The Futures We Want: How Goal-Directed Imagination Relates to Mental Health

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Word count (excluding figures): 12235

Abstract

Imagination is an adaptive ability that can be directed towards the pursuit of personal goals. While there is a wealth of research on goals, and on imagination, few studies lie at the intersection—little is known about individual differences in *goal-directed imagination*. In 153 adults, we examined how 28 aspects of goal setting and goal-directed imagination relate to mental health. Higher well-being and lower depressive symptoms were strongly linked to having goals that were more attainable, under control, and expected to bring more joy; and to goal-directed imagination that was clearer, more detailed, and more positive. These variables also predicted greater goal progress two months later. Importantly, having more intrinsically rewarding goals predicted a decrease in depressive symptoms over time, while more positive imagination predicted an increase in well-being. These findings contribute to our understanding of goal-directed imagination, and highlight potential targets for goal- and imagery-based interventions to improve mental health.

Keywords: goal setting, episodic simulation, future thinking, depression, dysphoria

From learning a new language to making new friends, most people possess at least a few personal goals that they hope will become a reality. Given the myriad definitions of 'goals' it is worth first clarifying what we mean: goals are an individual's ambitions, dreams, or aims that they are currently or intending to work towards, that are personally meaningful, require some effort to be realised, and are realistically achievable (cf. with fantasy; Oettingen, 2012). Goals provide structure to life, directing action and motivating engagement (Little, 1989; Seligman, 2011). Indeed, it is widely agreed that the pursuit of personal goals is fundamental to subjective well-being (Klinger, 1977; Klug & Maier, 2015; Wiese, 2007). For many people, it is inherently rewarding to accomplish small steps on the way to a goal, and to experience positive, anticipatory feelings of energy and excitement as goals draw nearer (Emmons, 1986). Of course, achieving a goal itself can also be rewarding, giving rise to a sense of mastery or attainment—which are core components of some models of well-being (e.g., Seligman, 2011).

Goal Setting and Mental Health

Many studies from social, clinical, and positive psychology have linked individual differences in goal setting to mental health—at both the high and low ends (reviewed in MacLeod, 2017). Here, we focus on links with well-being and depressive symptoms. One of the earliest studies in this area found that happiness was related to pursuing a greater number of goals, i.e., 'goal fluency' (Wessman & Ricks, 1966); since then, having meaningful goals across a wide variety of life domains has been proposed as a protective factor against depression (Champion & Power, 1995). Depression has also been linked to having fewer 'approach' goals and motives (i.e., focused on reaching something positive) but not more 'avoidance' goals and motives (i.e., moving away from something negative; e.g., Dickson & MacLeod, 2004a). Depressed individuals may also view their personal goals as *more* important to their future happiness and sense of identity (Street, 2002) whilst simultaneously viewing goal attainment as less likely and less under their control (Dickson, Moberly, & Kinderman, 2011). Individuals who set more specific (e.g., 'run a marathon next April') rather than abstract goals (e.g., 'I want to be fit') also tend to score higher on positive affect and purpose in life (Dickson & Moberly, 2013; Freund & Baltes, 2002). Finally, the pursuit of goals that are more intrinsically rewarding and autonomously motivated has been found to predict higher well-being and fewer depressive symptoms

(Sheldon & Elliot, 1999; Winch, Moberly, & Dickson, 2014). In short, there is a wealth of evidence that many dimensions of goal setting and pursuit are linked to important mental health outcomes.

Imagination and Mental Health

> *"I dreamed of it, ceaselessly and vividly… so that I could more clearly picture to myself how I would act when the time came. I was full of enthusiasm. More and more my intended action began to seem both likely and possible."*
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> —*Fyodor Dostoevsky* (1864/2010; p. 61)

One of the cognitive tools at our disposal to assist in goal pursuit is *episodic simulation*: the mental construction of possible future event(s) in one's life (Addis, 2018; Schacter & Addis, 2007). Episodic simulation (which we use interchangeably with the term 'imagination') involves flexibly accessing and integrating details from episodic memory to create novel scenarios. Simulations can range from the mundane (e.g., picking up groceries on the way home) to the meaningful (e.g., envisioning what life might be like in another city, in a new job, or with a different partner). We can imagine the steps leading up to a goal, to plan and prepare for contingencies, or can visualise the outcome of goal attainment (Taylor, Pham, Rivkin, & Armor, 1998). Simulation is not always clearly adaptive; it can take the form of purposeless mind-wandering or fantasy, which sometimes come at the cost of *de*motivation (reviewed in Mooneyham & Schooler, 2013; e.g., Oettingen, Mayer, & Portnow, 2016; Pham & Taylor, 1999). Nonetheless, many of our everyday imaginings are constructive, purposeful, and directed towards the futures we want (Andrews-Hanna et al., 2013; McMillan, Kaufman, & Singer, 2013).

As with goal setting, individual differences in simulation have been linked to important functional outcomes. In depression, for example, episodic simulation of positive future events tends to be less specific and detailed (Gamble, Moreau, Tippett, & Addis, 2019), and mental imagery is often experienced from an observer (third-person) rather than field (first-person) perspective (Holmes, Blackwell, Burnett Heyes, Renner, & Raes, 2016). Individuals who are able to more vividly imagine positive scenes in their future also tend to be more optimistic (Ji, Holmes, & Blackwell, 2017). Such studies have typically required participants to imagine future scenes *generally*—not scenes related to

their own goals. We think the latter may be especially relevant to functioning: generating more vivid mental imagery about one's personal goals is thought to increase the perceived likelihood of goal attainment (Kahneman & Tversky, 1982) and produce stronger feelings of anticipation (Holmes & Mathews, 2010). Moreover, three recent experimental studies have shown that positive imagery interventions, relative to non-imagery control conditions, can increase anticipatory pleasure and engagement in rewarding behaviours in depression (Hallford, Sharma, & Austin, 2019; Renner, Ji, Pictet, Holmes, & Blackwell, 2017) and amplify motivation for personal goals (Renner, Murphy, Ji, Manly, & Holmes, 2019). Clearly, goal-directed imagination is an important ability, and warrants further investigation.

Present Study

Given the adaptiveness of imagination, and the value of personal goals, surprisingly little is known about individual differences in goal-directed imagination, and how these relate to mental health (Gerlach, 2013). For example, do people with higher well-being simulate their goals differently than people with lower well-being or depression? If so, what are those differences? Do certain 'styles' of simulation predict actual goal progress or change in mental health over time? The present study aims to address these questions, and to extend the current literature in several ways.

First, considering the plethora of variables that have been studied in relation to goal setting and imagination, we developed a new task to assess many of these variables simultaneously. This task allowed for examination not only of which variables relate to mental health, but of the relative magnitude of those associations. Second, given that each person possesses a unique constellation of goals (Klinger, 1977), we took an ideographic approach, having participants imagine scenes related to their *own* goals—in an effort to increase ecological validity. Third, although many studies in this area have used categorical designs (e.g., depressed patients vs controls), depressive symptoms exist along a continuum of severity throughout the population (Ayuso-Mateos, Nuevo, Verdes, Naidoo, & Chatterji, 2010); we thus employed a correlational design. And fourth, it has been suggested that a thorough examination of mental health should account for both positive and negative dimensions of experience (MacLeod, 2017), so we included measures of both well-being and depressive symptoms.

We had specific directional hypotheses for many of the goal setting and simulation variables and their relationship to mental health; these are shown in the Results section, together with quantified evidence for each. In brief, based on the findings discussed above, we predicted that higher well-being and lower depressive symptoms would be associated with: (1) having goals that were more specific, attainable, under control, approach-focused, intrinsically rewarding, varied across life domains, and less central to one's identity; and (2) goal-directed imagination that was more detailed, vivid, sensory, process-focused, positive, seen from a field (rather than observer) perspective, less fragmented, and less negative. In addition to these confirmatory analyses, we also explored which aspects of goal setting and imagination predicted later goal progress and change in mental health over time.

