Socratic Questioning and Therapist Adherence as Predictors of Symptom Change in Cognitive Therapy for Depression

Thesis

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By

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Abstract

While cognitive therapy (CT) for depression has considerable evidence for its efficacy, the mechanisms of symptom change remain unclear. Socratic questioning is a key therapeutic strategy in cognitive therapy (CT) for depression. Yet, little is known regarding its relation to outcome. Previous studies have sought to identify candidate mechanisms of symptom change by examining therapist adherence to three dimensions of CT (Cognitive Methods, Negotiating/Structuring, and Behavioral Methods/Homework) as predictors of session-to-session symptom change early in treatment, but the results were mixed across the two studies. The purpose of this study is to examine therapist use of Socratic questioning and therapist adherence to CT for depression as predictors of session-to-session symptom change (BDI-II) across sessions 1-3.

Participants were 55 depressed adults who participated in a 16-week course of CT (see Adler, Strunk, & Fazio, 2014). Socratic questioning and therapist adherence were assessed through observer ratings of the first three sessions. We disaggregated each of these ratings into scores reflecting within-patient and between-patient variability for each variable, and examined the relation of within-patient variability in these scores to session-to-session symptom change. In a series of single predictor models, in which the within-patient components for each variable were entered into separate regression models, both
therapist use of Socratic questioning and therapist adherence to Cognitive Methods significantly predicted subsequent session-to-session symptom change.

We then conducted a multiple predictor model in which the within-patient scores for all 4 variables of interest were entered as predictors simultaneously. No variable remained significant in this model. Only Socratic questioning remained a predictor of subsequent symptom change at the level of a non-significant trend. We assessed two facets of the alliance (i.e., Relationship and Agreement alliance) and entered their respective within-patient components into the previous model as covariates to control for the any alliance effects. Again, Socratic questioning predicted subsequent symptom change at a trend-level.

This study offers the first empirical support for the association between therapist use of Socratic questioning and subsequent session-to-session patient symptom change across the early sessions (sessions 1-3) of cognitive therapy for depression. If replicated, this relation of Socratic questioning to subsequent symptom change may reflect a causal relation between Socratic questioning and symptom change; if so, efforts to disseminate CT would likely need to provide appropriate emphasis on, and training in the use of Socratic questioning.
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Chapter 1: Introduction

In the treatment of depression, cognitive therapy (CT) has considerable evidence for its efficacy (Strunk & DeRubeis, 2001). Compared to antidepressant medication, CT yields comparable response rates and superior rates of sustained response (DeRubeis, Gelfand, Tang, & Simons, 1999; DeRubeis et al., 2005). Recent evidence for the effectiveness of CT in routine clinical settings is promising (Gibbons et al., 2010). Nonetheless, the mechanisms of symptom change in CT remain unclear (Garratt, Ingram, Rand, & Sawalani, 2007). An understanding of which therapist behaviors are most important to the positive outcomes achieved through CT is of interest not only for its scientific value, but also for its ability to inform efforts to disseminate the treatment. In this paper, we evaluate two sets of therapist behaviors thought to be critical to the successful delivery of CT: therapist use of Socratic questioning and therapist adherence to CT. We examine the relation of these therapist behaviors as predictors of session-to-session symptom change early in treatment, using a sample of depressed adults treated by therapists recently trained in CT.

Socratic Questioning

Although Socratic questioning is widely regarded by experts as a key element to CT (Beck, 1979; Beck, Wright, Newman, & Liese, 2011; Beck, 1995; IAPT Programme, 2007), the role of Socratic questioning in psychotherapy and more specifically CT has received little empirical attention. Overholser (1987), who seems to have published the
most on the topic, purports that when done properly the method should reduce “subjective distress” and “acute symptomatology.” However, we know of no studies examining the potential effects of Socratic questioning on subjective distress or symptoms to date. In fact, it appears that there is only one published study that aimed to examine therapist use of Socratic questioning empirically (Calero-Elvira, Froján-Parga, Ruiz-Sancho, & Alpañés-Freitag, 2013). In a sample of seven patients that received treatment from a single cognitive behavioral therapist, verbal statements of reinforcement or punishment during Socratic dialogues were associated with respective increases or decreases in patient verbal behavior consistent with the goals of treatment. Although relevant to the potential therapeutic value of therapists’ interaction style, this study did not assess therapist use of questioning during such Socratic dialogues, and did not assess change in symptoms. To better understand the importance of Socratic questioning in CT, a technique believed to be instrumental to cognitive therapies (Beck et al., 1979; Beck et al., 2011), it is necessary to understand whether changes in therapist use of Socratic questioning translates to clinically meaningful change, such as treatment outcome.

