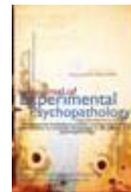




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Within-person process-outcome relationships in residential cognitive and interpersonal psychotherapy for social anxiety disorder: A reanalysis using disaggregated data

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Abstract

Process-outcome research in psychotherapy has mainly focused on between-person data (e.g., how differences in psychological process among patients are related to differences in outcome among the patients). However, this level of analysis is in danger of missing its target because psychotherapy models and therapists focus primarily on within-person relationships (e.g., whether change in a patient's cognitive process during the course of therapy may lead to a reduction of symptoms in that client). The study of within-person processes requires collection of repeated data and a disaggregation of the between- and within-person components of time-varying process predictors. The purpose of this study was to examine whether the results of a previously published longitudinal process-outcome study of cognitive and interpersonal therapy for social anxiety disorder (SAD) (Hoffart, Borge, Sexton, & Clark, 2009) were maintained when the process predictors were disaggregated. Eighty social phobic patients were randomized to 10-week residential cognitive or interpersonal psychotherapy. In the present reanalysis, time-varying predictors were disaggregated by use of person-mean centering. For the cognitive process predictors (self-focus, estimated probability and estimated cost of negative social events, safety behaviors), the within-person relationships between predictors and subsequent social anxiety remained significant when disaggregating the predictors. On the other hand, the previously significant within-person relationship between the interpersonal variable of perceived acceptance by others and subsequent social anxiety disappeared with disaggregation. Disaggregated social anxiety also predicted fluctuations in self-focus, estimated probability and estimated cost of negative social events, but not in safety behaviors and perceived acceptance.

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Keywords: Cognitive therapy, interpersonal psychotherapy, social phobia, process-outcome, disaggregation of within- and between-person effects.

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Table of Contents

Introduction

Method

Subjects

Treatments

Therapists and Therapist Training

Diagnostic Interviews

Integrity Ratings

Process Measures

Weekly Outcome Measure

Procedure

Statistical Analyses

Results

Changes over the Course of Treatment

Within-person Relationships

Discussion

Acknowledgements

References

Introduction

Several forms of psychotherapy have proven effective for a range of problems (e.g., Roth & Fonagy, 2005). However, the field of psychotherapy lacks a solid knowledge base about how and why therapy works (Kazdin, 2009) and research on mediators and mechanisms of change is still at an early stage. For example, most mediation research does not focus on the most appropriate level of analysis. Most studies have focused *between-person relationships*, that is, the extent to which people who change less than average on a potential mediator variable (e.g., catastrophic cognitions) among panic disorder patients also change less than average on an outcome variable (e.g., panic attacks). So, it is the individual's relationship to other individuals that is the focus of the analysis. However, therapists are not primarily interested in how a patient differs from other patients. Rather, it is whether the patient in one point of time is different from him-/herself on a different point, that is, whether the patient *changes*. In particular, therapists look for and try to facilitate within-person changes in variables which are supposed to maintain the patients' problems and therefore operate as mediators of change. In addition, they examine whether within-person change in a maintaining/mediating variable (e.g., catastrophic cognitions) is followed by within-person change in the problems (e.g., panic attacks). Thus, therapists focus on *within-person relationships* between mediator and outcome variables. In this activity, therapists are helped by knowing therapy models that specify such within-person relationships.

Methodologists have recently pointed out that between-person and within-person relations are different conceptually and empirically and that confounding or misattributing them could lead to faulty conclusions (Curran & Bauer, 2011). Hoffman and Stawski (2009) propose that between-person and within-person variation in a variable may represent two different constructs and therefore their effect on a given outcome will often be of different magnitudes or even in different directions. For instance, in the case of negative mood, chronic factors such as personality variables and lifestyle differences may be responsible for some persons being grumpier than others. On the other hand, the reason why negative mood is worse on some days than others will be due to more transient factors, such as time-specific deviations from normal routines of work, family, or health. Molenaar (2004) theoretically and empirically showed that results from between-person analyses can be generalized to within-person findings only when certain strict assumptions are met. First, each subject in the population has to obey the same statistical model (homogeneity of the population). That is, the main features of a statistical model describing the data (e.g., number of factors, factor loadings) are stable across subjects. Second, the data must be stationary, that is, have stable statistical characteristics (e.g., factor loadings) across time. No wonder that it seems to be the rule rather than an exception that within- and between-person relations are different. For instance, the DSM-5 defines generalized anxiety disorder (GAD) as a factor consisting of the features excessive worry, difficulty controlling worry, restlessness, easily fatigued, difficulty concentrating, irritability, muscle tension, and sleep disturbance. This factor model is largely based on the