Method

Our hypotheses, design and analysis plan were preregistered on the Open Science Framework (OSF) prior to data collection (osf.io/8jgd4). The analysis script, variables codebook, de-identified summary data, and other relevant files for this project are also available online (osf.io/vycrw); we provide links to specific files throughout the following sections. All analyses were run using R (Version 3.6.0; R Core Team, 2019); the R packages used for data cleaning, analyses and visualisations are listed in the analysis file (osf.io/bhyk7).

Participants

Participants in the final sample were 153 adults from the general Auckland community (98 females; 2 gender diverse; age: M = 26.0 years, SD = 5.8; years of education: M = 17.0 years, SD = 3.0). The sample was highly diverse, with participants born in 34 countries including New Zealand (24.2%), India (14.4%), China (7.2%), the Philippines (7.2%), and the USA (6.5%); additional demographic data are available at osf.io/bhyk7. The target sample size was determined *a priori* to provide 80% power to detect small-medium sized correlations (rho = .2) at $\alpha = .05$. This effect size was not based on prior findings, which are often inflated due to publication bias, but on the smallest effect size of interest (Lakens & Evers, 2014).

Participants were recruited via flyers posted around the University of Auckland (UoA) campus and broader community, emails and social media posts to relevant groups, online advertising on the UoA Psychology Research page, and by word-of-mouth. To encourage a sample spanning a spectrum of mental health, some advertisements were targeted at individuals with depressive symptoms, while others were worded more generically (see osf.io/nsfc7 for examples). Inclusion criteria were 18-50 years of age, no history of neurological or psychiatric conditions (other than depression/anxiety, but including substance use disorders) and fluency in English. An additional four participants (beyond the final N = 153) attended the session but had not disclosed during screening information indicating they did not meet inclusion criteria (due to a history of epilepsy, a history of drug addiction, current alcohol addiction, and an insufficient level of English); these participants were excluded from analyses. All participants received a $25 grocery voucher and those who completed the online follow-up survey (n = 136; 88.9%) also entered a draw to win one of two $250 grocery

vouchers. Written informed consent was obtained from all participants (including permission to share their de-identified summary data on the OSF) and the study was approved by the UoA Human Participants Ethics Committee (ref: 019029).

Procedure

Participants were pre-screened for eligibility via a brief form sent over email (osf.io/kwt8f). Sessions were conducted one-on-one by the first author in an interview room at the UoA and lasted around 2.5 hours, with breaks offered whenever needed. Sessions comprised four parts: (a) demographics and screening (15 min); (b) goal setting and simulation (60 min); (c) well-being and mood questionnaires (15 min); and (d) a cognitive battery (60 min). An overview of the entire task flow can be viewed at osf.io/qmvsj. Sections (b) and (d) were counterbalanced to reduce any order effects of those tasks, such that participants completed either {a, b, c, d} or {a, d, c, b}. Section (c), comprising less demanding self-report tasks, always separated sections (b) and (d) to reduce any participant fatigue. We administered the cognitive battery to explore later which cognitive abilities may relate to simulation, but this question was beyond the scope of the current paper and is not mentioned further (data are available at osf.io/6eqt7).

Measures

Demographics and screening. After obtaining informed consent, the experimenter conducted the Structured Clinical Interview for DSM-5 Research Version (SCID-5-RV; First, Williams, Karg, & Spitzer, 2015), which was shortened to include only those questions relevant for the current study. Specifically, we administered questions from the Nonpatient Overview to collect demographics (age, educational and occupational history) as well as medical information (e.g., history of psychiatric conditions) to screen more thoroughly for study eligibility; and questions from Module A to derive researcher-based diagnoses for major depressive episode (current or past; A1-53).

Goal setting and simulation. We developed a comprehensive new measure of ideographic goal setting and simulation, the Goal-Directed Simulation Task (GDST). Altogether, the GDST yielded 14 variables related to goal setting and 14 variables related to goal-directed simulation. These are outlined below but see the variables codebook online (osf.io/xzt4k) for a more thorough

description of each variable and how it was scored. The GDST was delivered online via Qualtrics; the *.qsf* file is available for reuse or adaptation (osf.io/q6nyr).

The task began with the experimenter at the computer and the participant opposite. Participants were told they would be asked to think of goals they wanted to achieve in their life over three time periods (short-, medium-, long-term), and goals were defined as "important aims, dreams or ambitions that you're working towards, or planning to work towards, in your life." We instructed that goals should be personally relevant, plausible, and specific, and gave examples of a non-specific ("I want to be happy") and specific goal ("I want to pass my end of term exams") in line with Belcher and Kangas (2014). Short-term goals were defined as "goals you want to achieve over the next few weeks", medium-term goals as "…over the next few months" and long-term goals as "…more than one year from now." The purpose of including multiple time periods was not to examine temporal differences *per se* (although that could be later explored) but to obtain a more representative assessment of goal setting and simulation across time—in other words, to increase content validity.

Participants were given 60 seconds to verbally name as many of their short-term goals as possible and then, with no time limit, were asked to choose the two most important of those goals (following Steca et al., 2016); meanwhile the experimenter entered all goals generated into Qualtrics. The process was repeated for medium- and then long-term goals. After this goal generation phase, the participant sat at the computer and was presented with seven questions about each of their six chosen goals. The order of goals and questions was randomised to reduce any effects of temporal sequence or repetitive presentation on responses. The seven questions tapped into the variables of perceived attainability, sense of control, degree of difficulty, expected joy (if the goal is achieved), expected sorrow (if the goal is not achieved), importance of the goal, and centrality to the participants' identity. Response options were presented on 0-100 horizontal scales (e.g., 0 = "not at all"; 100 = "extremely"); participants were also asked to write a few words about their underlying motive for each goal in a text box.

The six chosen goals for each participant (a total of 918 trials) were later scored on an additional six variables by a trained research assistant, who was blind to study hypotheses and the identity of participants. The six variables were goal specificity, life domain, whether the goals were

intrinsically or extrinsically focused, whether goals and motives were approach or avoidance, and whether motives were autonomous or controlled. More information about how each of these variables was scored can be found in the online scoring manual (osf.io/ 6k7yt). To assess inter-rater reliability the first author scored a random subset of 10% of trials (*n* = 92); Cohen's kappa for each variable was as follows: specificity (.66), life domain (.84), intrinsic vs. extrinsic (.86), approach vs. avoidance goals (.73), approach vs. avoidance motives (.71), and autonomous vs. controlled motives (.89). These scores indicated moderate (.60 –.79) and strong (.80–.90) inter-rater reliability according to McHugh's (2012) grading system. The total number of goals generated across the three time periods was also taken as a measure of goal fluency.

For the simulation phase of the GDST, participants were presented with each of their six important goals in random order and given three minutes to imagine and verbally describe a specific future scene or scenes in their life, related to that goal. Participants were instructed to imagine and describe the scene(s) in as much detail as possible and were told that the scene(s) could occur before or after achieving the goal, as long as they were in the future. We instructed that participants should project themselves into the scenes as though they were really there, and could use all of their senses; i.e., describe what they could see, hear, feel, taste, and smell. If participants were silent for longer than 30 seconds or struggled to generate a specific scene (e.g., if they provided only semantic information) they were given up to three generic prompts per goal to remind them of the task, such as, "When you think about this goal, are there any particular scenes or images that come to mind?"

In addition to their six chosen goals, participants also simulated scenes related to two pre-defined control goals, which were randomly selected from a set of three previously used by Vincent, Boddana and MacLeod (2004): 'getting on well with someone close to you', 'feeling good about yourself', or 'having an enjoyable job'. Including these control goals allowed for possible future analysis of nomothetic simulation (i.e., uninfluenced by the idiosyncratic nature of personal goals themselves), though the present paper is focused only on participants' six ideographic goals. Presentation was again counterbalanced so that control goals appeared before or after personal goals. All verbal descriptions were recorded and later transcribed for scoring. After each simulation, participants were presented with a further seven questions, again in random order and on 0-100 scales,

about the simulation itself. These questions related to the variables of positivity, negativity, vividness, detail, clarity, fragmentation, and perspective (first vs. third person); exact wording of questions can be seen in the online codebook (osf.io/xzt4k).

