Consciousness and Cognition 22 (2013) 898–912

Contents lists available at SciVerse ScienceDirect

Consciousness and Cognition

journal homepage: www.elsevier.com/locate/concog

Implicit measurement of positive and negative future thinking as a predictor of depressive symptoms and hopelessness

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ARTICLE INFO

Article history:
Received 1 February 2013
Available online 28 June 2013

Keywords:
Implicit measures
IRAP
Future thinking
Future Thinking Task

ABSTRACT

Research using explicit measures has linked decreased positive future thinking, but not increased negative future thinking, with clinical depression. However, individuals may be unable or unwilling to express thoughts about the future, and can be unaware of implicit beliefs that can influence their behavior. Implicit measures of cognition may shed light on the role of future thinking in depression. To our knowledge, the current study presents the first implicit measure of positive and negative future thinking. A sample of 71 volunteers (38 healthy; 33 with sub-clinical depression) completed both implicit and explicit measures of positive and negative future thinking. The findings indicate differences in the evaluation of both positive and negative future events between the two groups. However, group differences were more pronounced on the implicit measure. These findings point to the potential utility of an implicit measure of future thinking in mental health research and clinical practice.

1. Introduction

Thinking about the future is a core and distinguishing feature of human cognition. Previous research links altered future thinking with conditions such as depression and anxiety (MacLeod, Pankhania, Lee, & Mitchell, 1997; MacLeod, Rose, & Williams, 1993). One well-established method of future thinking assessment is the Future Thinking Task (FTT; MacLeod, Pankhania, Lee, & Mitchell, 1997; MacLeod et al., 1993). According to studies employing the FTT, depressed or anxious individuals differ from their healthy counterparts in their ability to generate positive and negative future expectancies. Specifically, depressed individuals demonstrate lower positive, but similar negative, expectancies compared with healthy individuals (i.e. MacLeod, Tata, Kentish & Jacobsen, 1997). Meanwhile, anxious individuals show higher negative, but not lower positive, future expectancies. There is also a burgeoning literature on links between future thinking and suicidality (cf. Szpunar, 2010). This work is exciting given the potential clinical utility of an assessment that allows early detection of suicidal ideation.

Individuals with comorbid anxiety and depression demonstrate higher negative expectancies and lower positive expectancies (MacLeod & Byrne, 1996). Until recently, intervention and assessment of future expectancies in participants with

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http://dx.doi.org/10.1016/j.concog.2013.06.001

comorbid anxiety and depression have aimed to either increase positive future thinking based on depression research, or alleviate negative future thinking based on anxiety disorder research. However, neither of these approaches specifically target future expectancies associated with comorbid anxiety and depressive disorders (Brown, Schulberg, Madonia, et al., 1996; Kessler, Stang, Wittchen, et al., 1998; Sherbourne, Wells, Meredith, et al., 1996; Coryell et al., 1998). Given the fact that those diagnosed with comorbid anxiety and depression have a greater risk of suicide-related behaviors and completed suicide (Angst, Angst, & Stassen, 1999; Lepine, Chignon, & Teherani, 1993; Roy-Byrne, Stang, Wittchen, et al., 2000; Sareen et al., 2005; TenHave et al., 2009) than those with either depression or anxiety alone it is important to have an understanding of future expectancies in comordid patients. Thus, gaining a better understanding of distinctive future thinking patterns characterized by comorbid depression and anxiety is acutely important.

The Future Thinking Task (FTT) was designed to specifically target valence differences in individuals' cognitions about the future (MacLeod et al., 1993, 1997). Initial findings with the FTT indicated that positive and negative cognitions concerning the future represent two separate aspects of experience (e.g. MacLeod, Byrne, & Valentine, 1996), and other work indicates that generalized positive and negative future expectancies are differentially associated with biological outcomes (e.g., O'Donovan et al., 2009; Sharot, Riccardi, Raio, & Phelps, 2007). Whereas reduced generation of positive future events has been linked with depression and suicidal ideation, increased generation of negative future events has been linked with anxiety (e.g. Conaghan & Davidson, 2002; Hunter & O'Connor, 2003; MacLeod et al., 1997). However, studies examining estimates of negative future event likelihood have been mixed in clinical and non-clinical samples have been mixed. In some studies, individuals with dysphoric mood, rated negative future events as more likely compared to controls (depressed patients, Butler & Mathews, 1983; MacLeod et al., 1997; dysphoric students, Andersen, Spielman, & Bargh, 1992; Pietromonaco & Markus, 1985). However, other studies did report lower generation of positive future events in depression (depressed patients, MacLeod & Cropley, 1995; Pyszczynski & Greenberg, 1987; dysphoric students, Andersen, Spielman, & Bargh, 1992).

Administering the FTT involves explicitly asking participants to generate a number of potential events for the future (i.e., positive events that the individual is 'looking forward to' and negative events that the individual is 'not looking forward to') over different time periods in the future (i.e. the next week, the following year and the subsequent five to ten years). The explicit nature of the task renders it easy to administer, however, the direct questioning style of the task leaves it prone to weaknesses inherent to explicit measures (Gannon, 2006; Roche, Ruiz, O'Riordan & Hand, 2005). For example, it has been found that self-report measures are affected by factors such as the immediate mood of the respondent and their physical surroundings (Schwarz & Clore, 1983; Schwarz & Strack, 1991)(Hepburn, Barnhofer, & Williams, 2006). Despite efforts to increase the validity of explicit self-report measures, such as controlling for these tendencies by using social desirability scales (Paulhus, 1988), only limited progress has been made in this direction (Holden, Book, Edwards, Wasylkiw, & Starzyk, 2003; Roefs et al., 2011). This is of particular concern in clinical research because the thoughts and beliefs people tend to conceal on such measures may reflect the cognitions they attempt to conceal from themselves too (Greenwald et al., 2002). In the long term, any level of suppression (experiential avoidance) may lead to the adoption of unhealthy coping strategies that may accumulate and reinforce negative thoughts about the self and the future (Hayes, 1994; Hayes, Barnes-Holmes, & Roche, 2001).

Implicit measures show much promise in comparison to explicit measures (see Roef's et al., 2011 for a review). Greenwald and Banaji (1995, p. 8) define implicit attitudes as '*introspective occurrences of past experience that facilitate evaluative feelings, thoughts, or actions toward ones social world*'. Thus, implicit measures not only aim to overcome tendencies to respond in a socially desirable manner, but also target 'automatic' beliefs and responses outside of conscious control (e.g., Barnes-Holmes et al., 2006; De Houwer, 2002; Fazio, Sanbonmatsu, Powell, & Kardes, 1986; Greenwald, McGhee, & Schwartz, 1998; Nosek & Banaji, 2001; Roefs et al., 2011). One study by Egloff and Schmukle (2002) demonstrated low or no correlation between explicit and implicit anxiety measures. However, the implicit anxiety measure did predict several behavioral measures of anxiety during a stressful speech task. Roefs et al. (2011) in a review of implicit measures has noted that 'the possible independence from overt reports has made them highly attractive' (p.186) for the study of depression and a variety of other psychiatric conditions. The core postulate behind implicit measures suggests that individuals are often unaware of the implicit beliefs that can subsequently influence their behavior.

