Table 5). However, participants in the past condition rated their mental images as more influential on their views of self and others than participants in the future thinking-condition.

Anxiety. *Anxiety* is a response to perceived psychological or physical harm, activated by uncertain, existential threats (Lazarus, 2001). Two studies assessed the effects of prolonged practice in episodic future thinking on trait anxiety. One of these showed that practice in imagining neutral future events reduced trait anxiety (Quoidbach et al., 2009). The other study, however, showed that anxiety was not influenced by practice in imagining specific events or practice in both remembering and imagining events (Chen et al., 2020). An important difference is that the study with an effect used a sample of local university workers, whereas the study with no effect used a sample of schizophrenia patients (Table 3). Schizophrenia patients are known to have impaired future thinking (Hallford et al., 2018).

Only the study with schizophrenia patients included phenomenological measures of future thinking, specifically observer-rated specificity and self-reported visual perspective (Table 5). Results showed an increase in observer-rated specificity. However, specificity was only assessed for four of the participants, thus making it unclear whether an increase in specificity occurred for the other 96 (Table 3). Also, there was no increase in *field perspective*, the experience of imagining an event from one's own perspective. If participants did not have more specific thoughts after the practice, and did not experience an increase in field perspective, one explanation for the null finding could be that participants did not actually engage in episodic future

thinking. Based on these results, the evidence for an effect on anxiety seems ambiguous.

Fear. *Fear* is a response to perceived psychological or physical harm, with the core feature that the emotion is associated with avoidance of specific threats (Ekman & Cordaro, 2011; Harmon-Jones, 2003; Levenson, 2011). One study showed that fearful facial expressions were relatively infrequent in episodic future thinking (El Haj et al., 2018). Another study showed that imagining an upcoming speech elicited a greater experience of being afraid, but not of being scared, than remembering the same event (See Footnote 1; Chiupka et al., 2012). Both the experience of being afraid and scared can be considered to reflect the emotion fear. Importantly, this social situation might have been specifically distressing (see Table 4 for an overview of future thinking-interventions). Participants were asked to imagine holding a speech about why someone should be their friend. Thus, even in a situation where participants may have been likely to experience fear, the results are ambivalent regarding the effects of episodic future thinking on this emotion.

Compassion and Distress. *Compassion* can be considered as related to gratitude. Gratitude occurs as a response to altruism from someone else; compassion is experienced by someone offering help, directed towards aiding another person in need (Lazarus, 2001). *Distress* is related to fear, panic, and anxiety and can additionally occur as a response to another's situation (Roseman, 2001). These emotions can both be considered other-related emotions and were mostly assessed in the same studies.

Six within-subjects experiments assessed the effects of single-session episodic future thinking about helping people in need on both compassion and distress (Gaesser, Dodds, et al., 2017; Gaesser & Schacter, 2014; Sawczak et al., 2019). In five of these, episodic future thinking increased compassion (See Footnote 1; Table 4). Crucially, this was significant compared to most, but not all, active control conditions. However, episodic future thinking did not increase compassion compared to episodic memory. In the sixth experiment, there was no effect on compassion (See Footnote 1; Sawczak et al., 2019). This study included both epilepsy patients and healthy controls (See Table 3). For the healthy controls, there was a significant effect of future thinking on compassion. This suggests that the lack of an effect for the whole sample may have been driven by the absence of an effect in the epilepsy group (Table 4). Based on the available evidence, episodic future thinking seems to consistently increase compassion.

For distress, there was only an effect in one of the six aforementioned experiments (See Footnote 1; Gaesser, Dodds, et al., 2017). Compared to the supporting evidence for compassion, this suggests that the effect of future thinking on distress is considerably less consistent. One experiment assessed only distress, and not compassion (Table 4). This experiment showed that imagining an upcoming speech elicited a greater experience of distress than remembering the same social event (See Footnote 1; Chiupka et al., 2012). Despite this, most studies on distress suggest that it is relatively infrequently impacted by future thinking.

All six experiments on compassion and distress included measures of phenomenology. Episodic future thinking generally increased detail, clarity, and coherence of thoughts,

and participants reported a greater experience of pre-living events when they engaged in episodic future thinking about them (See Footnote 1; Table 5). Two of the experiments also included observer measures of *internal details*, specific to the event, and *external details*, such as semantic knowledge. The results showed that participants reported a greater number of internal details when engaging in episodic future thinking (Sawczak et al., 2019). Thus, in a similar manner to the studies on enjoyment, there is quite clear evidence that the quality of the future thoughts was episodic. This suggests that effects on emotions can be attributed to episodic future thinking. Interestingly, while there was a phenomenological difference in the thoughts reported while engaging in episodic future thinking and episodic memory (Table 5), participants did not experience greater compassion when engaging in episodic future thinking than when engaging in episodic memory (Table 4). This suggests that phenomenological changes may be necessary, but not sufficient, for evoking emotional responses to imagined scenarios.

