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ABSTRACT

Reduced tendency to engage in potentially rewarding activities is a hallmark of depression. The present study investigated the role of future expectancy biases in depression-linked behavioural choice, in participants varying in self-reported depression symptoms (dysphoria). A novel laboratory paradigm was developed to test the hypotheses that the degree to which higher dysphoria is associated with reduced tendency to engage in a potentially rewarding activity is dependent on the presence of negative biases in the expected outcomes of activity engagement. Specifically, two types of expectancy biases were distinguished: a) the expected likelihood of a negative rather than positive outcome, and b) the expected emotional impact of either outcome. $N = 176$ undergraduate students with varied levels of dysphoria were given the opportunity to choose to engage in a coin-tossing game that could result in a win or loss monetary outcome in terms of charity donations, and then rated both types of expectancies. Results indicated that higher dysphoria was associated with more negative expectations concerning the likelihood of objective outcomes and the emotional impact of such outcomes, and as hypothesised, such negative expectancy biases mediated indirect associations between dysphoria and behavioural choice.

1. Introduction

Depression is a leading cause of the global disease burden (World Health Organization, 2021). Centrally characterised by prolonged sad mood and loss of motivation and interest (American Psychiatric Association, 2022), people diagnosed with clinical depression show a reduced tendency to engage in potentially emotionally rewarding activities despite opportunities to do so (Jacobson, Martell, & Dimidjian, 2001). Even individuals with elevated depression symptoms that may not meet clinical diagnosis, which can be termed "dysphoria", are known to spend less time engaging in activities that could have positive impacts on their mood (Hopko, Armento, Cantu, Chambers, & Lejuez, 2003). Importantly, interventions such as Behavioural Activation treatment have demonstrated that increasing engagement in potentially rewarding activities leads to reductions in depression symptomology (Dimidjian, Barrera, Martell, Muñoz, & Lewinsohn, 2011), although maintaining activity engagement following treatment remains a challenge. Researchers have proposed that motivation and behavioural engagement in scheduled reward activities is an important contributor to treatment outcomes (Dimidjian & Hollon, 2011; Hopko, Magidson, &

Lejuez, 2011), with preliminary evidence supporting the idea that greater compliance with completion of assigned activity engagement homework is related to greater improvement in depression symptoms (Ryba, Lejuez, & Hopko, 2014; Santos et al., 2017, 2019). Thus, advancing understanding of modifiable cognitive mechanisms underpinning reward-seeking motivation and behaviour in dysphoria and depression may facilitate improvements in its treatment and prevention (Holmes et al., 2018).

1.1. Role of expectancies concerning objective future outcomes

Actions are motivated by their consequences (Thorndike, 1927), and expectations concerning the likely future consequences of one's behaviour, hereafter referred to as *action-contingent expectancies,* are known to influence behaviour (Bandura, 1977; Vroom, 1964). People are more likely to engage in an activity if they expect that doing so is likely to result in positive rather than negative outcomes, and vice versa. Therefore, it is plausible that biases in action-contingent expectancies concerning the objective outcomes of one's actions are contributing to depression-linked deficits in reward-seeking behaviour. Specifically, the

idea being pursued in the present research is that individuals with dysphoria and depression would be less likely to choose to engage in potentially rewarding activities than healthy individuals, in part because they have elevated expectations that activity engagement would result in objectively negative rather than positive outcomes.

1.2. Depression-linked biases in future outcome expectancies

While many studies have found that dysphoria and depression are associated with pessimistic expectations about future outcomes, such future outcomes concern general future events rather than outcomes that may occur *as a consequence* of one's behaviour. In a classic experimental study, Alloy and Ahrens (1987) asked undergraduate students with high versus low levels of dysphoria to rate the expected likelihood of a negative and a positive future outcome happening to themselves and others (being put on academic probation versus being put on the dean's list). Results showed that, even when relevant statistical information for making likelihood judgments are controlled, participants with high dysphoria had more pessimistic expectations concerning the likelihood of negative relative to positive outcomes in terms of future academic outcomes, particularly for themselves (Alloy & Ahrens, 1987). Since then, numerous studies have found that when asked to estimate the likelihood of possible negative and positive future life events, individuals with elevated dysphoria expect negative events to be more likely, and positive events to be less likely in their personal futures, as compared to those with low dysphoria (Miranda & Mennin, 2007; Pietromonaco & Markus, 1985; Pyszczynski, Holt, & Greenberg, 1987; Strunk & Adler, 2009; Strunk, Lopez, & DeRubeis, 2006), as well as clinical depression (Andersen & Limpert, 2001; MacLeod, Tata, Kentish, Carroll, & Hunter, 1997).

While prior research has shown that individuals with dysphoria and depression are pessimistic in their expectations of the future, we are not aware of any studies that have directly tested whether such expectations are linked to behavioural inactivity. However, there is preliminary indirect evidence that pessimistic expectancy is related to elevated goal disengagement in depression. In a study by Dickson, Moberly, O'Dea, and Field (2016), clinically depressed participants were found to have lower expectations that their future goals will be achieved, and this was found to be related to higher self-reported tendency to disengage from goal and lower tendency to re-engage with goal after failure (Dickson et al., 2016). While we are not aware of studies examining the relationship between action-contingent expectancies and behaviour in dysphoria, it is plausible that individuals with higher dysphoria may hold pessimistic expectations that their actions are more likely to lead to objectively negative rather than positive outcomes, and that such negative objective outcome expectancies serve to dampen motivation to pursue potentially rewarding activities.

1.3. Role of expectancies concerning the emotional impact of future outcomes

Whether a person chooses to engage in an activity may depend not only on expectancies concerning whether the objective outcomes of doing so will be positive or negative, but also how they would expect to feel if such outcomes did occur, also known as affective forecasting (Wilson & Gilbert, 2003). People are more likely to choose to engage in activities if they expect that doing so would result in positive emotional consequences, and vice versa (Baumgartner, Pieters, & Bagozzi, 2008; DeWall, Baumeister, Chester, & Bushman, 2016; Loewenstein & Lerner, 2003; Mellers & McGraw, 2001). For example, whether a person chooses to initiate a social invitation may depend not only on whether they expect the invitation will be accepted or not (objective outcome

expectancy), but also on how good or bad they expect to feel if the invitation was accepted or rejected, respectively.

Experimental research on how emotions guide behavioural choice has shown that behavioural choices are heavily guided by the emotional utility of each choice, where the goal is to make choices that maximise positive emotions and minimise negative emotions (Mellers, Schwartz, Ho, & Ritov, 1997; Mellers & McGraw, 2001). The emotional utility of choices was found to not simply reflect the likelihood and magnitude of actual monetary outcomes, but also incorporated situationally relevant factors such as surprise and counterfactual comparisons (Mellers et al., 1997; Mellers & McGraw, 2001). Importantly, the impact of emotions on behavioural choice extends beyond experienced emotions to *expected* emotions (Charpentier, De Neve, Li, Roiser, & Sharot, 2016; Morewedge, 2015).

1.4. Depression-linked biases in expected emotional impact of future outcomes

While objectively good and bad outcomes are likely to elicit positive and negative emotions, respectively, individuals also vary in their subjective emotional response to the same objective outcomes under the same contexts, due to a range of situational as well as internal factors that influence perceptions of the cause and implications of the outcome (Ortony, Clore, & Collins, 2022; Scherer, 1999; Smith & Lazarus, 1990). It is possible that dysphoria and depression are associated with biased expectations of the emotional impact of future events. In contrast to research on depression-linked biases in objective future outcomes and events, relatively few studies have examined depression-linked biases in expectations of the emotional impact of future outcomes, and no study has examined whether such biases are linked to behavioural choice.

