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**University makes me angry: Investigating stimulus-response (S-R) and cognitive-mediation (C-M) emotion beliefs in undergraduate students.**

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**Data availability statement:**

Data available on request from the authors. Also, a link to the data repository will be added to the accepted manuscript.

All authors contributed to the study conception and design. Material preparation was performed by Martin Turner, data collection was performed by all authors, and analyses were performed by Nanaki Chadha and Martin Turner. The first draft of the manuscript was written by Martin Turner and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

## 1 **Abstract**

2           Emotion regulation through cognitive reappraisal is well-studied, but less so are the  
3 predispositional and superordinate beliefs that influence reappraisal. Recently, researchers  
4 developed the cognitive mediation beliefs questionnaire (CMBQ), which measures two  
5 emotion beliefs, namely stimulus-response (S-R) generation beliefs and cognitive mediation  
6 (C-M) change beliefs. In working populations S-R generation beliefs are inversely related to  
7 cognitive reappraisal tendencies and positive mental health, and positively related to emotion  
8 reactivity. C-M change beliefs are positively related to cognitive reappraisal tendencies, and  
9 inversely related to emotion reactivity and positive mental health. As yet, there is no evidence  
10 for the validity of the CMBQ within student samples, or for the associations between its  
11 subscales and cognitive reappraisal, emotion reactivity, and positive mental health.  
12 Therefore, in the present study the CMBQ is tested for factorial, convergent (associations  
13 with cognitive reappraisal), and concurrent (associations with emotion reactivity and positive  
14 mental health) validity in a cohort of 621 undergraduate students in the United Kingdom  
15 (U.K.). Results indicate support for the factorial and convergent validity of the CMBQ, with  
16 mixed evidence for the concurrent validity of the CMBQ. A CM-SR discrepancy score  
17 appeared to provide a promising variable when associated with emotion reactivity and  
18 positive mental health. The findings are discussed in terms of practical and research  
19 implications of the findings.

20 **Keywords:** appraisal; REBT; cognitive change; cognitive restructuring; emotion; attitude

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## 1 **Introduction**

2 University students face mounting pressures both within and outside of the academic milieu,  
3 and there is evidence that being a student may become a stressful experience (1). Not only are  
4 there marked pressures for students to achieve the best grade possible at university, they also  
5 *pressure themselves* to fulfil their potential. Amidst these performance pressures, university  
6 students today face a volatile political landscape (i.e., Brexit), an interpersonal setting in  
7 which social media has become a dominant and pervasive force, and the financial burden of  
8 student fees and a cost-of-living crisis. On top of these factors, many university students are  
9 living away from home for the first time and are navigating independent living in isolation of  
10 family. The stressful context that students occupy is being reflected in rising mental health  
11 difficulties. A large-scale study (University Student Mental Health Survey, 2020) reported  
12 that 42.3% of students had a serious personal, emotional, behavioural or mental health  
13 problem for which they needed professional help, and 26.6% of students had received a  
14 mental health diagnosis. Another report (A Degree Of Uncertainty: Looking At Student  
15 Wellbeing, 2020) indicated that 37% of students believed their state of mental wellbeing  
16 deteriorated since they started studying, and 64% of students reported that studies and  
17 university lifestyle negatively impacted their state of mental wellbeing. Mark Crawford, a  
18 postgraduate student union officer, writing for Red Pepper, stated that “Driving our  
19 universities to act like businesses doesn’t just cannibalise the joy of learning and the social  
20 utility of research and teaching; it also makes us ill” (2).

21 One factor that can increase the risk, and exacerbate the symptoms, of mental illness,  
22 is difficulty in emotion regulation (3). Emotion regulation refers to attempts to influence  
23 one’s emotions (4), and successful emotion regulation is beneficial for various psychological  
24 and physical health outcomes (e.g., 5; 6) and, fortunately, there are many strategies one can  
25 employ to regulate emotion. These strategies have been conceptualised in Gross’ (7) process

1 model of emotion regulation, comprising of strategies such as situation selection, situation  
2 modification, attentional deployment, cognitive change, and response modulation. However,  
3 not all emotion regulation strategies are equal. Cognitive reappraisal (or cognitive change) is  
4 demonstrably one of the most effective (8), and well-studied (9) emotion regulation  
5 strategies. Cognitive reappraisal is the modification of one's appraisal of a situation to affect  
6 its emotional impact (4) and has been associated with many adaptive outcomes, both  
7 psychophysiological (e.g., 10), and neurologically (e.g., 11). The efficacy of cognitive  
8 reappraisal for successful emotion regulation is not just espoused by emotion scientists but is  
9 also the backbone of second wave cognitive behavioural therapies (CBTs), in which  
10 cognitive mediation is a key axiomatic principle (12). That is, our thoughts about events  
11 shape our emotional reactions (13). Thus, in many CBTs, patients are encouraged to  
12 understand the role of and to modify their maladaptive cognitions as a way to regulate  
13 emotion. The idea that cognitions mediate between stimuli and emotion is captured in theory  
14 (e.g., 14), and scientific evidence (see 15), and underpins second wave CBTs such as  
15 cognitive therapy (CT; 16) and rational emotive behaviour therapy (REBT; 17) where  
16 cognitive change is paramount.