study of between-person relationships (and the subjective judgments of experts) (Hofmann, 2014). Fisher (2015) had 10 individuals with GAD complete surveys of GAD symptoms for at least 60 consecutive days. Person-by-person analyses yielded 10 separate factor models. For instance, in one individual, the symptoms were reduced to three factors (general distress, restlessness, irritability) while in another to four factors (worry, avoidance, fatigue, muscle tension). Only two individuals exhibited a factor consistent with the DSM-5 definition of GAD. Further diversity appeared when the factor models were subjected to dynamic factor modeling to determine the sequential relationships between factors. Although some individuals exhibited overlapping factors, the sequential relationships between these common factors could be different. For instance, in one individual, more avoidance a day led to subsequent reductions in distress the following day. Conversely, in three other individuals, more avoidance led to successive increases in worry and anxiety. Thus, this examination of the structure and dynamics of GAD indicated that the homogeneity assumption was strongly violated. Still, there was *some* structural homogeneity across cases. Factors for worry, fatigue, and avoidance were each present for most participants. Thus, these preliminary data from person-by-person analyses point to worry, fatigue, and avoidance as possible core dimensions of GAD. This general structural model based on a summary of within-person relationships clearly differs from the one defined in DSM-5, which is largely based on the study of between-person relationships. Generalizing findings at the between-person level (e.g., findings related to the DSM-5 diagnosis of GAD) to the within-person level would be an error of inference. In general, Fisher's approach and findings demonstrate the structural and dynamical diversity among individuals meeting criteria for the same diagnosis and the necessity to derive general dimensions and models from the idiographic study of individuals.

A study of within-person processes involves an examination of the extent to which within-person temporal variation in a presumed cause is related to temporal variation in an outcome for the same person. This necessitates a collection of longitudinal data, where potential causes (e.g., mediators) and outcome are repeatedly measured over time for each individual. Various types of time series analyses are used on such data to develop dynamic models for single individuals. However, to test the *general* validity of therapy models, obtained within-person relationships need to be summarized across individuals. For this purpose, some kind of multilevel modeling (MLM) or structural equation modeling (SEM) is required (Curran, Howard, Bainter, Lane, & McGinley, 2014). In MLM, relationships between variables (e.g., a mediator and outcome) are calculated within individuals over time, and these relations are aggregated over all individuals to form an overall relation between the variables.

The original scales of time-varying variables represent a mixture of between- and within-person components. That is, the raw scores reflect both how the individual differs from other individuals in terms of level and potential trend and how the individual differs from him- or herself from occasion to occasion. Thus, because time-varying predictors are usually composed of these two sources of variation, using their original scales in MLM would lead to a *composite* effect: an un-interpretable blend of the within- and between-person effects (Hoffmann & Stawski, 2009). This means that the influence of the stable person-specific part of the predictor on an outcome cannot be separated from the influence of the transient time-specific part. By use of various *centering* and *detrending* approaches, however, the between- and within-person components of time-varying variables can be disaggregated (Wang & Maxwell, 2015). Centering a variable refers to a redefinition of the 0 point of the variable. A time-varying variable is person-mean centered by subtracting the person-specific mean for that variable from the value of the variable at each time point. The person-specific mean represents the person's expected or typical value on any time-point, that is, the level that differentiates him or her from other persons. The score that remains at each time point, by contrast, represents the person's time-specific deviance from his or her expected or typical score. Thus, by person-mean centering, between- and within-person variation are represented and separated. Detrending refers to the statistical operation of removing the trend from a time series. In the present context of examining the relation between a time-varying predictor and outcome, detrending refers to controlling for the effect of time while examining the relation between the two variables. There are multiple possible detrending options. In Curran and Bauer's (2011) two-step approach, for instance, the within-person component is created by regressing the predictor on time separately for each individual. The resulting within-person deviations from the person's trend line represent the within-person component of the time-varying predictor.

As part of ongoing research on cognitive-behavioral (CBT; Heimberg, 1991; Clark & Wells, 1995) and interpersonal (Lipsitz, Markowitz, Cherry, & Fyer, 1999) therapies for social anxiety disorder (SAD), some process-outcome studies

have been conducted. A recent literature review of threat reappraisal as a mediator of change in cognitive-behavioral treatment of SAD (Smits, Julian, Rosenfield, & Powers, 2012) found that a relationship between reappraisal and social anxiety reduction was supported in most studies. However, only a few of the reviewed studies had a longitudinal design and could study within-person relationships (e.g., Smits, Rosenfield, McDonald, & Telch, 2006; Hoffart et al., 2009). In none of the studies of within-person relationships were the threat reappraisal scores disaggregated, implying that – as elaborated above – the results represent the composite of between- and within-person effects. We have identified two process-outcome studies of CBT of SAD after this review. Calamaras, Tully, Tone, Price, and Anderson (2015) investigated only between-person effects of judgmental biases and this study was therefore – according to the present conceptualization – not a proper mechanisms study. Mörtberg, Hoffart, Boecking, and Clark (2014) estimated the parameters in a multilevel model using a procedure described in Bauer, Preacher, and Gil (2006). In this procedure, the relationship between mediator and outcome is already decomposed into within- and between person components. Mörtberg et al. found that within-person change from self-focused to externally focused attention mediated improvements in social anxiety one week later. On the other hand, within-person change in the frequency of, or belief in, negative SAD related automatic thoughts did not predict subsequent social anxiety. With regard to disaggregation, this study appears to be the one most correctly conducted to date and therefore provides relatively interpretable results.

