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Metacognition, cognition and social anxiety: A test of temporal and reciprocal relationships

Henrik Nordahl [a,*], Frederick Anyan [a], Odin Hjemdal [a], Adrian Wells [b,c]

[a] Department of Psychology, Norwegian University of Science and Technology, Trondheim, Norway
[b] Division of Psychology and Mental Health, School of Health Sciences, Faculty of Biology, Medicine and Health, The University of Manchester, Manchester, United Kingdom
[c] Greater Manchester Mental Health NHS Foundation Trust, Manchester, United Kingdom

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ABSTRACT

Cognitive models of social anxiety give prominence to dysfunctional schemas about the social self as the key underlying factors in maladaptive self-processing strategies and social anxiety symptoms. In contrast, the metacognitive model argues that beliefs about cognition represent a central belief domain underlying psychopathology and cognitive schemas as products of a thinking style regulated by metacognition. The present study therefore evaluated the temporal and reciprocal relations between metacognitive beliefs, social self-beliefs, and social anxiety symptoms to shed light on possible causal relationships among them. Eight hundred and sixty-eight individuals gathered at convenience participated in a four-wave online survey with each measurement wave 6 weeks apart. Using autoregressive cross-lagged panel models, we found significant temporal and reciprocal relations between metacognition, social self-beliefs (schemas), and social anxiety. Whilst social self-beliefs prospectively predicted social anxiety this relationship was reciprocal. Metacognitive beliefs prospectively predicted both social interaction anxiety and social self-beliefs, but this was not reciprocal. The results are consistent with metacognitive beliefs causing social anxiety and social self-beliefs and imply that negative social self-beliefs might be a product of metacognition. The clinical implications are that metacognitive beliefs should be the central target in treatments of social anxiety.

1. Introduction

Social anxiety disorder (SAD) is among the most common of mental disorders with a lifetime prevalence of 13% (Kessler, Petukhova, Sampson, Zaslavsky, & Wittchen, 2012). SAD typically has an early onset (Kessler et al., 2005, 2012), is associated with high levels of comorbidity (Ruscio et al., 2008) and often precedes the development of other disorders (Fehm, Beesdo, Jacobi, & Fiedler, 2008).

Cognitive-behavioural therapy (CBT) based on the model of Clark and Wells (1995) is recommended by the National Institute for Health and Care Excellence as the treatment of choice for SAD (National Institute for Health and Care Excellence, 2013). The development of this approach draws on both Beck (1976) schema theory and the metacognitive model (Wells & Matthews, 1994) of disorder. Clark and Wells drew on schema theory in postulating the nature of social-self-schemas in social anxiety, whilst drawing extensively on principles of metacognitive theory (Wells & Matthews, 1994) to explore and map the processing styles involved (i.e. worry, rumination, threat-monitoring and self-focused processing). More recently the linking of these processing styles to general beliefs (schemas) about the social self and world has been questioned. In the metacognitive model processes such as worry, rumination and biased attention are attributed to a metacognitive control system containing metacognitive knowledge (beliefs) that is separate from schemas (Wells, 2009, 2019). For example, the cognitive model attributes biased processing to beliefs such as: "People think I'm boring; If I show anxiety people will think I'm foolish" but the metacognitive model attributes biased processing to metacognitive beliefs such as: "I cannot control my worrying; Worrying about my appearance means I can be prepared". In other words, these two models place emphasis on different knowledge structures (and processing systems) as the key underlying factor in self-processing and social anxiety. This is important, as determining which level of processing (i.e. cognitive schemas vs metacognition) contributes to distress and disorder and could enhance formulation and treatment.

* Correspondence to: Department of Psychology, University Outpatient Clinic, NTNU, Dragvoll, 7491 Trondheim, Norway.
E-mail address: henrik.nordahl@ntnu.no (H. Nordahl).

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In line with the cognitive model (Clark & Wells, 1995), negative social cognitions positively and significantly correlate with social anxiety (see Gkika, Wittkowski, & Wells, 2018, pp. 2127 for a review). Studies with longitudinal designs have investigated the relationships between social anxiety and negative social cognitions. Gregory, Wong, Marker, and Peters (2018) reported that change in negative social self-beliefs was a significant predictor of later change in social anxiety symptoms while the reversed relationship did not hold in a sample of SAD patients undergoing CBT. Similarly, Thew et al. (2020) reported that change in negative social cognitions predicted subsequent social anxiety symptoms in a sample of SAD patients undergoing CBT in routine clinical practice. However, in this study, changes in social anxiety symptoms predicted subsequent changes in negative social cognitions, consistent with a bidirectional relationship which has also been reported by others (Huppert et al., 2018; Santoft et al., 2019). Lervik, Hoffart, Knapstad, and Smith (2021) reported that avoidant behaviour but not negative social cognitions showed a significant within-person relationship with subsequent symptoms of anxiety when these variables where added in the same model in socially anxious individuals treated in routine clinical practice, indicating that change in avoidance may be more important for outcome than change in negative social cognitions. In sum, there is to date some limited evidence consistent with a causal role of negative social cognitions in social anxiety. Such a relationship seems to be bidirectional meaning that change in social anxiety may lead to change in negative social cognitions (see also Heeren, Bernstein, & McNally, 2020). However, the temporal role of negative social cognitions in social anxiety when compared to higher-level cognition such as metacognitive beliefs remains understudied.