The Implicit Association Task (IAT; Greenwald et al., 1998) is one of the more commonly used implicit measures. The IAT was designed to examine non-conscious differential associations of two target concepts with an attribute across individuals (Olson & Fazio, 2001). In a typical IAT, participants are required to pair two target concepts with a particular attribute. Faster reaction times and improved accuracy are generally reported when associated concepts are assigned to the same response (e.g., young- beautiful as opposed to when associated responses are assigned to different responses (e.g., old-beautiful) (Greenwald et al., 1998). The IAT protocol is based on the simple assumption that a person's response should be faster when associating items that they would pair together such as 'young' and 'beautiful' than when associating items that they would not pair together such as 'old' and 'beautiful' (Nosek & Hansen, 2008). The IAT effect has been depicted by the latency variance between trials that pair congruent stimuli and trials that pair non-congruent stimuli. Thus, the IAT is very useful in measuring stimuli that we categorize together or apart from each other.

Despite its widespread use and applicability for examining individuals pre-experimental associations, the IAT paradigm may be limited in that it only allows the measurement of associations between categories. Specifically, such measurement of associations does not provide information about the nature or direction of the association (Barnes-Holmes et al., 2006) rendering the IAT procedure inadequate for distinguishing between positive and negative future thinking. Recent research

has extended the IAT to allow for the inclusion of relations other than pure associations (Barnes-Holmes et al., 2006). The Implicit Relations Assessment Procedure (IRAP) presents participants with specific relational terms (e.g., similar, opposite, better, worse) so that the relations between and among the chosen stimuli can be assessed. Similar to the IAT, the IRAP instructs participants to quickly and accurately relate words or phrases in ways that do, or do not, correspond to their pre-experimentally established verbal relations (Barnes-Holmes et al., 2006; Hussey & Barnes-Holmes, 2012). The IRAP requires individuals to respond to trials that are consistent or inconsistent with their history of responding (i.e., alternate directions which may be presented in form of specific relations, 'similar', 'opposite', 'before', 'after'). The strength of the relational responses is defined as the 'IRAP effect'. That is, the response time difference between consistent (congruent) and inconsistent (non-congruent) trials, or the 'ease' at which the relations are made, offers information on the individual's history of past, and likelihood of future, responding (Barnes-Holmes et al., 2006; Hussey & Barnes-Holmes, 2012). The Relational Elaboration and Coherence (REC) model offers a detailed account of this effect in terms of behavioral events that may occur either publicly or privately and has been detailed in a recent article (Barnes-Holmes et al., 2010; see also Hughes, Barnes-Holmes, & De Houwer, 2011).

The response latency data for each participant are typically transformed into D_{IRAP} scores using the D_{IRAP} -algorithm, derived from the $D_{algorithm}$ developed by Greenwald, Nosek, and Banaji (2003) for the IAT (Dawson, Barnes-Holmes, Gresswell, Hart, & Gore, 2009; see also Back, Schmukle, Egloff, & Gutenberg, 2005; Cai, Sriram, Greenwald, & McFarland, 2004; Mierke & Klauer, 2003). Thus the IRAP effects are derived for each trial-type from the raw response latencies using a technique based on the 'improved scoring algorithm'. The D measure is an established way of addressing the general finding that participants with longer average latencies tend to show larger raw effects than those who respond more quickly. O'Toole and Barnes-Holmes (2009) found that their raw IRAP effect (the response latency differences between consistent and inconsistent trials) correlated significantly with various measures of intelligence; yet when the D-transformation was performed on the data (not reported in the article) no significant correlations with intelligence were observed. Because the D algorithm largely removes the influence of extraneous factors, Nosek, Greenwald, and Banaji (2007) recommended it for making group comparisons when latencies are variable between groups. In a typical IAT design, *D* is computed for data cumulated across all trials including practice trials. In contrast, the IRAP's design allow for its D_{IRAP} effects to be calculated at the more detailed level, that is, the IRAP allows a D_{IRAP} score to be calculated for each trial-type (i.e., the four possible stimulus combinations of sample- with target-type), on each of the three pairs of consistent and inconsistent test-blocks.

The measurement of specific relations rather than merely associations between the self and future events is of particular relevance to the current work. Imagine for example, in the examination of future expectancies (i.e., expectancy relations) associatively pairing "future expectations" with positive events such as "wealth" or "happiness" and so forth, only informs the researcher about the direct pairing of expectations with these events. Specifically, information is only gained pertaining to the strength of association between the personal future and these stimuli. As such an understanding about the nature or direction of the association is lacking. However, by directly targeting the relations between stimuli, other than associations, the IRAP offers a direct examination of the relational nature of an individual's pre-existing beliefs.

The basic IRAP effect has now been replicated across a number of studies, which have shown that the IRAP compares well with the IAT as a measure of individual differences (Barnes-Holmes, Murtagh, Barnes-Holmes, & Stewart, 2010; Barnes-Holmes, Waldron, Barnes-Holmes, & Stewart, 2009), is not easily faked (McKenna, Barnes-Holmes, Barnes-Holmes, & Stewart, 2007), produces effects that clearly diverge from those obtained from explicit measures when targeting socially sensitive attitudes (Dawson et al., 2009; Power, Barnes-Holmes, Barnes-Holmes, & Stewart, 2009). The IRAP has been used to show that stronger implicit beliefs about the positive effects of cocaine use prior to treatment were associated with poorer treatment outcomes (Carpenter, Martinez, Vadhan, Barnes-Holmes, & Nunes, 2012). A recent study examined the IRAP as a measure of implicit depression relating to psychological flexibility (Hussey & Barnes-Holmes, 2012). Hussey and Barnes-Holmes (2012) found differential changes in depression IRAP scores between groups of participants with low versus mild/moderate levels of depressive symptoms who completed a sad mood induction. Specifically, a significant decrease in the positivity of emotional responses was observed for the "mild/moderate" depression but not the no depression group. A similar pattern was noted with the depression IRAP between groups with high versus lower scores on a functional measure of psychopathology (i.e., the Acceptance and Action Questionnaire; Bond et al., 2011).

The current study aimed to adapt the IRAP to construct an implicit future thinking task, more specifically, an implicit version of the FTT (MacLeod et al., 1998) with an emphasis on the expectancy component. In the study, we used the implicit future thinking measure, the Future Thinking IRAP (FT-IRAP) to measure future positive and negative expectancies across a sample of sub-clinically depressed and healthy control undergraduate students. The FT-IRAP was designed to assess relational responding consistent with future optimism. Participants will be required to respond 'True' or 'False' on trials presenting one of the two phrases 'I expect' and 'I don't expect' alternately in combination with one of six positive future expectancies ('Friendship', 'Enjoyment', 'Happiness', 'Wealth', 'Success' and 'Love'), and six negative future expectancies, ('Worry', 'Loneliness', 'Failure', 'Stress', 'Sadness' and 'Illness'). To this end the current study aimed to examine implicit future thinking using the FT-IRAP and to compare the explicit FTT and FT-IRAP. In line with previous research on the FTT, we predicted that participants who scored high on the Beck Depression Inventory (BDI-II; sub clinically-depressed participants) would show lower levels of future positive thinking on the FTT *and* respond slower on trials that pair positive future events with "expected" relative to their healthy counterparts (i.e., low scorers on the BDI).

2. Method

2.1. Participants

Eighty-four students from Swansea University volunteered to take part in the current experiment. After applying the exclusion criteria, data from thirteen participants were removed, and thus only data from seventy-one participants were used in the analyses. As such, the subsequent analysis pertains to the included 18 males and 53 females ranging in age from 18 to 34 years old ($M = 21.14$, $\sigma = 3.36$). In order to accurately capture healthy and sub clinically depressed participants, any participants with a score of 0 ($N = 10$) or above 29 ($N = 3$, $M = 31.75$) were excluded from the analysis. Participants with Beck Depression Inventory-II (BDI-II) scores from 10 to 29 ($N = 33$; $M = 15.72$) were included in the Subclinical Depression Group and the control group included participants presenting scores of 1–9 ($N = 38$; $M = 4.55$) on the BDI-II (non-depressed Group). See Table 1 for sample characteristics.