Transcriptions were later scored by the research assistant to examine the degree to which the simulation was focused on the 'process' or 'outcome' of the goal, in line with the distinction proposed by Taylor et al. (1998). More specifically, we assessed the proportion of total words generated that were related to the steps leading up to the goal (i.e., process) vs. to achieving the goal or the time after (i.e., outcome). Words not obviously related to either process or outcome were not coded. To assess inter-rater reliability the first author scored a random subset of 10% of simulations (92 trials); Cronbach's α was .83 for process words and .79 for outcome words, indicating moderate-strong reliability.

Finally, transcriptions were also analysed using the Linguistic Inquiry and Word Count Dictionary (LIWC; Pennebaker, Booth, Boyd, & Francis, 2015), which Hach, Addis and Tippett (2016) have previously used as an objective, micro-level measure of the episodic detail of simulations. We used the LIWC to count the number of words in transcriptions falling into five pre-defined categories: negative and positive words were used as additional measures of emotional valence; perceptual words (i.e., related to seeing, hearing, feeling) as a measure of how 'sensory' simulations were; space-related words as a measure of 'spatial coherence'; and present-focused words as a measure of engagement during the simulation (following Park, St-Laurent, McAndrews, & Moscovitch, 2011).

All participants verbally confirmed throughout the session that they understood the tasks, and the experimenter was present in the room to answer any questions. No goals or simulations were excluded from subsequent analyses as we considered any variation in aspects of these responses, such as lack of specificity or detail, as directly relevant to the research questions; in other words, this variability was the very topic of interest.

Well-being and mood questionnaires. We assessed well-being using the PERMA-Profiler (Butler & Kern, 2016), a 23-item self-report on the five 'pillars' of well-being: positive emotion, engagement, relationships, meaning, and accomplishment (Seligman, 2011). Questions included, for

example, ‘How often do you feel positive?’ (0 = never; 10 = always) and ‘To what extent do you feel loved?’ (0 = not at all; 10 = completely). Participants’ overall well-being score ranged from 0-160 (from low to high well-being) and was calculated from the sum of responses from three questions from each pillar and one more general question about happiness. The PERMA-Profiler has excellent internal reliability (Cronbach’s α = .94) and good test-retest reliability (Pearson’s *r* ranges from .69 - .88; Butler & Kern, 2016).

We measured depressive symptoms using the Centre for Epidemiological Studies Depression Scale-Revised (CESD-R; Eaton, Smith, Ybarra, Muntaner, & Tien, 2004), a 20-item self-report on depressive symptoms over the past two weeks (e.g., ‘My appetite was poor’ and ‘I could not shake off the blues’). Five response options were provided: 0 = not at all or less than one day; 1 = one to two days; 2 = three to four days, 3 = five to seven days, and 4 = nearly every day for two weeks, yielding a total score of 0-80 (0 = absence of symptoms; 80 = severe depression). This continuous score was our main outcome of interest for depressive symptoms, although we also used the algorithm from Eaton et al. (2004) to classify each participant into one of five categories: meets criteria for major depressive episode (MDE), probable MDE, possible MDE, subthreshold depressive symptoms, or symptoms of no clinical significance. The CESD-R has excellent internal reliability (Cronbach’s α = .92) and the classification scheme yields base-rates of depression in line with epidemiological studies (Van Dam & Earleywine, 2011). We also administered a brief 7-item self-report measure of anxiety (GAD-7; Spitzer, Kroenke, Williams, & Löwe, 2006) to allow for later exploratory analyses, but anxiety was beyond the scope of the present paper and is not included in our analyses (anxiety data are available in the ‘GAD7’ tab at osf.io/6eqt7).

Follow-up survey. Two months after the session, participants were emailed a link to a brief follow-up survey on Qualtrics to be completed remotely on a computer, tablet, or smartphone. The survey involved re-taking the well-being and mood questionnaires and responding to two statements about progress made so far on each of the six chosen goals; surveys were personalised to include participants’ own personal goals. The two statements were ‘I have made a great deal of progress concerning this goal’ and ‘I have had quite a lot of success in pursuing this goal’ (from Steca et al., 2016), with responses made on 0-100 scales (0 = completely disagree; 100 = strongly agree). As

described *a priori*, the mean of these two responses was used as the main measure of goal progress. The order of the four blocks in the follow-up survey (i.e., well-being, depressive symptoms, anxiety, and goal progress statements) was randomised, as was the order of goals and the two progress statements (see the task flow document at osf.io/qmvsj).

Inference

As planned, we used Bayesian statistics for our primary analyses. A Bayesian approach allowed for quantification of the evidence for null effects (i.e., 'evidence of absence') rather than only failing to reject the null ('absence of evidence'). This approach was particularly important in the present study as we were equally interested in quantifying the presence or absence of effects. We used default non-informative Cauchy priors for the Bayesian correlational analyses. The primary statistic for inference was the Bayes factor (BF_{10}), representing the relative evidence for an effect (in either direction) vs. no effect. For example, a BF_{10} of 4.34 can be interpreted as an effect being 4.34 times more likely than no effect given the data. We interpreted BF_{10} values of 3–10 as substantial evidence for an effect, 10–30 as strong evidence, 30–100 as very strong evidence, and >100 as extreme evidence (see for example Lee & Wagenmakers, 2013). The same criteria were applied but inversely to evidence for a null effect (i.e., BF_{10} values of $\frac{1}{3}$–$\frac{1}{10}$, $\frac{1}{10}$–$\frac{1}{30}$, $\frac{1}{30}$–$\frac{1}{100}$, and $<\frac{1}{100}$, respectively). BF_{10} values of $\frac{1}{3}$–3 were taken as insufficient evidence to draw any conclusions. For the confirmatory analyses, the corresponding frequentist findings are also presented for comparison. As planned, we did not correct for multiple comparisons given that (i) we had a separate and specific directional hypothesis for each analysis; (ii) the focus of Bayesian inference is on quantifying relative evidence rather than controlling error rates; and (iii) all confirmatory analyses were preregistered and fully reported, which mitigates the multiple comparison problem (Cramer et al., 2016).

Results

Preliminary analyses

Missing data. No data relating to well-being or depressive symptoms were missing or incomplete. A small number of data points relating to goal setting and simulation were missing due to some goals and motives that were too ambiguous for the research assistant to classify into one of the specified categories. This was the case for some motives scored for approach vs avoidance (3.7% of trials) and autonomous vs. controlled (1.6%), and for some goals scored for specificity (2.2%), intrinsic vs. extrinsic (1.0%), and approach vs. avoidance (0.2%). In all instances, we imputed these missing data based on the mean of the participant's other scores for each variable.

The two-month follow-up surveys were completed by 136 participants (88.9% of the sample). We ran logistic regression analyses to check if completion vs. non-completion of surveys as a binary outcome was related to other key variables of interest; if so, it may have indicated non-random sampling at Time 2. We found no evidence that survey completion was related to Time 1 scores on well-being, $b = -0.10$, $p = .422$, depressive symptoms, $b = 0.10$, $p = .634$, or any goal setting and simulation variable, all ps > .05. Follow-up surveys thus appeared to be missing at random, at least relative to baseline scores.

Assumptions check. Following the preregistered decision tree (osf.io/2mvds), we checked whether the main confirmatory analyses (i.e., correlations between goal setting and simulation and well-being and depressive symptoms) met criteria for parametric or non-parametric analysis. For all the correlations of interest, Shapiro Wilk's tests showed evidence of non-normality of residuals, indicated by W < .99 and $p < .05$. Visual inspection of the QQ-plots further suggested that the distribution of residuals was non-normal (section 3.1 of the analysis file at osf.io/bhyk7). These preliminary tests indicated that all subsequent correlational analyses should be non-parametric; thus, rather than Pearson's R, we used Kendall's tau[1], a method of rank-order correlation that is robust to non-normality. To calculate Kendall's tau we used the 'psych' package (Version 1.8.12; Revelle,

[1] While Spearman's rho is a more common non-parametric correlation than Kendall's tau, this preference in the literature is due more to historical than statistical reasons; the latter test is thought to be more robust, efficient, and interpretable (Croux & Dehon, 2010).