Some studies have examined depression-linked individual differences in general expectations of future emotional states, which have found that individuals with dysphoria (Marroquín & Nolen-Hoeksema, 2015; Wenze, Gunthert, & German, 2012) and clinical depression (Mathersul & Ruscio, 2020; Thompson et al., 2017) expect to feel more negative emotions in the future compared to healthy controls. In relation to expectancies concerning the emotional impact of specific future events, an early study by Pietromonaco and Markus (1985) found that when asked to imagine how a range of standardised future life events would make them feel, undergraduate students with dysphoria expected that they themselves, but not others, would experience more subjectively sad rather than happy future events, relative to those without dysphoria. In clinically depressed patients, there has also been evidence of reduced expectations of subjectively emotionally positive future events relative to healthy controls (MacLeod & Salaminiou, 2001). However, since objective outcome expectancies were not delineated from emotional impact expectancies in such studies, it is unclear whether results reflect elevated expectations of objectively negative rather than positive outcomes, or elevations in the expected magnitude of the emotional impact of such outcomes, or both.

We are aware of only two studies that have assessed dysphoria-linked individual differences in the magnitude of expected emotional responses to standardised objective future outcomes. In one study, undergraduate students rated their expected emotional responses to set amounts of monetary wins and losses on a gambling task, and those with dysphoria were found to expect lower positive emotions to winning money, but not greater negative emotions to losing money (Yuan & Kring, 2009). While Yuan and Kring (2009) used a task where the objective outcomes were pre-determined and known by participants, Hoerger, Quirk, Chapman, and Duberstein (2012) assessed expected emotional responses to standardised scenarios under more naturalistic conditions, where the outcome was not known beforehand. The study asked dysphoric versus

non-dysphoric undergraduate students to rate their expected emotional state during and immediately following Valentine's Day, in the event that they did not have a date (an objectively negative outcome) versus in the event that they did have a date (an objectively positive outcome). Results showed that those with dysphoria expected to experience greater negative emotions, in the event of both objectively negative and objectively positive outcomes, compared to non-dysphoric controls (Hoerger et al., 2012).

While the above studies suggest that dysphoria may be associated with negative biases for the expected emotional impact of objectively negative and positive outcomes, the link between such biases and behavioural choice in dysphoria and depression remains to be investigated.

1.5. Depression-linked individual differences in emotional impact expectancies – the potential role of internal attribution style

If dysphoria and depression are associated with negative biases in emotional impact expectancies, and such expectancies are in turn associated with elevated behavioural inaction, then it would be pertinent to consider what factors might be giving rise to such negative emotional impact expectancy biases. One possible contributing factor is an elevated tendency to take responsibility for negative, but not positive, outcomes, also known as a negative internal attribution style. For example, one person may expect to feel worse about an objectively negative outcome than another person because they feel more responsible for the outcome. This hypothesis predicts that the extent to which individuals with heightened dysphoria will expect to feel worse about an objectively negative outcome will be a function of the degree to which they have a negative internal attribution style. Most commonly assessed using the Attribution Style Questionnaire (Peterson et al., 1982), elevated negative internal attribution style is a well-established feature of depression. Numerous studies have found that clinically depressed individuals are more likely to blame themselves for negative outcomes, whereas healthy individuals are more likely to blame external circumstances for the same outcomes (Sweeney, Anderson, & Bailey, 1986). This depression-linked negative internal attribution bias has even been found in situations where one has no control over whether the outcome is negative or positive (Abramson, Seligman, & Teasdale, 1978; Abramson & Sackheim, 1977).

As such, it is possible that dysphoria is also associated with elevated negative internal attribution tendency, and that individuals with higher dysphoria may expect to feel worse if their outcomes resulted in objectively negative outcomes than those with lower dysphoria because of an elevated tendency to blame oneself for negative outcomes in life.

1.6. The present study

This study investigated the role of action-contingent expectancies in dysphoria-linked activity engagement behavioural choice. It is assumed that individuals with higher levels of dysphoria would be less likely to choose to engage in potentially rewarding activities than those with lower levels of dysphoria. The general hypothesis under test is that individuals with higher dysphoria, relative to those with lower dysphoria, hold more negative expectations concerning the consequences of engaging in potentially rewarding activities, which in turn serves to dampen their willingness to engage in such activities.

Two non-mutually exclusive variants of this general hypothesis were distinguished, one concerning negative biases in the expected objective outcomes of activity engagement, this will be referred to as the *negative objective outcome expectancy* account; and the other concerning negative expectancy biases in the expected emotional impact of objective outcomes, this will be referred to as the *negative emotional impact expectancy* account.

Predictions generated by the *negative objective outcome expectancy* account are therefore that, when given the opportunity to choose

whether to engage in a potentially rewarding activity: 1) individuals with higher relative to lower dysphoria will have greater expectations that the objective outcome of activity engagement would be negative rather than positive; 2) greater negative bias in objective outcome expectancies would be associated with lower likelihood of choosing to engage in the activity; and 3) such negative objective outcome expectancies would mediate an indirect relationship between dysphoria and behavioural choice.

Predictions generated by the *negative emotional impact expectancy* account are that, when given the opportunity to choose whether to engage in a potentially rewarding activity: 1) individuals with higher relative to lower dysphoria will expect the negative emotional impact of an objectively negative outcome to be higher, or the positive emotion impact of an objectively positive outcome to be lower, or both; 2) higher expected negative emotional impact of a negative outcome, or lower expected positive emotional impact of a positive outcome, would be associated with a lower likelihood of choosing to engage in the activity; c) such emotional impact expectancies would mediate an indirect relationship between dysphoria and behavioural choice.

In addition, the study aimed to test hypothesis concerning the role of internal attribution style in mediating dysphoria-linked negative emotional impact expectancy bias. If individuals with higher relative to lower dysphoria did report greater negative biases in emotional impact expectancies (i.e., expected to feel worse if the objective outcome was negative, and/or expected to feel less good if the objective outcome was positive), it was hypothesised that such dysphoria-linked bias may be due to a greater tendency to attribute responsibility to oneself for objectively negative, but not positive, outcomes (negative internal attribution style). This *negative internal attribution style hypothesis* generated the prediction that: 1) individuals with higher dysphoria, relative to those with lower dysphoria, will score higher on internal attribution for negative events, and/or lower on internal attribution for positive events; 2) greater negative, and/or lower positive, internal attribution style is associated with higher negative emotional impact of an objectively negative outcome, or lower positive emotional impact of an objectively positive outcome, respectively; 3) that such negative internal attribution styles would mediate a significant indirect association between dysphoria and negative emotional impact expectancy. The role of internal attribution style in depression-linked negative bias in objective outcome expectancy was also explored to test the specificity of the subjective emotional impact expectancy effects.

1.7. Methodological considerations

To test whether the predicted pattern of relationships generated by the above hypotheses would be observed ,[1] a task was required to provide participants varying along the continuum of dysphoria with the opportunity to choose between engaging in a potentially rewarding activity or to do nothing, and to assess participants' expectancies concerning the likelihood of objectively positive or negative outcomes resulting from activity engagement independently from expectancies concerning the emotional impact of such outcomes.

To assess the presence of dysphoria-linked biases in expectancies and their relationship to behavioural decision-making, it was deemed desirable to control for the contribution of other factors that may be systematically related to depression in real world contexts, such as actual or perceived variation in skill, ability, past experience, and so on. To achieve this aim, we deliberately chose a simple task where good and bad outcomes were equally likely and based on chance, rather than skill, effort, or past experience. To assess individual differences in emotional

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[1] Given the lack of prior research examining both emotional impact expectancy from objective outcome expectancies in the context of a prosocial monetary task, conservative assumptions about the magnitude of relationships between dysphoria and action-contingent expectancies being small were made.

impact expectancies, the activity used should be one where participants would expect that choosing to engage in the activity would have potential positive or negative emotional consequences depending on the outcome of the activity. Further, to assess activity engagement as a choice relative to doing nothing (i.e., inactivity), it was required that choosing to engage in the activity would involve potential benefits or costs in terms of objective outcomes as well as emotional impact *relative* to the "do nothing" option.