Socratic questioning involves the therapist asking a series of graded questions to guide patient behavior and thought processes toward therapeutic goals. The therapist shapes patient behaviors in an effort to help patients develop and implement the skills emphasized in treatment (e.g., developing alternative responses to negative automatic thoughts; Beck et al., 1979; Beck, 1995; Calero-Elvira et al., 2013; Overholser, 1993). In using Socratic questioning, therapists avoid a didactic style and instead use questions to help patients develop new perspectives (Overholser, 2011; Padesky, 1993), as it is believed that active engagement can help in the learning process (Neenan, 2009). While
evidence for the facilitation of learning is limited in the context of psychotherapy, others have suggested that similar styles of interaction (e.g., powerless communication) may be effective methods of negotiation and persuasion (Grant, 2013).

Experts typically emphasize the use of open-ended questions aimed at helping patients consider new sources of information or adopt broader perspectives (Overholser, 2010; Padesky, 1993). The importance of using a Socratic approach has been emphasized, with experts suggesting the use of this approach helps patients to achieve cognitive change, use cognitive therapy skills, and obtain improvements in depressive symptoms (Neenan, 2009; Overholser, 2011; Padesky, 1993). Even outside of CT, Socratic questioning is a key strategy in several psychotherapies, perhaps most notably Motivational Interviewing (Miller & Rollnick, 2012). However, not all psychotherapy developers have shared the same view on Socratic questioning. For example, Rational Emotive Behavior Therapy is characterized by a particular emphasis on the utility of a didactic approach (Ellis & Dryden, 1997). Despite these issues being discussed by treatment developers for some time, there is little evidence to address the issue.

Therapist Adherence

Another important psychotherapy process variable is therapist adherence, or the degree to which a therapist utilizes the different theory-specified techniques of a manualized treatment (Feeley et al., 1999). In the study of CT for depression, two process-outcome studies have examined therapist adherence as a predictor of immediate (i.e., session-to-session) subsequent symptom change early in treatment (Strunk, Brotman, & DeRubeis, 2010; Strunk, Cooper, Ryan, DeRubeis, & Hollon, 2012). In light of the limitations of previous factor analyses, these studies utilized a more recent factor
analysis, which identified three dimensions of therapist adherence, including: Cognitive Methods, Negotiating/Structuring, and Behavioral Methods/Homework (Strunk et al., 2012). In addition to the adherence factors, the therapeutic alliance was also examined.

Therapist adherence to the Cognitive Methods factor refers to the therapist’s efforts to identify and evaluate the accuracy of a patient’s negative thought patterns, which includes the use of thought records. While therapist adherence to the Negotiating/Structuring factor refers to the degree to which the therapist encourages a collaborative effort to structuring therapy content, therapy pace, and time allocation to each agreed upon topic. Finally, therapist adherence to the Behavioral Methods/Homework factor refers therapist efforts to implement behaviorally-oriented strategies such as aiding the patient in using a daily activity log, increasing pleasure and mastery, and scheduling or structuring activities, as well as, assigning and reviewing homework related to any cognitive behavioral strategies (i.e., not limited to behavioral strategies).