Sadness. *Sadness* is a response to a loss of an object or a person to which one has an attachment (Ekman & Cordaro, 2011; Lazarus, 2001; Levenson, 2011). One study showed that sad facial expressions were relatively infrequent when participants were asked to engage in episodic future thinking (El Haj et al., 2018). Episodic future thinking about an annoying noise increased sadness (See Footnote 1), whereas episodic future thinking about emotionally ambiguous events did not (J. S. Lee et al., 2015; Van Boven & Ashworth, 2007). Finally, engaging in episodic future thinking-practice reduced daily reported sadness compared to simply describing future events (Hallford, Sharma, et al., 2020). Thus, results suggest that episodic future thinking can occasionally influence sadness. Results on phenomenological measures showed that episodic future thinking increased self-reported detail/vividness and mental imagery (Table 5). Despite these consistent effects for phenomenology, an effect for sadness was only found in some of the studies. This suggests that while phenomenological changes may be necessary for episodic future thinking to influence sadness, they may not always be sufficient for such an effect to occur.

Anger. *Anger* is triggered by the threat of psychological harm, physical harm, or interference with the pursuit of an important goal (Ekman & Cordaro, 2011; Levenson, 2011). One study showed that angry facial expressions were relatively infrequent when participants were asked to engage in episodic future thinking (El Haj et al., 2018). Another study showed that participants' anger did not differ depending on whether they imagined, anticipated, or remembered an annoying noise (See Footnote 1; Van Boven & Ashworth, 2007). This second study assessed degree of mental imagery, showing that participants were equally engaged in mental imagery in both the episodic future thinking-condition and the semantic future thinking-condition, and more so than in the memory condition (Table 5). Thus, despite both conditions evoking a greater degree of mental imagery, they did not evoke a greater degree of anger. This lends additional support to the idea that phenomenological changes may be necessary, but not sufficient, for emotional effects of episodic future thinking to occur.

Surprise and Disgust. *Surprise* is a response to an unexpected event caused by others that is perceived as pleasant (Ekman & Cordaro, 2011; Lerner et al., 2015). *Disgust* is closely connected to sensory experiences, evoked by sensing something that is repulsive or indigestible (Ekman & Cordaro, 2011; Lazarus, 2001). Only one study assessed surprise and disgust (El Haj et al., 2018). Surprise was one of the most frequent facial expressions when engaging in episodic future thinking, but the frequency was not higher than when remembering an episodic memory (Table 4). Disgusted facial expressions were relatively infrequent. Thus, the only available evidence for surprise and disgust suggests that surprise is affected by future thinking, and is frequently expressed, whereas the same is not the case for disgust. As for the other emotions assessed in this study on facial expressions, positive emotions seem to be more frequent than negative emotions, reflecting a positivity bias in future thinking (Schubert et al., 2020).

Interest and Guilt. *Interest* is associated with exploration and is specifically sensitive to signals associated with potential rewards (Levenson, 2011; Panksepp & Watt, 2011). *Guilt* is associated with a regretted transgression and a desire to address oneself for the behavior (Ekman & Cordaro, 2011; Lazarus, 2001; Roseman, 2001). Only one study assessed both interest and guilt, showing that imagining holding an upcoming speech increased neither (See Footnote 1; Chiupka et al., 2012). Participants in the future thinking-condition endorsed more frequent mental images but reported these to be less influential than participants in the memory condition (Table 5). Seeing as the same study showed an effect on distress, but not interest and guilt, this supports some emotional specificity for the effects of episodic future thinking. In other words, specific situations in the future may evoke some, but not all, seemingly relevant discrete emotions.