The purpose of this study was two-fold. First, to examine whether the results of the previously published longitudinal process-outcome study referred to above (Hoffart et al., 2009) were maintained when the process predictors were disaggregated and the “pure” within-person effects could be analyzed. The second purpose was, by this re-analysis, to illustrate methods of disaggregation and the considerations leading to choice of method. This may encourage researchers in the field to adopt similar approaches and thus produce results directly applicable for clinicians. In the previous study, eighty SAD patients were randomized to 10-week residential cognitive (ResCT) or interpersonal psychotherapy (ResIPT). The outcome results are reported in Borge et al., (2008). The patients in both conditions showed robust improvements from pre- to post treatment, and continued their improvements in the one-year follow-up period. There were no differences in outcome between residential ResCT and ResIPT. They completed process measures every Thursday and a symptom measure every Monday. The ratings were analysed with mixed models. Without disaggregation (using the raw scores of the time-varying process variables), within-person changes in the process variables derived from the cognitive model (self-focus, estimated probability and estimated cost of negative social events, safety behaviors) predicted subsequent changes in social phobic symptoms (see Table 3). Also fluctuations in the interpersonal variable perceived acceptance by others predicted subsequent changes in symptoms. On the other hand, fluctuations in symptoms predicted fluctuations in self-focus, estimated probability and estimated cost of negative social events, and safety behaviors. There were no interactive effects of process with treatment.

Method

Subjects

The participants were selected among referrals to specialized inpatient treatment programs for SAD at Modum Bad, a national Norwegian clinic established for the residential treatment of non-psychotic patients that lack adequate local treatment opportunities or have not responded adequately to outpatient care. Due to the scattered settlement in Norway, residential adaptations of programs developed in an outpatient setting assist in providing specialized and intensive treatment opportunities for the entire Norwegian population. The outpatient clinics in Norway were informed about the project and asked for referrals. Patients being considered for inclusion in the trial were given an evaluation interview, including the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I; First, Spitzer, Gibbon, Williams, & Benjamin, 1994a) for assessing Axis I diagnoses. The inclusion criteria were: (a) satisfying DSM-IV (American Psychiatric Association, 1994) criteria for social phobia, (b) the patient and assessor considered social phobia the primary current diagnosis and had no immediate need for additional treatment, (c) age 18-65 years, and (d) willingness to withdraw all psychotropic medication. Patients who met these criteria were fully informed about the study and gave written consent. The study was conducted in compliance with the regional ethical committee. All medication was gradually withdrawn before or within the first week of treatment. The patients were randomly allocated

to one of the two treatment conditions. Eighty patients were included and admitted to the two programs in groups of eight, constituting five blocks of patients. The characteristics of the sample are reported in Table 1. The patients in the two conditions did not differ, except that the diagnoses of panic disorder with agoraphobia and body dysmorphic disorder were more frequent among the ResCT patients (10 vs. 4 and 9 vs. 4, respectively). More details about the sample are available elsewhere (Borge et al., 2008).

Table 1: Means (SDs)/Frequencies for Characteristics of Total Sample and Treatment Groups

Variable	Total sample (N = 80)	ResCT (n = 40)	ResIPT (n = 40)
Female/male	41/39	21/19	20/20
Age	37.5 (11.4)	37.7 (11.3)	37.2 (11.6)
Duration of SAD	19.7 (12.3)	19.8 (13.2)	19.7 (12.3)
Generalized subtype of SAD	66 (83%)	33 (83%)	33 (83%)
Working (> 50%) last 6 months	29 (36%)	11 (28%)	18 (45%)
Previous psychiatric treatment	64 (80%)	32 (80%)	32 (80%)
Co-morbid Axis I disorder	73 (91%)	36 (90%)	37 (93%)
Personality disorder	48 (60%)	25 (63%)	23 (58%)
Used anxiolytics last month	28 (36%)	17 (43%)	11 (28%)
Used antidepressants last month	17 (21%)	9 (23%)	8 (20%)
Drop out from treatment	11 (14%)	8 (20%)	3 (8%)

Note. SAD = Social anxiety disorder.