Both studies used a session-to-session approach to examine the above three dimensions of therapist adherence as predictors of early session-to-session symptom change, which was assessed using the Beck Depression Inventory-II (BDI-II) administered at the beginning of each session. This session-to-session approach offers several advantages over previous process studies, which have typically examined these relationships over longer time intervals, often spanning from pre-to post-treatment. Therapist adherence and outcome are measured on a one-to-one basis, rather than allowing additional therapy sessions, and thus unmeasured therapist behavior to occur between the measurement of adherence and outcome (Webb et al., 2010). Research
suggests that process variables may exert their effects over such brief session-to-session time intervals (Tang & DeRubeis, 1999), and that the rate and degree of symptom change tends to be the greatest in early sessions (Tang & DeRubeis, 1999; Kelly, Roberts, & Ciesla, 2005; Tang et al., 2005). Consequently, any relationships between the adherence factors and outcome are likely to be evident in the early sessions if the hypothesized causal effects are truly operative. Finally, by assessing symptom severity at every session the authors were able to control for current symptom severity levels prior to each process-outcome interval. To accomplish this, BDI-II scores assessed at the current session were entered as a covariate (i.e., BDI-II scores at session 1 were entered as a covariate when examining adherence, assessed at the concurrent session, as a predictor of BDI-II scores at session 2, etc.).

Strunk and colleagues (2010) found that therapist adherence to Cognitive Methods was the strongest predictor of subsequent symptom change, such that greater adherence to Cognitive Methods was associated with a decrease in subsequent depressive symptoms. Negotiating/Structuring was also a significant predictor, in the same predicted direction. However, Strunk and colleagues (2012) identified different predictors of symptom change in their analyses of a subsequent trial, such that adherence to the Behavioral Methods/Homework factor was predictive of subsequent symptom change, but Cognitive Methods and Negotiating/Structuring were not. Although not directly tested, the authors highlighted the inclusion of antidepressant medication (ADM) and lesser-experienced therapists as compared to previous CT process studies (DeRubeis & Feeley, 1990; Feeley et al., 1999; Strunk et al., 2010) as possible explanations for the discrepant results.
While these studies considered methodological issues raised in the literature regarding previous process research by establishing temporal precedence of the predictor (i.e., ensuring that the predictor variable occurs prior to the outcome it is hypothesized to predict; Webb, DeRubeis, & Barber, 2010), these studies did not capitalize on the full potential of such repeated measures designs, which allow for the disaggregation of within-and between-patient variation in the predictor variables.

Within-and Between-Patient Disaggregation of Variables

Recently, several quantitative experts have explained inferential benefits of disaggregating raw process scores into scores reflecting within-patient and between-patient variability when analyzing repeated measures data (Allison, 2005; Curran & Bauer, 2011). The raw process scores represent a combination of within-and between-patient variability, which allows for process-outcome relations to be driven by either a true causal effect of the therapeutic process on outcome, or a spurious relation introduced by one or more stable patient characteristics (Curran & Bauer, 2011). When researchers using raw process scores interpret a significant process-outcome effect as evidence consistent with a potential causal effect on outcome, these analyses do not rule out possible spurious effects of stable between-patient differences.

Alternatively, a patient characteristic may be linked to both treatment response and therapist behaviors; even if these behaviors were not therapeutic, a relation with outcome could be present. In such a case, the relation of therapist behavior and outcome could be driven by between-patient effects, rather than reflecting a “dose-response” relationship of the variable of interest on outcome (i.e., within-patient effects). Thus, a
relation of process and outcome could be identified even in the absence of a true causal effect.

Psychotherapy researchers studying process-outcome relations largely have yet to capitalize on methods that allow disaggregation of raw process variables into within-and between-patient variance. One of the first to do so, Falkenström, Granström, and Holmqvist (2013) examined the therapeutic alliance assessed by the patient at each session as predictors of overall psychological distress in the following session. The sample consisted of 646 patients that participated in psychotherapy in a primary care setting (mean number of sessions attended was 4.6). The within-patient variation in the alliance significantly predicted session-to-session symptom change ($\beta = -.05$), however the effect was very small.

As noted above, obtaining repeated measures process data and utilizing a procedure, such as that proposed by Curran & Bauer (2011), offers several advantages. It allows researchers to maximize the utility of observational data by focusing on the effects of within-patient variability, ruling out spuriousness due to stable between-patient characteristics. Beyond this, such methods are well suited to address the conditions characteristic of longitudinal treatment studies in which the mean level of a process variable is expected to change across treatment (i.e., nonstationarity). However, this method does have one important limitation in that it cannot rule out spuriousness due to unknown time-varying effects; it only removes the potential influence of time-invariant or stable between-patient effects. Thus, we focus our analyses on within-patient variability in Socratic questioning and therapist adherence to CT, ensuring that no stable between-patient differences can confound the results. Moreover, if a true causal effect
exists, a relation of within-patient variability and outcome should be evident.