Risk of Bias Assessment

Risk of bias-plots were created using the Risk-of-bias VI-Sualization (robvis) tool and are displayed in Figures 2 and 3 (McGuinness & Higgins, 2021). The figures report risk of bias-domains in the order used in the assessment instruments. Results for the RoB-2 tool and the ROBINS-I tool are described in order of severity in the text, with domains with low risk of bias first, and domains with high risk of bias last. Risk of bias assessments for future thinking and emotion measurement are only described in the text. Disagreements between the reviewers occurred 3 times in the coding of general risk of bias, and the interrater reliability was high (weighted Cohen's kappa of 0.94). There were no disagreements for risk of bias connected to the quality of the future thinking task and the measures of discrete emotions, resulting in a weighted Cohen's kappa of 1.00.

Regarding missing outcome data, confounding, and classification of interventions, most studies were judged to have a low risk of bias, suggesting negligible influence on the results from these domains. Concerning deviations from intended interventions, most studies were judged to either have a moderate or low risk of bias, suggesting at most that slight procedural deviations may have influenced the results. All within-subjects studies were judged to have a low

Study	Risk of bias domains					Overall
	D1	D2	D3	D4	D5	
Chen et al. (2020)	-	-	+	X	-	X
Chiupka et al. (2012)	+	-	X	X	-	X
Hallford, Yeow et al. (2020)	+	X	X	+	-	X
Lee et al. (2015)	+	-	+	+	-	-
Quoidbach et al. (2009)	-	X	+	X	-	X
Van Boven & Ashworth (2007)	-	-	+	X	-	X

Domains:
D1: Bias arising from the randomization process.
D2: Bias due to deviations from intended intervention.
D3: Bias due to missing outcome data.
D4: Bias in measurement of the outcome.
D5: Bias in selection of the reported result.

Judgement
X High
- Some concerns
+ Low

Figure 2. Risk of Bias-Visualization for the Between-Subjects Experiments.

risk of bias in this domain. For the randomization process, selection of the reported results, and selection of participants, at least half of the studies were judged to have a moderate risk of bias, suggesting that potentially inadequate randomizations and selection of participants into analyses could have affected the results. It also suggests the possibility of unreported results. Most studies were judged to have a high risk of bias in measurement of the outcome, employing self-report measures of emotions without adequate concealment. As seen from the overall risk of bias assessment in [Figure 2](#) and [Figure 3](#), the main reason for why studies were judged as high in aggregated risk of bias was the potential bias associated with the measurement of the outcome variable. This is important to consider in evaluating the results.

Regarding risk of bias in the future thinking-task procedure and the measures of discrete emotions, judgements suggest stronger risk of bias for the emotion measures than the experimental manipulations. The scoring of these domains is reported in the section on risk of bias in the Method section. For future thinking, no studies scored 0, four studies scored 1, and seven studies scored 2. Most articles described both the experimental manipulation and its duration in detail. For discrete emotions, eight studies scored 0, one study scored 1, and one study scored 2. Generally, each emotion was measured using one item. For the last study, the researchers did not use self-report to assess emotions (El Haj et al., 2018). Because the assessment tool was designed for self-report measures, the quality of the measure was not evaluated. It is worth mentioning that this study was the only within-subjects study with low risk of bias in measurement of the outcome. These results correspond with results from the general risk of bias assessment, suggesting particular risk of bias for the emotion measures.

To summarize, 12 experiments tested the effects of episodic future thinking on discrete emotions. For anger, disgust, interest, guilt, surprise, and pride, there was no effect of future thinking. For happiness, anxiety, fear, distress, and sadness, the effects of future thinking were inconsistent. For enjoyment and compassion, the results overwhelmingly support an effect of episodic future thinking: Imagining a specific, personal future increases the experience of enjoyment and compassion in the present. However, all studies are at moderate risk of bias for one or more domains. Crucially, the risk of bias in measurement of the outcome is high for nearly every study, meaning that the quality of the measures of the main outcome can be called into question. The overall risk of bias suggests caution in interpreting the results.

Discussion

Emotional, Episodic Future Thoughts

How we imagine our personal futures is crucial for our decisions. By contrasting our present with our potential future, we are afforded flexibility in choosing between short-term and long-term rewards. Crucially, this process is tinted by affect; our feelings in the present about our imagined futures give us information about the desirability of those imagined futures. These feelings serve as tools to make future-oriented choices. This systematic literature review was conducted with the aim of further exploring the effects of episodic future thinking on affect, with an emphasis on assessing the available evidence for an effect on discrete emotions.