To meet these requirements, a novel laboratory behavioural choice task was developed where choosing to do nothing is associated with a baseline monetary value of $5 and choosing to engage in the activity could result in a $5 monetary gain, or a $5 monetary loss, with equal probability. Based on research on prosocial spending showing that even small amounts of money spent for the benefit of others is associated with emotional rewards, and such emotional rewards tend to be greater than the equivalent amount of money used for oneself (for a review, see Dunn, Aknin, & Norton, 2014), the monetary gains and losses were in the form of charity donations in the present study. To maximise the personal relevance and emotional impact of the activity, participants were given the opportunity to choose their favourite charity out of a list of reputable charities.

2. Method

2.1. Design

The study utilised a within-subject correlational design with participants who varied in dysphoria levels.

2.2. Participants

Recruitment. A sample of $N = 179$ undergraduate psychology students participated in the study. Recruitment was guided by candidate participants' scores on the depression subscale of the 21-item Depression Anxiety and Stress Scale (DASS-21; Lovibond & Lovibond, 1996), obtained during a mass screening of first-year undergraduate psychology students. Participants were recruited from across the full range of the score continuum. Recruitment for the study involved extending invitations to all first-year students who scored in the top and bottom tertiles of the distribution of DASS-21 depression subscale scores (expecting regression to the mean). Recruitment involved making a fixed number of timeslots available for participants to sign up on a first-come first-served basis. Sample size was guided by recommendations by (Steffener, Preprint), where a minimum of $N = 175$ participants would be needed to achieve 80% power if any of the standardised paths of a simple mediation was small ($\beta = 0.20$) .[2] All participants provided electronic informed consent and received one course credit for participation in the study.

Data exclusion. Of the 179 participants who completed the study, 3 participants completed the study more than once due to accidental premature closer of the web browser hosting the Qualtrics task. These participants were allowed to complete the study again in order to gain their credit point for study participation, but their data were not included for analysis. No other data exclusions were applied prior to analysis. Thus, data from $N = 176$ participants were valid and analysed.

Participant characteristics. The sample comprised 130 (73.90%) participants self-identifying as female, 44 (25%) as male, one as non-binary/third gender (0.06%), and one preferred not to say (0.06%). The average age of the sample was $M = 20.37$ ($SD = 29.37$), with 90.9% of participants aged between 17 and 23, 4.6% aged between 24 and 36, and the final 4.5% aged above 37, reflecting mature-aged first-year students. The average of $M = 13.30$ years of education ($SD = 1.83$).

Ninety-seven (55.10%) participants identified as of European ethnic origin, 24 (13.60%) s South Asian, 16 (9.10%) as East Asian, 7 (4.00%) as Middle Eastern, 8 (4.50%) as African or South African, 6 (3.40%) as Southeast Asian, 5 (2.80%) as Aboriginal Australian or Torres Strait Islander, and 13 (7.39%) as mixed or other in ethnic origin .[3]

2.3. Materials

Dysphoria. The depression subscale of the 21-item Depression Anxiety and Stress Scale (DASS-21; Lovibond & Lovibond, 1996) was used to assess participants' level of dysphoria. This subscale has seven items assessing the frequency to which various depression symptoms were experienced over the past week, each rated on a four-point Likert scale ranging from 0 (*did not apply to me at all*) to 3 (*applied to me very much or most of the time*). The scores on the Depression subscale range from a minimum possible score of 0 to a maximum possible core of 21, with higher levels of dysphoria. The depression subscale has good concurrent validity as measured with other depression scales, such as the Beck Depression Inventory-II (Beck, Steer, & Brown, 1996) ($r = 0.79$), and has excellent reliability (Antony, Bieling, Cox, Enns, & Swinson, 1998), and demonstrated measurement invariance across cultures (Bibi, Lin, Zhang, & Margraf, 2020). Internal reliability for the depression subscale in the present sample was excellent, Cronbach's $\alpha = 0.914$. DASS-21 depression scores found in the present first year university student sample ($M = 5.86$, $SD = 4.50$) were comparable to those found in other Australian student populations (Szabo, 2010; Schofield, O'Halloran, McLean, Forrester-Knauss, & Paxton, 2016). Based on validated cut-off scores (Lovibond & Lovibond, 1996), 46.6% of the present sample scored in the "normal" range indicating minimal depression symptoms. Of the 53.4% reporting depression symptoms, 14.8% scored in the "mild" range, 22.1% in the "moderate" range, 9.1% in the "severe" range, and 7.4% in the "extremely severe" range.

Internal attribution style. The Attribution Styles Questionnaire (ASQ; Peterson et al., 1982) was used to assess negative internal attribution style. The ASQ presents subjects with six negative events (e g, you meet a friend who acts hostilely toward you) and six positive events (e g, you do a project that is highly praised) and asks subjects to write down the most plausible cause of each event, followed by self-ratings of the cause on scales of internality (the extent to which the event was caused by the self or external causes such as other people or circumstances), stability (the extent to which the event cause will be present for similar situations in the future), and globality (the extent to which the event cause will be present across situations). The ASQ is a widely used measure of attribution style and has been found to have good construct validity but average reliability (Sweeney et al., 1986). Negative Internal Attribution Scores and Positive Internal Attribution Scores were computed by averaging participants' responses across the negative internality and positive internality questions, respectively. Internal reliability of all negative item attributions in the present sample was acceptable, Cronbach's $\alpha = 0.737$, as was for all positive item attributions, Cronbach's $\alpha = 0.736$. However, the internal reliability of the Internal Attribution subscale in the present sample was low and below acceptable levels (Cronbach's $\alpha = 0.464$ for the negative internal attribution subscale, and Cronbach's $\alpha = 0.472$ for the positive internal attribution subscale).

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[2] By error of omission, the present study did not collect information on participants' income or socioeconomic status.

[3] After the tasks described in this manuscript and immediately before receiving the study debrief, participants were also asked to report on any mental images they experienced about the Coin Toss for Charity game. As preregistered, these data are exploratory in nature and are not reported in this manuscript as it is beyond the scope of the questions under investigation in this study.

2.4. Equipment

All components of the study were programmed using Qualtrics and completed on a standard PC computer with a 22-inch monitor in a testing laboratory, and responses were recorded using a keyboard.

2.5. Behavioural inactivity assessment task

A novel laboratory paradigm, "Coin Toss for Charity Game", was developed to assess individual differences in behavioural inactivity by providing participants with an opportunity to choose to engage in an activity involving a coin toss game for charity, lasting approximately 5 min. Choosing to not engage in the activity meant doing nothing and waiting for 5 min and would result in $5 being donated to charity. In contrast, choosing to engage in the activity will either result in an objectively positive outcome ($10 being donated if the result was more Heads than Tails), or objectively negative outcome ($0 being donated if the result was more Tails than Heads).

Step 1. Charity selection. To increase the personal relevance of the activity, participants were asked to choose their favourite charity from a list of eight charities selected from the Australian Charity Reputation Index's 2020 ranking of Australia's top 40 most reputable charities. The eight charities represented a broad range of beneficiary targets (animals, sick children, disadvantaged families, and mental health), affiliation status (non-religious and religious affiliations), and geographic coverage (national vs. international). Participants were presented with the logo and a brief description of each charity in a list, with the rank order of charities randomised across participants (see Appendix 1 for the full list of charities and details).