The experiment was conducted in accordance with British Psychological Society ethical standards and approved by the Ethics Committee of the Department of Psychology, Swansea University. Participants were recruited through advertisements within the Psychology Department; in return for their participation, the students earned course credit. All participants provided written informed consent.

2.2. Materials

Participants were screened for pre-study levels of depression, state anxiety, hopelessness, life orientation (optimism) and experiential avoidance using *the BDI-II* (Beck, Steer, & Brown, 1996; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961), *The State Trait Anxiety Inventory* (STAI-Y; Spielberger, Gorsuch, & Lushene, 1970), *Beck Hopelessness Scale* (BHS; Beck, Weissman, Lester, & Trexler, 1974), the Life-Orientation Scale (LOT-R; Scheier, Carver, & Bridges, 1994), and the Acceptance and Action Questionaire-2 (AAQ-2; Bond et al. (2011); Hayes, Strosahl, et al., 2004), respectively.

Verbal Fluency Task: (FAS: Lezak, 1976). In line with previous FTT studies, the FAS was employed to control for pre-experimental levels of verbal fluency (MacLeod & Byrne, 1996; MacLeod et al., 1993, 1998).

2.2.1. IRAP stimuli. Pilot study

A list of 32 items thought to be applicable to most people was derived from a list of positive and negative future events generated by participants who completed the FTT in the laboratory of Dr. Andrew MacLeod (data received through personal correspondence, February, 2006). The second and third author added an additional 60 items to this list for a total of 46 positive and 46 negative items. Criteria for inclusion as life events in the survey were that the events had to be clearly positive or negative and have the potential to be applicable to most people. A pilot survey was conducted where respondents were asked to state whether the event 'could possibly happen to them in the future' and rate this as very unlikely (1) to very likely (7); and also rate 'how negative (1) or positive (7) they deemed the event to be'. Based on these survey ratings from 120 participants (separate to the participants who completed the FT-IRAP), the six positive and six negative future events with the highest likelihood of occurrence were selected as stimuli for use in an implicit measure targeting future expectancies, namely the specifically composed Future Thinking-Implicit Relational Assessment Procedure.

IRAP. The IRAP was written in Microsoft Visual Basic 6.0 and was administered to participants on a Toshiba portable computer with a color monitor, Intel Pentium 1500 MHz processor, and Windows XP operating system (Barnes-Holmes et al., 2006). The program presented stimuli and recorded participants' responses. On each trial, one of two target stimuli ('I expect' or 'I don't expect') and a single positive or negative target stimulus were presented by the program. Two response options

Table 1
BDI-II group split presentation of Demographics and Psychometric tests, presented as Mean scores with Standard Deviations (SD) for the Depressed and Non-Depressed groups.

Variable	Depressed *(SD)*	Non-Depressed *(SD)*
Gender: Females (Males)	26 (7)	27 (11)
Age	21.30 *(3.72)*	21.00 *(3.05)*
FAS	10.03 *(2.86)*	10.27 *(3.23)*
BDI-II	15.72 *(5.04)*	4.55 *(2.58)*
BHS	5.96 *(3.12)*	2.87 *(2.04)*
STAI	38.67 *(8.11)*	33.84 *(7.52)*
LOT-R	12.84 *(4.44)*	17.12 *(3.50)*
AAQ-II	37.27 *(7.68)*	50.08 *(9.32)*
PA	28.48 *(7.19)*	30.89 *(6.08)*
NA	16.55 *(5.26)*	14.32 *(4.96)*

Note: FAS = Verbal Fluency measure; BDI = Beck Depression Inventory; BHS = Beck Hopelessness Scale; STAI = State Anxiety Inventory; LOT-R = Life Optimism Test-Revised; AAQ-II = Acceptance and Action Questionnaire-II; PA = Positive Affective Scale; NA = Negative Affective Scale.

(i.e. 'True' and 'False') were also presented on each trial. The response options, and all sample and target stimuli presented, are detailed in Appendix A, Table A.1.

2.3. Procedure

Participants were tested for verbal fluency using the FAS, immediately followed by the FT-IRAP. The FT-IRAP program consisted of a minimum of one practice and three test blocks. Each block comprised of one consistent and one inconsistent trial. In line with previous IRAP presentations, a block of consistent trials, which on the FT-IRAP reflects an optimistic future outlook, requires the following pattern of responses: I expect – Positive – *True*; I expect – Negative – *False*; I don't expect – Positive – *False*; I don't expect – Negative – *True*. A block of inconsistent trials requires the reverse response pattern (denoting a reduced positive future outlook; I expect – Positive – *False*; I expect – Negative – *True*, etc.). Participants are put through an alternating series of consistent and inconsistent blocks as the IRAP program reverses the feedback contingencies across the repeated blocks. The order of sequence, consistent followed by inconsistent or inconsistent followed by consistent, is further counterbalanced across participants. Therefore, participants in the Consistent-Relations-First condition commenced with a block of consistent trials and thereafter alternated between inconsistent and consistent blocks; participants in the Inconsistent-Relations-First condition were exposed to the blocks in the opposite sequence (i.e., Inconsistent followed by Consistent). In each block the trials were presented in a quasi-random order with the constraint that each of the 2 sample stimuli appeared once with each of the 12 target stimuli. On each trial, a combination of sample and target stimuli appeared simultaneously on screen with the two response options. The response options appear at the bottom left and right of the screen and switch randomly from trial-to-trial.

During consistent blocks, a consistent response cleared the screen for 400 ms and then the next trial was presented. If an inconsistent response was emitted, or any other key was pressed, a red X appeared immediately under the target stimulus. To remove the red X and continue to the 400 ms inter-trial interval, the participant was required to emit the consistent response. Consistent with the early IRAP programs, no trial-by-trial latency feedback was offered and a correct response had to be emitted for the trial to be completed. When the participant had completed all 24 IRAP trials the screen cleared and two types of feedback were presented for that block (1) the percent of correct responses, and (2) the median response latency.

Following the FT-IRAP participants were cycled into the FTT (MacLeod et al., 1998), during which the participants were given three set time periods in which to generate future events; the next week, the next year, and the next 5–10 years. The measure included positive (looking forward to/would like to happen) and negative (not looking forward to/would not like to happen) conditions, presented consecutively, such that the entire task was made up of six trials, three positive and three negative, over each of the time periods. Each trial was completed in 1 min.

Following the FTT participants were asked to complete a set of questionnaires (BDI-II and STAI) administered in a randomized order. On completion of all tests, participants were thanked, debriefed and given a printed debriefing document to retain.

2.4. Data analysis

Analysis of the Future Thinking Task scores were performed following the procedure set by MacLeod et al. (1998) with composite index scores calculated for each period in each condition by multiplying the *number* of responses generated in a period by the mean *likelihood* ratings given for those responses and by the mean *feelings* ratings given for those responses. Latency data from the FT-IRAP was transformed into the D_{IRAP} measure (see Barnes-Holmes et al., 2010 for further description of this transformation of data).