17         Research in university students is equivocal with regards to emotion regulation  
18 development, with some research indicating no change in cognitive reappraisal capacity  
19 among students during their studies (e.g., 18; 19), and some research suggesting an increased  
20 use of maladaptive emotion regulation (suppression: 20), whilst other research reports  
21 decreased suppression and increased reappraisal (21). This equivocality is troubling amidst  
22 the evidence that increases in maladaptive emotion regulation strategies occur with age (22),  
23 and the findings that greater tendencies to utilise adaptive emotion regulation strategies  
24 (cognitive reappraisal) is related to better personal and social wellbeing outcomes (19),  
25 reduced suicidal behavior (23), and better psychological and general health (24). Therefore,

1 research that aims to understand the predetermining factors that could predict greater  
2 engagement in adaptive emotion regulation strategies, such as cognitive reappraisal, in  
3 university (college) student populations is needed.

4         Given the effectiveness of cognitive reappraisal for emotion regulation, an  
5 understanding of the factors that could predetermine reappraisal attempts is important to  
6 study. That is, if we know the preceding factors that make reappraisal attempts more likely,  
7 then we can seek to influence those preceding factors with a view to helping students regulate  
8 emotion adaptively. One potential preceding or concomitant concept that has emerged in  
9 recent emotion regulation literature is “emotion beliefs” (15, p. 74), considered to be beliefs  
10 about emotion and emotion regulation. Individual differences in what people believe about  
11 emotion and emotion regulation have meaningful consequences for emotion regulation (26;  
12 27). In other words, is it proposed that what we believe about our emotions can influence our  
13 attempts to regulate emotions. For example, the belief that emotion is malleable leads to  
14 higher emotional regulation capacity, that predicts better well-being, interpersonal  
15 functioning, and mental health (28, 29, 30). However, research in the field of emotion beliefs  
16 is still in its infancy (e.g., 31), although it is growing (32).

17         Amidst the burgeoning research into emotion beliefs, recently Turner et al. (2021, 33)  
18 conceptualised two superordinate emotion beliefs, measured using the cognitive-mediation  
19 beliefs questionnaire (CMBQ), that show promise in initial findings. These emotion beliefs  
20 are:

- 21         1) Stimulus-Response (S-R) generation beliefs (the belief that emotions are caused by  
22 events)
- 23         2) Cognitive Mediation (C-M) change beliefs (the belief that changes in cognition  
24 lead to emotion change).

1 To expand, S-R generation beliefs reflect the idea that emotion is solely caused by external  
2 situational events, and C-M change beliefs reflect the idea that emotion can be modified  
3 through cognitive reappraisal (or cognitive change). Initial findings concerning S-R  
4 generation and C-M change beliefs (33) indicate that greater C-M change beliefs and lower  
5 S-R generation beliefs are related to higher cognitive reappraisal tendencies (adaptive  
6 emotion regulation), greater ability to control thoughts, more positive mental health  
7 outcomes, and lower emotion reactivity (less persistence, sensitivity, and intensity of  
8 emotion). In brief, one's beliefs about emotion can indicate the extent to which one engages  
9 in particular emotion regulation attempts, such as cognitive reappraisal. As such, an  
10 individual with the belief that their emotions are caused solely by external events (S-R  
11 generation), is less likely to engage in cognitively driven emotion regulation strategies, such  
12 as cognitive reappraisal. This might be because an individual with high S-R generation  
13 beliefs may not recognise the role of cognitions in emotion aetiology and thus is not likely to  
14 employ a distinctly cognitive emotion modification strategy. The colloquial articulation of S-  
15 R generation beliefs can be witnessed easily in daily interactions with one another; "it makes  
16 me nervous", "they made me angry", "it made me feel really guilty". Technically, these  
17 statements are not accurate – an external event cannot singlehandedly *make* us feel anything,  
18 rather, it is the meaning we ascribe to events that shapes our emotion (34), not events alone.

19 In contrast, an individual with the belief that emotions can be cognitively mediated  
20 (C-M change), is more likely to engage in cognitive reappraisal (33, 35). This is important  
21 because of the support for cognitive reappraisal as an effective strategy for emotion  
22 regulation (e.g., 8), and thus, emotion beliefs that could indicate reappraisal likelihood (i.e.,  
23 less S-R and more C-M) might tell us more about how we can encourage adaptive emotion  
24 regulation. Indeed, in the second wave CBTs it is typical to help patients understand the  
25 important role of cognition in their emotions, and encourage them to take charge of their

1 cognitions in order to enable greater emotion regulation (36, 37). An understanding of S-R  
2 generation and C-M change beliefs can help us reflect on Mark Crawford's (2018, 2)  
3 aforementioned statement that the business-like actions of universities "makes us ill" (S-R  
4 generation) and help us to understand the environment-individual transaction in student  
5 emotion reactivity and mental health difficulties.

6         The current paper concerns the utility and validity of S-R generation and C-M change  
7 emotion beliefs for university students studying in the United Kingdom (U.K.). There were  
8 two aims of the current paper. First, we aimed to test the factor structure (factorial validity) of  
9 the CMBQ (33), a self-report psychometric that measures S-R generation and C-M change  
10 beliefs, with a student cohort for the first time. The CMBQ was initially developed within an  
11 occupational sample, and thus, prior to subsequent hypothesis testing, it was important to  
12 ensure that the measure was reliable in the student sample recruited for this study. Second,  
13 we aimed to examine the convergent and concurrent validity of the CMBQ by investigating  
14 the associations between S-R generation and C-M change beliefs, and cognitive reappraisal  
15 tendencies (convergent validity), and markers of emotion reactivity and positive mental  
16 health (concurrent validity). It is proposed in previous research (33, 35), and thus is  
17 hypothesised in the current study, that cognitive reappraisal tendencies should be inversely  
18 related to S-R generation beliefs, and positively related to C-M change beliefs, such that  
19 lower scores in S-R generation beliefs and higher scores in C-M change beliefs should be  
20 related to greater tendencies to apply cognitive reappraisal emotion regulation strategies.  
21 Also, in line with past research (33), it is hypothesised that greater S-R generation beliefs and  
22 lower C-M change beliefs will be related to higher (poorer) emotion reactivity and lower  
23 (poorer) positive mental health. In sum, it was hypothesised that the CMBQ would  
24 demonstrate factorial, convergent, and concurrent validity in an undergraduate student  
25 sample.