Treatments

The treatments were based on manuals for individual social phobia treatment by cognitive therapy (Clark, 1997) or interpersonal psychotherapy (Lipsitz, Markowitz, & Cherry, 1997) but modified for use in a residential setting. The first major modification was that the majority of treatment (88%) was conducted in groups rather than individual sessions (12%). For cognitive therapy, no group treatment manual was available and the team developed its own group modification. For interpersonal psychotherapy, an existing group treatment manual (Wilfley, MacKenzie, Welch, Ayres, & Weissman, 2000) was available and was used to help develop the group protocol. The second major change was that the individual sessions were shortened, 45-50 minutes as compared to 90 minutes in (Clark et al., 2006). Finally, the therapists did not see patients' weekly symptom or cognition measures and hence did not discuss them with patients at the start of each session (a normal individual cognitive therapy practice for focusing therapy sessions). In both ResCT and ResIPT patients received 360 minutes of group treatment (four sessions) and 45-50 minutes (one session) of individual treatment per week. Patients participated in the wards' general program, consisting primarily of physical exercise sessions and ward meetings. On weekends, patients most often returned to home. In the middle of the ten-week program, the patient groups were given one-week leave at home to test out their new abilities in their natural environment. Further details about the treatment are available elsewhere (Hoffart et al., 2009).

Therapists and Therapist Training

Two clinical psychologists, both experienced in performing cognitive therapy for anxiety disorders, were the individual therapists in ResCT. A clinical social worker with extensive psychiatric training and a psychiatrist were the individual therapists for the majority of ResIPT patients. Both programs included three psychiatric nurses/occupational therapists, who conducted the group sessions together with the individual therapists. Details about training and supervision of the therapists are provided elsewhere (Hoffart, et al., 2009).

Diagnostic Interviews

The SCID-I and -II interviews for assessing DSM-IV Axis I and II disorders (First et al., 1994a; First, Spitzer, Gibbons, Williams, & Benjamin, 1994b) were conducted at pretreatment (at the evaluation and during the initial part of

treatment) by the individual therapists. At one year follow-up, the Axis I interviews were again conducted by the therapists. The interrater reliability of the interviews was satisfactory (Borge et al., 2008).

Integrity Ratings

Videotaped individual sessions were stratified for therapist and number and randomly selected for expert evaluation. CT experts (Freda McManus and David M. Clark) rated the six selected ResCT tapes, and IPT experts (John C. Markowitz and Kathryn Bleiberg) rated the four selected ResIPT tapes. Ratings for both treatments were lower than would normally be required for a clinical trial of the individual treatments. For ResCT the mean Cognitive Therapy Scale (Vallis, Shaw, & Dobson, 1986) ratings were: overall competence in CT (0-6 scale) 2.79 ($SD = 0.56$) (trial target is at least 4), suitability as a CT trial therapist (0-4 scale) 1.13 ($SD = 0.71$) (trial target is at least 3.5). For ResIPT the mean Collaborative Study Psychotherapy Rating Scale-Form 6 (CSPRS-6; Hollon, 1984) rating for IPT items (1-7 scale) was 2.23 ($SD = 0.25$), whereas the mean rating for facilitative (supportive) items (1-7 scale) was 4.66 ($SD = 0.21$). Using a modified version of the CSPRS-6, two graduate psychology students independently rated 12 ResCT and 11 ResIPT randomly selected group sessions with satisfactory interrater reliability (Hoffart et al., 2009). Model-consistent differences between the two treatments were found: the ResCT sessions were rated higher than the ResIPT sessions on the CT items (1-7 scale) ($M = 3.58$, $SD = 0.86$ vs. $M = 1.44$, $SD = 0.24$, $t(21) = 7.99$, $p < .0001$), and lower on the IPT items (1-7 scale) ($M = 1.48$, $SD = 0.18$ vs. $M = 3.80$, $SD = 0.51$, $t(21) = 14.75$, $p < .0001$).

Table 2: Process Scales: Internal Consistencies, Correlations with Standard Scales, Items, and Item Sources