2019) and to calculate the associated Bayes factors, credible intervals and posterior distributions we used a function created by van Doorn et al (2018). Kendall's tau is robust to the presence of outliers; nonetheless, as planned, we inspected all data points with an SD above 3.0 to determine if they may have resulted from researcher error or participant non-compliance. All outliers appeared to be legitimate scores and so all data points were included in the analyses.

Descriptive statistics

Well-being and depressive symptoms. The sample encompassed a wide spectrum of well-being (M = 109.2; SD = 24.2; range = 37–147) and depressive symptoms (M = 13.6; SD = 14.6; range = 0–67) as measured on the PERMA-Profiler and CESD-R, respectively. Well-being and depressive symptoms were strongly negatively correlated (r = -.44, BF_{10} > 10000). The distribution of well-being scores was similar to base-rates reported in a previous large validation study (M = 112.3; SD = 26.6; Butler & Kern, 2016); a t-test showed no difference between that and our sample, M_{diff} = -3.1, t(32,117) = -1.58, BF_{10} = 0.84. Levels of depressive symptoms in our sample were also consistent with base-rates in the general population (M = 10.3; SD = 11.7; Van Dam & Earleywine, 2011) and a t-test again showed no difference, M_{diff} = 3.3; t(7,122) = 2.77, BF_{10} = 1.35. Based on the CESD-R's algorithmic classification, 10 participants met criteria for MDE (6.5% of the sample), four for probable MDE (2.6%), four for possible MDE (2.6%), 23 for subthreshold symptoms (15.0%) and 112 for symptoms of no clinical significance (73.2%). We corroborated these classifications by comparing them with researcher-based diagnoses from the SCID-5-RV; based on the latter, 17 participants met criteria for current MDE (11.1% of the sample). Cohen's kappa was .65, indicating moderate convergence of CESD-R and SCID-5-RV diagnoses. Overall, these results suggested adequate variability in well-being and depressive symptoms in our sample to examine links with the other variables of interest. We also ran paired t-tests to explore any overall changes in mental health from Time 1 to Time 2, and found no change in well-being, M_{diff} = -0.15, t(135) = -0.12, BF_{10} = 0.10, or depressive symptoms, M_{diff} = 0.52, t(135) = 0.68, BF_{10} = 0.12.

Goal setting and simulation variables. On average, participants generated 17.2 goals across the three time periods (SD = 5.0; range = 9–35) and all participants were able to name at least two goals for each time period. In general, the six chosen goals for each participant were rated as highly

attainable (*M* = 76.5; *SD* = 11.5; range = 36.7–99.8) and personally important (*M* = 78.3; *SD* = 11.6; range = 51.5–100). Most goals (53.2% of the 918 trials) related to the life domain of work and education (e.g., 'getting a job after I graduate'). The rest of the goals were categorised as follows: close relationships: 9.6% (e.g., 'having a happy family'); hobbies and growth: 7.5% (e.g., 'continue reading books at a book per week'); health and fitness: 6.9% (e.g., 'fully recover from my injury'); home life: 6.4% (e.g., 'get rid of my agapanthus in the front yard'); travel: 6.1% (e.g., 'book a flight to Thailand for April next year'); money: 4.8% (e.g., 'clear off debt'); emotions and feelings: 2.5% (e.g., 'trying to feel better with myself'); social life: 1.5% (e.g., 'see my new friends'); community and volunteering: 1.4% (e.g., 'educate younger people about primates'); and spirituality and religion: 0.1% ('get initiated into the Hare Krishna movement').

Overall, aspects of goal setting and simulation showed a large degree of variability across participants, with the exception of goals and motives scored for approach vs. avoidance. Only 4.5% of goals and 8.7% of motives were classified as avoidance, suggesting it may be difficult to detect links between these and other key variables. Full descriptive statistics for all goal setting and simulation variables are presented in section 2.5 of the analysis file (osf.io/bhyk7).

Confirmatory analyses

The confirmatory analyses (i.e., planned and with preregistered predictions) refer to correlations between the 28 goal setting and simulation variables and concurrent well-being and depressive symptoms. The specific directional hypothesis for each correlation, and whether or not that hypothesis was supported by the findings, is shown in Figure 1. All correlations (as Kendall's tau) and their 95% credible intervals and Bayes factors are also presented in Figure 1. Posterior distributions of the Kendall's tau values can be viewed in section 4.1 of the analysis file (osf.io/bhyk7). For comparison, the frequentist versions of these analyses are also available in section 4.4.2 of the analysis file. In general, the frequentist analyses were less conservative than the planned Bayesian analyses, and

	Well-Being						Depressive Symptoms					
Variable	tau	CI (Low)	CI (High)	BF10	Prediction	Correct?	tau	CI (Low)	CI (High)	BF10	Prediction	Correct?
Goal Setting												
Approach vs Avoidance	-0.07	-0.17	0.04	0.35	↓	?	0.10	-0.01	0.20	0.77	↑	?
Attainability*	0.37	0.25	0.45	>10000	↑	✓	-0.24	-0.33	-0.12	1458.46	↓	✓
Central to Identity*	0.16	0.05	0.26	11.61	↓	✗	-0.06	-0.17	0.04	0.31	↑	✗
Difficulty*	-0.13	-0.23	-0.02	2.41	↓	?	0.15	0.04	0.25	7.65	↑	✓
Expected Joy*	0.20	0.09	0.30	156.19	–	–	-0.17	-0.27	-0.06	14.49	–	–
Expected Sorrow*	0.01	-0.09	0.12	0.16	–	–	0.02	-0.08	0.12	0.17	–	–
Fluency	0.08	-0.03	0.18	0.44	–	–	-0.01	-0.11	0.10	0.16	–	–
Importance*	0.14	0.03	0.24	4.10	–	–	-0.03	-0.13	0.08	0.18	–	–
Intrinsic vs Extrinsic	0.04	-0.07	0.14	0.20	↓	✗	-0.11	-0.22	-0.01	1.34	↑	?
Motives: Approach vs Avoidance	-0.03	-0.14	0.07	0.19	↓	✗	0.09	-0.02	0.19	0.64	↑	?
Motives: Autonomous vs Controlled	0.09	-0.02	0.19	0.55	↓	?	-0.15	-0.25	-0.04	5.47	↑	✗
Number of Life Domains	-0.05	-0.15	0.05	0.24	↑	✗	0.16	0.04	0.25	8.48	↓	✗
Sense of Control*	0.25	0.14	0.35	6297.54	↑	✓	-0.14	-0.24	-0.03	3.49	↓	✓
Specificity	0.13	0.02	0.23	2.65	↑	?	-0.01	-0.12	0.09	0.16	↓	✗
Goal Simulation												
Clarity*	0.27	0.16	0.36	>10000	↑	✓	-0.15	-0.25	-0.04	7.06	↓	✓
Detail*	0.26	0.14	0.35	8122.29	↑	✓	-0.14	-0.24	-0.03	3.58	↓	✓
Engagement (LIWC)	-0.08	-0.18	0.02	0.47	↑	?	0.16	0.05	0.26	11.48	↓	✗
Fragmentation*	-0.13	-0.24	-0.03	3.08	↓	✓	0.11	0.00	0.21	1.22	↑	?
Negativity*	-0.25	-0.35	-0.14	4727.50	↓	✓	0.17	0.06	0.27	24.35	↑	✓
Negativity (LIWC)	-0.12	-0.23	-0.02	2.01	↓	?	0.17	0.06	0.27	16.61	↑	✓
Outcome-focus	-0.02	-0.12	0.09	0.17	–	–	0.11	0.00	0.21	1.03	–	–
Perspective: First vs Third Person*	-0.06	-0.17	0.04	0.30	↓	✗	0.03	-0.08	0.13	0.18	↑	✗
Positivity*	0.28	0.16	0.37	>10000	↑	✓	-0.14	-0.24	-0.03	3.68	↓	✓
Positivity (LIWC)	0.08	-0.03	0.18	0.41	↑	?	0.02	-0.08	0.13	0.17	↓	✗
Process-focus	0.04	-0.07	0.14	0.20	↑	✗	-0.16	-0.26	-0.05	8.51	↓	✓
Sensorialness (LIWC)	0.02	-0.08	0.12	0.17	↑	✗	0.05	-0.05	0.16	0.26	↓	✗
Spatial Coherence (LIWC)	0.09	-0.02	0.19	0.55	↑	?	-0.02	-0.13	0.08	0.17	↓	✗
Vividness*	0.22	0.10	0.31	370.41	↑	✓	-0.15	-0.25	-0.05	8.09	↓	✓