Focus of the Present Investigation

The primary purpose of this study is to examine the relation between therapist use of Socratic questioning and subsequent symptom change in CT for depression. As we detail in the Analytic Approach section, we use a session-to-session approach (Strunk et al., 2010; 2012), in which Socratic questioning in one session is examined as a predictor of depressive symptoms in the following session, while controlling for depressive symptoms in the current session. Using this same approach we examine therapist adherence to three dimensions of CT (i.e., Cognitive Methods, Negotiating/Structuring, and Behavioral Methods/Homework) as predictors of subsequent session-to-session symptom change.

This approach is well suited to capturing the relatively immediate (i.e., between session) effects of process variables identified in other studies of CT (Tang & DeRubeis, 1999). We focused on early sessions for two reasons. First, the rate and degree of symptom change appears to be greatest early in treatment (Tang & DeRubeis, 1999; Kelly, Roberts, & Ciesla, 2005). Second, we suspect the causal impact of Socratic questioning would be greatest early in treatment, when patients are likely to show the greatest variability in impeding or being resistant to the process of therapy. Consistent with this possibility, a group randomized to receive four sessions of Motivational Interviewing (an approach that uses Socratic questioning) exhibited significantly less resistance to CBT than a group that did not participate in Motivational Interviewing prior to CBT (Aviram & Westra, 2011). Following suggestions for analyzing panel data from Curran and Bauer (2011), we decomposed the raw Socratic process scores into scores
reflecting within-and between-patient variability, allowing us to effectively control for all stable between-patient differences and focus on the potential relation of within-patient variability in Socratic questioning and subsequent symptom change.
Chapter 2: Method

Participants

Participants were 67 depressed outpatients who participated in a 16-week course of CT as part of a separate study (see Adler, Strunk, & Fazio, 2014). As our analyses require outcome data through session 4 (described below), some patients were necessarily excluded. One patient discontinued treatment prior to the first session. In addition, 11 patients attended session 1, but dropped out of treatment prior to session 3. Thus, the final sample size was reduced to 55 patients. These 55 patients were largely Caucasian (89%); with 9% being African American and 2% Asian. 53% were women. Ages ranged from 18-69 years (M = 37.1, SD = 13.9).

We conducted a series of t-tests and found that those patients that were necessarily removed from the analyses did not differ from those remaining on either intake BDI scores or either facet of the alliance at session 1 (for which all patients had scores; all ps > .24). For Socratic questioning scores in session 1, a t-test using the Satterthwaite correction for unequal variance showed no difference between removed and included patients (included: M = 1.1, SD = .87; removed: M = .74, SD = .78; d = .44, \( t(15.3) = 1.41, p = .18 \).

Inclusion criteria were: (a) diagnosis of Major Depressive Disorder (MDD), according to DSM-IV criteria (APA, 1994); (b) 18 years or older; and (c) able and willing to give informed consent. Exclusion criteria were: (a) history of bipolar affective disorder
or psychosis; (b) current Axis I disorder other than MDD if it constituted the predominant aspect of the clinical presentation and if it required treatment other than that being offered; (c) subnormal intellectual potential (IQ below 80; assessed only when clinically indicated); (d) evidence of any medical disorder or condition that could cause depression; (e) clear indication of secondary gain (e.g., court ordered treatment or compensation issues); and (f) current suicide risk sufficient to preclude treatment on an outpatient basis.

Patients on medication at the initial evaluation agreed to maintain a stable dose over the course of treatment.

Procedure

Four advanced graduate students, with clinical experiencing ranging from 1 to 2 years prior to the study, provided cognitive therapy across 16-weeks of treatment. Therapists received approximately 100 hours of clinical training in CT, with a focus on experiential learning through role-play. Therapists received weekly individual and group supervision over the course of treatment from which the therapy session recordings were obtained. Daniel R. Strunk, Ph.D. provided supervision and training. Therapists followed procedures described in *Cognitive Therapy of Depression* by Beck et al. (1979). For additional details, see Adler et al. (2014).