3. Results

3.1. Sample characteristics

The two groups did not differ with respect to age, $t(69) = -.377$, $p = .708$, gender, $\chi^2(2) = .558$, $p = .455$, or verbal fluency, $t(69) = .331$, $p = .741$. Participants in the Sub-clinically depressed group had significantly higher BDI-II scores than those in the non-depressed group, $t(69) = -11.994$, $p < .001$, significantly higher levels of hopelessness (BHS; $t(69) = -5.019$, $p < .001$), lower levels of dispositional optimism (LOT-R; $t(69) = 4.510$, $p < .001$), higher levels of experiential avoidance (AAQ-II; $t(69) = 6.259$, $p < .001$) and higher levels of anxiety (STAI; $t(69) = -2.559$, $p = .011$). No state mood differences were found between the two groups (PA: $p = .131$; NA: $p = .071$). The psychometric means are presented with the participant demographics in Table 1.

3.2. Future thinking in subclinical depression

3.2.1. Composite FTT scores

Analysis of the composite scores with a Group (Depression: Low BDI, High BDI) × Valence (Future expectancy: Positive/Negative) × Period (Week, Year, 5–10 years) mixed model ANOVA produced three significant effects. There was a significant

main effect of Valence, with stronger valence ratings for positive compared to negative future expectancies ($F(1,69) = 185.98$, $p < .001$, $\eta p^2 = .729$). A significant main effect of Period was found, reflecting greater generations for the next 5–10 years relative to the next year and the next week ($F(2,68) = 12.12$, $p < .001$, $\eta p^2 = .149$). There was also a significant interaction effect found for Period × Valence ($F(2,68) = 9.45$, $p < .001$, $\eta p^2 = .120$), with the more distant future of 5–10 years found to have the greatest composite scores. The predicted effect of a Group × Valence interaction was not significant ($F(1,69) = 2.618$, $p = .110$, $\eta p^2 = .037$), nor was there a main effect for Group ($F(1,69) = .076$, $p = .784$, $\eta p^2 = .001$).

The three-way interaction involving Group, Valence and Period did not approach significance ($F(2,68) = .611$, $p = .544$, $\eta p^2 = .009$). Thus, the FTT index scores suggest that the Sub-clinically depressed and non-depressed individuals held similar expectations with regards to their subjective future experiences, with positive and negative expectancies consistently diverging across the three different time periods for both groups. Appendix B Table B1 presents the collapsed FTT Index data.

3.2.2. Raw FTT scores

The raw FTT scores were analyzed for each of the three FTT components. Thus, raw scores for the number of events generated, likelihood values, and feeling ratings were calculated and are presented in Table 2. The same analysis was utilized with the raw data as for the FTT index scores.

Number of events generated for future events was firstly examined where a Group (Depression: Low BDI/High BDI) × Valence (Number of Future Thoughts: Positive/Negative) × Period (Week, Year, 5–10 years) mixed-model ANOVA found a significant main effect for Valence, $F(1,69) = 52.63$, $p < .001$, $\eta p^2 = .433$); that is, participants generated significantly more positive events ($M = 5.86$, $\sigma = 1.73$) for the future relative to events that they were not looking forward to ($M = 4.77$, $\sigma = 1.66$); the mean number of future thoughts by time period and valence for the Sub clinically depressed and non-depressed groups are displayed in Table 2. A significant main effect was also found for Period ($F(2,68) = 5.24$, $p = .006$, $\eta p^2 = .071$) reflecting a lower number of events generated for the next year relative to the next week and the next 5–10 years. No main effect for Group was produced by the ANOVA ($F(1,69) = .593$, $p = .444$, $\eta p^2 = .009$). An interaction effect was observed for Valence × Group ($F(2,68) = 4.81$, $p = .032$, $\eta p^2 = .065$), with the non-depressed group generating a greater number of positive future events relative to the Sub clinically depressed group (non-depressed, $M = 6.16$, $\sigma = 1.77$; Sub clinically depressed, $M = 5.52$, $\sigma = 1.65$). No interaction effect was observed between Valence × Period ($F(2,68) = 2.529$, $p = .083$, $\eta p^2 = .035$) nor was an effect found for the three way interaction for Group × Valence × Period ($F(2,68) = 1.432$, $p = .242$, $\eta p^2 = .020$).

The raw data pertaining to likelihood ratings of the future events generated was examined in the same manner as the fluency variable, that is, a Valence (Events Likelihood: Positive/Negative) × Period (week, year, 5–10 years) × Group

Table 2
Means and Standard Deviations (SD) for Positive and Negative Future Thinking Task *Raw Scores* for Fluency (number of events generated), Likelihood Ratings (summed for all events) and Feeling Ratings (summed for all events) for each Time Period for the Depressed and Non-Depressed groups.

Variable	Non-Depressed Mean *(SD)*	Depressed Mean *(SD)*
Positive Responses, Next Week		
Fluency (no. of events)	6.31 *(2.15)*	5.42 *(2.13)*
Likelihood	5.29 *(0.90)*	4.89 *(1.44)*
Feeling	2.20 *(0.43)*	2.33 *(0.54)*
Positive Responses, Next Year		
Fluency (no. of events)	5.63 *(1.79)*	5.30 *(1.67)*
Likelihood	5.20 *(0.91)*	5.02 *(1.06)*
Feeling	2.46 *(0.39)*	2.59 *(0.43)*
Positive Responses, Next 5–10 years		
Fluency (no. of events)	6.53 *(2.10)*	5.91 *(2.05)*
Likelihood	5.21 *(0.92)*	5.03 *(1.10)*
Feeling	2.67 *(0.31)*	2.93 *(0.76)*
Negative Responses, Next Week		
Fluency (no. of events)	4.61 *(1.95)*	4.78 *(1.71)*
Likelihood	4.06 *(1.43)*	3.99 *(1.46)*
Feeling	1.71 *(0.59)*	1.65 *(0.68)*
Negative Responses, Next Year		
Fluency (no. of events)	4.55 *(1.94)*	4.91 *(1.92)*
Likelihood	3.78 *(1.42)*	3.64 *(1.22)*
Feeling	2.18 *(0.65)*	2.20 *(0.54)*
Negative Responses, Next 5–10 years		
Fluency (no. of events)	5.13 *(2.13)*	4.69 *(1.57)*
Likelihood	3.68 *(1.19)*	3.86 *(1.13)*
Feeling	2.29 *(0.56)*	2.17 *(0.86)*

(Depression: Low BDI/Hi BDI) mixed-model ANOVA was utilized in the analysis. A significant main effect for Valence was found, $F(1,69) = 104.720$, $p < .001$, $\eta p^2 = .603$); that is, across all three time periods participants reported significantly more positive future events as likely to occur ($M = 30.01$, $\sigma = 9.84$) relative to the negative future events ($M = 17.41$, $\sigma = 5.98$). No significant main effects were found for Period ($F(1,69) = 1.040$, $p = .356$, $\eta p^2 = .015$), nor Group ($F(1,69) = .495$, $p = .484$, $\eta p^2 = .007$). Further, no interaction effects were seen for Valence and Group ($F(2,68) = .963$, $p = .330$, $\eta p^2 = .014$), for Period and Group ($F(2,68) = .605$, $p = .548$, $\eta p^2 = .009$), nor for Valence and Period ($F(2,68) = 1.293$, $p = .278$, $\eta p^2 = .018$). The three way interaction of Valence × Period × Group ($F(2,68) = .336$, $p = .715$, $\eta p^2 = .005$), further failed to produce any significant interaction effects.