Consistent with the metacognitive model (Wells & Matthews, 1994; Wells, 2019), maladaptive metacognitive beliefs positively and significantly correlate with social anxiety (Gkika et al., 2018, pp. 2127) and treatment studies of SAD that have incorporated metacognitive interventions and abandoned dealing with social phobic beliefs and schemas have produced positive outcomes (Nordahl & Wells, 2018; Nordahl et al., 2016; Vogel et al., 2016; Wells & Papageorgiou, 2001). However, to date there are no longitudinal studies investigating the relationships between metacognitions and social anxiety, but several cross-sectional studies have tested the association between metacognitive beliefs and social anxiety and related problems while controlling for social self-beliefs with the aim of providing initial evidence that metacognitions might be explanatory. Nordahl, Nordahl, Hjemdal, and Wells (2017, pp. 2083) explored predictors of outcome in SAD patients undergoing treatment with cognitive therapy, paroxetine, or their combination. In this study, change in social self-beliefs did not significantly predict outcome when change in negative metacognitive beliefs and change in self-focused attention was controlled. While both belief domains significantly decreased during treatment, the relationship between change in social self-beliefs and social anxiety symptoms seemed to be dependent on change in attention-based processes. Furthermore, change in negative metacognitive beliefs added predictively over and above change in social self-beliefs and change in self-consciousness, and therefore seemed to be a more important underlying correlate of symptom improvement than change in social self-beliefs. Other studies have reported that metacognitive beliefs rather than social self-beliefs are more reliable predictors of social anxiety severity in a community sample (Nordahl & Wells, 2017), correlate with work status among high socially anxious individuals (Nordahl & Wells, 2017), and correlate positively with depression symptoms in patients with primary SAD (Nordahl, Nordahl, Vogel, & Wells, 2018, pp. 2181).

In line with the metacognitive model (Wells, 2019), these studies imply that treatment of SAD should aim to address metacognitive beliefs rather than social self-beliefs. However, the implications remain tentative because these data are derived from cross-sectional studies indicating a need to test the unique contribution of metacognitive beliefs to social anxiety symptoms when controlling for social self-beliefs in longitudinal data. Furthermore, if social anxiety symptoms are positively associated with underlying metacognitive beliefs rather than social self-beliefs and schemas, this raises an important question: how should social self-beliefs be conceptualized?

According to the metacognitive model (Wells & Matthews, 1994; Wells, 2019), negative and biased cognitions (which includes beliefs) are viewed as outputs of maladaptive styles of processing such as worry and threat monitoring, with these styles linked to higher-level metacognition that includes metacognitive beliefs. Thus, metacognitive beliefs are seen as a stable marker of whether an individual will engage in maladaptive processing and sustain negative cognitions in response to social threat. For example, social self-beliefs may be the situational output of running a particular plan for processing such as ruminating about failures, which leads to negative views of the self as output (e.g. "I'm just a loser") which then becomes a more stable and recurrent theme in processing.

To the authors' knowledge, no published study has directly examined the temporal and reciprocal relations between metacognitive beliefs, social self-beliefs and symptoms of social anxiety. Clarification of this relationship using longitudinal data can add to previous studies and to understanding the contribution of metacognition to the conceptualization of social anxiety. Our hypotheses were as follows: 1) Negative social self-beliefs, metacognitive beliefs, and social anxiety symptoms will be positively inter-correlated; 2) metacognitive beliefs will prospectively predict symptoms of social anxiety when the effect of social self-beliefs is controlled; and 3) metacognitive beliefs will prospectively predict social self-beliefs but the reverse relationship will not hold (consistent with the metacognitive model).

2. Methods

2.1. Procedure and participants

The current study used data from an online self-report survey with four measuring points each 6 weeks apart using a programme called "Select Survey" provided by the Norwegian University of Science and Technology. Participants were invited through advertisement on social media assisted by several Norwegian voluntary organizations for mental health and were offered participation in a lottery to win a laptop if they completed the survey at all four time points. Participants were gathered at convenience but had to be 18 years old or above and had to be able to read Norwegian. The research was conducted in accordance with the Declaration of Helsinki and was approved by the Norwegian Regional Committee for Medical and Health Research Ethics (REC; reference: REK-Midt, 2016/705). Upon entering the survey portal, participants were presented with an information sheet that was approved by REC and were informed that proceeding to the main survey would be regarded as a signed informed consent.