Step 2. Behavioural choice assessment. Following charity selection, participants were told they had the opportunity to choose whether or not to play a "Coin Toss for Charity" game. They were provided the following instruction: *"In this part of the study, you will get to choose whether you would like to play a coin-tossing game or not. The game involves you tossing a coin 31 times and recording the outcome of each toss on a sheet of paper. If you choose to play (approximately 5 min long), then: a) If you get HEADS more than 50% of the time (16 times or more), the amount we donate from this study session will be $10; b) If instead you get TAILS more than 50% of the time (16 times or more), the amount we donate from this study session will be $0. If you choose not to play the game, then: You will wait in this room for 5-min, and the amount we donate from this study session will be $5."* Behavioural inactivity was indicated by participants' selection of the choice "*I would like to not play the game*" rather than "*I would like to play the game*".

Step 3. Action-contingent expectancy bias assessment. Following behavioural inactivity assessment, participants were informed that they have been randomly allocated to an experimental group that did not in fact involve playing the coin-tossing game, and instead they will be asked about their perceptions about what would have happened had they chosen to play. To independently assess individual differences in the two variants of action-contingent expectancies, participants were asked to report what they expected to occur in terms of objective outcomes (win or lose outcome), followed by what they expected their emotional state to be in the event of a win vs. lose outcome.

Objective outcome expectancy bias was indexed by ratings of expected game outcome, ranging from −100 (highest confidence in the negative outcome "more TAILS than HEADS - donation decreased to $0") to 100 (highest confidence in a positive outcome "more HEADS than TAILS - donation increased to $10"), where 0 indicates the absence of bias in outcome expectancy, and scores below 0 indicating negative bias. For ease of results interpretation, scores were reversed to produce the Negative Objective Outcome Expectancy score, where higher scores indicate greater expectancy of a negative outcome

(donation is $0) rather than positive outcome (charity donation is $10).

Emotional impact expectancy bias was indexed by ratings of the expected emotional response in the event of a) the negative outcome ("more tails": $0 donated), and b) the positive outcome ("more tails": $10 donated). Both outcomes were rated on a continuous scale ranging from −50 (extremely negative emotional impact) to 50 (extremely positive emotional impact), with question order counterbalanced across participants. For ease of results interpretation, an *Expected Emotional Impact of Negative Outcome* score was created by reversing the negative objective outcome emotional impact rating, such that higher scores indicate greater negative emotional impact of the objectively negative outcome. In addition, an *Expected Emotional Impact of Positive Outcome* score was created using the non-reversed ratings of the positive objective outcome emotional impact rating, where higher scores indicate greater positive emotional impact of the objectively positive outcome.

2.6. Procedure

Participants were tested in a computer laboratory in groups of up to three participants at a time. After providing informed consent and demographics information, participants completed the DASS-21 and ASQ questionnaires, before being provided with instructions for the "Coin Toss for Charity" task. Participants then selected the charity of their choice and completed the Behavioural Engagement and Action-Contingent Expectancies assessment components of the task.[4] At the end of the study, participants were debriefed that the purpose of the study was to understand the relationship between mood and decision-making as a function of the perceived likely consequences of one's actions and the potential emotional impact of such consequences. After the debrief, participants received course credit and were thanked for their participation. The study was approved by the University of Western Australia Human Research Ethics Committee (approval code 2021ET000074).

2.7. Analysis plan

For hypothesis testing, zero-order correlational analysis were first conducted to test the predicted relationships between dysphoria, action-contingent expectancies, and behavioural choice. Next, simple mediation analyses were conducted with dysphoria as the predictor variable and behavioural choice as the binary outcome variable, and action-contingent expectancy scores as the mediator variable. Simple mediation analyses were also conducted to test the role of *negative internal attribution style* in mediating depression-linked negative biases in emotional impact expectancy and objective outcome expectancy. Mediation analyses were conducted in SPSS using the Hayes PROCESS Plugin, with bootstrapped confidence intervals using the percentile method for indirect paths based on 10,000 samples.

3. Results

3.1. Transparency statement

Study pre-registration. All analyses for the negative bias in subjective emotional impact hypothesis and the negative internal attribution style hypothesis were pre-registered, and all deviations and changes from the pre-registration are described in a transparent changes document, both available at https://osf.io/crpu2. Note that due to the ASQ Internal Scale having below than acceptable levels of internal reliability, statistical analyses involving the ASQ Internal Scale are presented in the Supplementary Materials section for transparency purposes, and results should be interpreted with extra caution and treated as tentative. Additional exploratory questions concerning the experience of emotional mental imagery during expectancy formation (as stated in the

study's pre-registration), which participants answered following the study conclusion (immediately before they were provided with the study debrief) are not reported here.

3.2. Descriptive statistics

Descriptive statistics for dysphoria, behavioural choice, action-contingent expectancies, and internal attribution style are presented in Table 1. As most scores were non-normally distributed, Spearman's rank-order correlations are reported for continuous variables.

As can be seen from Table 1, across the whole sample, the mean outcome expectancy negative bias score was −12.60 (median = −12.00), indicating that more participants expected to win than lose on the coin toss game. Given that the present sample had a median DASS-21 depression score of 5, with 46.60% of participants scoring in the "normal" range of minimal dysphoria, and 53.40% of participants reporting mild to extremely severe dysphoria, based on validated cut-off points (Lovibond & Lovibond, 1996) a median split was conducted to separate participants into "Non-dysphoric" and "Dysphoric" groups to further explore sample response characteristics. Descriptive statistics of objective outcome expectancy ratings (reported in Supplementary Table 1) for these two groups of participants indicate that while participants in the Non-dysphoric group were on average optimistic about their chances of winning (mean = −21.30, median = −27.00), with 68.30% of non-dysphoric participants predicting they would win rather than lose. In contrast, the Dysphoric group's expectations were more aligned with actual event probability (mean = −2.37; median = −1.00), with 54.30% predicting to win.

In terms of emotional impact expectancy ratings, across the whole sample, the Coin Toss for Charity task demonstrated its desired capacity to elicit expectations of negative and positive emotional impact for negative and positive outcomes, respectively. Specifically, the mean expected emotional impact rating for the negative outcome (donation decreased to $0) was 27.76 (reverse scored scale: 50 (extremely positive impact) to 50 (extremely negative impact)), and the mean expected emotional impact of the positive outcome (donation doubled to $10) was 36.55 (scale: 50 (extremely negative impact) to 50 (extremely positive impact)).

Finally, across the sample, 70 (40%) participants chose to engage in the activity (play the coin-toss game), and 106 (60%) participants chose to not engage (not play the coin-toss game).

Table 1
Descriptive statistics for dysphoria score, behavioural choice, action-contingent expectancy scores, and internal attribution style scores.

	Mean	SD	Range
DASS-21 Depression score	5.86	4.50	0 to 20
Behavioural Choice (Play/No-Play)	106/70	60%/40%	
Objective Outcome Expectancy Negative Bias score [a]	−12.60	43.31	−100 to 70
Emotional Impact of Negative Outcome Expectancy score [a]	27.76	16.59	−23 to 50
Emotional Impact of Positive Outcome Expectancy score	36.55	14.21	−22 to 50
Negative Internal Attribution score	4.04	0.93	1 to 7
Positive Internal Attribution score	4.36	0.82	1 to 6

Note.
[a] Objective Outcome Expectancy Negative Bias Score and Emotional Impact of Negative Outcome Expectancy scores reflect reversed scores, where scores above 0 indicate expectations of negative outcome and emotional impact. For Emotional Impact of Positive Outcome Expectancy scores, scores above 0 indicate expectations of positive emotional impact.