The feeling values were explored in a similar fashion to the fluency and likelihood data, with an analysis of variance (ANOVA) completed with positive and negative future feeling raw scores. A Valence (Feeling: Positive/Negative) × Period (week, year, 5–10 years) × Group (Depression: Low BDI/Hi BDI) mixed-model ANOVA found a significant main effect for Valence, $F(1,69) = 85.699$, $p < .001$, $\eta p^2 = .554$); that is, across all time periods participants foresaw feeling more positive of future events they were looking forward to ($M = 14.64$, $\sigma = 4.32$) relative to reports of negative anticipation relating to events that they were worried about ($M = 9.68$, $\sigma = 4.20$). A significant main effect was also found for Period ($F(1,69) = 39.935$, $p < .001$, $\eta p^2 = .367$) with participants reporting increased feeling ratings for the next year and next 5–10 years compared with the next week. However, no main effect was seen for Group ($F(1,69) = .514$, $p = .476$, $\eta p^2 = .007$). No interaction effects were found for Valence and Group ($F(2,68) = 3.374$, $p = .067$, $\eta p^2 = .058$), notably a trend was observed with the non-depressed group reporting greater affect ratings relative to the Sub clinically depressed group. The Valence and Period interaction also demonstrated a trend towards increased reports of positive affect across the three time periods relative to negative affect though this was not found to be significant ($F(2,68) = 2.794$, $p = .065$, $\eta p^2 = .039$). Similarly the interaction between Period and Group found the non-depressed participants reporting greater affect for more proximate future events relative to the Sub-clinically depressed group, though this was not of statistical significance ($F(2,68) = .068$, $p = .935$, $\eta p^2 = .001$). No three way interaction was found for Valence × Period × Group ($F(2,68) = .728$, $p = .485$, $\eta p^2 = .010$) as produced by the ANOVA.

These results show that the feeling variable on its own was unable to detect any differences in responding between the two groups, although it is noted that the expected interaction between Valence and Group did approach significance.

3.3. Summary of FTT findings

The FTT index score was unable to account for any future thinking divergence between the Sub-clinically depressed and non-depressed groups. However, the independent fluency variable did find an interaction effect for valence and group; consistent with previous literature this interaction effect suggests reduced fluency for positive future events within the Sub-clinically depressed group. The likelihood and feeling variables were unable to offer any further insight to the variance observed between groups pertaining to fluency.

3.3.1. The implicit relational assessment procedure

Participant-type analyses. Composite positive and negative D_{IRAP} scores were calculated for the four trial-types, with a positive marker including the two trial-types confirming positive future and denying negative future relations (+; i.e. consistent trials; $D_{IRAP\text{-}POS}$) and respectively, a negative marker combining the two trial-types analogous to the verification of negative future and refutation of positive relations (−; i.e. inconsistent trials; $D_{IRAP\text{-}NEG}$). The $D_{IRAP\text{-}POS}$ and $D_{IRAP\text{-}NEG}$ scores calculated for both groups of participants are presented in Fig. 1. The data show the mean FT-IRAP effect for the non-depressed group ($D_{IRAP\text{-}POS} = .34$, $\sigma_{DIRAP\text{-}POS} = .33$; $D_{IRAP\text{-}NEG} = .10$, $\sigma_{DIRAP\text{-}NEG} = .35$) demonstrates opposing different pattern of responses to that of the Sub-Clinical Depression group ($D_{IRAP\text{-}POS} = -.05$, $\sigma_{DIRAP\text{-}POS} = .64$; $D_{IRAP\text{-}NEG} = -.22$, $\sigma_{DIRAP\text{-}NEG} = .52$). Specifically, the non-depressed group, relative to the Sub-clinically depressed group, responded more rapidly on trials that required

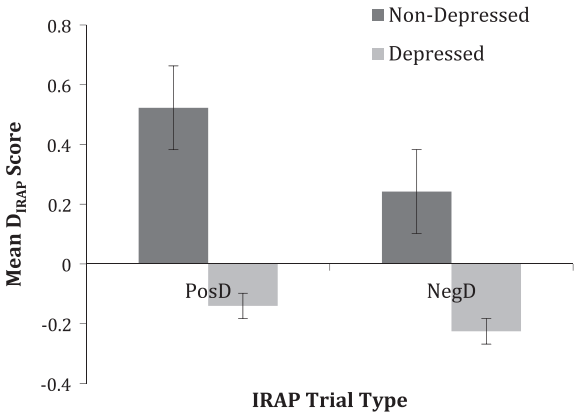

Fig. 1. Mean Positive and Negative D_{IRAP} scores, with Standard Error Bars (S.E) for the Depressed and Non-Depressed groups.

confirmation of future-positive and denial of future-negative relations (i.e. consistent trials) over tasks requiring confirmation of future-negative and denial of future-positive relations (i.e. inconsistent trials). In short, the descriptive FT-IRAP data indicate that the non-depressed group convey a greater level of expectations for positive future experiences as compared to the Sub-clinically depressed group.

A mixed model ANOVA found a main effect for Valence ($F(1,69) = 17.204$, $p < .001$, $\eta p^2 = .200$) with participant responses discriminating between positive and negative future expectancies. No interaction effect was found for Valence and Group ($F(1,69) = .606$, $p = .439$, $\eta p^2 = .009$), though a main effect for group was found ($F(1,69) = 12.747$, $p = .001$, $\eta p^2 = .156$) with the non-depressed group responding in line with the consistent FT-IRAP effect, that is, relating to expectancies of positive future events, whereas the Sub-clinically depressed group did not show this effect (see Fig. 1 for an illustration of the two groups $D_{\text{IRAP-POS}}$ and $D_{\text{IRAP-NEG}}$ scores).

3.3.2. FT-IRAP trial-type analysis

In order to explore the FT-IRAP data further and gain an indication of the relational responses within the groups, planned one-sample T-tests were employed to determine if the mean D_{IRAP} scores for the four trial types differ significantly from zero.

As can be seen in Fig. 2 there was a difference in the implicit responses by the two groups. The non-depressed participants were found to show an optimistic bias represented in the trial-type data by a positive value based on the comparison of 'I-expect-positive-*True*' (S1T1), to' I-don't-expect-negative-*True*'(S2T2) both of which were significantly different from zero ($t(37) = 6.611$, $p < .001$ and $t(37) = 3.120$, $p = .003$ respectively). However, the trials requiring denial of negative expectancies were not found to be significantly different from zero based on the comparison of 'I-expect-negative-*False*' (S1T2; $t(37) = 1.465$, $p = .151$) and 'I-don't-expect-positive-*False*' (S2T1; $t(37) = 1.829$, $p = .076$).

For the Sub clinically depressed group the pattern of responses were again noted as different to that of the non-depressed group, though with a significant bias found in confirmation of negative expectancies on one of the trial types (i.e. 'I-expect-negative-*True*'; S1T2; $t(32) = -2.818$, $p = .008$). Participants in this group displayed no trend in their response towards confirmation of positive expectancies (S1T1; $t(32) = .010$, $p = .992$). Neither were there any significant findings in regards to denial of positive expectancies (S2T1; $t(32) = -1.176$, $p = .248$) nor for denial of negative expectancies (S2T2; $t(32) = -.962$, $p = .343$). Fig. 2 depicts the two groups' responses on each of the four trial types, as can be seen here, a clear optimistic bias is observed for the non-depressed group, with an analogous reduced optimistic pattern found for the sub-clinically depressed group.