A total of 868 participants participated in the study and in the total sample, the mean age was 33.90 ($SD = 12.92$) years and 660 (76.0%) of the participants were female. Two hundred and sixty (30.0%) reported they were single, 138 (15.9%) were in a relationship, 418 (48.2%) cohabiting or married, 42 (4.8%) separated or divorced, four (0.5%) reported being widowed, and six (0.7%) did not report their marital status. In occupational status, 299 (34.4%) were students, 367 (42.2%) reported to be working, 25 (2.9%) were unemployed, 26 (3.0%) reported being on short-term sick leave, 115 (12.7%) were on long-term sick leave (> 1 year), 37 (4.3%) reported being retired, while 4 (0.5%) did not report their occupational status. 339 (39.1%) endorsed having a higher education (completed 3 years or more at a university or equivalent).

Three hundred and eighty-seven participants participated in all four waves of the survey, while 133 participated in three, 128 participated in two, and 220 participated once.

2.2. Measures

Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987; Fresco et al., 2001) is a 24-item self-report scale assessing social anxiety severity where the respondent is asked to rate the degree of fear and avoidance in 24 different social situations during the past week. Each item is rated on a 4-point scale, indicating degree of fear from 0 (none) to 3 (severe) and avoidance, from 0 (never) to 3 (usually) separately. The LSAS has shown excellent internal consistency ($\alpha = 0.96$; Dos Santos, Loureiro, Crippa, & de Lima Osório, 2013). In the current study the internal consistency was excellent (T1$\alpha = 0.98$).

The Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998) is at 20-item self-report scale measuring fear of and responses to social interactions. Responses are required on a five-point scale ranging from 0 (Not at all characteristic or true of me) to 4 (extremely characteristic or true of me). SIAS has a range from 0 to 80, high scores indicating higher levels of social interaction anxiety. It has shown high internal consistency ($\alpha = 0.93$) and test-retest reliability (0.92) (Mattick & Clarke, 1998). In this study, the Cronbach's alpha was T1$\alpha = .90$.

Self-Beliefs Related to Social Anxiety Scale (SBSA; Wong & Moulds, 2009; Wong, Moulds, & Rapee, 2014; Wong, Gregory et al., 2021) is a 15-item self-report scale which was developed to assess the strength of social phobic beliefs based on the Clark and Wells (1995) model of social phobia. Responses are required on an 11-point Likert scale ranging from 0 (do not agree at all) to 100 (strongly agree). SBSA has three subscales; high standard beliefs (4 items), unconditional beliefs (4 items) and conditional beliefs (7 items). Higher scores reflect stronger endorsements of the beliefs in question. The measure has shown good internal consistency with α ranging from .80 to .89 and a re-test correlation for the total scale was .82 (Wong & Moulds, 2011). In this study, the Cronbach's alpha was .89 for high standards, .90 for unconditional beliefs and .95 for conditional beliefs.

The Metacognitions questionnaire 30 (MCQ-30; Wells & Cartwright-Hatton, 2004) is 30-item self-report scale measuring beliefs about cognition (i.e. metacognitive beliefs). Responses are required on a four-point scale ranging from 1 (do not agree) to 4 (agree very much). MCQ-30 has a replicable five-factor structure concerning: 1) positive beliefs about worry; 2) negative beliefs about the uncontrollability and danger of worry; 3) cognitive confidence; 4) need to control thoughts; and 5) cognitive self-consciousness. Higher scores reflect stronger endorsements of the beliefs in question. The measure has shown good internal consistency with α for the subscales ranging from .72 to .93 and a re-test correlation for the total scale of .75 (Wells & Cartwright-Hatton, 2004). In the current study, the internal consistency ranged from .81 to .89.

2.3. Statistical analyses

All analyses were performed in Mplus version 8.6 (Muthén & Muthén, 1998–2021). To make use of all available data, full-information maximum likelihood was used with robust estimation (MLR) due to non-normality. Prior to testing structural relations, an acceptable measurement model for each construct needed to be established. The measurement models of social interaction anxiety (SIAS) and social fear/avoidance (LSAS) did not show acceptable fit to the data as was the case when using them as item parcels. Thus, we decided to use observed scores (total scores) of the SIAS and LSAS which also enabled us to evaluate the relations in two separate analyses to assess consistency of the model.

Metacognitive beliefs (MCQ) and Social self-beliefs (SBSA) were operationalized as latent constructs. Subscales of metacognitive beliefs (i.e., positive metacognitive beliefs, negative metacognitive beliefs, cognitive confidence, need for control, cognitive self-consciousness) and social phobic beliefs (i.e., high standard beliefs, unconditional beliefs, conditional beliefs) were computed and used as indicators to define their latent constructs. For the latent constructs, a well-fitting measurement model was established for subsequent analyses. To ensure that there were no confounding problems of discrimination (loading information) or sensitivity (mean-level information) in the factor models across time when using subscales as indicators, longitudinal factorial invariance was estimated prior to specifying the structural relations in the autoregressive cross-lagged panel model (AR-CLPM) for metacognitive beliefs and social self-beliefs. When intercepts were constrained equal across measurement occasions, latent means from the second measurement occasion were freely estimated. Autocorrelations in indicator uniqueness were freely estimated to account for temporality in indicator-specific variance and capture methodological biases such as response bias among participants (Wickrama, Lee, O'Neal, & Lorenz, 2016).