This review has a clear theoretical grounding in a subset of discrete emotions identified in the research literature. Additionally, it operated with transparent criteria for de-

Study	Risk of bias domains							Overall
	D1	D2	D3	D4	D5	D6	D7	
El Haj et al. (2017)	+	+	+	+	+	+	-	-
Gaesser, Dodds et al. (2017)	+	X	+	+	+	X	-	X
Gaesser & Schacter (2014)	+	-	+	+	+	X	-	X
Hallford, Farrell et al. (2020)	+	-	+	+	+	X	-	X
Hallford, Sharma et al. (2020)	+	-	+	+	+	X	-	X
Sawczak et al. (2019)	+	X	+	+	+	X	-	X

Domains:
D1: Bias due to confounding.
D2: Bias due to selection of participants.
D3: Bias in classification of interventions.
D4: Bias due to deviations from intended interventions.
D5: Bias due to missing data.
D6: Bias in measurement of outcomes.
D7: Bias in selection of the reported result.

Judgement
X Serious
- Moderate
+ Low

Figure 3. Risk of Bias-Visualization for the Within-Subjects Experiments.

ciding whether an intervention counts as an instance of episodic future thinking as well as for whether a measure counts as a measure of a discrete emotion. It also established clear theoretical grounds for why episodic future thinking may impact discrete emotions, with explicit links to both cognitive appraisal theory and the effects of discrete emotions on decision making.

Other reviews of research on episodic future thinking have assessed the effects of future thinking on delay discounting and decision making, how psychopathology impacts future thinking, and how future thinking impacts affect (Hallford et al., 2018; Rösch et al., 2021; Rung & Madden, 2018; Schubert et al., 2020; Ye et al., 2021). The current systematic review complements these reviews by summarizing research on the effects of future thinking on discrete emotions. This is particularly important in understanding how thinking about the future affects decision making, as discrete emotions are known to have differential effects on decisions (Lerner et al., 2015). Systematizing the current research on the subject further consolidates the literature on episodic future thinking.

Which Emotions Have Been Studied?

Our literature review shows that studies of episodic future thinking have assessed the following 13 emotions: Happiness, enjoyment, pride, anxiety, fear, compassion, distress, sadness, anger, surprise, interest, disgust, and guilt. The main lesson, however, seems to be the lack of research on discrete emotions. Of the subset of discrete emotions identified in our inclusion criteria, there were no studies assessing joy, contentment, fright, rage, frustration, contempt, dislike, seeking, play, panic, grief, love, lust, care, shame, envy, regret, jealousy, relief, hope, gratitude, aes-

thetic experience, boredom, or challenge. Compared to the 13 emotions that were found in experiments on episodic future thinking, nearly twice as many emotions seem not to have been assessed in published empirical studies.

The lack of research on discrete emotions is also evident in how emotions were studied in the existing studies. For most studies, the main goal was not to assess the effects of episodic future thinking on discrete emotions. For example, in the experiments on compassion and distress, researchers focused on the effect of future thinking on willingness to help (Gaesser, Dodds, et al., 2017; Gaesser & Schacter, 2014). Another example is the study assessing the effects of episodic future thinking with *cognitive bias modification*, a method for changing the interpretation of emotionally ambiguous situations (J. S. Lee et al., 2015). This study emphasized the effects on interpretative bias, with the emotions sadness and happiness included as secondary outcomes. There were some exceptions where emotions were more strongly emphasized. One example is the study assessing the effects of prolonged episodic future thinking on anxiety and happiness, where that was the main stated purpose of the study (Quoidbach et al., 2009). From the number of emotions that have not been studied, and the main research questions explored in most included studies, it is evident that there is little focus on the effects of episodic future thinking on discrete emotions in the research literature.

Does Episodic Future Thinking Evoke Discrete Emotions?

While the included studies may have collectively assessed 13 discrete emotions, a consistent effect of future thinking was found only for a few of these. For pride, anger,

interest, disgust, and guilt, no effect of episodic future thinking could be found (Chiupka et al., 2012; El Haj et al., 2018; Van Boven & Ashworth, 2007). For happiness, only one study showed an effect on state happiness, and one study showed an increase in trait happiness after engaging in prolonged episodic future thinking (Quoidbach et al., 2009). For fear, distress, surprise, and sadness only some studies showed an increase in state emotion after episodic future thinking (Chiupka et al., 2012; El Haj et al., 2018; Gaesser, Dodds, et al., 2017; Gaesser & Schacter, 2014; Hallford, Sharma, et al., 2020; J. S. Lee et al., 2015; Van Boven & Ashworth, 2007). For anxiety, there was partial support for an increase in trait anxiety after engaging in episodic future thinking (Chen et al., 2020; Quoidbach et al., 2009).