Figure 1. Correlations (as Kendall's tau) between the 28 goal setting and simulation variables (from the Goal-Directed Simulation Task) and concurrent well-being (left) and depressive symptoms (right). Darker green and orange shading reflect stronger positive and negative correlations, respectively. Bayes factors (BF_{10}) > 3 show evidence for an effect (in either direction); BF_{10} < ⅓ show evidence for a null effect. The directions of preregistered predictions are depicted as arrows (up and green when positive; down and red arrows when negative) and dashes indicate variables for which no prediction was made. In the 'Correct?' column, tick icons represent correct predictions (evidence for an effect in the predicted direction), cross icons depict incorrect predictions (evidence for the opposite effect or the null); and question marks depict insufficient evidence to draw a conclusion. *=a self-report variable; CI=95% credible intervals; LIWC= Linguistic Inquiry and Word Count.

would have resulted in more of our predictions being labelled as ‘correct’ (i.e., 18/46 vs. 22/46 predictions inferred as correct from the Bayesian versus frequentist analyses, respectively).[2]

Goal setting and well-being. Of the 14 goal setting variables, there was extremely strong evidence that attainability and sense of control were positively correlated with well-being (in line with predictions), as was expected joy (for which we had made no prediction). There was substantial evidence that the degree to which goals were central to participants’ identity was positively correlated with well-being (we had predicted a negative correlation). Another six goal setting variables yielded substantial evidence for having no relationship with well-being, while the remaining four goal setting variables did not yield conclusive evidence either way (see Fig. 1). Overall, of the 10 directional hypotheses made regarding links between goal setting and well-being, only two were correct (i.e., evidence for an effect in the predicted direction), five were incorrect (i.e., evidence for either the null or an effect in the opposite direction), and three inconclusive (i.e., no substantial evidence either way).

Goal setting and depressive symptoms. There was extremely strong evidence for a negative correlation between depressive symptoms and attainability (as predicted), and strong evidence for a negative correlation between depressive symptoms and expected joy (no prediction was made). In addition, there was substantial evidence for depressive symptoms being positively correlated with perceived goal difficulty (as predicted), number of life domains, and having more autonomous motives (for the latter two variables, we had predicted the opposite). There was substantial evidence for a negative correlation between sense of control and depressive symptoms (as expected). Five goal setting variables showed substantial evidence for no relationship with depressive symptoms and the remaining three were inconclusive (see Fig. 2). Of the 10 directional hypotheses made regarding links between goal setting and depressive symptoms, three were correct, four incorrect, and three inconclusive.

[2] In interpreting the *magnitude* of effect sizes throughout the results section, we suggest readers refer to the new benchmarks proposed for correlational analyses in psychology by Funder and Ozer (2019). Although these refer to Pearson’s correlations, Kendall’s tau values are typically lower than *r*, making our interpretations slightly more conservative. The benchmarks are as follows: $r = .05$ is a very small effect, $r = .10$ a small effect, $r = .20$ a medium effect, $r = .30$ a large effect, and $r = .40$ a very large effect.

Goal-directed imagination and well-being. Of the 14 variables related to goal-directed simulation, there was extremely strong evidence that self-reported clarity, detail, vividness, and positivity were positively correlated with well-being, and that negativity was inversely correlated with well-being (all as predicted). There was also substantial evidence that fragmentation was negatively correlated with well-being (as predicted). There was evidence for the absence of a relationship between well-being and four simulation variables, and evidence for the remaining four variables was inconclusive. Overall, of the 13 directional predictions made regarding goal-directed simulation and well-being, six were correct, three incorrect, and four inconclusive.

Goal-directed imagination and depressive symptoms. There was strong evidence that negativity (as measured by both self-report and the LIWC) was positively correlated with depressive symptoms (as predicted). Unexpectedly, there was also strong evidence that engagement (as measured on the LIWC) was positively correlated with depressive symptoms; we had predicted the opposite effect. There was substantial evidence that the variables process-focus, clarity, detail, vividness, and positivity were negatively correlated with depressive symptoms (as predicted). There was evidence for no relationship between depressive symptoms and perspective: first vs. third person, as well as the three other variables measured on the LIWC (positivity, sensorialness, and spatial coherence); we had predicted negative correlations. The two remaining variables, fragmentation and outcome-focus, showed only inconclusive evidence. Of the 13 directional predictions made regarding goal-directed simulation and depressive symptoms, seven were correct, five incorrect, and one inconclusive.

Exploratory analyses

Factors of goal setting and imagination. Next, we explored whether aspects of goal setting and imagination at Time 1 predicted goal progress and change in mental health at a two-month follow-up. However, with so many Time 1 variables, it was impractical to run these analyses on every aspect of goal setting and simulation separately (potentially 84 analyses). We thus reduced the dimensionality of goal setting and simulation variables via Bayesian exploratory factor analysis (BEFA: Conti, Fruhwirth-Schnatter, Heckman, & Piatek, 2014). This method also allowed us to explore whether aspects of these processes might be more parsimoniously explained by broader underlying factors. For example, 'detail' and 'vividness' have often been used interchangeably in studies of simulation (see Gamble et al., 2019, for a meta-analysis), though we are not aware of any empirical justification to do so, and it is unknown how closely these terms relate to other concepts, such as 'fragmentation'. We reasoned that such variables might be explained by a broader underlying factor reflecting the 'clarity' of simulations.

We used BEFA as it has been shown to vastly outperform traditional methods of factor analysis (Conti et al., 2014). BEFA uses Markov chain Monte Carlo via the Metropolis-Hastings algorithm to simultaneously estimate the latent factor structure, the allocation of variables to factors, and factor loadings. The model is dedicated (i.e., each variable loads onto only one factor) and factors are allowed to correlate. BEFA was run using the 'BayesFM' package in R (Version 0.1.2; Piatek, 2017), which requires the specification of a number of prior parameters relating to, for example, plausible values for the number of factors (K) and correlations between the factors (section 5.1.2 of the analysis file: osf.io/bhyk7; see R package documentation for the equations for each parameter). Note that the prior specification can have a substantial impact on the factor structure revealed (Conti et al., 2014); we simulated plausible prior distributions using built-in functions in the 'BayesFM' package, based on the number of manifest variables included (n = 28) and a specified maximum number of latent factors (K_{max} = 8). The sampler was run for 100k iterations (40k burn-in). A clear six-factor solution emerged (K = 6; probability .93), with a Metropolis-Hastings acceptance rate of .36. Although the most likely identification matrix had only a low posterior probability of .05 (relative

to all the possible models visited by the sampler), the next nine most likely models revealed overall similar solutions, with all suggesting six factors.

The first three factors related primarily to the goal setting process (see Fig. 2) and were labelled and interpreted as follows. 'Attainability' reflected the perceived likelihood of goal achievement and sense of control over the outcome of goals. 'Importance' reflected the extent to which goals were important and central to participants' identity, as well as the likely impact of goal achievement (in terms of expected joy) or failure (in terms of expected sorrow). 'Extrinsic Drive' represented the extent to which goals were externally-focused (rather than being intrinsically rewarding) and motived by controlled rather than autonomous reasons. This factor also included the extent to which a participant's goals spanned only a narrow variety of life domains—reflecting that many individuals who cited mostly work and education goals would have scored both low on number of life domains, and high on extrinsic focus. The Extrinsic Drive factor also had small loadings from two simulation variables as measured on the LIWC: sensorialness and spatial coherence. Thus, participants who had more extrinsic goals also tended to generate simulations that contained fewer sensory words (related to seeing, hearing, feeling) and space-related words (e.g., up, down, left, right).