3.3.3. Primary data analyses

The primary data from the IRAP are response latencies, defined as the time in milliseconds (ms) that elapses between the onset of the trial and a correct response emitted by a participant. Consistent and inconsistent blocks were aggregated to create composite mean scores for each block type. Independent *t*-tests found that within groups there was a significant difference in response time between consistent ($M = 1854.5$ ms) and inconsistent (1993.4 ms) blocks for the non-depressed group ($t(37) = -5.293$, $p < .001$); however no significant difference in response times was found within group for the Sub-clinically depressed sample between consistent (1930.9 ms) and inconsistent ($M = 1832.8$ ms) blocks ($t(32) = 1.890$, $p = .068$). Notably the Sub-clinically depressed group responded more slowly than the Non-depressed group across Consistent blocks, whereas the reverse response pattern was observed across inconsistent blocks.

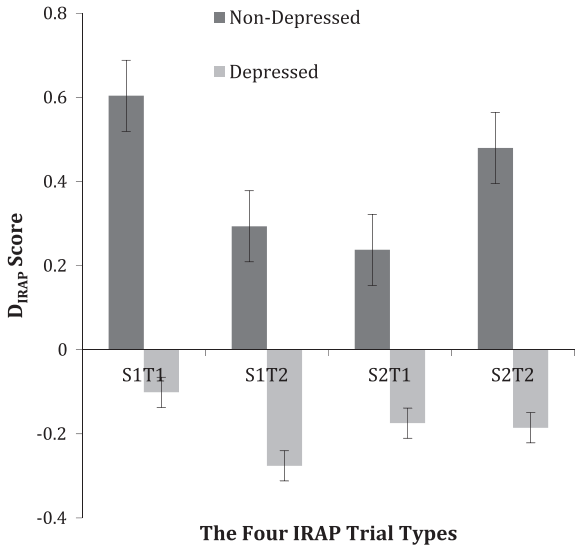

Fig. 2. Mean D_{IRAP} scores (with S.E bars) for the two groups across the four FT-IRAP Trial-Types. Trial types are represented by sample and target distribution of Positive (T1) and Negative (T2) Target Words presented with the Samples 'I expect' (S1) and 'I don't expect' (S2).

3.4. Summary of the FT-IRAP findings

The FT-IRAP data at split and combined levels of analysis suggest different patterns of responding for the two groups; the trial-type analysis found that, relative to the sub-clinically depressed group, the non depressed group demonstrated an optimistic bias. This is supported by the primary data analyses where the Sub clinically depressed group responded faster on the inconsistent blocks (M = 1832.8 ms). The response time average is comparative to that of the non-depressed group across consistent blocks (M = 1854.5 ms). Thus suggesting that the between group differences are in the type of relational responding required not slower response times for sub clinically depressed participants.

3.4.1. Correlations and hierarchical regression analyses

The sensitivity of the FTT and the FT-IRAP in identifying sub-clinical depression and hopelessness was evaluated by two hierarchical regression analyses and a series of correlations.

3.4.2. Relationship between implicit and explicit measures

Zero-order correlations were conducted at group level for depression, hopelessness, explicit (FTT) and implicit future expectancies (FT-IRAP) (a summary of the Pearson's' correlations can be found in Appendix C Table C.1). Consistent with prior studies (e.g., Bosson, Swann, & Pennebaker, 2000; Gemar, Zindel, Sagrati, & Kennedy, 2001; Haeffel et al., 2007), no significant correlations emerged between implicit and explicit measures for either group.

3.4.3. Future thinking as a predictor of depression

A hierarchical logistic regression analysis was used to assess future thinking as a predictor of sub clinically depressed or non-depressed group classification. The predictor variables were hopelessness scores (BHS) entered at the first step, positive (PFT) and negative future thinking fluency (NFT), entered at the second step, and implicit future expectancy (D_{IRAP}) entered at the final step. Fluency was the only FTT component to display the expected group and valence interaction across the FTT analyses (as opposed to the index scores and raw likelihood and feeling scores).Because the FTT fluency variable is commonly used in the future thinking literature, along with its pronounced relevancy within the current findings, it was selected as potentially the strongest predictor of sub-clinical depression. The single overall D_{IRAP} score (calculated across all four trial-types) was used as the implicit predictor, as this has been identified as the strongest correlate of associated explicit measures in previous work (cf. Barnes-Holmes, Barnes-Holmes, Stewart, & Boles, 2010). A test of the full model versus a model with intercept only was statistically significant, $\chi^2(4, N = 71) = 87.51$, $p < .001$. The model was able to correctly classify 78.9% of those who reported a low score on the BDI-II and 66.7% of those who scored high on the BDI-II, with an overall success rate of 73.2%.

After controlling for hopelessness neither positive future thinking nor negative future thinking (from the FTT) were found to be significant predictors of depression at step 2, ($t(69) = .304$, $p = .119$ and $t(69) = .147$, $p = .939$ respectively (see Appendix D Table D.1). However, the FT-IRAP was a significant independent predictor of depression scores at step 3, ($t(69) = 9.349$, $p < .001$). A.4 shows the logistic regression coefficient, Wald test, and odds ratio for each of the predictors. It is notable that, whereas the explicit FTT measure failed to explain a significant amount of variance in the model, the FT-IRAP explains an additional 5% of the depression variance with a moderate effect size (Cohen's $f^2 = .091$; Cohen, 1992).

In a separate analysis, the FT-IRAP scores were dichotomized to assess whether individual D_{IRAP} scores represented a relation between depression and expectancies of positive future events (D_{IRAP} score > 0) versus expectancies of negative future events (D_{IRAP} score < 0). The larger the D_{IRAP} score the greater the difference in response latencies between the consistent and inconsistent trials. Positive D_{IRAP} scores denote responding in accordance with the pre-experimentally defined biases (i.e., within the current study, with expectancies for the future as concordant to positive relative to negative future experiences) and negative scores indicate the opposite (i.e., the future as concurring to negative relative to positive experiences). A zero score indicates that the participant was unable to discriminate between positive and negative future experiences (i.e. the responses showed no difference in relation to subjective expectations of either positive or negative experiences).

Participants whose performance revealed greater expectancy of negative future events were significantly more likely to report higher scores on the BDI-II (32.4%) relative to those with a greater expectancy of positive future events (14.1%), $\chi^2(1, N = 71) = 11.752$, $p = .001$. This cut point appears to produce adequate sensitivity and positive predictive value, as well as strong specificity and negative predictive value (see Table 3).

3.4.4. Future thinking as a predictor of hopelessness

The second hierarchical logistic regression analysis focused on the same relationship with one difference, the outcome variable was hopelessness rather than depression. Given the lack of predictive ability for the explicit measures in relation to sub-clinical depression it was of interest to see if the FTT fluency variable was able to predict hopelessness ratings by participants. As deficiencies in positive future thinking have been identified as a marker of hopelessness and suicidal ideation, we examined if the predictive strength lies in these components specifically as opposed to depression more generally. The hierarchical regression analysis was conducted with hopelessness as the dependent variable and positive and negative fluency, along with the D_{IRAP} as covariates. The hopelessness variable was dichotomized using a cutoff point of 5 on the Beck Hopelessness Scale, that is participants with a BHS score of <5 were considered healthy ($N = 44$, $M = 2.36$; Low BHS Group) whereas those with a score of $\geqslant 5$ were considered to be showing clinically significant signs of hopeless ideation ($N = 27$,

Table 3
Classification Statistics for the Future Thinking Implicit Relational, Assessment Procedure in Prospectively Predicting Depression Levels ($N = 71$).