Two separate analyses were conducted to investigate the temporal and reciprocal relations between metacognitive beliefs, social self-beliefs, and social anxiety. Social anxiety was operationalized by the total scores of two separate scales namely, Social Interaction Anxiety Scale (that specifically measures anxiety experienced in social interactional situations – *social interaction anxiety*) and Liebowitz Social Anxiety Scale (that specifically measures persistence of fear of embarrassment and/or avoidance of social encounters and performance – *social fear/avoidance*) in two separate analyses. A baseline model (Model 1; see Fig. 1) was specified to freely estimate all structural parameters in the AR-CLPM. This was followed by increasingly restrictive models that constrained all autoregressive paths (Model 2) and cross-lagged paths (Model 3) equal over time to account for the short time interval between occasions of measurements and the assumption of stationarity. The tenability of these constraints was tested using a chi-square difference test. If the constrained model fits the data significantly worse, the imposed constraints are untenable.

Each variable was allowed to predict subsequent follow-up assessment of itself, measuring the stability of individual differences in the construct from one occasion to the next. Cross-lagged effects were estimated, controlling for the prior level of the construct being predicted. For example, when symptoms at Time 2 was predicted by metacognitive beliefs at T1, symptoms at T1 was controlled to rule out the possibility that the cross-lagged effect is simply due to correlations between symptoms and metacognitive beliefs at Time 1. Model fit was evaluated with the following indices: Standardized Root Mean Square Residual (SRMR) (Browne & Cudeck, 1993) and Root Mean Square Error of Approximation (RMSEA) (Hu & Bentler, 1999) values less than .08 and values equal to or less than .06 (upper 90% CI close to or < 0.08) respectively, a Comparative Fit Index (CFI) and a non-Normed Fit index (NNFI; aka TLI) greater than .95 (Hu & Bentler, 1999). Mplus codes for analyses and outputs are available on the Open Source Framework platform via this link https://osf.io/7gkyh/?view_only=455ce57f37e049f5947de4039ce33ab2.

3. Results

Tables S1 and S2 in the Supplementary File contain descriptive statistics and correlations for all study variables across the four waves of measurement.

3.1. Longitudinal factorial invariance of latent constructs

For metacognitive beliefs, model fit across time was acceptable for configural ($\chi^2 = 252.746$, $df = 134$, $p < .001$; RMSEA = 0.033; CFI = 0.987), metric ($\chi^2 = 276.451$, $df = 146$, $p < .001$; RMSEA = 0.033; CFI = 0.986) and scalar ($\chi^2 = 331.580$, $df = 158$, $p < .001$; RMSEA = 0.037; CFI = 0.981) models with change in model fit indicating a trivial change in fit between configural and metric (ΔCFI = −0.001; ΔRMSEA = 0.000), and between metric and scalar (ΔCFI = −0.005; ΔRMSEA = 0.004) models according to CFI and RMSEA cut-off recommendations by Cheung & Rensvold, 2002; Chen, 2007; Rutkowski & Svetina, 2014. For social self-beliefs, the configural ($\chi^2 = 43.348$, $df = 30$, $p = .05$; RMSEA = 0.024; CFI = 0.998), metric

