Behaviour Research and Therapy 70 (2015) 11–22

Contents lists available at ScienceDirect

Behaviour Research and Therapy

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

Mindfulness and acceptance-based group therapy and traditional cognitive behavioral group therapy for social anxiety disorder: Mechanisms of change

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ARTICLE INFO

Article history:
Received 12 August 2014
Received in revised form
24 March 2015
Accepted 11 April 2015
Available online 12 April 2015

Keywords:
Social anxiety disorder
Social phobia
Cognitive behavioral therapy
Acceptance and commitment therapy
Mindfulness
Treatment mediator
Mechanism of change

ABSTRACT

The present study investigated mechanisms of change for two group treatments for social anxiety disorder (SAD): cognitive behavioral group therapy (CBGT) and mindfulness and acceptance-based group therapy (MAGT). Participants were treatment completers ($n = 37$ for MAGT, $n = 32$ for CBGT) from a randomized clinical trial. Cognitive reappraisal was the hypothesized mechanism of change for CBGT. Mindfulness and acceptance were hypothesized mechanisms of change for MAGT. Latent difference score (LDS) analysis results demonstrate that cognitive reappraisal coupling (in which cognitive reappraisal is negatively associated with the subsequent rate of change in social anxiety) had a greater impact on social anxiety for CBGT than MAGT. The LDS bidirectional mindfulness model (mindfulness predicts subsequent change in social anxiety; social anxiety predicts subsequent change in mindfulness) was supported for both treatments. Results for acceptance were less clear. Cognitive reappraisal may be a more important mechanism of change for CBGT than MAGT, whereas mindfulness may be an important mechanism of change for both treatments.

Although there are various empirically supported treatments for social anxiety disorder (SAD), including longstanding support for traditional cognitive behavioral therapy (CBT; see Heimberg, 2002 for a review) and growing support for mindfulness and acceptance-based approaches (Craske et al., in press; Dalrymple & Herbert, 2007; Kocovski, Fleming, Hawley, Huta, & Antony, 2013), each form of treatment may involve distinct (as well as shared) mechanisms of change. Traditional CBT models focus, in part, on cognitive reappraisal. Alternatively, mindfulness and acceptance-based models suggest that present-moment non-judgemental awareness and willingness to experience anxious thoughts and feelings are at least, in part, responsible for change. The purpose of the present study was to evaluate the role of cognitive reappraisal, mindfulness and acceptance as potential mechanisms of change for two forms of group therapy for SAD, cognitive behavioral group therapy (CBGT; Heimberg & Becker, 2002) and mindfulness and acceptance-based group therapy (MAGT; Fleming & Kocovski, 2009), using data from a recent randomized controlled trial (Kocovski et al., 2013). An understanding of how these treatments work may allow for further treatment refinement and ultimately improved treatment efficacy.

1. Traditional CBT for SAD: mechanisms of change

A number of studies have recently examined mechanisms of change for CBT for SAD, mostly focusing on cognitive reappraisal as well as probability and cost estimates of feared outcomes. Cognitive reappraisal, an emotion regulation strategy in which the interpretation of a situation is changed in order to reduce the emotional impact (Gross & John, 2003), is related to the commonly used CBT technique of cognitive restructuring, which encourages clients to shift their interpretation of a situation. Moscovitch et al. (2012) found that change in cognitive reappraisal during CBT for SAD distinguished responders and nonresponders, as did change in social probability and cost estimates. Further, Goldin et al. (2012) found that cognitive reappraisal self-efficacy (i.e., the belief that

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http://dx.doi.org/10.1016/j.brat.2015.04.005
0005-7967/

one can successfully use cognitive reappraisal to regulate emotions) mediated change in CBT for SAD.

In addition to change in probability and cost estimates distinguishing responders and nonresponders (Moscovitch et al., 2012), several other studies have found support for the importance of reducing probability or cost estimates. Change in estimated social cost was found to mediate change in social anxiety for both CBGT and an exposure-based group treatment (Hofmann, 2004). Similarly, change in the cost of negative evaluation mediated change in social anxiety for an enhanced CBT group, but not for a standard CBT group (comparable to CBGT; Rapee, Gaston, & Abbott, 2009). In contrast, in a sample of individuals with SAD completing a series of public speaking exposures, Smits, Rosenfield, McDonald, and Telch (2006) found that decreased cost estimates were a consequence of decreased fear, whereas reductions in probability estimates led to subsequent fear reduction.

Finally, Hedman et al. (2013) compared four possible mediators (avoidance, self-focused attention, anticipatory processing, and postevent processing, all assessed weekly using one-item scales) for individual vs. group CBT for SAD. The treatments were based on similar cognitive models (Clark & Wells, 1995; Rapee & Heimberg, 1997) but employed different treatment components (e.g., cognitive restructuring vs. behavioral experiments). Although individual CBT led to greater decreases than CBGT on all four variables, only avoidance and self-focused attention mediated change for individual CBT, whereas self-focused attention, anticipatory processing and postevent processing mediated change for CBGT. Therefore, in addition to process differences based on theoretical framework, there may be differences based on differing treatment strategies and modality (individual vs. group).

2. Mindfulness and acceptance-based treatments for SAD: mechanisms of change

Experiential acceptance (Hayes, Luoma, Bond, Masuda, & Lillis, 2006) is a construct that is commonly examined as a mechanism of change in ACT, typically assessed using the *Acceptance and Action Questionnaire* (AAQ; Hayes et al., 2004). In an open trial of MAGT (Kocovski, Fleming, & Rector, 2009), as well as Dalrymple and Herbert's (2007) ACT open trial, preliminary support was found for acceptance (measured using the AAQ) as a possible mediator of treatment change. In both studies, change in AAQ by midtreatment significantly predicted change in social anxiety from pre to posttreatment, suggesting that acceptance is a variable that would be of interest to examine as a mediator in a randomized trial.

Although acceptance is part of most definitions of mindfulness, mindfulness is a broader construct that includes an awareness component (Baer, 2011). In the MAGT open trial (Kocovski et al., 2009), change in mindfulness was significantly correlated with change in social anxiety; however, further analyses were not supportive of mindfulness as a mediator, though power may have been an issue. Burton, Schmertz, Price, Masuda, & Anderson (2013) examined the effect of exposure group therapy and virtual reality exposure therapy on mindfulness levels and also evaluated mindfulness as a potential moderator of treatment response. Mindfulness did not change significantly across treatments; nor did mindfulness moderate treatment outcome.

3. Comparing mechanisms of change across traditional CBT and ACT for SAD

Only one study has compared mechanisms of change for CBT and ACT for SAD, and treatments were delivered in individual formats (Niles et al., 2014). Niles and colleagues examined experiential avoidance (a hypothesized mechanism underlying treatment response in ACT; the opposite of experiential acceptance) and frequency of negative cognitions (a hypothesized mechanism underlying treatment response in CBT) utilizing a longitudinal framework in which these two constructs were assessed on five occasions during treatment. They used multilevel modeling analyses to examine the rate of change of their hypothesized mediators across treatment and the relationship between this change and outcome. They concluded that early decreases in negative cognitions predicted change in both treatments whereas early decreases in experiential avoidance predicted change in ACT only. It should be noted that Arch, Wolitzky-Taylor, Eifert, and Craske (2012) also compared mechanisms of change for individual ACT and CBT, but in a sample of mixed anxiety disorders (20% with SAD). There was support for cognitive defusion (a hypothesized ACT-specific mediator) as a mechanism of change for a broad range of outcomes for both treatments, and for anxiety sensitivity (a hypothesized CBT-specific mediator) as a mediator for one outcome (worry) in both treatments.

4. Present study

The purpose of the present study was to examine three variables that may represent unique mechanisms of change for CBGT or MAGT: cognitive reappraisal, mindfulness, and acceptance. Although similar research examining mechanisms of change in ACT compared to CBT has been published, only one study has focused on SAD, and this involved individual therapy. Given there may be different mechanisms for different disorders, and different mechanisms for group and individual approaches (as found by Hedman et al., 2013), further research is warranted. Additionally, this is the first analysis examining these questions using latent difference score (LDS) analysis, which allows for a) the determination of how each of these variables change independently over time, b) determining how each longitudinal series may relate (comparing four possible clinically relevant models), and c) examining how this dynamic process might change based on treatment modality.