The two emotions with the clearest effects of episodic future thinking seem to be compassion and enjoyment. In most included studies, episodic future thinking increased compassion, suggesting that imagining instances of helping others may increase the compassion we feel towards them in the present moment (Gaesser, Dodds, et al., 2017; Gaesser & Schacter, 2014; Sawczak et al., 2019). For enjoyment, people seem to generally report experiencing enjoyment in the present from imagining positive events that may occur in the future (Hallford, Farrell, et al., 2020; Hallford, Sharma, et al., 2020; Hallford, Yeow, et al., 2020). These effects can be considered particularly consistent because there were several experiments assessing the emotions, and these overwhelmingly support effects of episodic future thinking.

Ironically, given the focus of this review, the effects on compassion and enjoyment may be explained by affective valence. Both compassion and enjoyment can be considered positive emotions, even if there is some disagreement about the classification of compassion (Smith et al., 2014). This may seem to justify the focus on affective valence in research on episodic future thinking. There may, however, be better, alternative explanations. Firstly, despite compassion and enjoyment being positive, there does not seem to be any strong connection between the affective valence of the remaining emotions and whether they were impacted by future thinking. Pride, interest, and happiness are also positive emotions, but there was no effect on either pride or interest, and inconsistent effects on happiness. Similarly, while there was no effect on anger and guilt, some studies showed effects on fear, distress, sadness, and anxiety. If anything, these results strengthen a central theoretical argument in this review: To fully understand the effects of episodic future thinking on decision making, we must go beyond the dimension of affective valence.

This is not to say that affective valence is unimportant in interpreting the results. The studies on enjoyment and compassion both employed experimental instructions directing participants' attention to the positive aspects of their imagined thoughts. For the enjoyment studies, participants were asked to imagine positive events or events they were looking forward to. For the compassion studies, participants were asked to imagine helping someone in need. Thus, it may seem that consistent effects of future thinking on emotions may occur more frequently with positively valenced future events.

One way to theoretically examine the role of affective valence more closely would be to examine the functions of positive and negative emotions. The *broaden-and-build theory* of positive emotions suggests that while negative emotions are linked to narrower, behavioral tendencies, positive emotions *broaden* perceived action opportunities and cognition (Fredrickson, 2004). Thus, their function is mainly connected to *building* resources which are used in future situations. Perhaps because enjoyment and compassion are more strongly related to future resources, rather than immediate solutions to situations, they are more influenced by episodic future thinking. This functional perspective would explain why there are inconsistent or no effects for other, more immediate emotions, such as fear, distress, and anger. However, this would still not explain why there was no consistent effect on happiness, or why there seems to be support for some effects on negative emotions. This suggests that other explanations may be necessary and relevant to understand the emotional effects of future thinking. Gaining a deeper understanding of why episodic future thinking seems to affect some, but not all, emotions also requires considering the phenomenological features of the future thoughts.

What Characterizes the Episodic Future Thoughts?

To understand episodic future thoughts, it is essential to rely on self-reported or observer-rated aspects of phenomenological quality (Miloyan & McFarlane, 2019). If episodic future thoughts are specific thoughts about a personal future, this implies several associated phenomenological experiences. These include an experience of "pre-living" that which might occur in the future (Miloyan & McFarlane, 2019; Tulving, 1985). Effects on phenomenological measures are not only vital for ensuring efficacy of experimental manipulations; they are also important for gaining insight into relevant mechanisms.

There seems, however, to be little correspondence between effects on discrete emotions and the phenomenological quality of future thoughts. There are several studies in which episodic future thinking-manipulations affected the phenomenological quality of thoughts but had no effect on discrete emotions. However, for compassion and enjoyment, the two emotions with strongest empirical support, the results on phenomenological measures supported the efficacy of the episodic future thinking-manipulations. This suggests that phenomenological changes may be necessary, but not sufficient, to evoke discrete emotions. In other words, some emotional experiences may lend themselves more to influence from episodic future thoughts. For other emotions, phenomenological changes associated with engaging in episodic future thinking may not be sufficient to evoke them. However, even if this is the case, there may be more mechanisms at play that explain why there is an effect on enjoyment and compassion. These may also explain, for example, why there is an inconsistent effect on happiness, or why there is no effect on distress. Crucially, this implies that there is an explanatory gap yet to be filled with additional mechanisms after examining affective valence and phenomenological quality.