Seventeen advanced undergraduate students rated video recordings of sessions 1 through 3. Each rater participated in approximately 50 hours of training prior to making the study ratings, and 4 additional hours of training during the rating period to minimize rater drift. To avoid any rater bias that might be related to knowledge of a patient’s other sessions, we randomly assigned therapy session recordings such that raters did not review more than one therapy session per patient. Each session recording was rated four times.
The average of these 4 ratings (i.e., the raw score for each patient and session) was further decomposed into within-patient and between-patient scores for each variable of interest, as described below.

**Analytic Approach**

Following Curran and Bauer (2011), we derived scores reflecting within-patient and between-patient variability from a series of ordinary least squares (OLS) regression models applied separately for each patient and variable. In these models, the variables of interest were examined as predictors of session number (mean-centered). To obtain the between-patient scores, we used the intercept of each of these models. Because time was mean centered, the intercepts reflect the estimate of each predictor variable mean at the midpoint of the sessions examined (i.e., session 2). To obtain the within-patient scores, we used the session-specific residuals of these models, which consist of the deviation of a patient’s score from the model predicted values at each session. This procedure requires at least 3 observations per patient for each variable, as otherwise the regression would perfectly fit the data, resulting in no residual values. By examining deviation from patient-specific slopes of the variables of interest, Curran and Bauer (2011) have argued that this approach avoids violating the assumption of stationarity (i.e., the assumption of no change in the mean level of a repeated measures predictor across time). To clarify this approach, we provide a step by step explanation of this disaggregation procedure for a single patient selected at random (see Appendix B). From this point forward, we will refer to these respective components as Socratic-within, Socratic-between, Cognitive-within, Cognitive-between, etc.
Our model of symptom change focused on session-to-session change following the first three sessions. We conducted repeated measures regression analyses using SAS Proc Mixed (without specification of random effects). In this analysis, BDI-II scores for each participant (i.e., BDI-II scores from sessions 2-4) were entered as the dependent variable. To account for prior symptom severity, the BDI-II score measured at the current session was entered as a covariate (i.e., BDI-II score at session 1 was entered as a covariate when predicting the BDI-II score at session 2, etc.). For each model, we conducted two sets of analyses: one analysis, which includes only the within-patient components of the variables of interest and to be comprehensive a second analysis, which includes both the within- and between-patient scores of the variables. However, the focus of our analyses and discussion will pertain to the within-patient processes, as they most reflect results consistent with a causal relationship.

While we believe that therapeutic outcome (e.g., symptom change) results from an amalgam of these different processes (which may not be wholly inclusive), and thus models should reflect multiple process predictors simultaneously; we first conducted single predictor regression models separately for each process variable (controlling for BDI at the current session and stable patient characteristics), due to concerns of compromising power when including all variables of interest simultaneously. After examining the single predictor models, we conducted multiple predictor regression models including observer ratings of all 4 process variables of interest. In a third step, we included observer ratings of two facets of the therapeutic alliance (i.e., Agreement and

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1 We conducted models with and without therapist specified as a random effect, but found no differences in model fit (i.e., -2 Residual Log Likelihood). Thus, we did not include therapist as a random effect.
Relationship) as covariates to rule out the alliance as a possible alternative explanation for any observed results in the final model.

We predict that greater than expected therapist use of Socratic questioning at a given session (i.e., Socratic-within) will predict a reduction of symptoms in the subsequent session, provided its hypothesized importance in the literature (Beck et al., 1979; Beck, 1995; Beck et al., 2011; Calero-Elvira et al., 2013; IAPT, 2007; Neenan, 2009; Overholser, 1993; 2010; 2011; Padesky, 1993; Rutter & Friedberg, 1999). Also, we predict that greater than expected therapist adherence to Cognitive Methods (i.e., Cognitive-within), at a given session will predict a reduction in symptoms in the subsequent session for a given patient, as it was found to be predictive in the most analogous study (Strunk et al, 2010).

Measures

Diagnostic

The Structured Clinical Interview for the DSM-IV Axis I disorders (SCID-I; First, Spitzer, Gibbon, & Williams, 2001) was used to assess Major Depressive Disorder (MDD). The reliability for a diagnosis of current MDD based on double-ratings for 12 cases was excellent (kappa = 1.00; see Adler, Strunk, & Fazio, 2014).