Cognitive Model Constructs
Self-focus (rated on 0-8 scales, $\alpha = .84$, all relevant items of standard scale used)
The extent to which your attention was focused on yourself or on the external situation for social situations in general (SPWSS, item nr. 3)
The extent to which your attention was focused on yourself or on the external situation for social situations that you found difficult (SPWSS, item nr. 4)
Estimated probability ¹ of negative social events (rated on 0-100 scales, $\alpha = .84$; $r = .76$)
I will be clumsy in front of other people (SPCQ, item nr. 3)
My voice will be unsteady (SPCQ, item nr. 4)
Someone will think I'm odd (SPCQ, item nr. 5)
I will feel nervous in a social situation (SPCQ, item nr. 13)
Estimated cost ¹ of negative social events (rated on 0-100 scales, $\alpha = .87$; $r = .73$)
I will be clumsy in front of other people (SPCQ, item nr. 36)
My voice will be unsteady (SPCQ, item nr. 37)
Someone will think I'm odd (SPCQ, item nr. 38)
I will feel nervous in a social situation (SPCQ, item nr. 46)
Safety behaviors (rated 0-3 scales, $\alpha = .65$, $r = .73$)
Try not to attract attention (SBQ, item nr. 2)
Make an effort to get your words right (SBQ, item nr. 3)
Try to picture how you appears to others (SBQ, item nr. 8)
Try to control shaking (SBQ, item nr. 11)
Interpersonal Model Construct Accepted by others (rated on 0-7 scales, $\alpha = .85$, new measure)
I felt myself accepted by others
I felt closeness to others

Note. SPWSS = Social Phobia Weekly Summary Scale (Clark et al., 2003); SPCQ = Social Probability and Cost Questionnaire (McManus, Clarke, & Hackmann, 2000); SBQ = Safety Behaviour Questionnaire (Clark et al., 2003)

¹Identical items are rated for probability and cost

Process Measures

Process was largely measured by shortened versions of previously validated standard scales. Shortened versions were used because of our need to repeatedly measure multiple constructs without unduly burdening the patients. Items of the standard scales that together had the highest Cronbach's *alpha* in a pilot sample were selected (Hoffart et al., 2009). We constructed new scales in some cases where relevant standard scales were not available. Table 2 lists the process scales, their items, and the names of the standard scales from which items were taken. Further psychometric data are available (Hoffart et al., 2009).

Weekly Outcome Measure

Social phobic symptoms were measured by the Social Phobia Weekly Summary Scale (SPWSS; Clark et al., 2003) items for severity of social anxiety, social avoidance, anticipatory processing prior to social encounters, and post event processing following these situations (rated on a 0-8 scale). The full six-item version of the SPWSS has been found to discriminate between different treatments which vary in outcome and to correlate highly with the Liebowitz Social Anxiety Scale (Clark et al., 2006). Cronbach's *alpha* of the symptom scale was .85. The correlations between scores on overall outcome measures (e.g. the Social Phobia and Anxiety Inventory; Turner, Beidel, Dancu, & Stanley, 1989) at pre-, mid-, and post treatment and scores on the weekly symptom measure at corresponding points of time were high, ranging from .56 to .84 (Borge et al., 2008).

Procedure

Assessment on the overall outcome measures took place at the precare evaluation interview (evaluation), at admission (pretreatment), when the patients returned from their home-week after five weeks (midtreatment), at discharge (posttreatment), and at one year after end of treatment (one-year follow-up). The process measures were completed every Thursday to obtain summary ratings of the process experiences during the most treatment intensive part of the week. The weekly outcome measure was completed every Monday to obtain a summary rating of the outcome during a less treatment intensive period. For both type of measures, subjects were asked to base the ratings on their experiences the last three days. To control for potential expectancy bias, the patients were informed that the therapists were blind to the patients' weekly ratings.

Statistical Analyses

A purpose of this study was to examine whether the within-person results of a previously published longitudinal process-outcome study (Hoffart et al., 2009) were maintained when the process variables were properly disaggregated. The interventions were designed to cause the within-person effects. Also as a result of the interventions, all the process variables were expected to change over time. For this situation, where change is deliberately sought for, Wang and Maxwell (2015) argue that person-mean centering of the time-varying predictors is the proper disaggregation method of the within-person and between-person effects. Any kind of detrending – controlling for the effect of time - would remove the purposefully designed experimental manipulation and could prevent the discovery of between- and within-person effects of interest.

Linear mixed effects models, which can adjust for the interdependence of the repeated observations within individuals that is typical in multilevel longitudinal data, were used (Fitzmaurice, Laird, & Ware, 2004). This dependency is accounted for by introducing individual-specific random effects and by modeling the covariance structure of the residuals. For each of the dependent variables in the analyses, the combination of random effects and covariance structure of the residuals that gave the best fit was chosen. Maximum likelihood (ML) was used as estimation method (Fitzmaurice et al., 2004). Akaike's Information Criterion (AIC) was used to compare the fit of different models.