# 1 **Materials and methods**

## 2 **Participants**

3           In order to minimize errors and maximize the accuracy and generalizability of  
4 population estimates in scale validity and reliability testing, an a priori participant:item ratio  
5 of 10:1 was considered (38; 39), alongside guidelines that between 500 (very good) and 1000  
6 (excellent) participants is suitable (40). Thus, six hundred and twenty-one students  
7 participated in the present study ( $M_{age} = 23.64$ ;  $SD_{age} = 8.25$ ; female = 304, male = 272, did  
8 not disclose = 45; Asian = 49, Black = 26, Mixed = 14, White = 484, did not disclose = 48;  
9 single = 398, married = 55, divorced = 5, in a relationship = 29, did not disclose = 134).  
10 Participants were recruited from four universities in the United Kingdom (U.K.) via  
11 convenience and snowball sampling between November 2019 and March 2021 by inviting  
12 prospective participants to take part via course virtual learning environments and in  
13 physically in class, and then asking students to circulate the information to fellow students in  
14 their year. Participants were mostly full-time students (fulltime = 598, part-time = 23) in their  
15 first year of undergraduate study (1<sup>st</sup> year undergraduate = 274, 2<sup>nd</sup> year undergraduate = 162,  
16 3<sup>rd</sup> year undergraduate = 87, postgraduate = 88, doctoral = 9, did not disclose = 1).  
17 Questionnaires were completed either online using Qualtrics (online survey provider), or  
18 physically in person using paper surveys. The questionnaires took no longer than 15-minutes  
19 to complete.

## 20 **Design**

21           We adopted a cross-sectional single timepoint study design, allowing us to test the  
22 hypotheses using confirmatory factor analysis, bivariate correlations, and multiple linear  
23 hierarchical regression.

## 24 **Measures**



1           **Cognitive Mediation Beliefs.** The 15-item CMBQ (33; S-R generation = 8 items, C-  
2 M change = 7 items) was scored on a 1 (*strongly disagree*) to 5 (*strongly agree*) Likert-scale  
3 (see Table 1 for the CMBQ items). Cronbach's  $\alpha$  for the current sample was .88 for S-R  
4 generation, and .82 for C-M change. Prior to distributing the questionnaire to prospective  
5 participants, we engaged ten undergraduate students (female = 7, male = 3; White = 8, Asian  
6 = 2; age range 19-24) in a small pilot study of the CMBQ to assess the face validity (e.g., 41)  
7 of the CMBQ within the undergraduate student population. Pilot participants completed the  
8 CMBQ online and were asked to indicate what they thought of the CMBQ, whether they  
9 could discern C-M change items from S-R generation items, and whether the items were  
10 readable or not. Specifically, participants were given a definition of C-M change and S-R  
11 generation beliefs, and then asked to read each item of the CMBQ thoroughly. They were  
12 asked to indicate which of either C-M change or S-R generation beliefs each item assessed,  
13 and then to score each item between 1 and 10 on item accuracy (how accurately the item  
14 captures either C-M change or S-R generation beliefs) and clarity (how clearly the item is  
15 worded) with higher scores indicator greater accuracy and clarity respectively. Students were  
16 also invited to write down any comments they had about each item as to its quality. All  
17 participants correctly identified which item belonged to which CMBQ subscale, all items  
18 were deemed to be accurate ( $M = 8.70$ ,  $SD = .54$ , range = 8.00-9.30) and clear ( $M = 8.94$ ,  $SD$   
19 = .47, range = 8.20-9.50). Students remarked that the items were easy to read, but some were  
20 repetitive, and eight students indicated that C-M change items were more desirable, one  
21 student indicated that S-R generation items were more desirable, and one student suggested a  
22 mix of C-M change and S-R generation was desirable. In all, the pilot indicated that the  
23 CMBQ demonstrated face validity, and thus we did not alter any items. The notion that items  
24 are repetitive is a feature of psychometric instruments and one that is important for internal  
25 validity. Therefore, we commenced participant recruitment forthrightly.

1           **Emotion Regulation.** The Emotion Regulation Questionnaire (ERQ; 42) is a 9-item  
2 (43) measure assessing the tendency to regulate emotions in two ways: (1) Cognitive  
3 Reappraisal and (2) Expressive Suppression. In the current, only reappraisal was measured  
4 due to its conceptual relevance to the CMBQ. Items were scored on a 7-point Likert scale  
5 from 1 (*strongly disagree*) to 7 (*strongly agree*). In the current sample, Cronbach's  $\alpha$  was .82.

6           **Emotion Reactivity.** The Emotion Reactivity Scale (ERS; 44) is a 21-item measure  
7 emotion reactivity, that assesses emotion sensitivity, intensity, and persistence. For the  
8 current study we used the ERS total score (Cronbach's  $\alpha$  was .96), whereby higher scores  
9 indicate greater emotion reactivity.

10           **Affective Reactivity.** The Affective Reactivity Index (ARI; 45) is a 6-item measure  
11 of chronic irritability with questions pertaining to anger threshold, anger frequency, and  
12 anger duration. In the current sample, Cronbach's  $\alpha$  was .86.

13           **Positive Mental Health.** The 9-item Positive Mental Health (PMH) scale (46)  
14 assesses emotional aspects of well-being via positive emotionality. Cronbach's  $\alpha$  was .90 in  
15 the current study.