3.3. Bivariate relationships between dysphoria, action-contingent expectancies, and behavioural choice

Zero-order correlations between dysphoria, action-contingent expectancies, and behavioural choice scores are shown in Table 2.

Consistent with predictions generated by the *Negative Bias in Objective Outcome Expectancy* and *Negative Bias in Emotional Impact Expectancy* accounts, higher dysphoria (DASS-21 Depression scores) was associated with higher Objective Outcome Expectancy Negative Bias scores, and higher Emotional Impact of Negative, but not Positive, Outcome Expectancy scores. Further, both higher Objective Outcome Expectancy Negative Bias scores and higher Emotional Impact of Negative Outcome Expectancy scores were associated with greater likelihood of choosing not to play the coin-toss for charity game (Behavioural Choice - No-Play vs. Play). It is interesting to note that, contrary to our assumption, there was no direct association between dysphoria and behavioural choice, $r_{pb} = -0.024$. However, the hypothesised indirect relationships between dysphoria and behavioural choice via action-contingent expectancy biases were still tested, consistent with recommendations by Hayes (2009), where mediation analyses of indirect relationships can be tested irrespective of whether a first-order association exists between the predictor and outcome variable.

3.4. Indirect relationships between dysphoria and behavioural choice via action-contingent expectancy biases

Objective outcome expectancy. To test the predictions generated by the *Negative Bias in Objective Outcome Expectancy* hypothesis, a simple mediation model was conducted with DASS-21 Depression score as predictor, Behavioural Choice (No Play vs. Play) as outcome variable, and Objective Outcome Expectancy Negative Bias score as mediator. The predictor and mediator together predicted $R^2_{Nagelkerke} = 50.32\%$ of variance in behavioural outcome, which primarily reflects the fact that Objective Outcome expectancy Negative Bias score accounts for 47.80% of variance in behavioural choice. To facilitate interpretation of findings across study samples, unstandardized path coefficients for the model are shown in Fig. 1. Consistent with hypothesis, a significant indirect path between DASS-21 Depression score and Behavioural Inactivity via Objective Outcome Expectancy Negative Bias score was found. Each unit increase in DASS-21 Depression score was associated with a 1.705 unit increase in Objective Outcome Expectancy Negative Bias score. In turn, Behavioural Inactivity was 1.044 times more likely to occur with every unit increase in Negative Objective Outcome Expectancy Bias score. Indirectly, Behavioural Inactivity was 1.077 times more likely to occur with every unit increase in DASS-21 Depression score, via their relationship with Objective Outcome Expectancy Negative Bias score.

Emotional impact expectancy. Given only negative outcome emotional impact expectancy scores were associated with DASS-21 Depression scores, only this score was included in the subsequent tests of the indirect effects predicted the negative emotional impact expectancy hypothesis. To test the *Negative Bias in Subjective Emotional Impact Expectancy* hypothesis of depression-linked behavioural inactivity, a simple mediation model was conducted with DASS-21 Depression score as predictor, Behavioural Inactivity (No Play vs. Play) as outcome variable, and Emotional Impact of Negative Outcome Expectancy score as mediator. The predictor and mediator together accounted for $R^2_{Nagelkerke} = 7.03\%$ of variance in behavioural outcome. Path coefficients for the model are shown in Fig. 2. Consistent with hypothesis, a significant indirect path between DASS-21 Depression score and Behavioural Inactivity via Emotional Impact of Negative Outcome Expectancy score was found. A one unit increase in DASS-21 Depression score was associated with a 0.623 unit increase in Emotional Impact of Negative Outcome Expectancy score, and Behavioural Inaction was 1.031 times more likely to occur with every unit increase in Emotional Impact of Negative Outcome Expectancy score. Indirectly, Behavioural Inactivity was 1.019 times more likely to occur with every unit increase in DASS-

Table 2
Spearman's rank order correlations between dysphoria, behavioural choice, action-contingent expectancies, and internal attribution style scores.

|			1	2	3	4	5	6	7
1	DASS-21 Depression score	rho	—						
2	Behavioural Choice (No-Play choice)	rpb	−0.024	—					
3	Objective Outcome Expectancy Negative Bias score [a]	rho	.187*	.622**	—				
4	Emotional Impact of Negative Outcome Expectancy score [a]	rho	.231**	.234**	.260**	—			
5	Emotional Impact of Positive Outcome Expectancy score	rho	0.042	0.015	0.005	.558**	—		
6	Negative Internal Attribution score	rho	.332***	0.036	.087	.232**	0.153*	—	
7	Positive Internal Attribution score	rho	−.141	−0.013	−0.049	0.116	.254***	−0.068	—

Note.

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

*** Correlation is significant at the 0.001 level (2-tailed).

[a] Objective Outcome Expectancy Negative Bias Score and Emotional Impact of Negative Outcome Expectancy scores reflect reversed scores, where scores above 0 indicate expectations of negative outcome and emotional impact. For Emotional Impact of Positive Outcome Expectancy scores, scores above 0 indicate expectations of positive emotional impact.
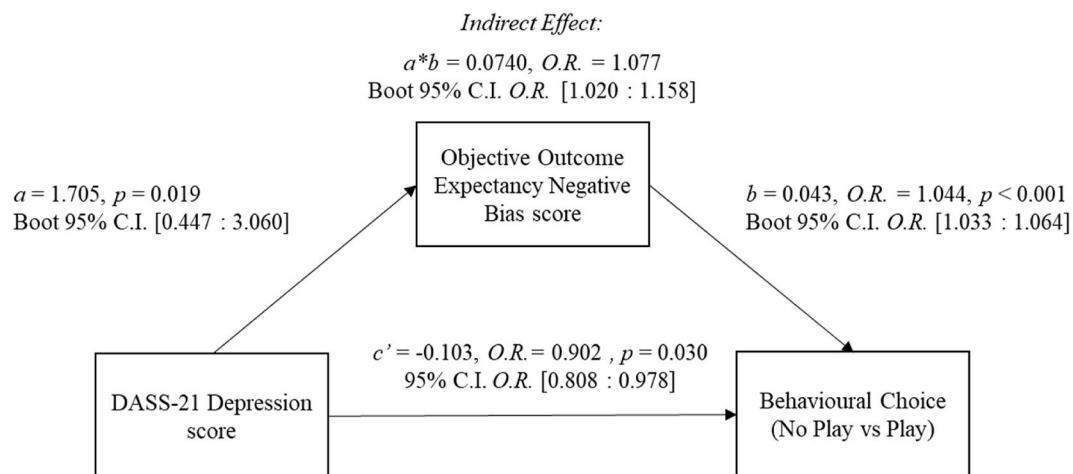
Fig. 1. Path coefficients from the simple mediation analysis testing the Negative Bias in Objective Outcome Expectancy account of dysphoria-linked behavioural choice.
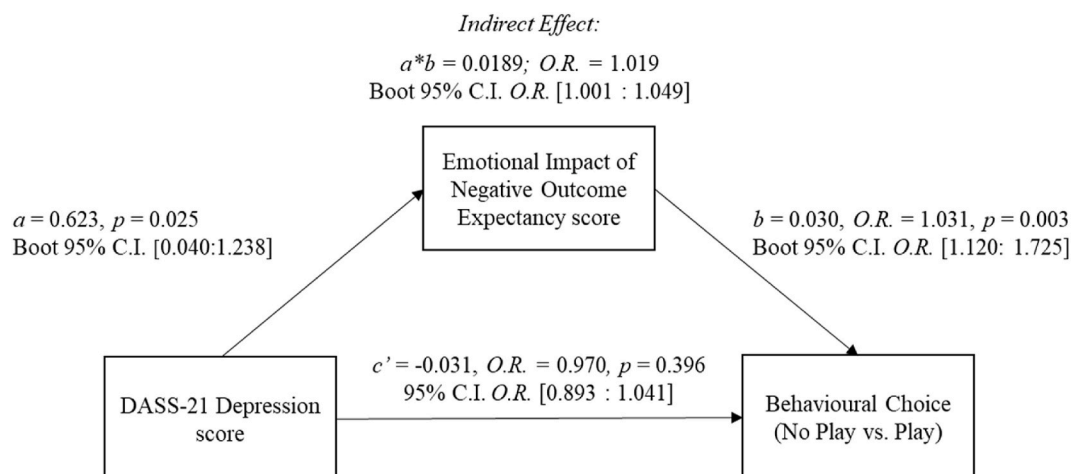
Fig. 2. Path coefficients from the simple mediation analysis testing the Negative Bias in Subjective Emotional Impact Expectancy account of dysphoria-linked behavioural choice. (Note: for ease of interpretation, the Emotional Impact of Negative Outcome Expectancy Score were reversed such that higher scores indicate greater negative emotional impact).