First, we examined whether the process and outcome variables changed over the course of treatment by regressing them on time (week) and treatment in mixed models. Then, in a series of models examining study hypotheses, social phobic symptoms (SPWSS-4) were used as dependent variable and the person-mean centered process variable and the person-mean of the process variable were used as the within- and between-person components, respectively, of the cognitive (self-focus, estimated probability, estimated cost, safety behaviors) and interpersonal (perceived

acceptance) process variables. A separate analysis was conducted for each process variable. To establish a temporal sequence between process and outcome, the process scores on Thursdays ($t-1$) were related to the symptom scores the following Mondays (t). Thus, we estimated the effect of process on symptoms in the following model:

$$\text{Symptoms}_{it} = \gamma_{00} + \gamma_{01}\text{MeanProcess}_{i.} + \gamma_{10}(\text{Process}_{i, t-1} - \text{MeanProcess}_{i.}) + u_{0i} + u_{1i}\text{Week} + e_{it}$$

Symptom score at time point t for person i is a function of a fixed intercept, γ_{00} ; a fixed effect of the person's mean on the process variable, γ_{01} (between-person effect); a fixed effect of the time-specific deviation from the person's mean on the process variable, γ_{10} (within-person effect); a person-specific random intercept, u_{0i} ; a person-specific random effect of week, u_{1i} ; and a week- and person-specific residual, e_{it} .

Next - to explore the possibility of reversed causation - the cognitive/interpersonal variables and symptoms switched roles in the five models. That is, person-mean centered symptoms and person-mean of symptoms were the independent variables, whereas the cognitive/interpersonal variables were the dependent variables in the models. Symptom scores on Mondays were linked to the process scores at the subsequent Thursdays to establish a time line.

There was about 8% of missing data, mainly due to drop out from treatment. To correct for the possibility of Type I error, a sequential rejective approach to the study hypotheses was applied (Holm, 1979). The most extreme p -level was compared to the alpha significance level of .05 (two-tailed) divided by the number of tested hypotheses (5), yielding a level of .01. Then the next most extreme p -level was compared to $.05/4 = .0125$, and so forth. For the exploratory comparisons, a liberal p -level of .05 (two-tailed) was used. Effect sizes (ESs) were computed as Hedges' g for dependent samples (Borenstein, Hedges, Higgins, & Rothstein, 2009). The program SPSS 23.0 was used.

Results

Changes over the Course of Treatment

The weekly scores on the process and outcome scales were used as dependent variables in mixed models. Week and treatment (ResCT vs. ResIPT) were used as predictors. For the SPWSS-4, a random intercept and slope and a one-lag autoregressive heterogeneous (ARH(1)) covariance structure for the residuals turned out to have the best fit. There was a significant improvement on the SPWSS-4 during treatment, $\gamma = -0.147$, $SE = 0.018$, $t(74.3) = -8.23$, $p = .001$. As previously reported (Borge et al., 2008), the ResCT and the ResIPT patients did not improve differently, indicated by a non-significant treatment (ResCT = 1, ResIPT = 0) by week interaction, $\gamma = -0.016$, $SE = 0.036$, $t(73.3) = -1.46$, $p = .146$.

For all the cognitive process variables, a random intercept and slope, an unstructured covariance structure for the random effects (allowing the intercept and slope to co-vary), and a diagonal covariance structure for the residuals fitted best. For perceived acceptance by others, a random intercept and an ARH(1) covariance structure for the residuals had the best fit. Scores on the cognitive process variables displayed change over the course of treatment (self-focus, $\gamma = -0.127$, $SE = 0.021$, $t(64.8) = -5.99$, $p < .001$; estimated probability, $\gamma = -2.254$, $SE = 0.353$, $t(66.8) = -6.47$, $p < .001$; estimated cost, $\gamma = -2.256$, $SE = 0.314$, $t(67.6) = -7.08$, $p < .001$; and safety behaviors, $\gamma = -0.065$, $SE = 0.008$, $t(68.5) = -8.63$, $p < .001$). The interpersonal variable perceived acceptance by others was the only process subscale that did not exhibit change over the course of treatment $\gamma = -0.005$, $SE = 0.014$, $t(71.7) = -0.26$, ns . In a second step, a week by treatment interaction was added to examine the possibility of different degrees of change in the two treatments. These interactions were non-significant for all variables (all absolute t -values < 1.65) except for estimated cost, $\gamma = -1.597$, $SE = 0.606$, $t(65.7) = -2.63$, $p < .01$. The negative sign of the coefficient indicates that cost scores decreased more in ResCT.

Table 3: The Effects of Process Variables on Social Phobic Symptoms (SPWSS-4)

Predictors	γ	SE	df	t
Self-focus	0.136	0.034	533.5	4.00**
Estimated probability	0.016	0.002	542.3	5.82**
Estimated cost	0.019	0.003	532.0	6.73**
Safety behaviors	0.545	0.104	561.9	5.24**
Accepted by others	-0.092	0.046	517.9	-2.08*

Note. Results of separate mixed models for each process variable. SPWSS-4 = Social Phobia Weekly Summary Scale, 4 items version (Clark et al., 2003). * $p < .05$; ** $p < .001$ (two-tailed).