A dataset from a recently published randomized controlled trial (RCT; Kocovski et al., 2013) comparing CBGT, MAGT, and a waitlist control condition (WAIT) was used in the present study. Participants in the treatment conditions both fared significantly better than those in the WAIT condition but were not significantly different from one another on most variables examined in the study, including social anxiety severity, depression, and valued living. Consistent with Moscovitch et al. (2012) and Goldin et al. (2012), it was hypothesized that cognitive reappraisal would affect subsequent longitudinal change in social anxiety symptoms over each time period for clients in the CBGT group (but not MAGT), and that mindfulness and acceptance would affect subsequent longitudinal change in social anxiety symptomatology over each time period for clients treated with MAGT (but not CBGT).

5. Method

5.1. Participants

Participants were 69 treatment completers, initially diagnosed with social anxiety disorder, according to the *Structured Clinical Interview for DSM-IV* (First, Spitzer, Gibbon, & Williams, 1996), who contacted the study team seeking treatment in response to advertisements (i.e., online, newspaper, flyers etc.). The present study represents a secondary data analysis and details regarding the randomized controlled trial are presented elsewhere (Kocovski et al., 2013). Overall, the sample had a mean age of 34 years, was fairly even in terms of gender split (54% female), was mostly single (62%) and close to half had a history of major depressive disorder (47%). Individuals with current major depressive disorder or current alcohol or substance abuse/dependence were excluded. There were no significant differences across conditions with respect to demographics or patterns of comorbidity. The RCT consisted of 137 participants ($n = 53$ in each treatment condition, $n = 31$ in WAIT); however, the present study, which focuses on mechanisms of change, included only the treatment completers for MAGT ($n = 37$) and CBGT ($n = 32$).

5.2. Measures

5.2.1. Social anxiety

The *Social Phobia Inventory* (SPIN; Connor et al., 2000) was used to assess social anxiety. It is a 17-item self-report measure of fear and avoidance of a range of social situations and of physiological symptoms of anxiety. The SPIN has been validated for use in clinical populations, has strong convergent and discriminant validity, good internal consistency and test–retest reliability (Radomsky et al., 2006), and has been used by others as a primary measure of social anxiety (e.g., Moscovitch et al., 2012). Alphas ranged from .88 to .92 across the four assessment points in the present study.

5.2.2. Cognitive reappraisal

The *Emotion Regulation Questionnaire* (ERQ; Gross & John, 2003) reappraisal subscale was used to assess cognitive reappraisal. Alphas for the ERQ are generally good (.83–.86 in Moscovitch et al., 2012; .84 to .89 in the present study) and test–retest reliability was .69 over 3-months (Gross & John, 2003). The factor structure of the ERQ has been supported using confirmatory factor analysis (Melka, Lancaster, Bryant, & Rodriguez, 2011).

5.2.3. Mindfulness

The *Freiburg Mindfulness Inventory* (FMI; Walach, Buchheld, Buttenmüller, Kleinknecht, & Schmidt, 2006) was used to assess mindfulness. It was first developed as a 30-item scale for experienced meditators (Buchheld, Grossman, & Walach, 2001) but later shortened to a 14-item version that can be used with non-meditators, and which correlates highly ($r = .95$) with the full version (Walach et al., 2006). The FMI views mindfulness as a unidimensional construct with the following interrelated facets: mindful presence, nonjudgemental acceptance, openness to experiences, and insight. Alphas ranged from .82 to .92 in the present study.

5.2.4. Acceptance

The *Social Anxiety – Acceptance and Action Questionnaire* (SA-AAQ; MacKenzie & Kocovski, 2010) was used to assess acceptance specific to social anxiety. It was based on the AAQ (Hayes et al., 2004) but adapted so items reflect a social anxiety context. There was support for a unidimensional factor structure in two nonclinical samples. The SA-AAQ correlated with measures of social anxiety but at a lower magnitude than measures of social anxiety correlated with each other and it correlated moderately with the AAQ-II and mindfulness (MacKenzie & Kocovski, 2010). The SA-AAQ has excellent internal consistency (.94 in MacKenzie & Kocovski, 2010; range of .88–.95 in the present study).

5.3. Procedure

Participants were randomly assigned to CBGT, MAGT, or WAIT (see Kocovski et al., 2013 for further details). Treatment groups completed the above listed measures pre, mid, posttreatment and at the 3-month follow-up. Treatment consisted of 12 weekly 2-h group sessions. CBGT was delivered according to the published manual (Heimberg & Becker, 2002) and MAGT was delivered as per an unpublished manual (Fleming & Kocovski, 2009).

5.4. Data analysis

Latent difference score analysis (LDS; see McArdle, 2001; McArdle & Hamagami, 2001) was used to explore the longitudinal and temporal dynamics of social anxiety symptom change as related to cognitive reappraisal, mindfulness, and acceptance.[1] LDS is a structural modeling approach for longitudinal data that integrates features of latent growth curve models (Meredith & Tisak, 1990) and cross-lagged regression models (Joreskog & Sorbom, 1979). LDS combines features of both classes of models by considering dynamic longitudinal growth within a time series while also examining multivariate relationships and determinants. Using the latent rate of change as the outcome variable, there are several ways to model change in the process of interest.

First, a univariate model was established, clarifying how each variable (i.e., social anxiety, cognitive reappraisal, mindfulness, acceptance) independently changed over time (Hamagami & McArdle, 2001; McArdle, 2001; McArdle & Hamagami, 2001; McArdle & Nesselroade, 2002). The univariate analyses conducted were exploratory, as no *a priori* hypotheses regarding the nature of univariate change were proposed. Next, bivariate LDS analyses were used to evaluate temporal relationships between univariate series by considering cross-lagged regressions. Here, the possible "coupling" of two univariate processes can be examined in terms of whether one process predicts the rate of change in the other. Bivariate LDS analyses examined the coupling relationship between social anxiety and each variable of interest (cognitive reappraisal, mindfulness, and acceptance). Next, multigroup LDS analysis compared MAGT with CBGT, considering whether longitudinal associations differed between treatment groups. Finally, multigroup invariance (equivalence) analyses were used to understand whether bivariate models differed between treatment conditions (for a more detailed explanation of this analytical approach as applied to clinical data, see Hawley, Ho, Zuroff, & Blatt, 2006, 2007).

The AMOS 20.0 program (Arbuckle, 2011) was used to evaluate all univariate, bivariate and multigroup LDS models. Parameters were estimated by the maximum-likelihood method, which compares the fit of a hypothesized structural model to the observed variance-covariance matrix. AMOS provides a variety of measures for assessing absolute and relative model fit. The chi-square index is considered a measure of absolute model fit, and a heuristic is typically used in which chi-square to degrees of freedom ratios (χ^2/df) near two represent acceptable model fit (Byrne, 2004). The root mean square error of approximation is provided as a measure of absolute model fit (RMSEA; Steiger & Lind, 1980). RMSEA indicates "model discrepancy per degree of freedom", with values less than .05 indicating a "close fit," whereas RMSEA values larger than .10 suggest a "poor fit" (Browne & Cudeck, 1993). Further, we consider the p-value for testing the null hypothesis that the population RMSEA is no greater than .05 (MacCallum, Browne, & Sugawara, 1996), reported as "p close fit." The *Comparative Fit Index* (CFI) indicates the relative reduction in model misfit when comparing the target model relative to a baseline (independence) model. CFI values greater than .90 indicate a good fit of the model to the observed data (CFI; Bentler, 1990). Further, the relative fit of competing models is compared using the Akaike Information Criterion (AIC; Akaike, 1973), which considers model complexity in relationship to the number of parameters. The model with smaller AIC is preferred. Finally, certain key parameter estimates

[1] Each variable was evaluated for longitudinal measurement invariance. A confirmatory factor analysis (CFA) was first conducted for each measure. Measurement invariance was evaluated using the items retained in the CFAs. Weak longitudinal measurement invariance (i.e., equal factor loadings over time) was demonstrated for all measures before proceeding with the LDS analyses.

Table 1
Correlations, means and standard deviations for study measures.