The next three factors related to the process of goal-directed simulation. As expected, detail, vividness, clarity and (to a lesser extent) fragmentation of simulations loaded onto a single factor, which we labelled as 'Clarity'. Self-rated negativity and (inversely) positivity of simulations, as well as negativity measured on the LIWC, loaded onto a broader factor that we labelled as 'Negativity'. Finally, the extent to which simulations were process- and outcome-focused loaded (inversely) onto a factor that we labelled as 'Outcome Focus'. Positivity as measured on the LIWC also loaded onto this factor, indicating that more outcome-focused simulations typically contained a high frequency of positive words. Having reduced the dimensionality of goal setting and simulation at Time 1 to six interpretable factors, we next explored their links with goal progress and changes in mental health over time.

What factors predict functional outcomes? As above, we checked whether these analyses should be parametric or non-parametric. Shapiro-Wilk's tests and QQ-plots (see section 5.2.1 of osf.io/bhyk7) showed no evidence of non-normality of residuals for the relationships between the six

factors identified, and goal progress and change in well-being; for these analyses, we therefore used Pearson's *r*. There was, however, evidence of non-normality of residuals for the relationships between the six factors and change in depressive symptoms, so for these analyses we used Kendall's tau. The results of all exploratory correlational analyses are presented in Figure 3.

There was extremely strong evidence that greater attainability of goals at Time 1 predicted greater goal progress at Time 2 (i.e., two months later). There was also substantial evidence that more important goals were associated with greater progress. There was a small positive correlation between the extent to which goals were extrinsically driven and progress, although the BF_{10} was not large enough to indicate substantial evidence for this effect. There was extremely strong evidence that more positive (and less negative) simulations predicted more goal progress, and very strong evidence that greater clarity of simulations predicted more goal progress. The extent to which simulations were outcome-focused (vs. process-focused) did not have any relation to goal progress.

Only one of the six goal setting and simulation factors showed substantial evidence for predicting a change in well-being over time; individuals who rated their simulations as more positive (and less negative) were more likely to experience a later *increase* in well-being. There was substantial evidence that importance and clarity were not related to change in well-being, and evidence for the other three factors was inconclusive. The only factor showing substantial evidence for predicting a change in depressive symptoms was extrinsic drive. That is, individuals whose goals and motives were rated by the researcher as being more extrinsically driven, and spanning fewer life domains, tended to experience an increase in depressive symptoms from Time 1 to Time 2. There was substantial evidence that attainability, clarity and negativity were not related to change in depressive symptoms, and evidence for the other two factors was inconclusive.

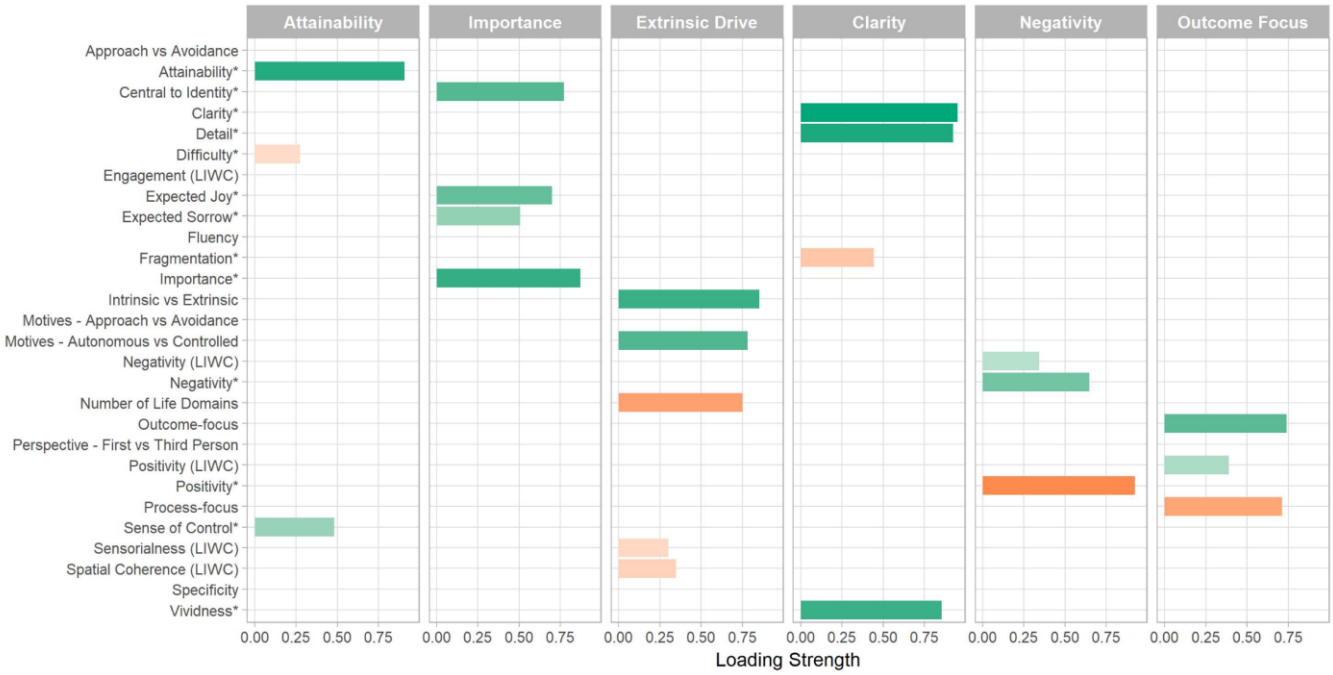

Figure 2. The six factors of goal setting and simulation, as generated by Bayesian exploratory factor analysis (BEFA). The first three factors relate generally to goal setting, and the next three factors to goal-directed simulation. Darker green and orange shading reflect stronger positive and negative factor loadings, respectively. * = a self-report variable; LIWC= Linguistic Inquiry Word Count.

	Goal Progress (T2)				Change in Well-Being (T2 - T1)				Change in Depressive Symptoms (T2 - T1)			
Factors (T1)	r	CI (Low)	CI (High)	BF10	r	CI (Low)	CI (High)	BF10	tau	CI (Low)	CI (High)	BF10
Goal Setting												
F1. Attainability	0.46	0.30	0.61	>10000	0.18	0.00	0.33	1.64	-0.01	-0.12	0.09	0.16
F2. Importance	0.23	0.07	0.38	6.01	0.06	-0.10	0.22	0.26	-0.07	-0.18	0.03	0.38
F3. Extrinsic Drive	0.18	0.00	0.33	1.50	-0.20	-0.36	-0.02	2.83	0.15	0.03	0.24	5.04
Goal Simulation												
F4. Clarity	0.30	0.13	0.45	92.13	0.06	-0.11	0.21	0.25	0.01	-0.09	0.12	0.16
F5. Negativity	-0.33	-0.47	-0.16	299.15	-0.21	-0.36	-0.04	3.83	0.05	-0.05	0.15	0.25
F6. Outcome Focus	0.01	-0.16	0.17	0.20	0.14	-0.04	0.29	0.65	-0.10	-0.21	0.00	0.94

Figure 3. Correlations between the six factors of goal setting and simulation and goal progress two months later (left), change in well-being (middle), and change in depressive symptoms (right). Correlations are Pearson's *r* or Kendall's tau, depending on whether assumptions were met for parametric analyses. Darker green and orange shading reflect stronger positive and negative correlations, respectively. Bayes factors (BF_{10}) > 3 show evidence for an effect (in either direction); BF_{10} < ⅓ show evidence for a null effect. CI = 95% credible intervals.

Discussion

To our knowledge, this study is the first detailed assessment of goal-directed imagination and its links to mental health. In a community sample, we found strong associations between many aspects of goal setting and imagination and concurrent well-being and depressive symptoms. We also found a number of null and unexpected effects that, in some cases, ran counter to theory or prior findings. In addition, we explored the broader factors that may underlie the goal setting and imagination processes, and found that some of these factors predicted later goal progress and change in mental health over two months. We first discuss the findings related to goal setting, before turning to goal-directed imagination.