## 16 **Data analysis**

17           Data were screened for missing cases. Cases that were missing completely at random  
18 (Little's MCAR  $p > .05$ ) were replaced using the Expectation Maximization (EM) method. In  
19 all, 6 cases for CMBQ, 3 cases for ERQ, 42 cases for ERS, and 2 cases for PMH were  
20 MCAR and replaced. Data were also screened for outliers (standardized  $z$  values  $> 3.29$ ), and  
21 outliers were Winsorized ( $n = 39$  from 34,776 cases = .11%).

22           For main analyses, first, the 15-items of the CMBQ were subjected to CFA using  
23 SEM in AMOS version 25 (47), whereby a correlated two-factor model was tested (Table 1).  
24 We subjected the CMBQ to CFA following guidelines for best practices, it is recommended  
25 that multiple factor analysis be performed within different populations to increase the

1 factorial validity (38) previously the measure has only been tested in working populations  
2 (33), but not in student populations. Thus, we first sought to confirm the structure of the  
3 CMBQ in the student sample. The goodness of fit indices posited by Schermelleh-Engel et al.  
4 (2003, 48) were used to determine an acceptable fit. Specifically, goodness of fit was  
5 assessed using the  $\chi^2$  statistic, the comparative fit index (CFI), the standardised root mean  
6 square residual (SRMR), and the root mean square error of approximation (RMSEA). Values  
7 close to .08 for the RMSEA and .08 for the SRMR are indicative of an acceptable model fit,  
8 as are values above .90 for the CFI (49; 50; also see 51). The modification indices (MI)  
9 guidelines by Rossier et al. (2012, 52) were applied ( $< .20$ ). Also, in the current study the  
10 covarying of subfactor item errors occurred where subfactor items possessed similarities in  
11 item content (53).

12         Second, in line with the original CMBQ research (33), we calculated Pearson's  
13 correlation coefficients to examine the bivariate associations (between C-M and S-R beliefs,  
14 and cognitive reappraisal to assess the convergent validity of the CMBQ in a student sample.

15         Third, to assess the concurrent validity of the CMBQ in a student population, we  
16 conducted two sets of linear hierarchical multiple regression analyses. The first set were in  
17 line with the original CMBQ research (33) which regressed emotion reactivity (ERS and  
18 ARI) and positive mental health (PMH) onto C-M and S-R beliefs (step 2), whilst controlling  
19 for the effects of age, sex, study level (from 1 = undergraduate to 4 = post-graduate), and  
20 mode of study (full-time, and part-time) (step 1). The second set addressed a call by Turner et  
21 al. (2021, 33) to examine the effects of a CM-SR beliefs discrepancy score on emotion  
22 reactivity and positive mental health. That is, whilst C-M and S-R beliefs may have  
23 independent effects on emotion reactivity and positive mental health (33), it could be that the  
24 extent to which one reports C-M beliefs over and above S-R beliefs, and vice versa, is more  
25 indicative of emotion reactivity and positive mental health. Indeed, a person can have high C-

1 M change beliefs *and* high S-R generation beliefs, and whilst inversely related, they are not  
2 necessarily orthogonal. We regressed emotion reactivity (ERS and ARI) and positive mental  
3 health onto a C-M and S-R discrepancy (CM-SR) score (step 2), whilst controlling for the  
4 effects of age, sex, study level, and mode of study (step 1). The CM-SR discrepancy scores  
5 were calculated by subtracting S-R beliefs scores from C-M beliefs scores, similar to the  
6 hedonic balance score derived from the Positive and Negative Affect Schedule (PANAS; e.g.,  
7 54).

8 Finally, to explore potential differences in the S-R generation and C-M change scores  
9 between study levels, we conducted a 4 x 2 between-subjects MANCOVA, accounting for  
10 the effects of participant age as a covariate. There were four between-subjects factors, namely  
11 undergraduate level 1 (UG1), undergraduate level 2 (UG2), undergraduate level 3 (UG3), and  
12 post-graduate level (PG). For PG level we include doctoral participants because the low N of  
13 this population (N = 9) precluded its use as a separate group.

#### 14 **Ethics, transparency and openness**

15 Ethical approval for this study was granted by the HPSC Research Ethics and  
16 Governance Committee of the first author's university (approval number: 20417). Ethical  
17 approval was attained prior to participant recruitment and all participants completed written  
18 informed consent prior to taking part. We report how we determined our sample size, all data  
19 exclusions, all manipulations, and all measures in the study, and we follow JARS (55). All  
20 data (S1 File), analysis code, and research materials are available at  
21 [https://osf.io/8evgm/?view\\_only=0a5f582aaf7b40ec8baa877afcbeecc1](https://osf.io/8evgm/?view_only=0a5f582aaf7b40ec8baa877afcbeecc1) . Data were analyzed  
22 using SPSS (including AMOS), version 25 (IBM) This study's design and its analysis were  
23 not pre-registered.

## 24 **Results**

### 25 **CFA for CMBQ (factorial validity)**

1           The 15-item two-factor model was a good fit,  $\chi^2 = 388.473$ ,  $df = 86$ ,  $p < .001$ ,  
2 RMSEA = .075 (90% CI = .068–.083), CFI = .92, SRMR = .065. See Table 1 for factor  
3 loadings. C-M change and S-R generation were negatively related (-.23).

#### 4 **C-M and S-R and cognitive reappraisal (convergent validity)**

5           Pearson's correlation coefficients revealed a positive association between C-M  
6 change scores and cognitive reappraisal ( $r = .36$ ,  $p < .001$ ), and a negative association  
7 between S-R generation scores and cognitive reappraisal ( $r = -.19$ ,  $p < .001$ ). In sum, greater  
8 C-M change and less S-R generation beliefs were related to greater cognitive reappraisal  
9 tendencies.