Variable	$SPIN_{t1}$	$SPIN_{t2}$	$SPIN_{t3}$	$SPIN_{t4}$	ERQ_{t1}	ERQ_{t2}	ERQ_{t3}	ERQ_{t4}	FMI_{t1}	FMI_{t2}	FMI_{t3}	FMI_{t4}	$SA\text{-}AAQ_{t1}$	$SA\text{-}AAQ_{t2}$	$SA\text{-}AAQ_{t3}$	$SA\text{-}AAQ_{t4}$
$SPIN_{t1}$	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
$SPIN_{t2}$	.73**	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–
$SPIN_{t3}$	.59**	.65**	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–
$SPIN_{t4}$	.53**	.72**	.67**	1.00	–	–	–	–	–	–	–	–	–	–	–	–
ERQ_{t1}	−.03	−.01	−.03	.18	1.00	–	–	–	–	–	–	–	–	–	–	–
ERQ_{t2}	−.05	−.17	−.11	−.06	.58**	1.00	–	–	–	–	–	–	–	–	–	–
ERQ_{t3}	−.08	−.19	−.22*	−.23	.58**	.67**	1.00	–	–	–	–	–	–	–	–	–
ERQ_{t4}	.06	−.08	−.30*	−.22	.50**	.68**	.86**	1.00	–	–	–	–	–	–	–	–
FMI_{t1}	−.35**	−.23*	−.21	−.26	.52**	.45**	.41**	.30*	1.00	–	–	–	–	–	–	–
FMI_{t2}	−.13	−.21*	−.27*	−.34*	.45**	.50**	.60**	.56**	.74**	1.00	–	–	–	–	–	–
FMI_{t3}	−.19	−.24*	−.51**	−.34*	.44**	.42**	.59**	.64**	.63**	.76**	1.00	–	–	–	–	–
FMI_{t4}	−.10	−.17	−.41**	−.36**	.43**	.47**	.69**	.68**	.67**	.74**	83**	1.00	–	–	–	–
$SA\text{-}AAQ_{t1}$	−.55**	−.30**	−.28**	−.19	.19	.09	−.02	−.25	.51**	.18	.21	−.04	1.00	–	–	–
$SA\text{-}AAQ_{t2}$	−.30**	−.46**	−.52**	−.38**	.15	.32**	1.73	.09	.38**	.41**	.48**	.23	.56**	1.00	–	–
$SA\text{-}AAQ_{t3}$	−.17	−.39**	−.63**	−.43**	.21	.24*	.30**	.43**	.17	.33**	.57**	.40**	.29**	.67**	1.00	–
$SA\text{-}AAQ_{t4}$	−.30**	−.50**	−.66**	−.59**	−.24	.17	.18	.24	.29**	.42**	.50**	.39**	.42**	.82**	.71**	1.00
M	44.46	39.39	34.17	27.59	23.58	25.69	25.88	27.56	29.36	30.05	31.96	34.02	7.78	8.34	8.73	9.01
SD	11.53	12.00	13.51	13.06	7.14	7.10	7.85	7.16	6.43	6.81	7.73	7.32	1.01	1.12	1.17	1.03

Note. SPIN = Social Phobia Inventory; FMI = Freiburg Mindfulness Inventory; ERQ = Emotion Regulation Questionnaire – cognitive reappraisal subscale; SA-AAQ = Social Anxiety-Acceptance and Action Questionnaire (square root transformed); t1 = time 1, pretreatment; t2 = time 2, midtreatment; t3 = time 3, posttreament; t4 = time 4, 3 month follow-up. *M* = Mean, *SD* = Standard deviation.
*$p < .05$. **$p < .01$.

are considered, although they are not measures of overall model fit. To evaluate the theoretical cogency of competing models, the bivariate LDS models can be discriminated based on whether the cross-lagged coupling parameter (γ) is significant. If the coupling is not significant, the model postulating that effect may not be supported (Hamagami & McArdle, 2001; McArdle & Hamagami, 2001; McArdle, 2001).

For the first multigroup LDS analysis, it was hypothesized that bivariate coupling would occur in which cognitive reappraisal effected the subsequent rate of change in SAD symptoms, and that coupling would only occur in the CBGT condition. For the second multigroup LDS analysis, it was hypothesized that bivariate coupling would occur in which mindfulness effected the subsequent rate of change in SAD symptoms, and that coupling would only occur in the MAGT condition. Similarly, for the third multigroup LDS analysis, it was hypothesized that bivariate coupling would occur in which acceptance effected the subsequent rate of change in SAD symptoms, and that coupling would only occur in the MAGT condition.

6. Results

Table 1 presents means, standard deviations, and correlations among study variables collapsed across the two active treatment conditions at pretreatment, midtreatment, posttreatment, and follow-up. The observed SPIN and FMI means decreased monotonically. The ERQ means demonstrated a non-linear pattern over time. The SA-AAQ means increased monotonically. As expected, measures from consecutive assessments were positively correlated for each measure, and there were several significant negative correlations between the SPIN and the ERQ, FMI, and SA-AAQ.

6.1. Univariate LDS models

First, LDS univariate analyses considered four longitudinal models for each variable, consisting of the "no-change" model, the additive "constant change" model, the "proportional change" model and the combined "dual-change" model for each time series separately, for the SPIN, ERQ, FMI, and SA-AAQ. Both time-varying and time-invariant proportional effects ($\beta(t)$) were considered in all models. Of the four univariate SPIN models considered, examination of parameter significance and goodness of fit indices indicated that longitudinal SPIN change was best represented as a dual change model, χ^2 (7) = 9.1.; χ^2/df = 1.30; AIC = 23.11, CFI = .99,

Table 2
Bivariate models involving the relationship of social anxiety (SPIN) and cognitive reappraisal (ERQ).

Parameters and fit indices	No coupling		SPIN → ERQ		SPIN ← ERQ		SPIN ←→ ERQ	
	SPIN	ERQ	SPIN	ERQ	SPIN	ERQ	SPIN	ERQ
Additive coefficient								
$E(s_n)$	2.76[c]	8.52[a]	2.63	11.90[a]	9.82[a]	8.72[a]	8.55	10.99[c]
σ^2 (s_n)	12.54	8.59	12.33	9.83	15.14	8.18	14.37	9.23
Proportional coefficients								
β_a	−.18	−.30[c]	−.18	−.36[c]	−.25[c]	−.29[c]	−.23[c]	−.34
β_b	−.18	−.30[c]	−.18	−.36[c]	−.25[c]	−.29[c]	−.23[c]	−.34
β_c	−.18	−.30[c]	−.18	−.36[c]	−.25[c]	−.29[c]	−.23[c]	−.34
Cross-lag coefficient								
$\gamma_{spin}/\gamma_{erq}$	0 (=)	0 (=)	−.05	0 (=)	0 (=)	−0.20[a]	.04	−.15
Goodness-of-fit indices								
Parameters	58		61		61		64	
Degrees of Freedom	28		27		27		26	
RMSEA (p close fit)	.09(.14)		.08(.16)		.06(.18) ns		.08(.18)	
CFI	.95		.94		.97		.95	
AIC	78.77		78.32		75.63		77.44	
χ^2	45.97		44.67		41.63		44.62	
χ^2/df	1.64		1.65		1.52		1.72	

Note. SPIN = Social Phobia Inventory. ERQ = Emotion Regulation Questionnaire – cognitive reappraisal subscale. 0 (=) indicates parameter is not estimated.
[a] $p < .05$; [b] $p < .01$; [c] $p < .001$.

RMSEA = .05, with time-invariant proportional effects. All parameter estimates were statistically significant ($p < .05$). Next, four univariate ERQ models were considered; longitudinal ERQ change was best represented by a dual change model, $\chi^2(2) = 1.16$; χ^2/df = .58; AIC = 25.16, CFI = 1.00, RMSEA = .01, with time varying proportional effects. All parameter estimates were statistically significant ($p < .001$). Next, four univariate FMI models were considered; longitudinal FMI change was best represented by a dual change model, $\chi^2(3) = 3.69$; χ^2/df = 1.23; AIC = 25.69, CFI = .99, RMSEA = .04, with time varying proportional effects. All parameter estimates were statistically significant ($p < .05$). Finally, four univariate SA-AAQ models were considered, using square root transformed data in order to correct for non-normal distributions. Longitudinal SA-AAQ change was best represented by a dual change model, $\chi^2(6) = 11.99$; χ^2/df = 2.00; AIC = 28.41, CFI = .96, RMSEA = .09, with time invariant proportional effects. All parameter estimates were statistically significant ($p < .05$). Although the RMSEA value is within the acceptable range, results for the SA-AAQ models should be interpreted accordingly.