Table 4: The Within-Person (WP) and Between-Person (BP) Effects of Process Variables on Social Phobic Symptoms (SPWSS-4)

Predictors	γ	SE	df	t
WP self-focus	0.165	0.037	456.7	4.41* ^a
BP self-focus	0.668	0.094	70.0	7.10**
WP estimated probability	0.015	0.003	496.5	5.17** ^a
BP estimated probability	0.050	0.006	77.1	8.61**
WP estimated cost	0.018	0.003	496.5	6.17** ^a
BP estimated cost	0.047	0.006	76.0	8.54**
WP safety behaviors	0.560	0.108	484.7	5.19** ^a
BP safety behaviors	1.515	0.224	78.5	6.78**
WP accepted by others	-0.075	0.048	414.7	-1.55
BP accepted by others	-0.266	0.133	75.5	-1.99*

Note. Results of separate mixed models for each process variable. SPWSS-4 = Social Phobia Weekly Summary Scale, 4 items version (Clark et al., 2003).

^a Significant according to a sequential rejective approach to the study hypotheses for WP effects (Holm, 1979) with overall $\alpha = .05$ (two-tailed tests).

* $p < .05$; ** $p < .001$ (two-tailed).

Within-person Relationships

The process variables were analysed one-by-one in mixed models. For ease of comparison, we first used the raw scores of the process variables as we did in the previous study (Hoffart et al., 2009) (see Table 3). Then, the disaggregated within- and the between-person components of the process variables were analyzed. Table 4 shows both the significances for the within-person relationships when corrected for multiple tests and the significances for the individual tests. There were within-person relationships between all the cognitive process variables and subsequent symptoms, but not between the interpersonal variable acceptance by others and symptoms. There were between-person relationships between all the process variables and symptoms, that is, the levels on the process variables over the course of treatment were related to level of symptoms. In a second set of analyses, week was

added as a predictor to rule out the possibility that the process-symptoms relationships could be due to a correlation of the slopes of the variables. The cognitive process variables were still significant (all t s absolute value was above 2.45). In a third set of analyses, the previous assessment SPWSS-4 scores were included as a covariate to control for this influence on the SPWSS-4 scores. The cognitive process variables were still significant (all t s absolute value was above 2.70). In a fourth set of analyses, cross-level interactions between treatment and the between-person component of the process variable, between treatment and the within-person component of the process variable, and between the within- and between person components, were added in the models. No significant interactions emerged. In order to explore the relative contribution of the four significant within-person process variables, they were included in the same model. Only estimated cost, $\beta = 0.011$, $SE = 0.004$, $t(505.2) = 2.90$, $p < .01$; and safety behaviours, $\beta = 0.311$, $SE = 0.118$, $t(517.6) = 2.63$, $p < .01$; made unique contributions to subsequent symptoms. Examining the reversed within-person relationships, symptoms proved to predict subsequent self-focus, $\beta = 0.155$, $SE = 0.040$, $t(496.6) = 3.88$, $p < .001$; estimated probability, $\beta = 2.292$, $SE = 0.513$, $t(507.1) = 4.47$, $p < .001$; and estimated cost, $\beta = 1.847$, $SE = 0.492$, $t(508.1) = 3.75$, $p < .001$; but not safety behaviours and perceived acceptance by others (both t s absolute value less than 1.20).

Discussion

The purpose of this study was to examine whether the results of a previously published longitudinal process-outcome study (Hoffart et al., 2009) were maintained when the time-varying process predictors were disaggregated to their between- and within-person components. In the reanalysis, the predictors were disaggregated by use of person-mean centering. For the cognitive process predictors (self-focus, estimated probability and estimated cost of negative social events, safety behaviors), the within-person relationships between predictors and subsequent social phobic symptoms were retained when disaggregating the predictors. On the other hand, the previously significant within-person relationship between the interpersonal variable perceived acceptance by others and subsequent symptoms disappeared with disaggregation. There were no interactive effects of process with treatment. As without disaggregation, disaggregated symptoms predicted subsequent fluctuations in self-focus, estimated probability and estimated cost of negative social events. However, symptoms no longer predicted safety behaviors.

Across treatments, the four cognitive process variables changed during the treatment period. As their weekly fluctuations predicted fluctuations in weekly outcome and as the weekly outcome measures changed over the course of therapy in parallel with overall outcome, the overall pattern of results support the hypothesis that cognitive model related process variables *maintain* social phobia. However, to establish their causal role conclusively, one also needs to show that a treatment enhanced in those components associated with a factor is more effective than the original treatment (Kraemer, Wilson, Fairburn, & Agras, 2002) or that experimental manipulations of the process variables modulate symptoms.