Explaining Emotional Episodic Future Thoughts

One mechanism that could fill this explanatory gap is cognitive evaluations (Lazarus, 2001; Roseman, 2001; Smith & Ellsworth, 1985). Even if none of the studies assessed cognitive evaluations, they may be relevant in explaining why episodic future thinking only seems to evoke some discrete emotions. For example, one explanation of why episodic future thoughts may evoke compassion could be that imagining others' plight gives us necessary information to assume their perspective (Smith et al., 2014). This may be a prerequisite for activating cognitive appraisals associated with compassion, such as perceiving that the person suffering is deserving of help (Atkins & Parker, 2012).

Appraisal dimensions may also be relevant in distinguishing between effects on compassion and distress. In the studies on these emotions, participants were asked to imagine helping people in need. Examples include people noticing a rat problem or being locked out of their home (Gaesser, Dodds, et al., 2017). While these situations may allow for perspective taking, and thus evoke compassion, they could lack a crucial component for distress: a perception of threat. There is some evidence suggesting that appraising a situation as threatening is linked to the experience of distress (Wang et al., 2012). Appraisal of threat can be linked to the perceived obstacle-dimension of some appraisal theories (Smith & Ellsworth, 1985). Thus, imagining instances of helping others without a perception of a threat or obstacle may evoke compassion, but not distress. Seemingly, appraisal theory may help explain why episodic future thinking about some scenarios may evoke some, but not all, discrete emotions.

Another emotion, enjoyment, may reflect excitement triggered by anticipation of positive benefits. Some research suggests that enjoyment is characterized by a high degree of *intrinsic pleasantness*, that is, that the event is generally considered pleasant (Scherer, 1993). Pleasantness is featured as an important cognitive appraisal in several appraisal theories (Roseman, 2001; Smith & Ellsworth, 1985). This would explain why there was a consistent effect for enjoyment, as participants were asked to imagine positive events or events they were looking forward to. Cognitive appraisals may clearly give a better overview of the circumstances in which we can expect episodic future thinking to influence discrete emotions. Future studies could also help determine their role as process mechanisms.

In addition to cognitive appraisals, examining the action functions of different emotions may also be relevant for understanding which emotions are impacted by episodic future thinking. As emphasized in the earlier discussion on affective valence, negative emotions may be more connected to immediate action than positive emotions. However, different emotions may also be differentially related to different actions, irrespective of their affective valence. This may be particularly relevant for explaining how episodic future thinking impacts compassion, but not distress, because they are both connected to the plight of others (Gaesser, Dodds, et al., 2017). Descriptions of compassion emphasize that its function is to aid others in need (Lazarus, 2001). Thus, thoughts about being in a situation in the future where someone else needs help may readily

evoke compassion, because the thought content is related to the behavioral function of the emotion. Distress, on the other hand, is associated with an experience of having reduced future influence over outcomes (Roseman, 2001). It is therefore also associated with removing oneself from a situation. Thus, one reason for why distress may be less affected by future thinking than compassion is that the thought content evoked by the imagined situation is less relevant for the function of distress than compassion. This may explain why episodic future thinking about someone in need evokes compassion, but not distress. Seemingly, both cognitive appraisals and the behavioral functions of the emotions are important in explaining effects of future thinking on discrete emotions.

Limitations

Measures of Discrete Emotions

Some limitations pertain to the quality of the available evidence synthesized in the review. As emphasized in the results section, researchers frequently used self-report measures. If participants gained some awareness about their experimental condition during the experiment, then the assessment of the outcome may have been influenced by this awareness, thus introducing bias. A clear exception is the study on emotional facial expressions, using a measurement method not equally susceptible to the same kind of bias (El Haj et al., 2018). Thus, while this synthesis suggests that some emotions, such as enjoyment and compassion, may be more strongly influenced by episodic future thinking, the general quality of the available evidence remains low.

Emotions are generally considered to consist of subjective experiences, cognitive evaluations, physiological activation, and behavioral responses (Mauss & Robinson, 2009). Thus, self-report measures target the important, subjective experience of emotions. Other measures do not necessarily capture more important aspects of emotions. However, these measures, such as measures of physiological activation, are less susceptible to bias. When a considerable number of studies rely solely on self-report measures, this introduces greater potential bias into the research literature. Thus, to be more confident of the preliminary conclusions in this systematic review, future studies must ensure the use of different kinds of emotion measures. This is crucial not only to reduce risk of bias, but also to assess convergence in results across different aspects of emotions (Mauss & Robinson, 2009).