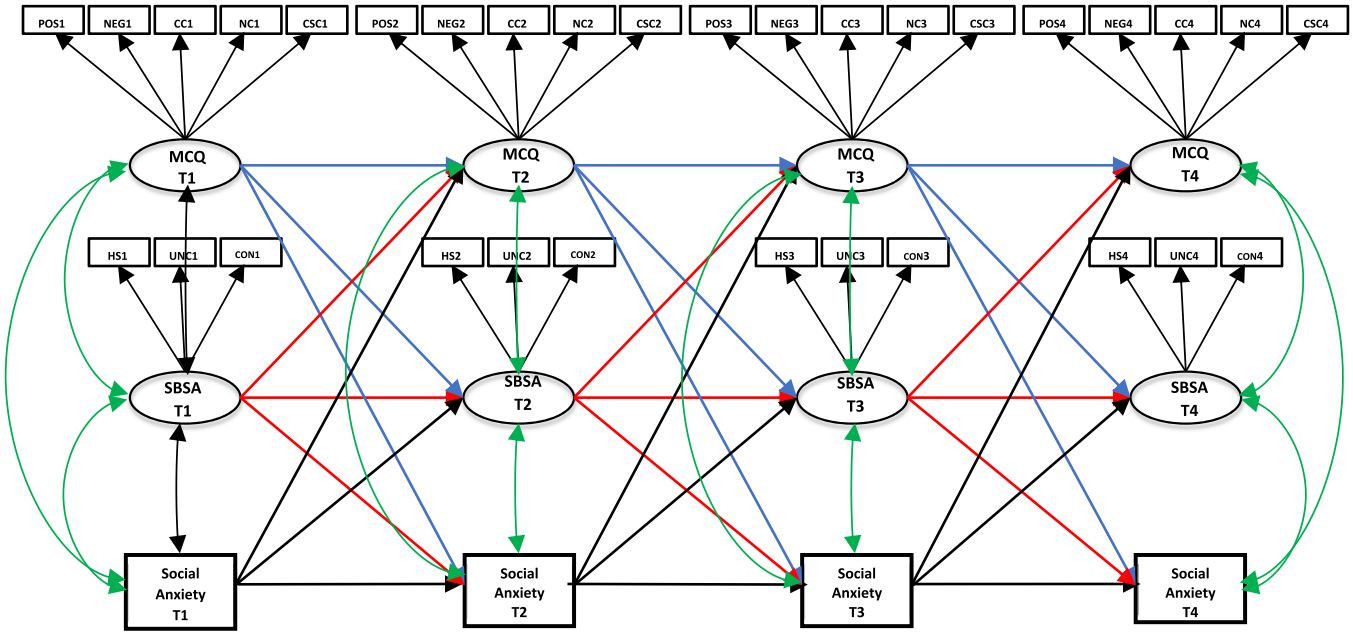

Fig. 1. Four-waves Autoregressive Cross-Lagged Panel Model (AR-CLPM). Autocorrelations in indicator uniqueness for latent variables were freely estimated, but not displayed. MCQ = Metacognitive beliefs, SBSA = self-beliefs about social anxiety (i.e., social phobic beliefs). Social anxiety was operationalized as total score for two separate measures in separate analyses (i.e., Social Interaction Anxiety Scale – SIAS, and the Liebowitz Social Anxiety Scale – LSAS).

($\chi^2 = 48.699$, $df = 36$, $p = .07$; RMSEA = 0.021; CFI = 0.998) and scalar models showed excellent fit to the data ($\chi^2 = 66.852$, $df = 42$, $p < .01$; RMSEA = 0.028; CFI = 0.996), although the chi-square reached significance in the scalar model. Nested model comparisons supported metric (ΔCFI = 0.000; ΔRMSEA = −0.003) and scalar (ΔCFI = −0.002; ΔRMSEA = 0.007) invariance across time (Chen, 2007; Cheung & Rensvold, 2002; Rutkowski & Svetina, 2014).

3.2. Model comparison

Table 1 displays the results from the nested model comparisons. The upper part of Table 1 contains the results for metacognitive beliefs, social self-beliefs, and social interaction anxiety. When the autoregressive paths were constrained equal over time, this restriction did not degrade model fit, $\Delta\chi^2(6) = 12.207$, $p = .057$, as was the case when the cross-lagged paths were constrained to be equal $\Delta\chi^2(12) = 17.209$, $p = .142$. The lower part of Table 1 contains results for metacognitive beliefs, social self-beliefs, and social fear/avoidance. Equality constraints on the autoregressive paths $\Delta\chi^2(6) = 6.555$, $p = .364$, and the cross-lagged paths $\Delta\chi^2(12) = 12.580$, $p = .400$ did not degrade model fit. Thus, the more restrictive models with equality constraints over time on the autoregressive and cross-lagged paths were retained (see Table 1) in the separate models. Fig. 2a and b presents the results from the analyses.

3.3. Within-wave, cross-sectional associations

At all the measurement occasions, the cross-sectional intercorrelations between metacognitive beliefs, social self-beliefs, social interaction anxiety and social fear/avoidance were significant and positive, ranging from $r = 0.25$, $p < .001$ to $r = 0.78$, $p < .001$. Within-wave, cross-sectional links are not shown in Fig. 2a and b to preserve readability, although they are shown in Fig. 1 as part of testing the hypothesized models.

3.4. Autoregressive and cross-lagged analyses

In the separate models, autoregressive effects of metacognitive beliefs, social self-beliefs, social interaction anxiety and social fear/avoidance were all positive and significant, meaning that initial level of the construct predicts its future levels, and that inter-individual differences in the construct being predicted is relatively stable over time, at least within the period of study assessments.

In the first model (Fig. 2a), initial levels of metacognitive beliefs predicted future levels of social self-beliefs and social interaction anxiety, but the reverse relationships did not hold. The effect of

Table 1
Nested model comparison test ($N = 868$).

Model (Constraints)	Compared with	*SB*-χ^2 (*df*)	RMSEA (CI)	SRMR	CFI	TLI	Δ χ^2 (*df*)	*p*-value
MCQ, SBSA, SIAS								
1		1330.401(547)	.041[0.038, 0.043]	.053	.964	.959		
2 (AR)	1	1341.895(553)	.041[0.038, 0.043]	.053	.964	.959	12.207(6)	.057
3 (AR + CL)	2	1357.172(565)	.040[0.037, 0.043]	.054	.964	.960	17.209(12)	.142
MCQ, SBSA, LSAS								
1		1295.098(547)	.041[0.038, 0.044]	.053	.965	.960		
2 (AR)	1	1298.617(553)	.041[0.038, 0.044]	.052	.966	.961	6.555(6)	.364
3 (AR + CL)	2	1307.778(565)	.040[0.038, 0.043]	.053	.966	.962	12.580(12)	.400

Note: AR = Autoregressive paths; CL = Cross-lagged paths; MCQ = Metacognitive beliefs, SBSA = Self-Beliefs about Social Anxiety; LSAS = Liebowitz social anxiety; SIAS = Social interaction anxiety.