Depressive Symptoms

To assess depressive symptom severity, we used the 21-item self-report Beck Depression Inventory-II (Beck, Steer, & Brown, 1996), at the intake evaluation and at the beginning of each therapy session. The BDI-II is a commonly used measure to assess depressive symptoms and has been shown to have satisfactory reliability.
Socratic Questioning

For this study, we developed a 6-item Socratic Questioning Scale (SQS). SQS items are rated on a 7-point scale reflecting the amount that a therapist uses Socratic questioning in a given session, where higher scores represent greater therapist use. Items focus on the degree to which the therapist uses Socratic questioning (e.g., “Did the therapist use the Socratic Method?”), open-ended questions (e.g., “Did the therapist ask open-ended questions that require thoughtful reflection, related to developing alternative responses?”), and whether the therapist focused on developing alternative perspectives through questioning (e.g., “How frequently did the therapist ask questions of the patient in the service of using cognitive strategies focused on developing alternative perspectives?”).

Therapist Adherence

As previously mentioned, a factor analysis revealed three subscales that comprise therapist adherence to CT, including: Cognitive Methods, Negotiating/Structuring, and Behavioral Methods/Homework, which will serve as predictors of interest in this study (Strunk et al., 2012). A subset of the Collaborative Study Psychotherapy Rating Scale (CSPRS; Hollon et al., 1988) representing these factors was used to assess therapist adherence. The 9-item Cognitive Methods subscale measures therapist efforts to help the patient identify and re-evaluate thoughts to be more accurate. The 8-item Negotiating/Structuring subscale measures therapist efforts to collaboratively structure and negotiate therapy content with the patient. The 5-item Behavioral Methods/Homework subscale measures therapist efforts to implement behavioral strategies and also homework related to any cognitive behavioral strategies into therapy.
Therapeutic Alliance

While the primary purpose of this paper is to examine the relation of treatment-specified therapist behavior to outcome, the therapeutic alliance presents a potential confound to these analyses as it is often cited as having a small, but reliable association with symptom change in process research (Martin, Garske, & Davis, 2000; Horvath et al., 2011). Although this relationship was no longer significant when the analyses were limited to just those studies that considered temporal precedence and examined the alliance as a predictor of subsequent symptom change specifically (DeRubeis, Gelfand, German, Fournier, & Forand, 2013), we nonetheless decided to control for the alliance in our models to rule out its potential influence as a rival explanation for any observed effects.

We used the short form of the observer-rated Working Alliance Inventory (WAI-O-S; Horvath & Greenberg, 1989; Tracey & Kokotovic, 1989), which consists of 12 items evaluated on a 7-point Likert scale. The WAI is a commonly used measure of the alliance, and has shown satisfactory reliability. Following the two-factor solution identified by Andrusyna and colleagues (2001), we derived two subscale scores from the WAI-S. The Agreement score is the total of 9 items assessing the consensus between therapist and patient on the tasks and goals of treatment. The Relationship score is the total of 3 items assessing the strength of the mutual and affective bond between therapist and patient.
Psychometric Properties of the Scales

We calculated random effects intraclass correlation coefficients (ICCs) to evaluate the inter-rater reliability of our observer ratings (see Table 3). ICCs were adjusted to reflect the reliability achieved with 4 raters (McGraw & Wong, 1996).

Socratic Questioning

Socratic Questioning yielded an ICC of .79, indicating satisfactory inter-rater reliability. Additionally, the SQS demonstrates acceptable internal consistency, yielding Cronbach’s alpha coefficients ranging from .84-.89 across sessions 1-3.

Therapist Adherence

All three dimensions of the raw therapist adherence ratings showed satisfactory inter-rater reliability. Cognitive Methods yielded an ICC of .84, Behavioral Methods/Homework yielded a coefficient of .73, and Negotiating/Structuring yielded a coefficient of .79.