Improving how emotions are measured in studies on episodic future thinking can be accomplished by following promising, recent methodological avenues, particularly toward an increased use of physiological measures. One example is the study included in this review in which emotions were measured using facial expressions (El Haj et al., 2018). In a more recent study, researchers used cues for happiness and sadness to explore whether emotionally specific episodic future thinking corresponds to emotionally specific expressions (El Haj et al., 2021). Results showed an increase in happy facial expressions after engaging in "happy" episodic future thinking and sad facial expressions

after engaging in “sad” episodic future thinking. The study was not included in the review because there was no comparison condition, only three future thinking-conditions. However, it illustrates one approach to measuring discrete emotions which is methodologically superior to self-report in some respects. Although one must first establish the correspondence between these physiological measures and experienced state emotions, the use of such measures would improve the general methodological quality of the field.

An additional methodological limitation is the consistent use of unvalidated single-item measures. It is important to emphasize that in many of the original studies, the authors used multi-item measures of affective experiences, such as positive affect, negative affect, or emotional concern. Thus, to some extent, the liability of single-item measures is enhanced by the method employed in this review. Extracting results from studies which did not originally intend to test effects on discrete emotions also means using single items from larger scales. However, even in cases where discrete emotions were included as primary or secondary outcomes, the researchers often employed single-item measures. Examples include some of the studies on sadness, happiness, and enjoyment (Hallford, Sharma, et al., 2020; Hallford, Farrell, et al., 2020; Hallford, Yeow, et al., 2020; J. S. Lee et al., 2015). As noted by other authors (e.g., Weidman et al., 2017), the widespread use of unvalidated, one-item, self-report measures of discrete emotions threatens the accumulation of knowledge about emotions. It also makes it difficult to compare results across studies purportedly examining the same emotions. The increased use of validated, multi-item measures of emotions would be an additional methodological improvement in the research field, complementing the use of other emotion measures than those relying on self-report.

Imagined Scenarios and Discrete Emotions

The available literature is also limited by its focus on a relatively narrow range of imagined future scenarios. Therefore, one reason why there seems to be little evidence for any effect of future thinking on certain emotions, such as pride or disgust, may simply be the lack of systematic examination into possible, future, pride- or disgust-relevant events. Thus, based on the available literature, it seems difficult to confidently conclude that episodic future thinking does not influence these emotions. The narrow range of imagined scenarios may also be part of the reason why episodic future thinking seems to impact compassion, but not distress. For example, prior research has shown that imagining oneself in need activates both empathy and distress, but that imagining another person in need only activates empathy (Batson et al., 1997). In the studies on compassion and distress, only situations with another person in need were imagined.

However, because distress is commonly recognized as something that may also occur as a response to another’s situation (Roseman, 2001), the narrow range of imagined scenarios is not a sufficient explanation of a selective effect of episodic future thinking on discrete emotions. Other explanations offered in this review, such as affective valence, phenomenological experience and cognitive appraisals,

seem particularly relevant. Nevertheless, it is still of critical importance that future research systematically examines the *content* of imagined scenarios and the *events* which people are asked to imagine. Both of these factors could be influential in explaining how future thoughts may evoke emotional responses.

Future Research

From the available literature, we can surmise that there is a lot we do not yet know about the effects of episodic future thinking on discrete emotions. Many emotions have been infrequently studied, and many more seem not to have been examined in published empirical studies. However, based on the available evidence that we do have, it is possible to identify many promising paths for future research. These include new studies to examine emotional effects of future thinking and behavioral interventions based on increasing both compassion and enjoyment through episodic future thinking.

A fruitful avenue for future research would be to systematically investigate the effects of episodic future thinking on discrete emotions, relying on literature on cognitive appraisals (i.e., Lazarus, 2001; Lerner et al., 2015; Roseman, 2001; Smith & Ellsworth, 1985). One starting point would be using cognitive appraisal literature to design experimental manipulations targeting distinct forms of episodic future thinking. For example, researchers could focus on degree of certainty and perceived responsibility, two appraisal dimensions linked to fear and anger, to design episodic future thinking-instructions to evoke distinct emotions. These might then, correspondingly, have differing consequences for decision making (Lerner et al., 2015). Another starting point would be to systematically vary the content in the scenarios that participants are asked to imagine. For example, researchers could ask participants to imagine a situation in the future that would make them proud, and then measure anticipatory pride and associated cognitive appraisals.