21 Depression score, via their relationship with Emotional Impact of Negative Outcome Expectancy score.

3.5. Role of negative internal attribution style

Due to the ASQ Internal Scale having below than acceptable levels of internal reliability, pre-registered analyses involving the ASQ Internal Scale scores are presented in the Supplementary Materials section for transparency purposes.

3.6. Exploratory parallel mediation analysis

While the questions under investigation concerned the presence and conceptual independence of depression-linked biases in two types of action-contingent expectancies, given both types of expectancies were related to dysphoria and behavioural choice, it was considered of interest to explore these two expectancies in the same mediation model. As depicted in Fig. 3, an exploratory parallel mediation analysis showed that when both expectancies are included, only objective outcome expectancy mediates the relationship between dysphoria and behavioural choice. This was perhaps not surprising given that Objective Outcome Expectancy Negative Bias score was a stronger mediator of the indirect relationship between dysphoria and behavioural choice than Emotional Impact of Negative Outcome Expectancy score.

4. Discussion

The present study aimed to discriminate the validity of hypotheses concerning two possible types of action-contingent expectancy biases that may be implicated in dysphoria-linked behavioural inactivity. Consistent with both the *negative bias in objective outcome expectancy* and *negative bias in emotional impact expectancy* accounts, higher dysphoria was associated with greater expectations that the objective outcome of activity engagement (playing the coin-tossing game) would be negative rather than positive, and greater expectations that the emotional impact of an objectively negative outcome would be more negative. Dysphoria was not related to the degree of expected positive emotional impact of objectively positive outcomes. In turn, both types of negative action-

contingent expectancies biases were associated with lower likelihood of choosing to engage in the activity. Importantly, both types of negative action-contingent expectancy biases mediated the indirect relationship between dysphoria and behavioural choice, such that higher dysphoria was indirectly associated with lower likelihood of choosing activity engagement via greater negative biases in the expected objective outcome and the expected emotional impact of the negative outcome.

The present findings demonstrate that the laboratory-based activity was capable of assessing dysphoria-linked variation in action-contingent expectancies and indirect relationships with behavioural choice. As desired, participants on average expected that the negative and positive outcomes of the activity to have negative and positive impacts on their emotions. Importantly, such expectancies tracked with dysphoria as well as behavioural choice. Of course, interpretations of the present findings must take into account the modest size of the indirect relationships observed. As reported in the Method section, a minimum sample of $N = 175$ participants was required to achieve 80% power if any of the paths within an indirect path was small in effect size ($\beta = 0.200$) (Steffener, Preprint). We note that the observed size of relationships between expectancies and behavioural choice was large for objective outcome expectancy and behavioural choice ($\beta = 0.614$), and small for emotional impact of negative outcome expectancy and behavioural choice ($\beta = 0.218$), but the relationship between dysphoria and expectancies were small and below $\beta = .20$ (objective outcome expectancy: $\beta = 0.177$; emotional impact of negative outcome expectancy: $\beta = 0.169$), thus the study may have been under powered to detect simple indirect mediating relationships.

Interestingly, while indirect associations between dysphoria and behavioural choice were found via negative action-contingent expectancy biases, a first-order association between the two variables was not observed in the present study. This can be considered as a limitation of the present study, and it is pertinent to speculate on why no such first order association was observed. Prior research has shown that parameters such as the magnitude of effort, reward, cost, and uncertainty all serve to influence dysphoria and depression-linked variation in willingness to exert physical effort to pursue potential rewards (for a review, see Horne et al., 2021). As discussed in further detail in the limitations section below, the present study deliberately employed a tightly
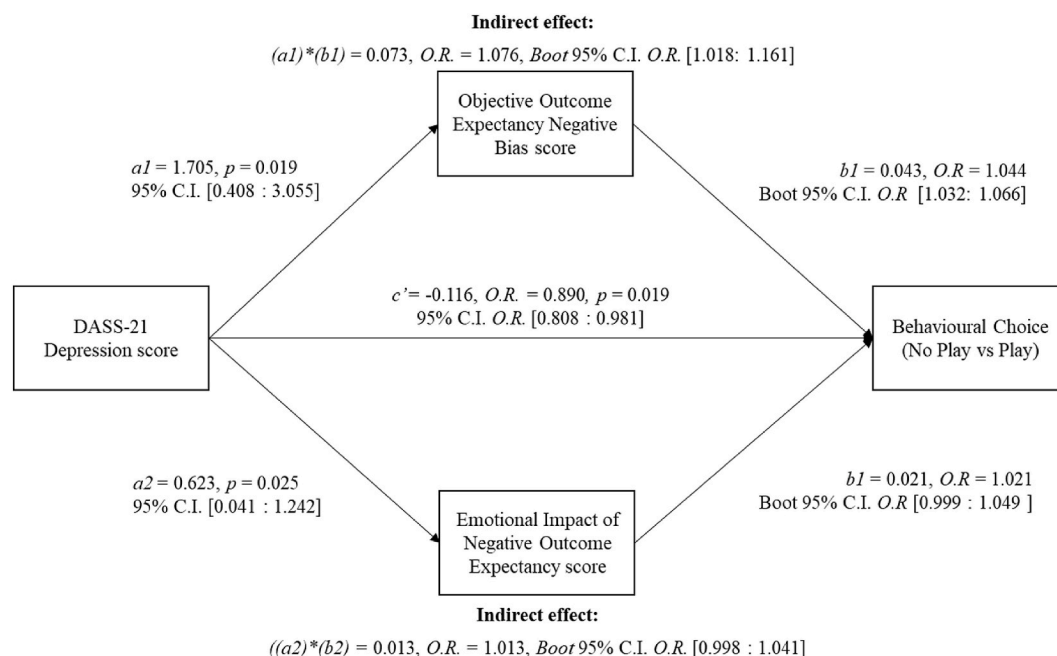

Indirect effect:
$(a1)*(b1) = 0.073$, O.R. = 1.076, Boot 95% C.I. O.R. [1.018: 1.161]

Objective Outcome Expectancy Negative Bias score

$a1 = 1.705$, $p = 0.019$
95% C.I. [0.408 : 3.055]

$b1 = 0.043$, O.R = 1.044
Boot 95% C.I. O.R [1.032: 1.066]

DASS-21 Depression score

$c' = -0.116$, O.R. = 0.890, $p = 0.019$
95% C.I. O.R. [0.808 : 0.981]

Behavioural Choice (No Play vs Play)

$a2 = 0.623$, $p = 0.025$
95% C.I. [0.041 : 1.242]