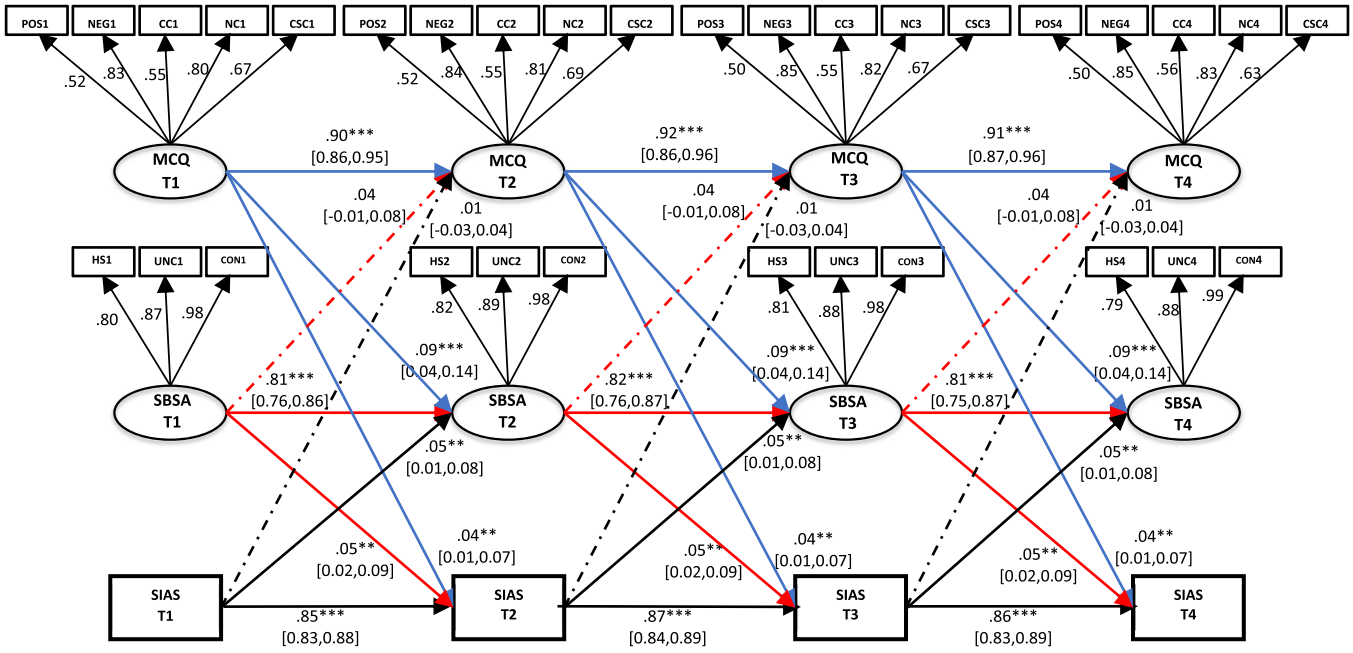

Fig. 2. a. Four-waves Autoregressive Cross-Lagged Panel Model (AR-CLPM) with standardized effects. Statistically significant effects are solid lines, whereas non-significant effects are dotted lines. All factor loadings were $p < 001$. MCQ = Metacognitive beliefs, SBSA = Self-Beliefs about Social Anxiety, SIAS = Social interaction anxiety. Within-wave, cross-sectional associations, and autocorrelations of indicator uniqueness for latent variables were estimated, but not displayed. The 95% Confidence Intervals are shown in square brackets. (b). Four-waves Autoregressive Cross-Lagged Panel Model (AR-CLPM) with standardized effects. Statistically significant effects are solid lines, whereas non-significant effects are dotted lines. All factor loadings were $p < 001$. MCQ = Metacognitive beliefs, SBSA = Self-Beliefs about Social Anxiety, LSAS = Social anxiety. Within-wave, cross-sectional associations, and autocorrelations of indicator uniqueness for latent variables were estimated, but not displayed. The 95% Confidence Intervals are shown in square brackets.

metacognitive beliefs on social self-beliefs and on social interaction anxiety were significantly different ($\chi^2 = 5.756$, $df = 1$, $p < .05$). Furthermore, initial levels of social self-beliefs predicted future levels of social interaction anxiety, and initial levels of social interaction anxiety predicted future levels of social self-beliefs. The reciprocal effects between social self-beliefs and social interaction anxiety were small and similar (Time 1→ Time 2: .05 vs. 05; Time 2 → Time 3: .05 vs .05; Time 3 → Time 4: .05 vs .05), indicating that neither social self-beliefs nor social interaction anxiety is causally dominant, and that the reciprocal relations are much more symmetric. After controlling for the stable portion of the constructs, very little variance was accounted for by the cross-lagged effects on social self-beliefs (ranging between .010 to. 011) and social interaction anxiety (ranging between .004 to .005). The explained variance by the stable portions of the constructs were all very

high, ranging between .84 to .90.