6.2. Bivariate and multigroup LDS analyses: social anxiety (SPIN) and cognitive reappraisal (ERQ)

Summary results for the bivariate LDS analyses of SPIN and ERQ are presented in Table 2. Four models are considered, indicating parameter and fit indices for the no coupling model, a unidirectional model in which a latent SPIN value effects the subsequent rate of change in ERQ values, a unidirectional model in which a latent ERQ value effects the subsequent rate of change in SPIN values, or a bidirectional model involving cross-lagged linkages between both univariate series. Examination of goodness of fit and parameter estimates demonstrated that model 3 (ERQ leads subsequent change in SPIN) was the best model among the four candidate models, particularly given that this model had the lowest AIC and RMSEA, the lowest χ^2/df ratio, and the highest CFI, $\chi^2(27) = 41.63$; χ^2/df = 1.52; AIC = 75.63, CFI = .97, RMSEA = .06.

Fig. 1 provides the path diagram for this unidirectional model. All parameter estimates were statistically significant (ps ranging from <.001 to < .05). The coupling coefficient (γ_{erq}) was of particular importance, as the unidirectional coupling from cognitive reappraisal to change in social anxiety was significant ($p < .05$), with the unstandardized estimate being $\gamma_{erq} = -.20$.

Using this bivariate model of social anxiety and cognitive reappraisal, a multigroup LDS analysis compared the MAGT and CBGT treatment conditions. The first step in a multigroup analysis involves consideration of parameter equivalence across groups; all parameter estimates (i.e., mean, variance and error estimates) for the SPIN and ERQ univariate series did not significantly differ between the two groups. Nonredundant parameters included the mean and variance of the ($\alpha \times s_n$) term, parameter estimates of the time-invariant β terms, and the mean and variance of time 1 SPIN and ERQ. However, the time-invariant γ_{erq} coupling term differed between conditions, with the γ_{erq} coupling effect being stronger for the CBGT condition ($\gamma_{erq} = -.38$; 95% CI, [−.56]−[−.20]) compared to the MAGT condition ($\gamma_{erq} = -.26$; 95% CI, [−.51]−[−.01]). Table 3 presents the resulting parameter and goodness of fit indices for this multigroup LDS model, which provided the best model fit to the data ($\chi^2[88] = 81.87$; χ^2/df = 1.26; AIC = 127.87, CFI = .93, RMSEA = .06). Results from this analysis indicate that cognitive reappraisal coupling, in which ERQ is negatively associated with the subsequent rate of change in SPIN, has a greater impact on SPIN scores in the CBGT condition compared to the MAGT condition, although the coupling is significant in both conditions.

Results from the bivariate multigroup model can be used to establish an equation, indicating the expected change in SPIN as it relates to ERQ cognitive reappraisal:

MAGT Treatment:

$$\begin{aligned} E[\Delta SPIN(t)_n] &= \alpha_{spin} \times E[S_{spin,n}] + \beta_s \times E[SPIN(t-1)_n] \\ &\quad + \gamma_{erq} \times E[ERQ(t-1)_n] \\ &= 9.82 - .25 \times E[SPIN(t-1)_n] \\ &\quad - .27 \times E[ERQ(t-1)_n], \\ &\quad \text{for } T1 < t \le T2,\ T2 < t \le T3,\ T3 < t \le T4 \end{aligned}$$

CBGT Treatment:

$$\begin{aligned} E[\Delta SPIN(t)_n] &= \alpha_{spin} \times E[s_{spin,n}] + \beta_s \times E[SPIN(t-1)_n] \\ &\quad + \gamma_{erq} \times E[ERQ(t-1)_n] \\ &= 9.82 - .25 \times E[SPIN(t-1)_n] \\ &\quad - .37 \times E[ERQ(t-1)_n], \\ &\quad \text{for } T1 < t \le T2,\ T2 < t \le T3,\ T3 < t \le T4 \end{aligned}$$

These equations can be used to estimate the expected change in SPIN for participants experiencing high or low levels of ERQ during treatment, as shown in Table 4. The longitudinal SPIN change trajectories differ significantly based on the level of ERQ. To illustrate, participants in the MAGT condition who experienced a high level of ERQ (with initial ratings one standard deviation higher than the group mean) experienced a cumulative decrease of 15.73 SPIN units whereas those who experienced a lower level of ERQ (one standard deviation below the group mean) experienced a cumulative decrease of 10.03 SPIN units. Alternatively, participants in the CBGT condition who experienced a high level of ERQ experienced a cumulative decrease of 24.76 SPIN units whereas those who experienced a low level of ERQ experienced a cumulative decrease of 17.80 SPIN units.

6.3. Bivariate and multigroup LDS analyses: social anxiety (SPIN) and mindfulness (FMI)

Summary results for the bivariate LDS analyses of SPIN and FMI are presented in Table 5. Four models are considered, indicating parameter and fit indices for the no coupling model, a unidirectional model in which a latent SPIN value effects the subsequent rate of change in FMI values, a unidirectional model in which a latent FMI value effects the subsequent rate of change in SPIN values, or a bidirectional model involving cross-lagged linkages between both univariate series. Examination of goodness of fit and parameter estimates demonstrated that bidirectional model 4 (FMI leads subsequent change in SPIN; SPIN leads subsequent change in FMI) was the best model among the four candidate models, particularly given that this model reported the lowest AIC and RMSEA, the lowest χ^2/df ratio, and the highest CFI, $\chi^2(23) = 44.67$; χ^2/df = 1.94; AIC = 86.67, CFI = .93, RMSEA = .06.

Fig. 2 provides the path diagram for this bidirectional model. All parameter estimates were statistically significant (ps ranging from <.001 to < .05). The coupling coefficients (γ_{fmi}, γ_{spin}) were of particular importance, as the unidirectional coupling from mindfulness to change in social anxiety was significant ($p < .01$), with the unstandardized estimate being $\gamma_{erq} = -.28$, and the coupling from social anxiety to mindfulness was significant ($p < .01$) with the unstandardized estimate being $\gamma_{spin} = -.16$.

Using this bivariate model of social anxiety and mindfulness, a multigroup LDS analysis compared participants who received MAGT with those who received CBGT. All parameter estimates (i.e., mean, variance and error estimates) for the SPIN and FMI series did not significantly differ between the two groups. Non-redundant

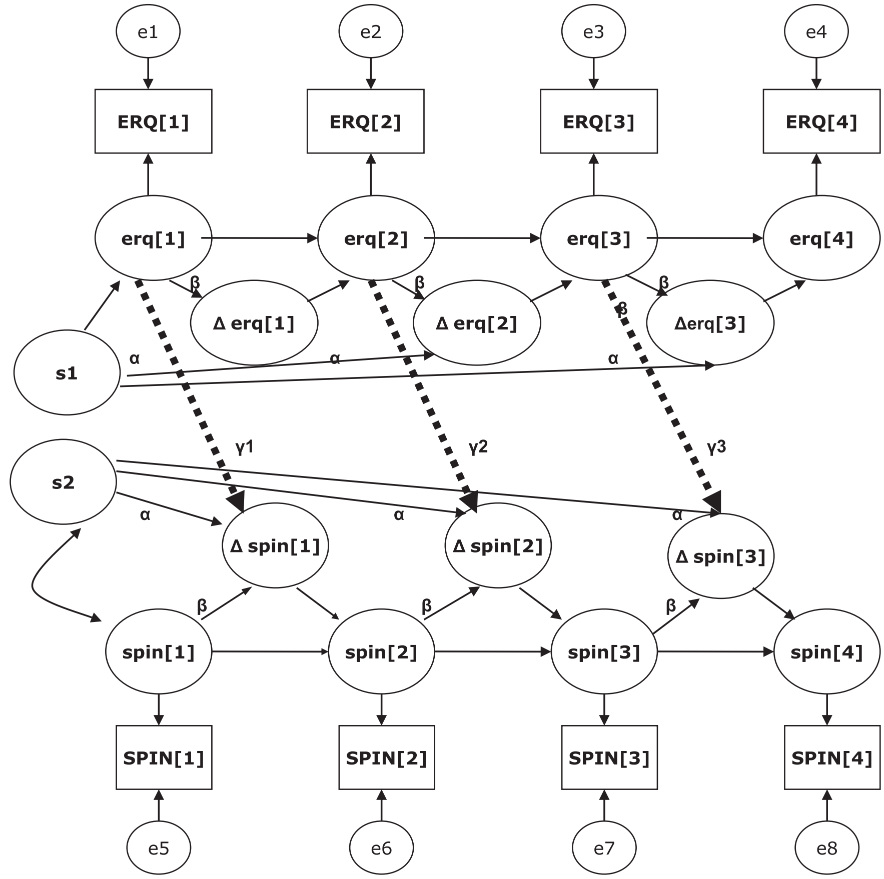

Fig. 1. Path diagram of the bivariate model, illustrating the longitudinal association of reappraisal (ERQ[t]) as it affects the proportional change in social anxiety symptoms (ΔSPIN [t]) through cross-lagged coupling (γ[t]) for each time period. Squares represent observed variables. Circles represent latent variables. Single-headed arrows represent regression coefficients. Double-headed arrows represent a correlation or covariance. ERQ[t] and SPIN[t] represent the reappraisal and social anxiety observed scores at time t. erq[t] and spin[t] represent the associated latent scores at time t. e(t) represents the error term at time t. ($\alpha \times s_n$) represents a fixed slope score. β(t) indicates the time-varying proportional effect, while γ[t] indicates the coupling effect between the univariate series.