Emotional Impact of Negative Outcome Expectancy score

$b1 = 0.021$, O.R = 1.021
Boot 95% C.I. O.R [0.999 : 1.049]

Indirect effect:
$((a2)*(b2) = 0.013$, O.R. = 1.013, Boot 95% C.I. O.R. [0.998 : 1.041]

Fig. 3. Path coefficients from the exploratory parallel mediation analysis testing the indirect relationships between DASS-21 Depression score and Behavioural Choice via Objective Outcome Expectancy Negative Bias score and Emotional Impact of Negative Outcome Expectancy score.

controlled chance-based task where the likelihood and magnitude of desirable and undesirable outcomes were equal, known, and held constant. This design allowed the study to investigate the hypothesised role of action-contingent expectancies as a mediator of dysphoria and behavioural choice independent of variation in effort, reward, cost, and uncertainty. Of course, in doing so it is very likely that the conditions under which first-order associations between dysphoria and behavioural choice are observable were not captured by the task. For example, dysphoria-linked variation in willingness to seek rewards is more readily observed under conditions of high effort than low effort (Sherdell et al., 2012; Treadway et al., 2009), thus the coin-toss activity may not have been sufficiently effortful in inducing sufficient motivational barriers to elicit dysphoria-linked variation in behavioural choice. It is also possible that under the present task conditions, a first-order association would be more readily observed in clinically depressed individuals rather than those with dysphoria. Having delineated the conceptual difference between objective outcome and emotional impact expectancies as mediators of dysphoria-linked behavioural choice, the task used in the present study is ripe for adaptation in future research to further advance understanding of the task conditions under which direct versus indirect associations between dysphoria and depression and behavioural choice are observable, by systematically examine variations in effort, reward, cost, and uncertainty, and comparing responses across participants with dysphoria, depression, and healthy controls.

Further, results shown in Fig. 1 indicated that when the indirect relationship between dysphoria and behavioural choice via objective outcome expectancy was statistically removed, there was a negative direct relationship between dysphoria and behavioural choice. This unexpected direct effect indicates that once the effect of negative expectancies about the likely objective outcomes of one's actions was statistically removed, dysphoria was associated with lower likelihood of choosing not to play the coin tossing game. Of course, given the strong association between dysphoria and outcome expectancy, it should be recognized that when variation in outcome expectancy is statistically removed from variation in dysphoria scores, the resulting residual does not represent variation in naturally occurring dysphoria. In real world settings, elevated dysphoria will be associated with negative outcome expectancies and will positively predict behavioural choice favouring inactivity through this indirect pathway.

The present study has several theoretical implications. First, the present study demonstrates the importance of assessing *action-contingent* expectancies when investigating depression-linked behavioural choice. While researchers have recently emphasised the links between negative future thinking and behavioural deficits in depression (Bulley & Irish, 2018; Roepke & Seligman, 2016), to our knowledge, this study is the first to directly test the link between negative action-contingent expectancies and behavioural inactivity, albeit in dysphoria, not clinical depression. While past research has focused on examining depression-linked individual differences in expectations of negative and positive outcomes in the future, results from the present study suggests that dysphoria and depression-linked behavioural inactivity may be linked to negative biases in "if-then" predictions about what might happen in the future *as a result of one's actions*.

Second, the present findings suggest that, when investigating individual differences in action-contingent expectancies, it may be important to distinguish expectations concerning the subjective emotional impact of possible action-contingent objective outcomes from expectations concerning the likelihood of such objective outcomes. While past research has established that dysphoria and depression are associated with pessimistic beliefs about the future in general, this knowledge is limited in its capacity to explain why some individuals are more likely to choose not to engage in some, but not all, activities. We argue that investigating biases in expectancies concerning the consequences of one's behaviour may help to advance understanding of the modifiable cognitive drivers of dysphoria and depression-linked behavioural deficits. While dysphoria was associated with negative biases in both types

of action-contingent expectancies in the present study, the contribution of either type of expectancy may differ with respect to other activities, such those requiring skill and effort, or involve different levels of risk or reward. In distinguishing between objective outcome expectancies and subjective emotional impact expectancies specifically in relation to one's own actions, the present study provides a more refined conceptual framework for investigating the mechanistic role of future expectancies in dysphoria and depression-linked variation in decision-making and reward-seeking behaviour.

In delineating emotional impact expectancy from objective outcome expectancy, the present study also advances understanding of depression-linked individual differences in optimism/pessimism. Exploratory analysis of the sample using a median split of depression scores showed that, based on objective outcome expectancy ratings, only 31.7% of non-dysphoric participants expected to lose, in contrast to 45.7% of dysphoric participants. The study deliberately chose the simplest possible chance-based task with a 50-50 probability of win versus lose, to reduce the possible influences of individual variation in statistical knowledge. The results demonstrate that despite the known objective chances of winning or losing being equal, healthy individuals, but not dysphoric individuals, were optimistically biased in their predictions. This pattern of findings is consistent with the well-established optimism bias found in healthy populations, who are known to exhibit unrealistic optimism about their own chances of negative future outcomes (Sheppard, Klein, Waters, & Weinstein, 2013) and having good luck (Day & Maltby, 2003). In contrast, the dysphoric group exhibited expectations that were more aligned to the actual probabilities of winning, consistent with prior research on depressive realism (for reviews, see Alloy & Abramson, 1988; Moore & Fresco, 2012).

Relatedly, although the study did not aim to assess the extent to which dysphoria-linked negative emotional impact expectancies represent affective forecasts errors vis-à-vis reality, the present study has implications for this area of research. It is possible that individuals with elevated dysphoria are more negative, but also more accurate, in their expectations that they will feel worse in the event of an objectively negative outcome. Alternatively, such expectations may represent overestimations true emotional impact of the objectively negative outcome. Prior studies that have investigated the accuracy of depression-linked affective forecasting suggests that both dysphoric (Hoerger et al., 2012) and clinically depressed individuals (Mathersul & Ruscio, 2020; Wu et al., 2017) tend to over predict negative emotional responses to life events. However, the objective outcome of life events in such studies were not standardised nor assessed, thus it is unclear whether the over prediction of negative emotional response was due to the eventuation of objective outcomes that were less negative than expected, or due to affective forecasting biases per se. The paradigm developed in the present study provides a controlled method of assessing individual differences in affective forecasting whilst controlling for objective outcomes. Thus, future research can use the present paradigm to test the degree to which dysphoria and depression-linked emotional impact expectancies reflect affective forecasting errors or accurate predictions of emotional impact, by extending the present study to include assessments of actual emotional impact.

It is interesting to consider that, given the do-nothing option involved a risk-free baseline donation of $5, the depression-linked behavioural inactivity observed in the present study may reflect depression-linked elevations in risk aversion. The present study was not designed to measure an individual's degree of risk aversion (Kahneman & Tversky, 1982), i.e., the point at which a person will forgo a risky reward for a risk-free but smaller reward, as the probability and magnitude of risk and reward was equal and constant in the coin toss activity. However, choosing not to play the coin toss for charity game (behavioural inaction choice) in the present study can be construed as *risk aversion behaviour*. At the same time, objective outcome expectancy can be construed as a measure of *subjective risk perception* (the perceived probability of a lose outcome for *me*), whereas the expected emotional

impact of the lose outcome can be construed as a measure of *subjective risk aversiveness* (the negative emotional impact of a lose outcome on *me*). The findings show that higher levels of dysphoria were not only associated with higher levels of *subjective perceived risk*, and it was also associated with higher levels of *subjective perceived risk aversiveness*. Of course, whether a person chooses to take risk in a given situation will undoubtedly be influenced by a range of factors, and exploratory binomial logistic regression in our data showed that action-contingent expectancies only accounted for 49% (R^2 $_{Nagelkerk}$ = 0.49) of variance in behavioural inaction choice. Future research can adapt the present paradigm to investigate the role of dysphoria and depression-linked biases in risk aversion in addition to risk perception, such as by assessing the reward value at which participants would accept a loss of a standardised value with 50% probability. Future research should also extend the present study to investigate the potential presence of alternative individual differences factors that may influence motivation and behavioural choice on the coin toss task, which may include individual differences in prosociality, impulsivity, socio-economic status, or even proneness to boredom.