Goal Setting

In terms of goal setting, some of the strongest links with mental health were higher perceived attainability, sense of control, and lower expected difficulty in achieving one's goals. These results were generally as predicted and align well with prominent theories of well-being and depression. For example, Seligman's (2011) PERMA model includes feeling a sense of attainment or mastery over one's goals as a core aspect of well-being. Similarly, Bandura (e.g., 2009) argues that perceived self-efficacy—which partly reflects people's belief in their ability to attain goals—is crucial to engaging in rewarding behaviours, and thus to emotional well-being: "Unless people believe they can produce desired effects by their actions, they have little incentive to undertake activities or to persevere in the face of difficulties" (p. 1). Indeed, perceived goal attainability was the strongest predictor of later goal progress. On the negative side of mental health, depression has also long been associated with a perceived lack of control over one's surroundings (i.e., the learned helplessness model of depression; Abramson, Seligman, & Teasdale, 1978). Viewing goals as unattainable and out of one's control may be a key maintenance factor in depression, whereby individuals avoid activities that could lead to positive emotions (e.g., exercise; Hopko & Mullane, 2008).

We had made no prediction about expected joy (from goal attainment) and sorrow (from failure) and links to mental health, given some apparently mixed prior findings. For example, Street (2002) proposed that depression is associated with conditional goal setting, whereby future happiness is seen as contingent on reaching important goals (e.g., 'If only I can marry Sarah one day, I will

finally be happy'). On the other hand, another body of work suggests that a core feature of depression is an *absence* of positive expectancies, such that depressed people would be expected to predict experiencing less joy upon reaching their goals (reviewed in Roepke & Seligman, 2015). Our findings indicated that higher depressive symptoms and lower well-being were related to *lower* expected joy (and not at all to expected sorrow), which aligns with the theory that depression is characterised by a deficit in positive prospection, rather than conditional goal setting.

Based on the notion of conditional goal setting (Street, 2002), we had also predicted that higher depressive symptoms would be linked to having goals that were *more* central to a participant's sense of identity—given that their goals might be seen as the 'key' to a future happy life. However, we found no relation between depressive symptoms and centrality to identity; the latter was in fact associated with higher well-being. Thus, while it is possible that some depressed participants expect to reach happiness if they succeed in their goals, the more general trend seems to be that depressive symptoms are linked to lower expected joy and to viewing one's goals as less central to one's sense of identity. Individuals who rated their goals as more important to them also tended to report greater progress on those goals two months later.

The 'why' of goals—whether driven by autonomous or controlled reasons—was also linked to mental health, but somewhat paradoxically. Counter to predictions, having more autonomous (vs. controlled) goals was not associated with well-being, and was in fact correlated with *higher* depressive symptoms. This result is surprising in the context of self-determination theory, which posits that goals chosen freely and pursued for their own sake should naturally bring one closer to a sense of autonomy, and thus confer a greater well-being benefit, than goals driven by some external pressure (Ryan & Deci, 2000). Based on our findings, one might get the opposite impression—that people are better off setting goals driven by *controlled* reasons. However, we think this finding was confounded by a third variable: goals that were driven by controlled reasons also happened to be viewed as more attainable. As described above, attainability was strongly associated with lower depressive symptoms. The more revealing result regarding the 'why' of goals may lie in change in mental health over time. Higher scores on externally-driven goals, despite correlating with lower depressive symptoms initially, predicted an *increase* in depressive symptoms over time. This finding

is more consistent with theory and prior research (e.g., Sheldon & Elliot, 1999). In short, setting goals that reflect one's *own* desires and are intrinsically rewarding—rather than driven by some external pressure—does seem to predict positive outcomes over time.

Autonomously-motivated and intrinsically-rewarding goals also tended to span a wider variety of life domains; these three variables loaded onto a single broader factor (labelled as External Drive; see Fig. 2). Surprisingly, having goals across a wider variety of life domains was *not* related to well-being, and in fact was related to higher depressive symptoms. We had predicted the opposite, based on previous findings that having few and unvaried goals is a cognitive vulnerability factor for depression (Champion & Power, 1995). Again, this association may have been confounded by attainability; having goals across fewer life domains was also linked to higher attainability, which was a strong predictor of lower depressive symptoms. When assessing depressive symptoms longitudinally, our findings are more consistent with Champion and Power (1995), as higher scores on the External Drive factor (which reflected fewer life domains) predicted an *increase* in depressive symptoms over time.

Unexpectedly, we found substantial evidence that the specificity of goals was *not* related to depressive symptoms. Higher specificity did show a small positive correlation with well-being, but the evidence was not strong enough to conclude the presence of an effect. In previous research, the 'macro-level' specificity of future thinking—i.e., at the level of the event or goal itself—generally shows small but robust inverse correlations with depressive symptoms (Gamble et al., 2019). What, then, could explain our null finding? The scoring of specificity in this study, while showing moderate inter-rater reliability, was nevertheless the least reliable of our researcher-rated variables; Cohen's kappa was .66, slightly lower than the score of .78 reported in the original study (Dickson & MacLeod, 2004b). Perhaps our null finding was due to measurement imprecision (and thus low power) rather than a true null effect. Whether the specificity of personal goals is truly reduced in depression still seems an open question for future research.

We also did not find the expected effects for goals and motives scored for approach vs. avoidance; there was no substantial evidence that these variables were linked to mental health. These results are surprising in the context of many previous studies showing that the frequency of approach

vs. avoidance is associated with both well-being and depression (reviewed in MacLeod, 2017). It is difficult to explain why we did not replicate these findings. The proportion of avoidance goals and motives that participants reported was very small (4.5% and 8.7%, respectively), suggesting that, in general, people set goals to move towards something positive, rather than away from something negative. Perhaps there was not enough variability in approach vs. avoidance goals and motives to detect relationships with mental health. Given substantial prior evidence of the importance of goal framing, we do not suggest that the approach vs. avoidance distinction is unrelated to mental health, though perhaps the magnitude of the effects is smaller than previously thought.

Goal-Directed Imagination

In terms of goal-directed imagination, variables reflecting the clarity of episodic simulation showed some of the strongest links with mental health. As predicted, higher well-being and lower depressive symptoms were correlated with greater clarity, vividness, and detail (although the association between detail and depressive symptoms did not quite reach the threshold for substantial evidence). The magnitude of these effects was almost identical to that estimated in our recent meta-analysis on the specificity of future thinking in depression (Gamble et al., 2019). Evidence for the fragmentation of simulations was only inconclusive, despite small correlations in the predicted directions. As expected, fragmentation was also correlated (moderately) with clarity, detail and vividness; these variables loaded onto the same broader factor that we labelled as ‘Clarity’. Importantly, individuals scoring highly on this factor tended to report making greater progress in their goals over time.

We believe this is the first evidence of individual differences in goal-directed imagination predicting actual goal progress. This finding aligns well with existing work on the importance of mental imagery and episodic simulation for functioning in general (e.g., Holmes & Mathews, 2010; Schacter, 2012). More specifically, this finding also maps well onto three recent experimental studies that showed generating vivid imagery of the future can increase engagement, anticipatory pleasure, motivation, and actual completion of goals (Hallford et al., 2019; Renner et al., 2017, 2019). Thus, there is now evidence that greater clarity of imagination—whether at the level of individual differences, or after experimental manipulation—is an important predictor of future goal progress.

In addition to these quantitative results on clarity, it is worth noting some anecdotal findings from the current study, which give some window into the subjective experience of goal-directed imagination. One participant, who met criteria for a current MDE, expressed how difficult it was to imagine a clear future, and speculated that this might impact goal setting itself: *'Everything is just so blurred, it's just like blackness… That's probably why I don't set goals—because I don't see anything.'* Another participant, who did not have depression but went on to experience a substantial drop in well-being, conveyed a similar idea: '*It's just like blank. It's so weird. It's just like grey. And I'm struggling to get beyond my current reality. Like I can't imagine being or feeling different than I do now.'* For these individuals, struggling to see a clear future seemed to have a notable impact on their everyday functioning.