In the second model (Fig. 2b), initial levels of metacognitive beliefs predicted future levels of social self-beliefs but did not predict future levels of social fear/avoidance. As in the first model, neither initial levels of social self-beliefs nor social fear/avoidance predicted later levels of metacognitive beliefs. Moreover, there were reciprocal effects between social self-beliefs and social fear/avoidance. These relations were small and only slightly different (Time 1→ Time 2: .04 vs .05; Time 2 → Time 3: .04 vs .05; Time 3 → Time 4: .04 vs .05). Similar to the first model, after controlling for the stable portion of the constructs, very little variance was accounted for by the cross-lagged effects on social self-beliefs (about .010 for all timepoints) and social interaction anxiety (about .001 for all timepoints). The explained variance by the stable portions of the constructs were all very high, ranging between .85 to .90.

4. Discussion

In the present study, we explored the temporal and reciprocal relations between metacognition (metacognitive beliefs), cognition (social self-beliefs), and social anxiety assessed in two different models with two different symptom measures – social interaction anxiety and social fear/avoidance. The results help identify which level of cognition (metacognitive vs cognitive) might contribute to psychopathology in the context of social anxiety symptoms. In line with our first hypothesis, we found positive and significant correlations between social self-beliefs, metacognitive beliefs, and social anxiety. In line with hypothesis two, that metacognitive beliefs would be prospective predictors of social anxiety symptoms when controlling for social self-beliefs was supported for social interaction anxiety. However, in the model of social/fear avoidance, social self-beliefs fully mediated the relationship between metacognitions and social fear/avoidance. In line with hypothesis three, we found that metacognitive beliefs prospectively predicted social self-beliefs, while the reversed relationship did not hold.

Our results are consistent with studies that have demonstrated prospective relationships between social self-beliefs and symptoms of social anxiety (both social interaction anxiety and social fear/avoidance) (Gregory et al., 2018; Thew et al., 2020; Huppert et al., 2018; Santoft et al., 2019). This effect emerged even when the effect of metacognitive beliefs was controlled and therefore lends support to cognitive models (Clark & Wells, 1995; Hofmann, 2007; Rapee & Heimberg, 1997). However, the relation between social self-beliefs and social anxiety appeared reciprocal, meaning that social anxiety symptoms might also influence social self-beliefs; a mutual causal association that could constitute a maintenance process as social anxiety and negative social cognitions are interconnected (Heeren et al., 2020).

Of particular relevance to our current hypotheses and an addition to previous research, we found that metacognitive beliefs prospectively predicted negative social-self beliefs in the separate models as well as social interaction anxiety (Fig. 2a), but not directly social fear/avoidance (Fig. 2b). There was no apparent mutual relationship between metacognition and either social interaction anxiety or cognition suggesting that metacognition might be causally related to both. In summary, the set of findings support prospective positive relationships between metacognitive beliefs and both social anxiety and negative social beliefs. In contrast to Thew et al. (2020) who found the strongest and most consistent effect leading from negative social cognitions to social anxiety symptoms rather than the other way around, we did not observe a clear pattern of causal precedence in the social cognition and anxiety relationship.

The current findings showed that metacognition directly and prospectively predicted social interaction anxiety (Fig. 2a) but it did not directly predict social fear/avoidance (Fig. 2b). The prospective relationship between metacognitions and social fear/avoidance seemed to be mediated by social cognition. Thus, the relationship between metacognition and fear/avoidance appears to be transmitted through lower level cognition (social beliefs). The emergence of the direct and indirect influence of metacognition is consistent with different pathways presented in the metacognitive model (Wells, 2019), where psychological disorder can be an effect of the influence of metacognition on conscious cognition and effects on neural networks such as those involved in arousal and interoception. Taken together, our findings indicate that metacognition- rather than social self-beliefs precede the development of social anxiety symptoms and also precede negative social beliefs. The relationship with social fear/avoidance differed, with earlier metacognitions appearing to have an effect on later social cognition, which in turn explained later social fear/avoidance. It appears that the longitudinal relationship between metacognition and specific social anxiety outcomes involves effects that are not dependent on social beliefs and indirect effects transmitted by social beliefs depending on the social anxiety construct assessed. Furthermore, metacognitions precede cognitions but the converse did not seem to apply in the present data.