parameters included the mean and variance of the ($\alpha \times s_n$) term, parameter estimates of the time-invariant β terms, and the mean and variance of time 1 SPIN and FMI. This finding was not supportive of our original hypothesis, in that neither of the coupling terms (γ_{spin}, γ_{fmi}) differed between treatment conditions, suggesting the impact of mindfulness on symptom change (and the impact of symptoms on mindfulness) were both significant; furthermore, the coupling did not differ across treatment conditions. Table 6

Table 3
Multigroup bivariate model (SPIN ← ERQ) comparing MAGT and CBGT.

Parameters and fit indices	MAGT		CBGT	
	SPIN	ERQ	SPIN	ERQ
Additive coefficient				
$E(s_n)$	9.82[a]	8.72[a]	9.82[a]	8.72[a]
σ^2 (s_n)	15.14	8.18	15.14	8.18
Proportional coefficients				
β_a	−.25[c]	−.29[c]	−.25[c]	−.29[c]
β_b	−.25[c]	−.29[c]	−.25[c]	−.29[c]
β_c	−.25[c]	−.29[c]	−.25[c]	−.29[c]
Cross-lag coefficient				
γ	0 (=)	−0.27[a]	0 (=)	−0.37[a]
Goodness-of-fit indices				
Parameters	88			
Degrees of Freedom	62			
RMSEA (p close fit)	.06 (.30)			
CFI	.93			
AIC	127.87			
χ^2	81.87			
χ^2/df	1.26			

Note. SPIN = Social Phobia Inventory. ERQ = Emotion Regulation Questionnaire – cognitive reappraisal subscale. 0 (=) indicates parameter is not estimated.
[a] $p < .05$; [b] $p < .01$; [c] $p < .001$.

Table 4
Expected change derived from bivariate multigroup models.

Parameters and fit indices	Bivariate (mean ERQ)		Bivariate (high ERQ)		Bivariate (low ERQ)	
	SPIN	ERQ	SPIN	ERQ	SPIN	ERQ
MAGT						
Initial mean score	41.77	23.67	41.77	30.79	41.77	16.55
Expected mean score						
T2	35.74	25.78	33.82	29.41	37.67	22.15
T3	31.62	26.86	29.50	28.71	33.72	25.01
T4	29.09	27.41	26.04	28.34	31.64	26.46
CBGT						
Initial mean score	44.81	23.64	44.81	30.72	44.81	16.56
Expected mean score						
T2	34.94	25.77	32.25	29.37	37.63	22.16
T3	28.32	26.85	25.36	28.69	31.28	25.02
T4	23.99	27.40	20.05	28.34	26.93	26.44

Note. SPIN = Social Phobia Inventory, ERQ = Emotion Regulation Questionnaire – cognitive reappraisal subscale. High ERQ refers to an ERQ score one standard deviation above the initial mean ERQ score. Low ERQ refers to an ERQ score one standard deviation below the initial mean ERQ score. Bivariate calculations based on the formula: $E[\Delta SPIN(t)n] = \alpha_{spin} \times E[s_{spin,n}] + \beta_{spin} \times E[SPIN\ (t-1)_n] + \gamma erq \times E[ERQ\ (t-1)]$ (e.g., predicted mean expected change of SPIN, given initial SPIN and initial ERQ values).

Table 5
Bivariate models involving the relationship of social anxiety and mindfulness.

Parameters and fit indices	No coupling		SPIN → FMI		SPIN ← FMI		SPIN ←→ FMI	
	SPIN	FMI	SPIN	FMI	SPIN	FMI	SPIN	FMI
Additive coefficient								
$E(s_n)$	10.14[c]	32.97	7.15[a]	40.23[c]	19.47[a]	34.60[a]	15.60[a]	39.41[c]
$\sigma^2(s_n)$	26.53	43.82	20.70	35.82	16.29	49.68	16.82	39.77
Proportional coefficients								
β_a	−.37[c]	−1.10[c]	−.29[c]	−1.03[c]	−.33[c]	−1.16[c]	−.30[c]	−1.07[c]
β_b	−.37[c]	−1.03[c]	−.29[c]	−1.00[c]	−.33[c]	−1.08[c]	−.30[c]	−1.03[c]
β_c	−.37[c]	−.97[c]	−.29[c]	−.98[c]	−.33[c]	−1.02[c]	−.30[c]	−1.00[c]
Cross-lag coefficient								
$\gamma_{spin}/\gamma_{fmi}$	0 (=)	0 (=)	−.21[a]	0 (=)	0 (=)	−0.36[a]	−.28[b]	−.16[b]
Goodness-of-fit indices								
Parameters	60		63		63		66	
Degrees of freedom	25		24		24		23	
RMSEA (p close fit)	.14(.01)		.13(.02)		.11(.01)		.06(.17)	
CFI	.88		.91		.90		.93	
AIC	118.01		104.70		91.36		86.67	
χ^2	80.01		64.70		51.36		44.67	
χ^2/df	3.20		2.69		2.51		1.94	

Note. SPIN = Social Phobia Inventory. FMI = Freiburg Mindfulness Inventory. 0 (=) indicates parameter is not estimated.
[a] $p < .05$; [b] $p < .01$; [c] $p < .001$.

presents the resulting parameter and goodness of fit indices for this multigroup LDS model, which provided the best model fit to the data, $\chi^2(88) = 81.87$; $\chi^2/df = 1.26$; AIC = 127.87, CFI = .93, RMSEA = .06. Results from this analysis indicate that bidirectional coupling occurs, in which FMI is negatively associated with the subsequent rate of change in SPIN, and SPIN is negatively associated with the subsequent rate of change in FMI, in both conditions.

Results from the bivariate multigroup model can be used to establish an equation, indicating the expected change in SPIN and FMI based on this reciprocal relationship:

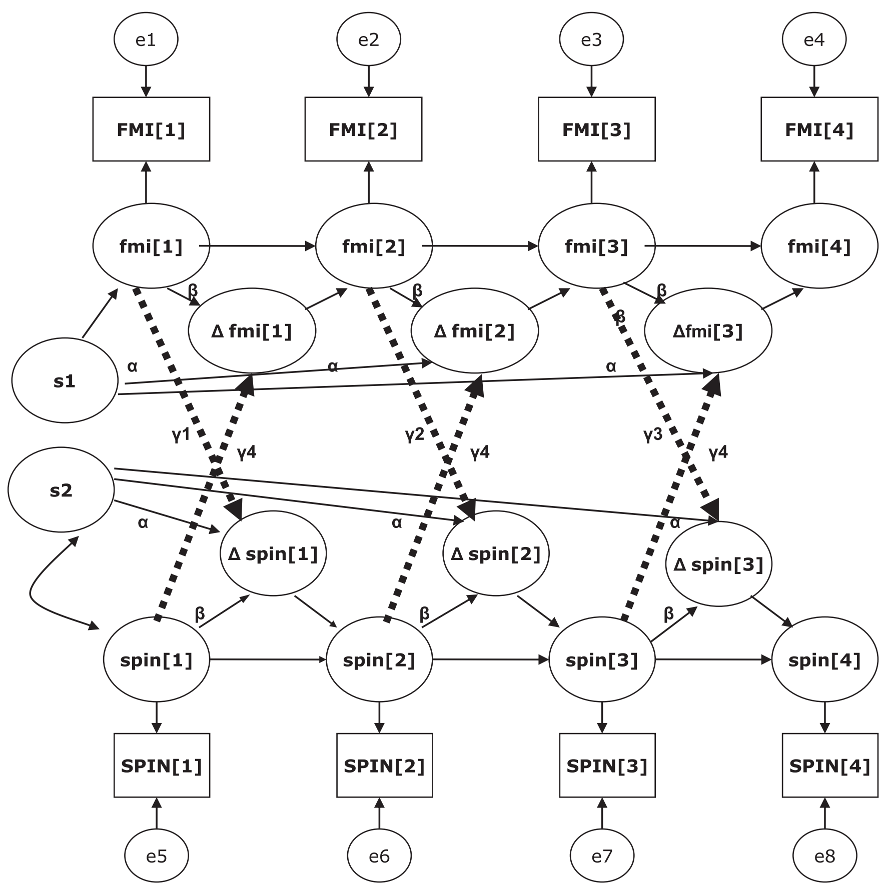

Fig. 2. Path diagram of the bivariate model, illustrating the longitudinal, reciprocal association of mindfulness (FMI[t]) as it affects the proportional change in social anxiety symptoms (ΔSPIN[t]) through cross-lagged coupling (γ[t]) for each time period. Similarly, social anxiety symptoms (ΔSPIN[t]) affect the proportional change in mindfulness (FMI[t]) through cross-lagged coupling (γ[t]). Squares represent observed variables. Circles represent latent variables. Single-headed arrows represent regression coefficients. Double-headed arrows represent a correlation or covariance. FMI[t] and SPIN[t] represent the mindfulness and social anxiety observed scores at time t. fmi[t] and spin[t] represent the associated latent scores at time t. e(t) represents the error term at time t. ($\alpha \times s_n$) represents a fixed slope score. β(t) indicates the time-varying proportional effect, while γ[t] indicates the coupling effect between the univariate series.

MAGT or CBGT Treatment:

$$E[\Delta SPIN(t)_n] = \alpha_{spin} \times E[s_{spin,n}] + \beta_s \times E[SPIN(t-1)_n] + \gamma_{fmi} \times E[FMI(t-1)_n] = 15.62 - .30 \times E[SPIN(t-1)_n] - .28 \times E[FMI(t-1)_n], \text{ for } T1 < t \le T2,\ T2 < t \le T3,\ T3 < t \le T4$$

$$E[\Delta FMI(t)_n] = \alpha_{fmi} \times E[s_{fmi,n}] + \beta_s \times E[FMI(t-1)_n] + \gamma_{spin} \times E[SPIN(t-1)_n]$$
$$= 39.45 - 1.07 \times E[FMI(t-1)_n] - .16 \times E[SPIN(t-1)_n], \text{ for } T1 < t \le T2$$
$$= 39.45 - 1.03 \times E[FMI(t-1)_n] - .16 \times E[SPIN(t-1)_n], \text{ for } T2 < t \le T3$$
$$= 39.45 - 1.00 \times E[FMI(t-1)_n] - .16 \times E[SPIN(t-1)_n], \text{ for } T3 < t \le T4$$

These equations can be used to estimate the expected change in SPIN or change in FMI for participants in either treatment condition; for purposes of illustration, expected changes in SPIN based on high or low levels of FMI are presented in Table 7. The longitudinal SPIN change trajectories differ significantly based on the level of FMI. To illustrate, clients who experienced a high level of FMI (with initial ratings one standard deviation higher than the group mean) experienced a cumulative decrease of 18.52 SPIN units whereas those who experienced a lower level of FMI (one standard deviation below the group mean) experienced a cumulative decrease of 11.74 SPIN units.

6.4. Bivariate and multigroup LDS analyses: social anxiety (SPIN) and acceptance (SA-AAQ)

Summary results for the bivariate LDS analyses of SPIN and SA-AAQ are presented in Table 8. Four models are considered, indicating parameter and fit indices for the no coupling model, a unidirectional model in which a latent SPIN value effects the subsequent rate of change in SA-AAQ values, a unidirectional model in which either a latent SA-AAQ value effects the subsequent rate of change in SPIN values, or a bidirectional model involving cross-lagged linkages between both univariate series. When examining the goodness of fit and parameter estimates, the results lack consistency; it is not entirely clear that one model provides the best overall fit, and so the results of these analyses should be interpreted accordingly. Bidirectional model 4 (SA-AAQ leads subsequent change in SPIN; SPIN leads subsequent change in SA-AAQ) was the best model insofar as it had the lowest AIC and RMSEA, the lowest χ^2/df ratio, and the highest CFI, χ^2 (23) = 34.22; χ^2/df = 1.49; AIC = 76.22, CFI = .97, RMSEA = .07. Further, the cross-lagged associations in which SPIN leads subsequent change in SA-AAQ were significant; however, the magnitude of this association was minimal (.10). As such, these results should be interpreted cautiously.

Fig. 3 provides the path diagram for this bidirectional model. All parameter estimates were statistically significant (*p*s ranging from <.001 to <.05). The time varying coupling coefficients ($\gamma_{sa\text{-}aaq}$) were of particular importance, as the unidirectional coupling from acceptance to change in social anxiety was significant ($p < .01$), with the unstandardized estimate being $\gamma_{sa\text{-}aaq} = -5.76$.

Results from the bivariate model can be used to establish an equation, indicating the expected change in SPIN based on the SA-AAQ score:

$$E[\Delta SPIN(t)_n] = \alpha_{spin} \times E[s_{spin,n}] + \beta_s \times E[SPIN(t-1)_n] + \gamma_{sa-aaq} \times E[SA-AAQ(t-1)_n] = 80.95 - 0.94 \times E[SPIN(t-1)_n] - 5.76 \times E[SA-AAQ(t-1)_n], \text{ for } T1 < t \le T2,\ T2 < t \le T3,\ T3 < t \le T4$$

Table 6
Multigroup bivariate model (SPIN ←→ FMI) comparing MAGT and CBGT.

Parameters and fit indices	MAGT		CBGT	
	SPIN	FMI	SPIN	FMI
Additive coefficient				
$E(s_n)$	15.62[a]	39.45[a]	15.62[a]	39.45[a]
σ^2 (s_n)	16.82	39.77	16.82	39.77
Proportional coefficients				
β_a	−.30[c]	−1.07[c]	−.30[c]	−1.07[c]
β_b	−.30[c]	−1.03[c]	−.30[c]	−1.07[c]
β_c	−.30[c]	−1.00[c]	−.30[c]	−1.07[c]
Cross-lag coefficient				
γ	−.16[a]	−0.27[b]	−.16[a]	−0.27[b]
Goodness-of-fit indices				
Parameters	68			
Degrees of freedom	64			
RMSEA (p close fit)	.06 (.20)			
CFI	.95			
AIC	157.34			
χ^2	109.34			
χ^2/df	1.71			

Note. SPIN = Social Phobia Inventory. FMI = Freiburg Mindfulness Inventory. 0 (=) indicates parameter is not estimated.
[a] $p < .05$; [b] $p < .01$; [c] $p < .001$.

These equations can be used to estimate the expected changes in SPIN based on high or low levels of SA-AAQ, as illustrated in Table 9. The longitudinal SPIN change trajectories differ significantly based on the level of SA-AAQ; this relationship is nonlinear.

Using this bivariate model of social anxiety and acceptance, a multigroup LDS analysis was carried out, comparing MAGT and CBGT conditions. Unfortunately, the goodness of fit indices for the multigroup model were not within the acceptable range; therefore, it would be inappropriate to report on this analysis. It is not entirely clear why this occurred; regardless, it is not possible to determine whether the established bivariate model differs by treatment group.

7. Discussion

The primary aim of the present study was to evaluate whether cognitive reappraisal represents a unique mechanism of change for CBGT and whether mindfulness and acceptance represent unique mechanisms of change for MAGT. We examined longitudinal, temporal dynamics involving social anxiety symptoms, cognitive reappraisal, mindfulness and acceptance for clients who either received CBGT or MAGT. Results from the first bivariate multigroup analysis indicate that cognitive reappraisal coupling, in which the latent ERQ value is negatively associated with the subsequent rate of change in SPIN, has a greater impact on SPIN scores in the CBGT condition compared to the MAGT condition, although the coupling is significant in both. Results from the second bivariate multigroup analysis indicate that bidirectional coupling occurs, in which the latent FMI value is negatively associated with the subsequent rate of change in SPIN, and the latent SPIN value is negatively associated with the subsequent rate of change in FMI, in both treatment conditions. The third bivariate multigroup analysis indicates that bidirectional coupling occurs in which the latent SA-AAQ value is associated with the subsequent rate of change in SPIN (and latent SPIN values predict change in SA-AAQ); however, the multigroup model did not converge, and so it is not possible to determine whether this bidirectional relationship differs based on treatment condition.