Therapeutic Alliance

The raw Agreement alliance subscale scores reached satisfactory inter-rater reliability yielding an ICC of .75. However, the ICC estimate for the Relationship alliance subscale yielded a weaker ICC of .49. It is important to note that non-significant effects with this lower ICC estimate should be interpreted with caution, as the lower reliability makes it more difficult to detect a true effect of interest.
Chapter 3: Results

Before conducting parametric statistical tests, it is important to examine the distributions for each variable of interest. The distribution of each variable was examined. Skewness and kurtosis were within the acceptable range for the distributions of the three dimensions of therapist adherence to CT (i.e., Cognitive Methods, Negotiating/Structuring, and Behavioral Methods/Homework), Socratic questioning and the two alliance subscales (i.e., Agreement and Relationship). Means and standard deviations of the within-and between-patient process variables are provided in Table 3. Additionally, the skewness and kurtosis of the dependent variable’s distribution, measured by the BDI-II, were within the acceptable range and did not require transformation. The mean BDI-II score at intake (M = 27.2, SD = 8.6) suggests that the sample was moderately depressed upon entering treatment on average. The interviewer evaluated 17-item Hamilton Rating Scale for Depression (HRSD-17; Hamilton, 1967) modified to include the assessment of atypical features also suggested a moderately depressed sample on average upon entering treatment (M = 20.8, SD = 4.7).

In the primary models, negative t-values would mean that any significant process-outcome relation is in the predicted direction, indicating that greater than expected therapist use of Socratic questioning or therapist adherence are associated with lower subsequent levels of depressive symptoms. We examined four covariance structures (i.e.,
auto-regressive, compound symmetry, toeplitz, and unstructured) and determined unstructured to have the best model fit of several fit statistics (i.e., -2 Residual Log Likelihood, AIC, AICC, and BIC).

**Exploratory Factor Analysis**

We conducted an exploratory factor analysis (EFA) on the items of the SQS scale. Because factor analytic methods for repeated measures data are not yet developed, and all ratings were assessed in the early phase of treatment, a time invariant factor structure was assumed. In order to account for dependency among the observations, all items were averaged across sessions for each patient, resulting in one patient-score per variable. A principal factor analysis was conducted using a Promax oblique rotation (Fabrigar et al., 1999). We used a parallel analysis to generate the eigenvalues that would be expected given a dataset of random variables with the same sample size and number of variables (Hayton, Allen, & Scarpello, 2004). We compared these eigenvalues to the eigenvalues obtained in the factor analysis to determine the number of factors to retain. As the eigenvalue for a one-factor solution was greater than the expected eigenvalues given a one or two-factor solution, a one-factor solution was retained. The factor loadings are provided in Table 2. The scree plot also indicated a one-factor solution. Thus, we used the average of the 6 items in the SQS as the estimate of therapist use of Socratic questioning.

**Single Predictor Models**

We conducted a series of single predictor regression models examining the within-patient process variables as predictors of subsequent session-to-session symptom change. Total symptom reduction from session 1 to session 4 was significant and
substantial ($d = 1.59, t = 5.58, p < .0001$). Among the 44 patients who completed treatment, symptom change over the session 1 to 4 interval accounted for 42.9% of the total symptom change that patients reported across 16 weeks of treatment.

**Socratic Questioning**

In our primary analysis, we examined the Socratic-within component as a predictor in a model of session-to-session symptom change. The Socratic-within component emerged as a significant predictor of subsequent symptom change ($r = -.33$, $t(54) = -2.57, b = -2.95, SE = 1.15, p = .013$), indicating that within patients, a one unit higher Socratic questioning score at a given session predicted a 2.95 unit improvement in BDI-II scores at the next session (see Table 4; after controlling for the BDI-II score at the current session).

Although we are primarily interested in whether within-patient variability predicts symptom change, to be comprehensive we conducted a model which included both the within-and between-patient components of Socratic questioning. In this model, the Socratic-within variable remained a significant predictor and the results were nearly identical to the previous model ($r = -.33, t(53) = -2.57, b = -2.92, SE = 1.14, p = .013$; see Table 5), which is likely due to the fact that by definition the within and between components are perfectly uncorrelated. The Socratic-between variable was not a significant predictor.

**Therapist Adherence**

We examined the within-patient components of the three dimensions of therapist adherence individually in separate regression models. Of the three, the Cognitive-within component significantly predicted subsequent symptom change (see Table 4; $r = -.26,$
\( t(54) = -2.01, b = -3.47, SE = 1.73, p = .049 \). Thus indicating that within patients, a one unit higher Cognitive Methods score at a given session predicted a 3.47 unit improvement in BDI-II scores at the next session (also after controlling for the BDI-II score at the current session).