Prioritizing systematic research on discrete emotions may be helpful in further exploring the effects of future thinking on decision making. For example, it is well-established that episodic future thoughts reduce delay discounting (Rung & Madden, 2018; Scholten et al., 2019). However, there is less research on probability discounting. One study showed an effect on delay discounting but not on probability discounting (Mok et al., 2020). With an emphasis on discrete emotions, researchers could explore whether episodic future thoughts that evoke distinct emotions could differentially affect probability discounting. For example, episodic future thinking triggering anger and fear should differentially impact probability discounting, based on research showing that fear increases, and anger reduces, risk perception (i.e., Lerner & Keltner, 2001).

Emphasizing discrete emotions may also help inform behavioral interventions, such as interventions to increase pro-environmental behavior. For example, one study showed that increasing compassion also increases intentions to behave in a pro-environmental manner in the future (Pfattheicher et al., 2016). Other studies have tested the effects of episodic future thinking on perceived risk,

pro-environmental intentions, and pro-environmental behavior, finding mixed support for effects (Bø & Wolff, 2019, 2020; P. S. Lee et al., 2020). Perhaps interventions to promote pro-environmental behavior may be developed more efficiently with an increased attention to the emotional consequences of episodic future thinking. This kind of research may give us a better understanding of when episodic future thinking may be expected to influence different kinds of behavior.

Gaining a better understanding of the effects of future thinking on discrete emotions may also help guide clinical interventions (Seligman et al., 2013). Studies on future thinking in psychopathology have shown impairments in future thinking-specificity in depression, schizophrenia, and bipolar disorder (Hallford et al., 2018). Crucially, all these disorders are also distinguished by different changes in affect; depression by depressed mood, schizophrenia by negative symptoms such as diminished emotional expression, and bipolar disorder by different mood episodes (American Psychiatric Association, 2013). Understanding how impairments in future thinking affect different discrete emotions, and how these affect judgments and decisions which are impaired by psychopathology, may help inform clinical interventions.

Conclusion

We often engage in episodic future thinking, imagining how our own future may turn out. This capacity is vital for understanding how we make our decisions. The anticipatory affect evoked by thinking about the future gives us crucial information used in these decisions. This review clearly shows that this effect on affect is not limited to affective valence. Some discrete emotions, such as compassion and enjoyment, seem to be readily evoked by thinking about a personal future. Because these emotions affect our choices differently, this helps establish a new dimension to emphasize in future research on episodic future thinking.

This systematic review has identified several gaps that future research may attempt to fill. Although there are some studies on some discrete emotions, there are many more for which the effects of episodic future thinking are hitherto unexplored. There are many mechanisms that have not yet been tested, particularly the cognitive appraisals that may determine the experience of different emotions. Additionally, there is room for methodological improvement. This is paramount if the goal is to establish accu-

lated knowledge about the effects of future thinking on emotional outcomes.

Crucially, the review also includes a framework with suggestions for how to address the gaps. Grounding research on episodic future thinking in cognitive appraisal theory helps identify relevant mechanisms to assess in future research. Additionally, emphasizing the distinct functions of different emotions aids the understanding of which behavioral outcomes we may expect different future-induced emotions to influence. Connecting the research on episodic future thinking and emotional effects on decision making may help lay the foundation for important, future studies. While a single study or a single review is rarely a cornerstone, it may at least be a steppingstone into the future.

Contributions

SB, EN and KW contributed to conception and design, interpretation of data, drafting and revising the article and approved the submitted version for publication. SB contributed to literature search, screening, acquisition of data, and analysis.

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Competing Interests

No competing interests exist.

Data Accessibility Statement

All the data connected to this project can be found in the appendices.

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Appendices

Appendices have been uploaded in the Open Science Framework. This decision was made by all co-authors. The appendices can be accessed through the following view-only link:

https://osf.io/fg2dp/?view_only=4c98592e55b94727a133883c69560b83

[Appendix A. Deviations From the Pre-Registration.](#)

[Appendix B. Pre-Registered Data Extraction Sheet.](#)

[Appendix C. Revised Data Extraction Sheet.](#)

[Appendix D. Near-Misses.](#)

[Appendix E. Additional Outcomes.](#)

[Appendix F. Emotion Descriptions.](#)

Supplementary Materials

Peer Review History

Download: https://collabra.scholasticahq.com/article/35232-discrete-emotions-caused-by-episodic-future-thinking-a-systematic-review-with-narrative-synthesis/attachment/88573.docx?auth_token=X9e0eJMbIhcPFc1XzNQI