#### 10 **Emotion reactivity and positive mental health onto C-M and S-R (concurrent validity)**

11           For ERS scores, step 1 (demographic variables) explained a significant proportion of  
12 variance ( $R^2\Delta < .08$ ,  $p < .001$ ). In step 2 C-M change and S-R generation scores explained  
13 11% of variance. In the final model,  $F(6,558) = 22.17$ ,  $p < .001$ , sex was positively related to  
14 ERS scores ( $\beta = .24$ ,  $t = 5.86$ ,  $p < .001$ ), as was study level ( $\beta = .10$ ,  $t = 2.00$ ,  $p = .047$ ), and  
15 so to was S-R generation ( $\beta = .35$ ,  $t = 8.77$ ,  $p < .001$ ). C-M change scores were not related to  
16 ERS scores ( $\beta = .07$ ,  $t = 1.86$ ,  $p = .063$ ).

17           For ARI scores, step 1 explained a significant proportion of variance ( $R^2\Delta < .02$ ,  $p =$   
18  $.014$ ). In step 2 C-M change and S-R generation scores explained 7% of variance. In the final  
19 model,  $F(6,558) = 9.08$ ,  $p < .001$ , S-R generation was positively related to ARI scores ( $\beta =$   
20  $.27$ ,  $t = 6.35$ ,  $p < .001$ ). C-M change scores were not related to ARI scores ( $\beta = -.01$ ,  $t = -.14$ ,  
21  $p = .89$ ).

1 **Table 1. Item properties, internal consistency, inter-item correlations, and descriptives, of the 15-item CMBQ.**

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	$\beta$	$R^2$	$\alpha$	M(SD)	Inter-item correlation	
					Range	M(SD)
<b>S-R generation</b>			.88			
How I feel is completely dictated by the things that happen to me in my life.	.43	.19		3.12(1.00)	.281-.474	.351(.062)
My feelings are entirely determined by peoples' actions towards me.	.72	.52		3.04(1.02)	.359-.580	.496(.085)
My feelings are completely controlled by the situation I am in.	.75	.56		3.09(1.04)	.346-.595	.511(.088)
My emotions are entirely caused by what people do around me.	.76	.58		3.00(1.03)	.307-.634	.510(.119)
My emotions are caused entirely by others' actions towards me.	.76	.58		2.95(1.07)	.281-.634	.511(.119)
My emotions are caused entirely by the things that happen to me.	.72	.52		3.20(1.00)	.328-.642	.498(.093)
What happens to me entirely dictates how I feel.	.79	.63		2.95(1.03)	.388-.571	.458(.060)
My emotions are completely dictated by what happens to me.	.58	.34				
<b>C-M change</b>			.82			
To change how I feel, my thoughts about the situation need to change.	.64	.40		3.53(.99)	.218-.492	.379(.094)
To change how I feel, I need to change what I think about things around me.	.52	.27		3.68(.78)	.282-.391	.349(.038)
Thinking differently about the situation will change how I feel.	.63	.40		3.61(.86)	.380-.477	.409(.036)
To change how I feel, I can change my thoughts about the situation.	.63	.39		3.67(.81)	.218-.521	.373(.100)
I can change my emotions by changing how I think about the situation.	.76	.58		3.49(.92)	.341-.521	.466(.066)
Because I can choose to think differently, I can choose to feel differently about the situation.	.63	.39		3.39(.98)	.282-.509	.396(.077)
To control my emotions, I need to change the way I think.	.66	.44		3.55(.92)	.327-.499	.420(.073)

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1 For PMH scores, step 1 explained a significant proportion of variance ( $R^2\Delta = .02, p =$   
2  $.027$ ). In step 2 C-M change and S-R generation scores explained 3% of variance. In the final  
3 model,  $F(6,558) = 4.86, p < .001$ , sex was negatively related to PMH scores ( $\beta = -.01, t = -$   
4  $2.19, p = .029$ ), and so too was year of study ( $\beta = -.12, t = -2.29, p = .022$ ). S-R generation  
5 was negatively related to PMH scores ( $\beta = -.10, t = -2.31, p = .021$ ), and C-M change scores  
6 were positively related to PMH scores ( $\beta = .14, t = 3.27, p = .001$ ).

7 In sum, females, those in a higher level of study, and those reporting higher S-R  
8 generation reported greater emotion reactivity and lower positive mental health. In addition,  
9 those reporting higher C-M change reported higher positive mental health.

#### 10 **Emotion reactivity and positive mental health onto CM-SR discrepancy (concurrent** 11 **validity)**

12 For ERS scores, step 1 explained a significant proportion of variance ( $R^2\Delta < .08, p <$   
13  $.001$ ). In step 2 CM-SR discrepancy scores explained 5% of variance in ERS scores. In the  
14 final model,  $F(5,559) = 16.48, p < .001$ , sex was positively related to ERS scores ( $\beta = .27, t =$   
15  $6.59, p < .001$ ), but CM-SR discrepancy was negatively related to ERS scores ( $\beta = -.23, t = -$   
16  $5.57, p < .001$ ).

17 For ARI scores, step 1 explained a significant proportion of variance ( $R^2\Delta < .02, p =$   
18  $.014$ ). In step 2 CM-SR discrepancy scores explained 4% of variance. In the final model,  
19  $F(5,559) = 7.96, p < .001$ , sex was positively related to ARI scores ( $\beta = .10, t = 2.42, p =$   
20  $.016$ ), but CM-SR discrepancy was negatively related to ARI scores ( $\beta = -.22, t = -5.16, p <$   
21  $.001$ ).