4.1. Potential clinical implications

In terms of potential clinical implications, it must be acknowledged that the present study was conducted in a student sample that varied in levels of dysphoria, and the clinical status of participants were not ascertained. As such, the extent and manner in which the findings extend to clinically depressed populations remains to be tested in future research. Nevertheless, negative expectations of the future are thought to be a hallmark of depression and an important target of cognitive therapy (Abramson, Metalsky, & Alloy, 1989; Beck, 1991), and the present research suggests that expectations concerning the future outcomes of one's actions may be an important clinical target for addressing behavioural withdrawal in depression. Distinguishing and assessing both objective outcome and subjective emotional impact expectancies in relation to one's actions may constitute potentially important novel clinical targets. As shown in Appendix B Supplementary Table 1, while low dysphoria participants tended to expect to win, high dysphoria participants were more even-handed in their expectations, consistent with depressive realism accounts. In contrast, for affective forecasts of the emotional impact of objective outcomes, high dysphoria participants on average anticipated higher levels of expected negative emotional impact for negative outcomes, but similar levels of expected positive emotional impact for positive outcomes, relative to low dysphoria participants. To the extent that the present findings generalises to clinically depressed samples, and if the cross-sectional relationships observed in the present study are found to be causal in future research, then the findings suggest that focusing on promoting a optimism bias in action-contingent objective outcome expectancies, as well as reducing negative affective forecasts for possible negative outcomes in the future, may contribute to alleviating deficits in reward activity engagement in depression. However, patterns of dysphoria and depression-linked action-contingent expectancy biases may vary across individuals and as a function of activity type and decision context, thus the appropriate intervention required may differ depending on the type of action-contingent expectancy that is negatively biased relative to healthy samples.

4.2. Limitations and future directions

Results from the present study should be interpreted in light of the following limitations. First, the cross-sectional nature of the present study design does not permit the drawing of any conclusions about causality. Thus, even when the predicted pattern of relationships are observed, this only constitutes evidence *consistent* with the hypothesis, but does not permit conclusions concerning the causal nature or direction of the relationships investigated. To directly test our hypothesis

concerning the functional contribution of action-contingent expectancies to behavioural inactivity in relation to dysphoria and depression, future research should aim to experimentally manipulate both variants of action-contingent expectancies to examine whether increases and decreases in such expectancies causally impact behavioural inactivity in dysphoric and depressed individuals.

Second, only the primary analyses concerning the relationships between dysphoria, subjective emotional impact expectancy, internal attribution style and behavioural inactivity were pre-registered, and all analyses involving internal attribution style are inconclusive due to low internal reliability of the measure. Future research should employ more reliable methods of assessing internal attribution style to test its relationship to action-contingent expectancy biases. Further, future research should seek to replicate the exploratory finding when both types of expectancy scores were included as mediators, only objective outcome expectancy statistically mediated the association between depression score and behavioural choice, which was not surprising given it was a stronger mediator in this particular task context.

Third, the present results should be interpreted within the specific behavioural decision-making context under which it was investigated. That is, behavioural choice was assessed using a chance-based task that involved equal and known risk ratios of objectively negative versus positive outcomes (50-50 chance), and such outcomes were of equal magnitude ($5). In addition, although there is no obvious reason for participants not to believe that the coin-toss activity was genuine, the study did not explicitly verify this, a limitation that should be addressed in future research. While the present laboratory activity afforded high experimental control with respect to minimising the influence of factors other than cognitive biases on expectancy judgments and behavioural choice, such a tightly controlled laboratory task also necessarily differs from everyday activities that require skill, involve risk of failure and rejection, and have direct personal gain, such as social interactions, physical exercise, and learning new skills. As such, the extent to which findings from the present study is representative of the broader range of activities associated with dysphoria and depression in more naturalistic settings remains to be investigated in future research. Future studies can adopt the framework developed by the present lab study to assess depression-linked variation in objective outcome expectancies as well as subjective emotional impact expectancies to examine the extent to which such expectancies account for variation in behavioural engagement in a range of social, physical, and mastery activities, in the laboratory as well as in the real world.

Fourth, the present study only used one method of assessing internal attribution, the Attribution Styles Questionnaire (Peterson et al., 1982). As emphasised earlier, although the ASQ had been widely used in the past, the internal reliability of the internal attribution subscales of the ASQ within the present sample was below acceptable, similar to those found in Hjelle, Belongia, and Nesser (1996), Cronbach's α = 0.41 and 0.37 for the Negative and Positive Internal Attribution subscales, respectively, and in Peterson et al. (1982), Cronbach's α = 0.46 and 0.50 for the Negative and Positive Internal Attribution subscales, respectively. This prevents the present study from drawing conclusions concerning the role of internal attribution style as a contributor to dysphoria-linked action-contingent expectancy bias. Future research should assess internal attribution style using reliable instruments, as well as seek to assess or manipulate the degree of internal attribution of responsibility within task-specific scenarios directly via subjective ratings, or via the endorsement of anticipated emotions that can discriminate between internal vs. external attributions of responsibility (e.g., guilt and shame versus anger, respectively).

Finally, beyond the role of internal attribution style in relation to depression-linked action-contingent expectancy biases, and future research should investigate other candidate explanatory factors that may be driving depression-linked negative biases in both objective outcome expectancies and subjective emotional impact expectancies. One such factor may be elevated tendency to use negative state emotion

as information (Clore, Gasper, & Garvin, 2001), which has been previously found to contribute to depression-linked negative affective forecasts of general future emotional states (Marroquín & Nolen-Hoeksema, 2015). Future research can use the present methodological approach to investigate the extent to which depression-linked negative biases in both types of action-contingent expectancies are due to greater tendency to rely on negative state emotion as information during future judgment and decision-making. Of course, the present study only investigated dysphoria-linked expectancy and behavioural choice, with dysphoria being assessed via a self-report questionnaire, and the study did not verify the clinical status of participants. It will be important for future research to replicate and extend the present research to clinical depression populations to examine the extent to which the correlational and causal nature of relationships extend to clinically depressed populations.

While determining the generality and causal nature of the relationship between dysphoria and depression-linked expectancy biases and behavioural inactivity must await the outcomes of future research, for the moment we can conclude on the basis of the present results that to the extent that individuals with higher dysphoria hold pessimistic biases in the expected consequences of engaging in an activity, in terms of being less optimistic about the likelihood of objectively good rather than bad outcomes, and anticipating greater emotional costs for negative outcomes, then they would be less likely to choose to engage in that activity than less dysphoric individuals. This contribution to knowledge and understanding, together with the newly introduced experimental approach, has the potential to enhance researchers' capacities to further investigate the role of action-contingent expectancy biases in dysphoria and depression-linked behavioural inactivity.

CRediT authorship contribution statement

Julie L. Ji: designed the study, built the task, conducted data collection, and, performed the data analysis with input from C.M, drafted the paper. **Colin MacLeod:** designed the study, provided critical revisions, All authors approved the final version of the paper for submission.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data for this study are available on the Open Science Framework (https://osf.io/crpu2)

Acknowledgement

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.brat.2023.104353.

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