The current study is the first to evaluate the relative importance of cognitions and metacognitions to social anxiety in longitudinal data. Our findings bring further support to the metacognitive model of psychological disorders (Wells & Matthews, 1996; Wells, 2019) which emphasizes metacognitive beliefs rather than cognitive beliefs or schemas as a primary source of biased processing and dysfunction. In line with cognitive models of SAD (Clark & Wells, 1995; Hofmann, 2007; Rapee & Heimberg, 1997) we found support for a role of social self-beliefs in social anxiety. However, the relationships may be different from the simple causal effects that these models depict. The present results imply that metacognitions might give rise to both negative cognitions (social beliefs e.g. “I’m boring”) and social anxiety symptoms, and that cognitions and symptoms mutually affect each other. These findings have potentially important implications. If they are correct, they support a conceptual transition from cognitive to metacognitive models of social anxiety. Although our findings cannot directly address SAD given our undiagnosed convenience sample, they do show that metacognitions may be aetiological factors in social anxiety symptoms and that they could be involved in the development of negative social cognitions. Negative social cognitions may be indicative of maladaptive self-processing such as worry (i.e. the Cognitive Attentional Syndrome; Wells, 2009) driven my metacognitions, a process that may make an additional contribution. The present findings may help to explain why change in metacognitive beliefs rather than social self-beliefs predicts treatment outcome in social phobia patients (Nordahl, Nordahl, Hjemdal, & Wells, 2017, pp. 2083); because metacognitions causally affect both cognition and emotion (anxiety symptoms). The findings add to cross-sectional data which has indicated that metacognitive beliefs might be more important to social anxiety than social self-beliefs (Nordahl & Wells, 2017).

If metacognitions are important in the development of social anxiety as the data suggest, then it is important to formulate and modify metacognitions in treatment. Metacognitive therapy (MCT: Wells, 2009) which has been developed for this purpose may therefore offer an improved treatment approach. Preliminary studies have examined the effects of MCT in social anxiety. Nordahl et al. (2016) evaluated the effects of CBT enhanced with MCT techniques in social anxiety patients and found that the treatment was more effective than SSRI’s. In a case-series of pure MCT, Nordahl and Wells (2018) demonstrated the feasibility and potential effectiveness of this treatment across different social anxiety subtypes. In an experimental study, Gkika and Wells (2015) investigated if modifying cognitions or metacognitions produced most benefit on measures of social anxiety in socially threatening situations. Targeting metacognition appeared to have wider-ranging positive effects than changing cognition. Targeting metacognitive beliefs that are more generic in nature and addressing universal thought processes as in metacognitive therapy, rather than the content of cognition could help overcome the difficulty with the heterogeneity of self-related beliefs held by individuals with social anxiety (see Gregory & Peters, 2017) and lead to broader effects than content- specific treatments such as CBT.

There are limitations to consider when interpreting the results of the current study. Participants were recruited at convenience and the sample consisted of young adults and substantially more females than males that may limit the generalizability of our findings. There are general limitations in using self-report measures such as the effect of social desirability bias. Whilst a strength of the study is the inclusion of autoregressive paths when estimating the cross-lagged effects, using AR-CLPM only estimates the covariance structure at the between-person level. Future studies are recommended that analyse stability and change, incorporating the joint between-person and within-person change to purely disaggregate the variations at both levels of analyses (Anyan, Morote, & Hjemdal, 2020). Examples of such models include the Random Intercepts Crossed-lagged Panel Model (RI-CLPM; Hamaker et al., 2015) or the Latent Curve Model with Structured Residuals (LCM-SR; Curran et al., 2014). Furthermore, we relied on a 6-week lag between timepoints for practical purposes to enable a time-interval within which the study could be completed as well as to reduce or prevent drop-out from the study. With regards to modelling stability and change, the time lag between timepoints is very crucial since this may have implications for when hypothesized autoregressive or cross-lagged effects may be significant or not significant (Anyan et al., 2020). Equally spaced, fixed lag schedules between measurement occasions suggests that the cross-lagged effects between the variables occur simultaneously. This may be untenable and introduces limitations to the study. This is because cross-lagged effects can emerge at different lag schedules than fixed lag schedules (Selig & Little, 2012). Future research should also investigate the temporal and reciprocal relations between metacognitive beliefs, cognitive beliefs and symptoms in clinical samples, and these relations in different types of distress.

The current study focused on beliefs specifically derived from the Clark and Wells (1995) model of social phobia at the exclusion of other cognitive models and broader areas of cognition (e.g., interpretations, perceptions, and judgements) and also more specific types of metacognitive beliefs. Additionally, the constructs examined in this study ("metacognition" and "cognition") reflect broad belief domains that may obscure specificity in the relations between more specific sub-domains or constructs. For example, some domains of metacognition (e.g. negative metacognitive beliefs) are considered more important to pathology than others (e.g. positive metacognitive beliefs) (Wells, 2009), and some domains of social self-beliefs (e.g. high standard beliefs) have been reported to be more strongly associated with social anxiety than others (e.g. unconditional beliefs) (Wong & Heeren, 2021). Thus, future studies are recommended to examine the relations between more specific constructs.

In conclusion, the present study adds to pre-existing cross-sectional data and supports a role of metacognitions in social anxiety by demonstrating prospective relationships with social anxiety and negative social cognitions. This finding implies that metacognitive beliefs rather than social self-beliefs should be considered as primary targets in treatments of social anxiety. The metacognitive model (Wells, 2019) has further potential to inform our understanding and development of effective interventions for SAD.

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Declaration of interest

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.janxdis.2021.102516.

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