Table 7
Expected change derived from bivariate multigroup models.

Parameters and fit indices	Bivariate (mean FMI)		Bivariate (high FMI)		Bivariate (low FMI)	
	SPIN	FMI	SPIN	FMI	SPIN	FMI
MAGT or CBGT						
Initial mean score	44.46	29.36	44.46	35.78	44.46	22.94
Expected mean score						
T2	38.37	37.39	36.61	36.95	40.10	22.15
T3	31.98	36.83	30.94	36.86	34.07	25.01
T4	29.15	36.80	26.04	37.21	32.72	26.46

Note. SPIN = Social Phobia Inventory. FMI = Freiburg Mindfulness Inventory. High FMI refers to an FMI score one standard deviation above the initial mean FMI score. Low FMI refers to an FMI score one standard deviation below the initial mean FMI score. Bivariate calculations based on the formula: $E[\Delta SPIN(t)_n] = \alpha_{spin} \times E[s_{spin,n}] + \beta_s \times E[SPIN(t-1)_n] + \gamma_{fmi} \times E[FMI(t-1)_n]$.

To our knowledge this was the first study to use a latent difference score analytic approach in a clinical sample with SAD (although Gallagher et al., 2013 used LDS in an anxious sample, specifically individuals with panic disorder). LDS is a comprehensive statistical approach which allows us to examine the longitudinal temporal relationships among variables. In doing so, there was support for the increased relevance of cognitive reappraisal for CBGT; the model wherein reappraisal predicted subsequent change in social anxiety was supported to a greater extent for CBGT compared to MAGT. However, for mindfulness, the bidirectional model (mindfulness predicts subsequent change in social anxiety; social anxiety predicts subsequent change in mindfulness) was supported for both treatments. Similarly, for acceptance, the bidirectional model (acceptance predicts subsequent change in social anxiety; social anxiety predicts subsequent change in acceptance) had the best fit; however, the attempt to compare treatments on acceptance resulted in an unacceptable fit, unfortunately making these analyses difficult to interpret. Overall, LDS results were less clear for acceptance but cognitive reappraisal appears more relevant for CBGT than MAGT, and mindfulness appears equally relevant for both treatments.

The mindfulness analysis revealed a surprising finding – although the precepts of mindfulness are not explicitly discussed in CBGT, and CBGT does not include any mindfulness techniques, there was support for mindfulness as a mechanism of change in this condition. Clinicians may find it to be intuitive that mindfulness increases during CBGT – the practice of stepping back from situations to identify and challenge automatic thoughts may contribute to subtle shifts in mindfulness which in turn may reduce social anxiety. To our knowledge, these results are the first to show that mindfulness may be a process variable for traditional CBT for SAD. One possibility is that exposure, present in both treatments but following different rationales (e.g., extinction rationale for CBGT, acceptance/willingness rationale in MAGT) was responsible for these mindfulness results. However, of interest, exposure-based treatments for SAD (without explicit cognitive components) did not result in changes in mindfulness in one study (Burton et al., 2013) which suggests that cognitive strategies may be particularly important for increasing mindfulness.

Other recent studies have similarly found shifts in processes that were not explicitly targeted in therapy for SAD, bringing to question how directly a process needs to be targeted. For example, Hedman et al. (2013) found that self-focused attention was a significant mediator for CBGT, even though self-focused attention was not explicitly targeted. Additionally, Arch et al. (2012) found that cognitive defusion more strongly mediated outcome for CBT (which does not explicitly target defusion) than in ACT (which does explicitly target defusion). Finally, Niles et al. (2014) found that negative cognitions decreased for ACT (as well as CBT) even though ACT does not explicitly aim to do so.

There are a number of differences between the findings of our study and those of Niles et al. (2014) comparing individual ACT and CBT for SAD. Unlike Niles and colleagues who found greater change on the AAQ for participants receiving ACT compared to those in CBT, treatment conditions in the present study did not differ in the extent to which they increased on acceptance. Moreover, Niles and colleagues found that early decreases in experiential avoidance were associated with more favorable outcomes for ACT but not CBT whereas in the present study, there was similar evidence for mindfulness and acceptance as mechanisms of change for both treatments. Finally, Niles and colleagues found that early decreases in negative cognitions (i.e., their hypothesized CBT mechanism of change) were associated with less social anxiety posttreatment for both treatment conditions whereas there was greater support for our hypothesized CBT mechanism of change (reappraisal) for CBGT

Table 8
Bivariate models involving the relationship of social anxiety and acceptance.

Parameters and fit indices	No coupling		SPIN → SA-AAQ		SPIN ← SA-AAQ		SPIN ←→ SA-AAQ	
	SPIN	SA-AAQ	SPIN	SA-AAQ	SPIN	SA-AAQ	SPIN	SA-AAQ
Additive coefficient								
$E(s_n)$	1.37	6.50	7.27[a]	3.42	62.06[a]	7.92[c]	80.95[a]	7.78[c]
$\sigma^2(s_n)$	16.06	.66	21.52	1.22	28.61	.54	63.96	.76
Proportional coefficients								
β_a	−.15[c]	.26[c]	−.29[c]	.45	−.59[c]	.26[c]	−.94[c]	.27[c]
β_b	−.15[c]	.23[c]	−.29[c]	.40	−.59[c]	.20[c]	−.94[c]	.21[c]
β_c	−.15[c]	.24[c]	−.29[c]	.55	−.59[c]	.21[c]	−.94[c]	.35[c]
Cross-lag coefficient								
$\gamma_{spin1}/\gamma_{sa\text{-}aaq1}$	0 (=)	0 (=)	.10[c]	0 (=)	0 (=)	−5.24[c]	.14	−5.76[b]
$\gamma_{spin2}/\gamma_{sa\text{-}aaq2}$	0 (=)	0 (=)	.10[c]	0 (=)	0 (=)	−5.24[c]	.16	−5.76[b]
$\gamma_{spin3}/\gamma_{sa\text{-}aaq3}$	0 (=)	0 (=)	.10[c]	0 (=)	0 (=)	−5.24[c]	.12	−5.76[b]
Goodness-of-fit indices								
Parameters	17		18		18		21	
Degrees of freedom	27		24		26		23	
RMSEA (p close fit)	.16(.01)		.09(.24)		.16(.00)		.07(.24)	
CFI	.84		.95		.85		.97	
AIC	129.52		76.35		126.24		76.22	
χ^2	95.52		37.05		90.24		34.22	
χ^2/df	3.54		1.54		3.47		1.49	

Note. SPIN = Social Phobia Inventory. SA-AAQ = Social Anxiety-Acceptance and Action Questionnaire. 0 (=) indicates parameter is not estimated.
[a] $p < .05$; [b] $p < .01$; [c] $p < .001$.