22 For PMH scores, step 1 explained a significant proportion of variance ( $R^2\Delta < .02, p =$   
23  $.027$ ). In step 2 CM-SR discrepancy scores explained 3% of variance. In the final model,  
24  $F(5,559) = 5.62, p < .001$ , sex was negatively related to PMH scores ( $\beta = -.09, t = -2.06, p =$

1 .039), and so too was year of study ( $\beta = -.12, t = -2.31, p = .021$ ). CM-SR discrepancy was  
 2 positively related to PMH scores ( $\beta = .18, t = 4.09, p < .001$ ).

3 In sum, females, and those reporting lower CM-SR discrepancy scores (lower C-M  
 4 change relative to higher S-R generation) reported greater emotion reactivity and lower  
 5 positive mental health. Higher year of study was related to lower positive mental health.

### 6 **CMBQ scores between study levels**

7 The 4 x 2 MANCOVA revealed a significant main effect for student level, Wilks  $\Lambda =$   
 8 .91,  $F(6, 1202) = 9.69, p < .001, \eta^2 = .05$ . At the univariate level, S-R generation differed  
 9 between groups,  $F(3,602) = 10.44, p < .001, \eta^2 = .05$ , and so too did C-M change,  $F(3,602)$   
 10  $= 9.46, p < .001, \eta^2 = .05$ . For S-R generation, pairwise comparisons revealed that  
 11 participants at PG level ( $M = 2.55, SD = .93$ ) scored significantly lower (all  $p < .001$ ) than  
 12 UG1 ( $M = 3.12, SD = .66$ ), UG2 ( $M = 3.16, SD = .72$ ), and UG3 ( $M = 3.29, SD = .68$ ) levels.  
 13 For C-M change, pairwise comparisons revealed that participants at UG1 ( $M = 3.43, SD =$   
 14  $.59$ ) scored significantly lower ( $p < .001$ ) than participants at UG2 ( $M = 3.72, SD = .57$ ), that  
 15 participants at UG2 scored significantly higher ( $p < .001$ ) than participants at UG3 ( $M = 3.41,$   
 16  $SD = .60$ ), and that participants at UG3 scored significantly lower ( $p = .028$ ) than participants  
 17 at PG level ( $M = 3.82, SD = .66$ ). As can be seen in table 2, data indicate that the highest  
 18 scores in C-M change and the lowest scores in S-R generation are reported by PG level  
 19 students.

20

21 Table 2. Means and SDs for CMBQ data between study years.

	UG1	UG2	UG3	PG
	M (SD)	M (SD)	M (SD)	M (SD)
S-R generation	3.12 (.66)	3.16 (.72)	3.29 (.68)	2.55 (.93)
C-M change	3.43 (.59)	3.72 (.57)	3.41 (.60)	3.82 (.66)



1 *Notes.* UG = undergraduate, PG = post-graduate.

2

### 3 **Discussion**

4         The chief purpose of the present study was to test the factor structure, and convergent  
5 and concurrent validity, of the CMBQ within a student cohort for the first time. The results  
6 confirmed the correlated two-factor structure of the 15-item CMBQ (factorial validity),  
7 offered support for its convergent validity, and indicated support for its concurrent validity,  
8 as hypothesised. Specifically, CFA indicated that the C-M change and S-R generation  
9 subscales offered a good fit to the data. Also, C-M change was positively related, whilst S-R  
10 generation was negatively related, to cognitive reappraisal. Further, greater S-R generation  
11 was associated with greater emotion reactivity and lower positive mental health, whilst  
12 greater C-M change was related to higher positive mental health but was not related to  
13 emotion reactivity. In addition, a CM-SR discrepancy score, whereby higher scores reflect  
14 greater C-M beliefs relative to S-R beliefs, was negatively related to emotion reactivity and  
15 positively related to positive mental health. Results are largely in line with previous research  
16 (27), and theory (25) concerning emotion beliefs, as well as previous findings specific to C-  
17 M and S-R beliefs (33). However, full support could not be offered due to the equivocal  
18 findings regarding C-M change beliefs and emotion reactivity in the current sample.

19         The finding that C-M change beliefs were not related to markers of emotion reactivity  
20 could indicate that endorsing the beliefs that emotions can be altered by changing one's  
21 thinking does not have implications for emotion reactivity. However, holding C-M change  
22 and/or S-R generation beliefs does not necessarily impact upon emotion reactivity directly.  
23 That is, Turner et al. (2021, 33) propose that holding high C-M change beliefs predisposes  
24 individuals to cognitive reappraisal attempts, thus it is through cognitive reappraisal that  
25 emotions are regulated. The positive relationship between C-M change beliefs and cognitive

1 reappraisal tendencies found in the current study is indicative of this proposal. Holding high  
2 C-M change beliefs is perhaps unlikely to be beneficial for emotion regulation unless it leads  
3 to the enlistment of cognitive reappraisal. The same argument could be made for S-R  
4 generation beliefs, that although S-R generation beliefs were inversely associated with  
5 emotion reactivity, it could be argued that these effects can occur only through or via  
6 diminished attempts at cognitive reappraisal.

7         A possible process through which emotion beliefs might influence emotion reactivity  
8 and mental health might start with deeply held beliefs about emotion, which could predispose  
9 us to certain emotion regulation strategies, which then shape emotion reactivity. For example,  
10 one might hold beliefs that emotions are caused only by external events (high S-R  
11 generation) and that I cannot alter my emotions via cognitive change (low C-M change),  
12 which predisposes me to less attempts at cognitive restructuring in the face of stimuli, and  
13 resultant high emotion reactivity. To test these assumptions, one would need to adopt  
14 temporal and or experimental research methods to apply mediation analyses, for example, to  
15 determine the causal relationships between emotion beliefs and reactivity through cognitive  
16 reappraisal.