BDI Scores		Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
Low	High				
D score > 0 *n* = 27 *D* score < 0 *n* = 11	*D* score > 0 *n* = 10 *D* score < 0 *n* = 23	.70 (23/33)	.71 (27/38)	.73 (27/37)	.68 (23/34)

Note: Scores on the Implicit Relational Assessment Procedure were dichotomized to indicate either a relation between future expectancies and negative events (*D* score > 0) or a relation between future expectancy and positive events (*D* score < 0). Sensitivity is the proportion of sub-clinically Depressed participants correctly identified by the FT-IRAP; Specificity is the proportion of Non-Depressed individuals correctly identified by the test. Positive Predictive Value is the proportion of individuals with a positive score who were correctly classified as Non-Depressed; Negative Predictive Value is the proportion of individuals with a negative test, correctly classified as a Depressed. Raw numbers for proportions are given in parentheses.

$M = 7.48$; High BHS Group; this cut off was based on a mean split). The group difference was found to be significant, $t(69) = -12.392$, $p < .001$.

The explicit future thinking reports were able to predict hopelessness ideation, though only positive future thinking (as represented by the fluency variable) predicted greater hopeless ideation (Appendix E Table E.1). At step 2 performances on the FT-IRAP predicted the reported occurrence of hopeless ideation above and beyond the influence of the explicit self-report variables, $\chi^2(1, N = 71) = 15.39$, $p < .01$, explaining an additional 28% of the variance in hopelessness (Cohen's $f^2 = .444$) – a large effect size (Cohen, 1992).

Dichotomized BHS scores were used to gain a measure of sensitivity, specificity and predictive value of the FT-IRAP positive and negative values in relation to hopeless ideation. As in the above analysis with the BDI-II, the FT-IRAP D-score values representative of positive future expectancy (D_{IRAP} score > 0) versus negative future expectancy (D_{IRAP} score < 0) were assessed as indicators of pathological future beliefs. Participants whose performance revealed stronger relations with negative future expectancies were significantly more likely to report higher scores on the BHS (29.3%) than were those with stronger positive future expectancies (19.5%), $\chi^2(1, N = 41) = 4.108$, $p = .043$). Thus it appears that this cut point offers adequate negative predictive value (see Appendix F Table F.1).

4. Discussion

The current study examined whether the FT-IRAP could be employed as a useful procedure to implicitly measure future thinking in depression, and to compare explicit and implicit measures of future thinking. Consistent with previous research, participants scoring high on the BDI-II were found to differ from those scoring low on the BDI-II in their generation of positive future events on the explicit FTT (MacLeod, Pankhania, Lee, & Mitchell, 1997) but not in their generation of negative future events. The FT-IRAP proved more sensitive in predicting depression levels as the non-depressed group demonstrated a tendency towards positive future expectancies by faster reaction times on the consistent trials whereas the depression group generated faster response times on the inconsistent trials. This predictability was also seen in regards to hopelessness, with the FT-IRAP but not the FTT fluency variables adding significantly to the regression model. The results from the current study indicated that the sub-clinically depressed participants demonstrated a reduced generation of positive future events on the explicit FTT, but no difference in expectancy ratings. The sub-clinically depressed participants did however demonstrate reduced positive future expectancies as measured by the FT-IRAP. In a regression analysis the FT-IRAP proved more sensitive and specific in the detection of depression levels. This improved predictability over the FTT was also seen in regards to hopelessness, with the FT-IRAP adding significantly to the regression model relative to the FTT variables.

4.1. Hopelessness

The FT-IRAP most significantly added to the hopelessness regression models, relative to the depression models, by accounting for 28% of the variance in the FTT/IRAP hopelessness model. As such the FT-IRAP measure of future expectancy maybe particularly relevant to research on hopeless ideation in future thinking, (e.g. suicidal ideation).

The current results indicate that the FT-IRAP may have value in predicting group membership relating to psychopathologies such as depression and hopelessness. Overall, the FT-IRAP added to the explicit FTT evaluations in terms of its predictive power of group membership in a sub-clinically depressed group. Specifically, it was found that the FT-IRAP demonstrated a high level of sensitivity and specificity in detection of depressed and hopeless ideation.

4.2. Limitations

There are two major limitations worth noting in the current study. First, many of the participants in the high BDI group were also high on the STAI measure of anxiety. Although the current trends are in line with previous FTT research that employed a mixed sample (i.e., sub clinical depressed/ anxious) a future study employing a 'pure' depressed group would be

worthwhile. A second limitation was that the sample was not a clinical sample. Future studies should employ the FT-IRAP with formally diagnosed patient samples. In the medical literature there has been substantial debate about the relationship between syndromal depression (clinical) (major depressive disorder) and sub-threshold depressive symptoms (sub-clinical depression) (e.g. Enns, Cox, & Borger, 2001). The debate was noted by Flett, Vredenburg, and Krames (1997) as of conceptual as well as practical importance. The discussion has centered on the differences in clinical depression and sub-clinical depression in regards to qualitative features or merely on a quantitative continuum, that is, if sub-clinical depression is in fact a less severe form of clinical depression. A relevant concern in this debate has been related to the correctness of utilizing sub-clinical student (e.g. convenience) samples in depression research. Notably, this is a concern which holds practical implications given that many researchers in the depression field have relied on undergraduate students as participants in their studies (Vredenburg, Flett, & Krames, 1993).

The most widely used instrument for measuring depression in students is the BDI,) (Beck et al., 1996) which is accepted as a reliable and valid measure of depression. In analog depression studies with students, a cut-off score on the BDI (commonly, $\geqslant 9$) has frequently been used, with students levels of depression found to be relatively similar to depression in clinical populations (Cox, Enns, Borger, & Parker, 1999; Hill, Kemp-Wheeler, & Jones, 1987); though notably depression in students has been found to be more transient (Vredenburg, O'Brien, & Krames, 1988). Agreement has emerged in support of clinical and sub-clinical depression as representative of varying levels on a continuum. The support for this came from several large clinical and community studies (e.g. Angst & Dobler-Mikola, 1984; Judd et al., 1998, 2000; Kendler & Gardner, 1998).

4.3. Future directions and clinical implications

The FT-IRAP may be useful in the assessment and treatment of underlying dysfunctional cognitive relations before depressive symptoms become more serious. Implicit assessment, by use of individualized implicit depression measures such as the FT-IRAP, in addition to self-report, may inform and support strategies to prevent an increase and recurrence of symptoms, and predict relapse. Further research is needed to investigate conditions under which implicit cognitive vulnerability takes effect. Vulnerability may be derived from patterns of implicit and explicit cognitions, and by further examination of how personal profiles may be individually related to depression in longitudinal studies. A better understanding of high-risk profiles would likely be able to inform individual treatment approaches.

Temporal distance from expected future events could be important, and may have some implication in regards to treatment approaches as more distant events may be interpreted as more neutral or isolated from affective relations (i.e. negative connotations of the events are weakened due to the remoteness of the event). Future FT-IRAP experiments should consider incorporating stimuli that account for such temporal relations. For instance, the target stimuli in an IRAP may integrate temporal relations such as before/after, I did [not] expect positive (negative) before – I do [not] expect positive (negative) now; or now/then, e.g. 'I [don't] expect positive (negative) today/next-week/next-year/next 5–10 years.

Improvements in assessment and treatment of depression may be warranted from evaluation of future thinking, consideration of implicit processes in depression, and the potential of relational responding predicting clinically relevant future behaviors, such as onset, relapse, and response to treatment and suicide attempts (Carpenter et al., 2012; Nock et al., 2010; Steinberg, Karpinski, & Alloy, 2007). Continued examination of implicit future cognition in depression may provide answers in the following areas: (i) how reduced positive future expectancy precipitates depression; (ii) which features in future-oriented cognitions constitute vulnerability to depression; (iii) the role of emotional avoidance, as stemming from past experiences, in future directed cognition; (iv) how reduced positive future thinking may facilitate continued depression; and (v) how cognitive vulnerabilities may be detected and altered. The current research is exploratory in its nature and further application of the FT-IRAP is needed within clinical samples before any final conclusions can be drawn in relation to implicit future thinking and depression.