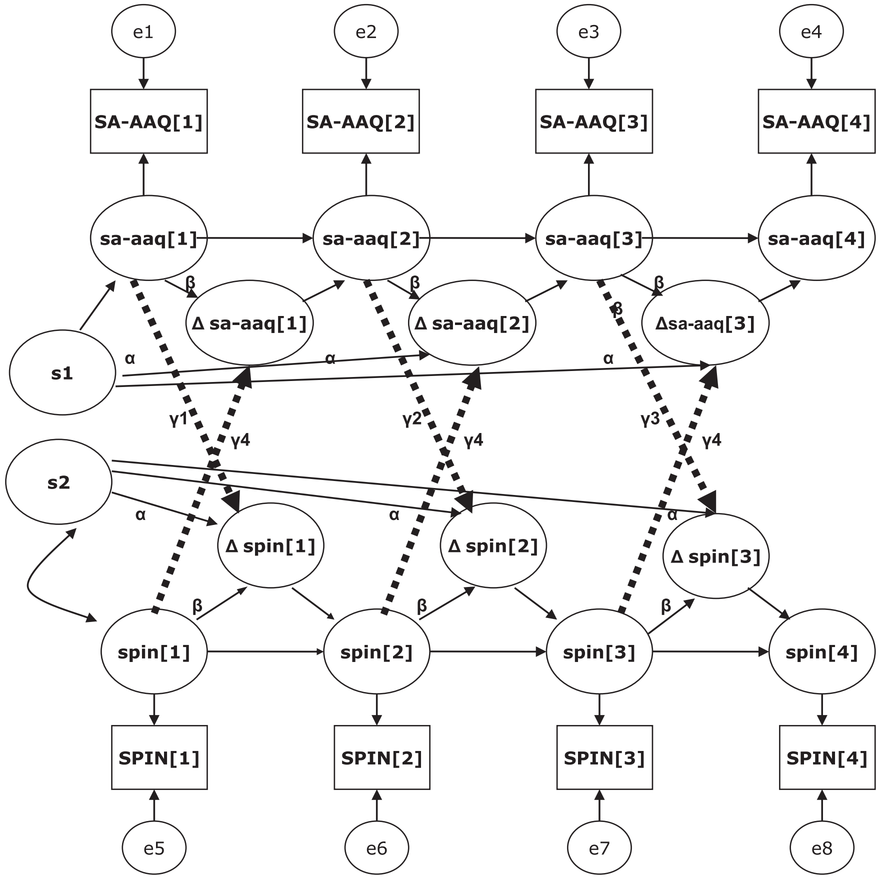

Fig. 3. Path diagram of the bivariate model, illustrating the longitudinal, reciprocal association of acceptance (SA-AAQ[t]) as it affects the proportional change in social anxiety (ΔSPIN[t]) through cross-lagged coupling (γ[t]) for each time period. Similarly, social anxiety symptoms (ΔSPIN[t]) affect the proportional change in acceptance (SA-AAQ[t]) through cross-lagged coupling (γ[t]). Squares represent observed variables. Circles represent latent variables. Single-headed arrows represent regression coefficients. Double-headed arrows represent a correlation or covariance. SA-AAQ[t] and SPIN[t] represent the acceptance and social anxiety observed scores at time t. sa-aaq[t] and spin[t] represent the associated latent scores at time t. e(t) represents the error term at time t. ($\alpha \times s_n$) represents a fixed slope score. β(t) indicates the time-varying proportional effect, while γ[t] indicates the coupling effect between the univariate series.

compared to MAGT. It is noteworthy that Niles et al. (2014) used a different analytic approach, examined individual rather than group therapy, had fewer participants, and used different measures for experiential avoidance (i.e., they used the AAQ-16-item version whereas a social anxiety specific measure was used in the present study) and for the hypothesized CBT mechanism of change (i.e., they assessed negative cognitions whereas cognitive reappraisal was assessed in the present study).

Table 9
Expected change derived from bivariate model.

Parameters and fit indices	Bivariate (mean SA-AAQ)		Bivariate (high SA-AAQ)		Bivariate (low SA-AAQ)	
	SPIN	SA-AAQ	SPIN	SA-AAQ	SPIN	SA-AAQ
MAGT or CBGT						
Initial mean score	44.46	7.79	44.46	8.80	44.46	6.78
Expected mean score						
T2	38.74	6.01	32.92	7.23	44.56	4.78
T3	45.98	3.84	41.29	5.32	56.07	2.36
T4	58.29	1.23	52.75	3.02	70.67	2.55

Note. SPIN = Social Phobia Inventory. SA-AAQ = Social Anxiety-Acceptance and Action Questionnaire (square root transformed). High SA-AAQ refers to an SA-AAQ score one standard deviation above the initial mean SA-AAQ score. Low SA-AAQ refers to an SA-AAQ score one standard deviation below the initial mean SA-AAQ score. Bivariate calculations based on the formula: $E[\Delta SPIN(t)_n] = \alpha_{spin} \times E[s_{spin,n}] + \beta_s \times E[SPIN\,(t-1)_n] + \gamma_{sa\text{-}aaq} \times E[SA\text{-}AAQ\,(t-1)_n]$.

Cognitive reappraisal and acceptance were evaluated as potentially distinct mechanisms underlying symptom change in this study; however, others have noted that these constructs may actually be similar in nature (e.g., Arch & Craske, 2008; Wolgast, Lundh, & Viborg, 2013). In nonclinical and clinical Swedish samples, Wolgast and colleagues conducted factor analyses on several relevant scales, including the AAQ and reappraisal subscale of the ERQ (which was used in the present study), as well as another emotion regulation measure and a suppression scale. In doing so, they found evidence of two higher order correlated factors (acceptance and cognitive restructuring) with six subfactors; "active acceptance," one of the subfactors, loaded on both acceptance and cognitive restructuring, calling into question how distinct these emotion regulation strategies actually are. In our dataset, cognitive reappraisal (ERQ) and acceptance (SA-AAQ) were not significantly correlated at baseline (but were modestly correlated at midtreatment and posttreatment). Of interest, the correlations between mindfulness and acceptance were similar in magnitude as those between mindfulness and reappraisal. Future research is needed to more fully understand these processes of change and in particular the similarities and differences between them.

With respect to limitations, the analyses presented herein relied purely on self-report data and there are a few points to consider regarding the specific self-report measures chosen. First, a unidimensional measure of SAD (i.e., the SPIN) was used, but different aspects of SAD (e.g., fear, avoidance) may have unique mechanisms of change. Second, we chose to use a symptom measure as our outcome in these analyses whereas following ACT theory would have led to a different choice (e.g., quality of life). Future research can examine the impact of mindfulness, acceptance and cognitive reappraisal on outcomes that would be ACT-consistent. Third, a unidimensional measure of mindfulness was used, but it is important to acknowledge that different aspects of mindfulness may relate differently to outcome.

Additional limitations include the small sample size, and that our results apply only to group therapy. Given that previous research has found differences in mechanisms between individual and group formats (Hedman et al., 2013), and treatment effects may be exaggerated when delivered in groups (Baldwin, Murray, & Shadish, 2005), future research should replicate these analyses using data drawn from participants undergoing individual therapy. Other limitations of the RCT, including attrition (about a third of participants discontinued treatment and therefore were not included in the analyses reported herein) are discussed in Kocovski et al. (2013). Further, given our interest in understanding processes of change for the two interventions, unlike in the outcome paper, the focus here was on treatment completers (similar to other studies on mechanisms of change; e.g., Goldin et al., 2012), despite the bias associated with this choice.

Finally, although the univariate and bivariate SA-AAQ analyses demonstrated adequate fit indices and converged properly, the multigroup SA-AAQ analysis did not. Given that the findings are not interpretable, they were not reported. It is unclear why this occurred. One possibility involves low factor loadings (associated with lower scale reliability), which makes nonconvergence or negative error variance more likely (Gagne & Hancock, 2006). Although there is support for the reliability and validity of the SA-AAQ (MacKenzie & Kocovski, 2010), we examined the test–retest reliability in this sample, and the correlation coefficients ranged from .29 (typically interpreted as a weak relationship) to .83 (typically interpreted as a strong relationship) across the four time points. Therefore, it is possible that this led to nonconvergence for the SA-AAQ multigroup model.

Although the theories underlying traditional CBT and ACT diverge on many elements, and there are different techniques depending on the approach (as well as some very similar techniques), the data thus far have only supported some of these differences. In support of these differences, cognitive reappraisal appears to be more relevant as a mechanism for change for CBT compared to ACT. However, there is support for mindfulness as a mechanism of change for both forms of therapy, even though CBT does not include explicit mindfulness practice, leading to both theoretical implications (e.g., Is mindfulness implicit in CBT models?), as well as implications for practice (e.g., Would the addition of explicit mindfulness practices improve outcomes for traditional CBT?).

This is the first study to address mechanisms of change for group therapy for SAD comparing traditional CBT and ACT, and also the first study to use LDS with a sample of patients with SAD. To summarize our main findings, cognitive reappraisal was associated with subsequent change in social anxiety for both groups, but the effect was stronger for CBGT. Mindfulness was associated with subsequent change in social anxiety (and social anxiety was associated with subsequent change in mindfulness) for both treatment conditions. Future research can determine whether these results hold true if these treatments are delivered in an individual format.

Conflict of interest

None.

Acknowledgments

The authors gratefully acknowledge financial support awarded to the first author from the Ontario Mental Health Foundation and the Ministry of Research and Innovation. Correspondence may be addressed to Nancy Kocovski, Department of Psychology, Wilfrid Laurier University, Waterloo, Ontario, Canada N2L 3C5; e-mail: nkocovski@wlu.ca.

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