17         Also, we must consider that C-M change beliefs reflect beliefs about change, whereas  
18 S-R generation beliefs reflect aetiology. It is possible that the processes related to emotion  
19 *generation*, are separable from the processes that relate to emotion *management* (e.g., 56;  
20 57). It could be that high S-R generation beliefs are suggestive of perceptions of a bottom-up  
21 emotion generation process (i.e., elicitation of emotion by the presentation of a stimulus that  
22 is inherently emotional; 58), rather than a top-down process (i.e., elicitation of emotion by the  
23 activation of high-level appraisals; 59). The differences in psychological and neural  
24 mechanisms for bottom-up vs. top-down emotion generation (e.g., 60) may have important  
25 consequences for emotion regulation attempts. Thus, strongly believing that emotions occur

1 as a direct result of external stimuli (S-R generation) may discount cognitive reappraisal as an  
2 emotion regulation strategy, since the role of cognition in emotion per se is ignored. As such,  
3 a strong S-R generation belief may be more directly related to emotion reactivity compared to  
4 C-M change beliefs.

5         The above points are perhaps illustrated by the findings in the current study  
6 concerning CM-SR discrepancy scores, where higher scores reflect greater C-M change and  
7 lower S-R generation beliefs. When considered independently, C-M change and S-R  
8 generation beliefs have variable associations with emotion reactivity, as discussed. But when  
9 taken together as a relative index of CM-SR beliefs, more consistent associations with  
10 emotion reactivity were found. Thus, it is perhaps the interaction between C-M change and S-  
11 R generation beliefs that is important for emotion reactivity outcomes, rather than each  
12 subscale alone. Because C-M change and S-R generation beliefs appear not to be orthogonal  
13 (one can score highly in both), then we must account for the interaction between each belief  
14 when making predictions concerning emotion reactivity. For example, perhaps C-M change  
15 beliefs are only indicative of emotion reactivity when S-R generation beliefs are accounted  
16 for. This is a clear area for future research, and one that could be approached by applying  
17 temporal mediation analyses whereby S-R generation is assessed as mediator of the  
18 relationship between C-M change and emotion reactivity. This would allow us to make  
19 conclusions closer to cause-effect than is possible at present due to the cross-sectional nature  
20 of the designs utilised to examine S-R generation and C-M change beliefs.

21         In the present study, we separate emotion beliefs from cognitive reappraisal and  
22 emotion reactivity and mental health outcomes. It is possible that emotion generation and  
23 regulation are inseparable (26), however, treating them as separate for research is favourable  
24 (61). Future research should more comprehensively examine the implications of C-M change  
25 and S-R generation beliefs on the process of emotion regulation, in line with the process

1 model proposed by Gross (2014, 7). We do not know at what point emotion beliefs influence  
2 emotion regulation, and we know little about how emotion beliefs may implicate other  
3 emotion regulation strategies, such as situation selection, situation modification, attentional  
4 deployment, and response modification. It could be implied that stronger S-R generation  
5 beliefs relative to C-M change beliefs might underpin situation selection and modification  
6 strategies, since the most viable approach for one who believes situations directly cause  
7 emotion is to change the causal agent. But this is conjecture and is in need of future research.

8         Alongside findings pertaining to the validity of the CMBQ, sex differences and study  
9 year effects also emerged in the present study. Specifically, female students reported emotion  
10 reactivity and lower positive mental health than males. This finding is partially in line with  
11 the original CMBQ validation study (33) in an occupation sample, in which females reported  
12 higher emotion reactivity scores than males, but no differences in positive mental health were  
13 found. It is not possible to categorically state why these sex differences emerged, however,  
14 sex has been found to be an important influencer of emotion regulation in past research (e.g.,  
15 62), possibly echoing the sex differences in the prevalence of psychopathologies that are  
16 characterised in part by deficits in emotion regulation (e.g., 63). Sex differences in mental  
17 health have been well-established in past research. For example, Scott-Young et al. (2020,  
18 64) found that female undergraduate students' overall mental health deteriorated over the  
19 course of their degree programme whilst male undergraduate students' overall mental health  
20 improved. Compared to males, female students have also reported higher overall levels of  
21 stress (e.g., 65), depression (e.g., 66), and anxiety (e.g., 66, 67). Whilst our findings are  
22 consistent with extant literature, whether and to what extent sex is implicated in C-M change  
23 and S-R generation emotion beliefs remains to be fully explored.

24         The finding that participants in a higher year of study report worse positive mental  
25 health is enlightening and concerning. Data indicate increasing numbers of U.K. students

1 reporting mental health problems (68), with recent data indicating high levels of depression  
2 and anxiety, with scores above the clinical cut off for over half of students sampled (69). This  
3 finding suggests that, for the sample studied, as one progresses through academic study,  
4 mental health declines. However, we have to be careful with our conclusions here because we  
5 do not have longitudinal data that indicate within-subjects declinations of mental health.  
6 What we do have is an indication that participants later in their academic study report poorer  
7 mental health. We need to explore this finding further, because if it is the case that academic  
8 progress is in some way a risk factor for mental health, then we need to first figure out why  
9 and how, and second we need to develop appropriate and ongoing support for those who are  
10 engaged in university study.