Several studies have used experimental manipulations and reported results in line with the cognitive model. Wells and Papageorgiou (1998) found that experimental induction of a state of externally focused attention led to reductions in catastrophic beliefs and social anxiety. Whereas Wells and Papageorgiou documented *parallel* changes in self-focus and symptoms, the present findings indicated a within-subject *sequential* relationship between these variables as did the findings of Mörtberg et al. (2014). Similarly, whereas between-subject variations in social cost reduction in the course of cognitive-behavioural therapy (Heimberg, 1991) have previously been found to predict longer term anxiety reductions (Hofmann, 2004), here within-subject decreases in estimated social cost predicted lessening of symptoms on a short-term level. Wells et al., (1995) found that an intervention consisting of exposure plus decreased safety behaviours was more effective than exposure alone in reducing social anxiety and belief in feared social catastrophe. The present results supported a within-subject sequential relationship between safety behaviors and social phobic symptoms.

Consistent with finding similar outcomes and similar process-outcome relationships, four of five process variables did not change differently in the two treatments. Thus, on these variables, the active ingredients of the two treatments may have similar effects. For instance, the ResIPT principle of substituting self-protective behaviours with disclosing and contact-seeking behaviour (see Hoffart et al., 2009) may affect the self-focus and the safety behaviours in a similar way as do the specific ResCT procedures. Estimated cost, on the other hand, changed more in ResCT than in RIPT. Thus, it appears that the specific ResCT procedures targeting estimated cost, which were evidenced in the

group adherence ratings (e.g. testing beliefs prospectively; Hoffart et al., 2009) had a specific effect on cost. This is consistent with the findings of Hofmann (2004) and McManus et al., (2000) who reported large changes in cost following CT, compared to the cost changes associated with other treatments.

The possibility that symptom change would precede cognitive therapy process, which has been suggested in studies of the relationship between cognitions and symptoms in cognitive therapy of depression (Kraemer et al., 2002) received some empirical support here. Social phobic symptoms did predict self-focus and estimated probability and cost of negative social events measured three days later. Thus, there appeared to be circular relationships between these process variables and symptoms.

Within-person relationships over the course of therapy are of particular relevance for psychotherapy theories. This is because therapy theories concern how change in a process variable relates to subsequent change in an outcome variable during therapy. Such knowledge directly informs therapists what process variables need to be affected to achieve patient improvement. By contrast, knowledge of between-person relationships - one patient having less reduction of self-focus and poor outcome and another having more reduction of self-focus and good outcome - does not imply that a reduction in the first patient's self-focus would lead to better outcome for that patient. That is, between-person findings cannot be used as evidence that working with a given patient to change self-focus will improve outcome for the same patient. Thus, relationships established on a between-person level do not imply that the same relationships hold on a within-person level. The present statistical approach appears to reflect this conception of therapy process well. It concurrently estimates the between- and within-person relationships of time-varying process variables to a given outcome and it effectively addresses the issue of assuring the time precedence of the process variable (Kraemer et al., 2002). Still, some methodological challenges remain, for instance concerning how to model the direct influence of social anxiety on itself across assessments (see Falkenström, Ekeblad, & Holmqvist, 2016).

Several limitations need to be mentioned. The majority of treatment was conducted in groups. Students' adherence ratings of the group sessions indicated model-consistent differences between the two therapies. However, the competence level in the individual RCT sessions rated by experts was only moderate, and appeared lower than in previous efficacy studies of CT for social phobia. Also the expert ratings of the adherence level in the individual RIPT sessions were relatively low. Thus, the therapies probably had lower effects on the process variables than they would in more competently performed therapies and this may have affected the process-outcome *relationships*. For instance, implementing behavioral experiments in an insufficient way reduces the change in estimated probability and cost of negative social events over the course of therapy and may also affect the weekly fluctuations of these variables (and thus the correlations with symptom fluctuations). One should also note that the sequential relationships between process and sub-outcome were obtained on a half-week (three or four days) time scale. Different relationships may prevail on a daily or moment-to-moment time scale. The present results were obtained in a severe and treatment-refractory sample of social phobic patients receiving treatments modified for a residential setting and it remains uncertain whether they can be generalized to outpatient samples.

In conclusion, the results suggest that one could maximize the effect of treatment on symptoms through a therapeutic emphasis on self-focus, estimated probability, estimated cost, and safety behaviors. The process of improvement may involve positive circles in that a reduction of symptoms, in turn, appeared to influence self-focus and estimated probability and cost. Future studies should develop and examine structural and dynamic models for individual SAD subjects who are currently not in treatment and summarize the resulting within-person findings to general models. Such studies require an extended list of SAD symptoms (including the process variables derived from the cognitive model of SAD) and an extended number of observations. Moreover, personalized treatments constructed and implemented on the basis of SAD patients' idiosyncratic models should be evaluated.

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