The data obtained from the current study have a number of implications for those involved in the assessment, treatment and management of depression. While technologies such as the IRAP are relatively new, the data presented herein suggests that there may be potential in developing these methodologies for use in the clinical domain. If the IRAP provides a valid measure of implicit beliefs, future research may be conducted to assess the link between implicit future expectancies and subsequent behavior, with recent research suggesting a possible causal relationship and a potential remediation programme that targets future expectancies directly (Lang, Blackwell, Harmer, Davison, & Holmes, 2012). The current study suggests that the relationship between implicit future expectancies and depression needs to be further explored.

5. Conclusions

This is the first study to validate an implicit measure of positive and negative future thinking. One contribution of this study is the introduction of an implicit measure of future thinking. Another is the proposal of a test of sub-clinical levels of depression, that in theory could be administered remotely (e.g., via the internet) without demand characteristics. In sum, implicit measures of future thinking may have value in both research and clinical settings. The present data underscore the potential usefulness of such measures in identifying depressed and hopeless individuals which could increase the early detection and prevention of depressive disorder and suicidality.

Appendix A

Table A.1
The Stimulus Arrangements Employed. The Positive and Negative FT-IRAP Target Words presented with the Sample Labels 'I expect' and 'I don't expect' along with the corresponding Response Options of 'true' and 'false'; i.e. the Four Stimulus–response Combinations deemed Consistent in the Future Thinking-IRAP.

Sample 1	Positive Targets	Sample 2	Negative Targets	Sample 1	Negative Targets	Sample 2	Positive Targets
I expect	*Love*	**I don't expect**	*Worry*	**I expect**	*Worry*	**I don't expect**	*Love*
	Friendship		Loneliness		Loneliness		Friendship
	Enjoyment		Failure		Failure		Enjoyment
	Happiness		Stress		Stress		Happiness
	Wealth		Sadness		Sadness		Wealth
	Success		Illness		Illness		Success
	Response option 1		Response option 1		**Response option 2**		Response option 2
	True		True		**False**		False

Note: By implication all of the other four possible stimulus–response combinations are deemed inconsistent.

Appendix B

Table B.1
Means and Standard Deviations (SD) for Positive and Negative Future Thinking Task *Index* Scores, incorporating Fluency, Likelihood and Feeling values for each Time Period as reported by the Depressed and Non-Depressed groups. *T*-Test score and statistical value (*p*) from between group comparisons are presented.

Variable	Non-Depressed *Mean (SD)*	Depressed *Mean (SD)*	*t(69)*	*p*
Positive Responses				
Next Week	70.62 *(24.89)*	62.57 *(39.56)*	1.046	*0.299*
Next Year	71.98 *(27.48)*	70.52 *(34.28)*	0.199	*0.843*
Next 5–10 Years	90.68 *(36.63)*	83.67 *(33.17)*	0.841	*0.404*
Negative Responses				
Next Week	36.54 *(13.01)*	43.29 *(21.61)*	−1.614	*0.111*
Next Year	32.51 *(14.11)*	37.67 *(17.93)*	−1.357	*0.179*
Next 5–10 Years	40.53 *(19.75)*	38.30 *(21.95)*	0.452	*0.653*

Appendix C

Table C.1
Zero order correlations for the Non-Depressed (ND) and Depressed (D) group for Depression, Hopelessness and the Explicit and Implicit Future Thinking Tasks.

Group and Variable Denominator	Variable	1	2	3	4
ND 1	BDI				
D 1	BDI				
ND 2	BHS	0.235			
D 2	BHS	0.167			
ND 3	PFT	0.135	0.011		
D 3	PFT	0.152	−0.005		
ND 4	NFT	0.255	0.001	0.730*	
D 4	NFT	−0.051	0.218	0.739*	
ND 5	$D_{\text{IRAP-TOTAL}}$	−0.126	−0.218	0.006	0.065
D 5	$D_{\text{IRAP-TOTAL}}$	−0.022	−0.146	0.113	−0.026

Note: BDI = Beck Depression Inventory, BHS = Beck Hopelessness Scale, PFT = Positive Future Thinking (fluency), NFT = Negative Future Thinking (fluency), $D_{\text{IRAP-TOTAL}}$ = composite D-score.
* $p < .001$.

Appendix D

Table D.1
Hierarchical Logistic Regression Analysis Predicting Depression Scores in a Sub-Clinical Population ($N = 71$).

Step and Variable	b	SE	Wald Statistic	Odds Ratio (95% confidence interval)	χ^2	R^2
Dependent variable: Depression						
Step 1					$\chi^2(1) = 22.521^{***}$	0.36
Beck Hopelessness Scale	0.487	0.125	15.215	1.628 (1.274–2.079)**		
Step 2					$\chi^2(2) = 2.740^{NS}$	0.40
FTT						
Positive Fluency	−0.426	0.277	2.367	0.653 (.380–1.124)		
Negative Fluency	0.291	0.283	1.062	1.338 (.769–2.329)		
Step 3					$\chi^2(1) = 3.805^{*}$	0.45
Implicit Relational Assessment Procedure	−1.704	0.999	2.907	0.163 (.021–1.255)^{AS}		

* $p < .05$.
** $p < .01$.
*** $p < .001$.
^{NS} = Not Significant.
^{AS} = Approaching Significance: $p = .06$.

Appendix E

Table E.1
Hierarchical Logistic Regression Analysis Predicting Hopelessness Ideation in a Sub-Clinical Population ($N = 41$).

Step and Variable	b	SE	Wald Statistic	Odds Ratio (95% confidence interval)	χ^2	R^2
Dependent variable: Hopelessness						
Step 1					$\chi^2(2) = 1.711$	0.055
AMT						
Positive Cue Specificity	−0.395	0.326	1.462	0.674 (.356–1.277)		
Negative Cue Specificity	0.157	0.306	0.263	1.170 (.642–2.135)		
Step 2					$\chi^2(1) = 7.444^{**}$	0.267
Implicit Relational Assessment Procedure	−5.335	2.347	5.165	0.005 (.000–.480)*		

* $p < .05$.
** $p < .01$.

Appendix F

Table F.1
Classification Statistics for the Future Thinking Implicit Relational Assessment Procedure in Prospectively Predicting Hopelessness Scores ($N = 41$).

BHS Scores		Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
Low	High				
D score > 0	*D* score > 0				.68
n = 15	*n* = 8	.60 (12/20)	.71 (15/21)	.65 (15/23)	(12/18)
D score < 0	*D* score < 0				
n = 6	*n* = 12				

Note: Scores on the Implicit Relational Assessment Procedure were dichotomized to indicate either a relation between future expectancies and negative events (*D* score > 0) or a relation between future expectancy and positive events (*D* score < 0). Sensitivity is the proportion of participants *with* hopeless ideation correctly identified by the FT-IRAP; Specificity is the proportion of participants correctly identified by the test as showing *no* hopeless ideation. Positive predictive value is the proportion of individuals with a positive test who were correctly classified as *not* pessimistic about their future; Negative predictive value is the proportion of individuals correctly classified as pessimistic with regards to their future outlook. Raw numbers for proportions are given in parentheses.

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