11 Data also indicated that participants in a later year of study reported lower S-R  
12 generation beliefs, and higher C-M change beliefs, relative to undergraduate study years  
13 (when controlling for age). This finding might indicate three things. First, it could be that  
14 progression through study years encourages students to adopt more adaptive emotion beliefs  
15 through experiential learning. That is, by facing a multitude of challenges associated with  
16 continued academic study, students come to understand how best they can regulate their  
17 emotions, thus are more likely to endorse C-M change beliefs and relinquish S-R generation  
18 beliefs. Second, and in somewhat the other direction causally, it could be that students with  
19 more adaptive emotion beliefs are more able and willing to undertake continued study, in part  
20 because they can regulate their emotions in times of challenge. But again, these reasonings  
21 are mere postulation because we do not have longitudinal data concerning the CMBQ from  
22 which we can draw cause-effect conclusions. In addition, whilst some temporal research does  
23 indicate that appraisal tendencies might change during university study (e.g., 20; 21), other  
24 research indicates no change (e.g., 18; 19). Third, perhaps level of education is an important  
25 antecedent factor for emotion beliefs, such that higher levels of education might be conducive

1 to more adaptive beliefs about emotions. Some research indicates that a higher level of  
2 education is positively associated with more adaptive emotion regulation tendencies (e.g., 70;  
3 71), and greater reappraisal tendencies are associated with better academic performance (72).  
4 But on the contrary, data elsewhere indicate a disconnect between reappraisal and level of  
5 education (73). Thus, it might be the case that education level is important for emotion beliefs  
6 and emotion regulation more broadly, but researchers are required to take a targeted approach  
7 to this question rather than merely controlling for level of education in their analyses as a  
8 matter of course.

9         The present study has some strengths such as the large sample size for the tests  
10 conducted, and the rigour with which we approach the CMBQ validity testing prior to main  
11 analyses. But the results of the current study should be considered against the backdrop of  
12 several limitations. First, this study is cross-sectional, and thus cause-effect conclusions  
13 cannot be drawn. To more fully test C-M change and S-R generation beliefs, experimental  
14 research should be conducted where these beliefs are manipulated to assess whether the  
15 effects of holding either belief predicts differential cognitive reappraisal attempts and  
16 subsequent acute emotion reactivity. Researchers could also examine how holding C-M  
17 change and S-R generation beliefs may predispose participants to emotion reactivity in  
18 response to real stimuli, be it in the laboratory, or in the field. More broadly, researchers  
19 could collect more objective emotion reactivity data such as cardiovascular (e.g., 74) and  
20 neuroimaging (e.g., 9) indicators. In addition, the results of the current study are specific to a  
21 U.K. undergraduate population, and thus generalisability across populations cannot be  
22 proffered.

23         In addition, there are multiple factors that could have been included in our data  
24 collection and analyses that are potentially important for emotion beliefs, regulation  
25 tendencies, and emotion reactivity. For example, although in the current study the aim was to

1 test the validity of the S-R generation and C-M change concepts in students specifically,  
2 participating students may have a number of roles that are pertinent to their emotional  
3 experiences. For example, they may be employed in part-time work and are required to, or  
4 choose to, balance their studies with work commitments. At the very least, working status  
5 should be accounted for in future research concerning the CMBQ, alongside a myriad of  
6 socioeconomic factors (e.g., 75, 76) to help us form a more sophisticated and comprehensive  
7 picture of factors that can inform emotional experiences. Furthermore, future research could  
8 conduct factor analyses on the CMBQ that is stratified across study level. In our data, we  
9 found that study level was important for Mean CMBQ scores and for the associations  
10 between CMBQ scores and the outcomes, but our data were not suitable (e.g., very low N for  
11 doctoral students) for CFA at each study level. It would be useful to know whether and what  
12 extent the CMBQ is factorially valid across all levels of study when analysed separately.

13         There are some potential practical implications of the present study for students, and  
14 for those working with students. In line with second-wave CBTs (77; 78), students could be  
15 encouraged to recognise the role their beliefs play in their emotions. Further, students could  
16 be encouraged to adopt and strengthen C-M change beliefs, whilst weakening S-R generation  
17 beliefs, with a view to more volitionally regulate their emotions via cognitive reappraisal.  
18 That is, students can exercise some control over their thoughts (although it is taxing; 79), and  
19 in turn, can exercise some control over their emotions. This suggestion is in part informed by  
20 the results of the current study, but it also a cornerstone of prominent CBTs, especially  
21 rational emotive behaviour theory (REBT; 13).

22         It is also important to outline how the findings of the present study should *not* be  
23 used, especially if the results are misinterpreted. The findings here, and those of Turner et al.  
24 (2021, 33), do not legitimise victim-blaming. That is, it is not that students are to blame for  
25 experiencing emotions or for facing emotionally evocative situations. Rather, in the face of a

1 stimulus, students can be encouraged to adopt thoughts and beliefs that make it more likely  
2 for them to effectively regulate their emotions. In line with second-wave CBT theory and  
3 practice, we suggest that in believing that emotion is cognitively mediated (high C-M change  
4 and low S-R generation beliefs), one is more able to regulate one's emotions.

## 5 **Conclusions**

6 In this study we conducted important validity tests concerning the CMBQ in a sample  
7 of undergraduate students for the first time. The correlated two-factor structure of the CMBQ  
8 was confirmed, and there was evidence of convergent validity, and partial evidence for  
9 concurrent validity. A CM-SR discrepancy score, which accounts for both S-R generation  
10 and C-M change beliefs, appeared to provide a promising variable when associated with  
11 emotion reactivity and positive mental health. However, additional research is required to  
12 examine cause-effect implications of S-R generation and C-M change beliefs, and to explore  
13 how S-R generation and C-M change beliefs interact to predict emotion reactivity.

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1 **Supporting information**

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3 **S1 File. Study data.**

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