As predicted, the emotional valence of simulation was also linked strongly to mental health; higher depressive symptoms and lower well-being were associated with simulations self-rated as less positive and more negative. Higher depressive symptoms were also associated with negativity as measured by the number of negative words generated (according to the LIWC). Our predictions were based on previous findings that people with depression often experience both a lack of positive mental imagery and an excess of negative intrusive mental imagery (Holmes et al., 2016). We suspected these processes would also plausibly occur during the imagining of one's goals; the results indicated this was indeed the case. Our findings also highlight that the relationship between emotional valence and depression may depend on the mode of prospection under investigation (Szpunar, Spreng, & Schacter, 2014). When setting goals (i.e., the *intention* mode of prospection), depression seems to be characterised by a lack of positive but not an increase in negative expectancies. However, when it comes to the *simulation* mode of prospection, depression seems to feature not only a deficit in positive but also an increase in negative future imagery (Holmes et al., 2016).

Surprisingly, the perspective adopted during simulation—whether from a field (first-person) or observer (third-person) viewpoint—was not related to mental health. Prior studies have shown that people with depression are more likely than healthy controls to experience mental imagery from an observer perspective (Holmes et al., 2016). Adopting a more distanced perspective is thought to reflect increased psychological distancing, which can down-regulate distress associated with negative

imagery (e.g., Williams & Moulds, 2008), but can also mitigate the beneficial effects of positive imagery (e.g., Lemogne et al., 2006). Most prior studies on perspective-taking in depression have focused on memories, but Hallford (2019) also found that dysphoric individuals (compared to controls) reported a greater frequency of the observer perspective during *future* thinking. There was, however, no group differences in field perspective. Perhaps the unexpected null finding in the present study can be partly explained by methodological differences. We used a single item to assess perspective, with field vs. observer options presented at either end of a single scale, while Hallford (2019) used separate items to assess each perspective. That he found group differences in the frequency of observer but not field perspective suggests these may be distinct dimensions of simulation, rather than opposing ends of the same spectrum. If so, individual differences in perspective may not have been adequately captured by our single item measure.

Our predictions regarding the focus of goal-directed simulation—i.e., whether on the process or outcome—were partially supported. We had predicted that higher well-being and lower depressive symptoms would be correlated with a tendency to focus on the steps leading to goal attainment (i.e., the process), given the many reported benefits of simulation when used for planning and problem solving, including on mental health (reviewed in Bulley & Irish, 2018). We found that greater process-focus was indeed correlated with lower depressive symptoms, although it was not related to well-being. We had made no prediction regarding outcome-focus and mental health, considering what we saw as some mixed prior findings. For example, while some studies report that outcome simulations (or related positive fantasies) are associated with poorer affect regulation (Taylor et al., 1998) and an increase in depressive symptoms over time (Oettingen et al., 2016), others suggest that imagining positive future events may boost motivation for rewarding activities (Renner et al., 2019). Our results showed no substantial evidence for a link between outcome-focus and mental health—perhaps reflecting a middle ground between prior findings. Envisioning a positive outcome may boost motivation in some individuals, but for others, might cross over into fantasy and even *de*motivation; a combination of these factors could plausibly have produced the overall null effect reported here.

In general, simulation variables as measured objectively by the LIWC were not strongly related to mental health as we had expected given that ‘micro-level’ measures of simulation (i.e., at

the level of individual words) have been linked to depression (e.g., Hach et al., 2016). For example, we did not find evidence that depressive symptoms or well-being were correlated with sensory and space-related words in simulations. It is difficult to explain why we did not replicate prior findings, but the discrepancy could be due to any number of methodological differences. For example, Hach et al. (2016) required participants to imagine future events related to non-personalised prompts (e.g., 'on the motorway') rather than personal goals; perhaps the former is more difficult, revealing more a more obvious distinction between depressed people and controls.

We had also expected higher well-being and lower depressive symptoms to correlate with greater engagement in simulation, measured as the number of present-focused words (by the LIWC). The use of the present tense during remembering (e.g., "I *see* the smoke" vs "I *saw* the smoke") may indicate a stronger sense of re-experiencing (Park et al., 2011)—an effect that we expected would extend to *pre*-experiencing. Surprisingly, we found that a higher frequency of present-focused words was associated with *higher* depressive symptoms. Although this finding may suggest (counter-intuitively) that depressed people are *more* engaged during simulation, such a conclusion would not fit well with our other results (e.g., that depression is associated with reduced clarity). On reflection, we think present-focused words as categorised by the LIWC may not tap into engagement as expected, but may sometimes reflect more abstract and metacognitive statements during simulation. For example, a participant who states, '*I don't know. I can't imagine much at all—it is not very clear,'* would potentially score highly on engagement when defined as present-focused words (Pennebaker et al., 2015).

Limitations and future directions

We believe the current study provides valuable insights into the little studied process of goal-directed imagination and its links to mental health. There are, however, also some limitations of the study to bear in mind. First, although our participants spanned a wide spectrum of well-being and depressive symptoms, a relatively small proportion of the sample met criteria for MDE. Thus, inferences from our study may not necessarily extend to individuals with the most severe and chronic depression. Second, despite our attempts to be as comprehensive as possible in the assessment of goal setting and simulation, there are countless more aspects of these processes that could be examined,

and which may relate to mental health. For instance, the extent to which goal-directed simulation contains intrusive images may be heightened in depression (Holmes et al., 2016). Third, it is unknown to what extent goal-directed simulation during the lab-based task resembles that during everyday life. We aimed for simulation to reflect real life by having participants imagine their *own* goals, but ecological validity could be further examined via methods such as experience sampling (e.g., Andrews-Hanna et al., 2013). Fourth, given that our aim was to assess individual differences, our study design was correlational; we cannot conclude that manipulating aspects of goal setting and simulation would lead to changes in mental health. Nonetheless, correlational and longitudinal evidence often serves as a basis for future intervention studies, by highlighting potential targets for manipulation. Evidence has emerged, for example, that engaging in positive and detailed imagery of the future can enhance behavioural activation in depression (Renner et al., 2017). The current study compliments such findings by highlighting additional goal setting and simulation variables that may be important for functioning—such as confidence in goal attainability, expected joy, and whether goals are autonomously motivated.

In a topic as broad as imagination and mental health, there are of course myriad more questions to be addressed. By making our data openly available, we hope to facilitate future investigations into questions that fall beyond the scope of the present paper. For instance, how does goal setting and simulation relate to other aspects of mental health such as anxiety? Is mental health more strongly linked to the setting and simulation of short, medium, or long-term goals? And how are goal setting and simulation related to participant's history of depression, or to antidepressant medication? These are just some of the questions that can be explored using the available dataset.

Conclusion

The current study underscores the intimate links between goal setting, imagination, and healthy functioning. For instance, imagining clear, vivid, and positive future scenes predicts higher well-being, lower depressive symptoms, and greater goal progress over time. Having goals that are pursued for one's own sake, rather than some external pressure, predicts a subsequent decrease in depressive symptoms. We hope that these and the other findings presented contribute to our growing understanding of prospection and mental health, and may potentially help to inform future

intervention studies. Imagination is clearly an adaptive ability—and one that might be better harnessed to help individuals reach the futures they want.

Author Contributions

B. Gamble, D. R. Addis and L. J. Tippett developed the study concept and design. B. Gamble conducted the participant sessions, analysed the data, and drafted the manuscript, with critical revisions from L. J. Tippett, D. Moreau, and D. R. Addis. All the authors approved the final manuscript for submission.

Acknowledgments

We thank Aimee Wiltshire for her excellent scoring work, and all the participants without whom this project would not be possible.

Declaration of Conflicting Interests

The authors declared that there were no conflicts of interest with respect to the authorship or the publication of this article.

Funding

B. Gamble was supported by a University of Auckland doctoral scholarship. D. Moreau was supported by funding from the Royal Society of New Zealand (Marsden) and from the Neurological Foundation of New Zealand. D. R. Addis was supported, in part, by funding from the Canada 150 Research Chairs Program.

Open Practices

All materials and de-identified summary data have been made publicly available via the Open Science Framework (OSF) and can be accessed at osf.io/vycrw. The design and analyses plan were preregistered on the OSF prior to the collection of data on 16th August 2017 and can be accessed at osf.io/8jgd4.

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