Again, we conducted models which included both the within-and between-patient components of a given adherence variable (see Table 5). The Cognitive-within component emerged as the sole predictor of subsequent change at the level of a non-significant trend \( (r = -.25, t(54) = -1.87, b = -3.23, SE = 1.73, p = .067) \), while the Cognitive-between component was not predictive. None of the other adherence components emerged as predictors in these models.

**Multiple Predictor Models**

As these processes are likely acting conjunctively, we conducted a combined regression model including Socratic-within and all 3 within-patient dimensions of therapist adherence as predictors. Correlations among these variables are provided in Table 6.

*Socratic Questioning and Therapist Adherence*

We examined the within-patient components of Socratic questioning (i.e. Socratic-within) and three dimensions of therapist adherence (Cognitive-within, Behavioral-within, and Negotiating-within) as predictors together in a single model (see Table 7). In this model, Socratic-within remained a predictor of subsequent symptom change at the level of a non-significant trend \( (r = -.23, t(54) = -1.76, b = -3.64, SE = 2.07, p = .084) \), such that within patients, a one unit higher Socratic questioning score at a given session is associated with a 3.64 unit decrease in BDI-II scores at the next session.
(controlling for within-patient variability in the three dimensions of adherence, and BDI-II scores at the current session). None of the three dimensions of adherence were predictive in this model.

As before, we examined a secondary model that included the between-patient scores in addition to within-patient scores (see Table 8). In this model, Socratic-within remained a predictor of a reduction in symptoms at a non-significant trend \( (r = -.27, t(50) = -1.96, b = -4.04, SE = 2.06, p = .056) \). Negotiating-between emerged as a predictor in the expected direction, but also at a non-significant trend \( (r = -.26, t(50) = -1.93, b = -2.54, SE = 1.32, p = .059) \). This latter finding indicates that patients who received greater therapist adherence to Negotiating/Structuring tended to have lower subsequent symptom severity on average. While Behavioral-between significantly predicted subsequent change in this model \( (r = .30, t(50) = 2.14, b = 1.45, SE = .68, p = .04) \), it did so in the unexpected direction, such that patients with greater therapist adherence to Behavioral Methods/Homework tended to have higher subsequent symptom severity on average.

**Socratic Questioning and Therapist Adherence as Predictors Controlling for Two Facets of the Therapeutic Alliance**

We disaggregated the Relationship and Agreement alliance factors into scores reflecting both the within-and between-patient effects for each scale, and entered the two within-patient alliance factors as covariates into the previous model containing the within-patient components of the 3 adherence variables and Socratic questioning (see Table 9). Socratic-within remained a predictor of symptom change at the level of a non-significant trend \( (r = -.23, t(54) = -1.77, b = -3.70, SE = 2.10, p = .083) \), such that within patients, a one unit higher Socratic questioning score at a given session predicted a 3.7
unit decrease in BDI-II scores in the following session (controlling for within-patient variability in the three dimensions of adherence, two facets of the alliance, and also BDI-II scores at the current session). None of the other variables were predictive.

Our final model was identical to the previous model, except that it included the between-patient components for all four process variables of interest, and the between-patient alliance components as additional covariates (see Table 10). In this model, Socratic-within predicted symptom change at a non-significant trend in the predicted direction \((r = -.27, t(48) = -1.92, b = -3.94, SE = 2.05, p = .06)\). This result indicates that within patients, a one unit higher Socratic questioning score at a given session predicted a 3.94 unit decrease in BDI-II scores in the following session (controlling for both within- and between-patient variability in the three dimensions of adherence, two facets of the alliance, and also BDI-II scores at the current session). Also, Negotiating-between predicted symptom change at the level of a non-significant trend \((r = -.26, t(48) = -1.85, b = -2.59, SE = 1.40, p = .07)\), such that those patients who received greater therapist adherence to Negotiating/Structuring tended to have lower subsequent symptom severity on average.
Chapter 4: Discussion

The purpose of this study was to examine the association of treatment-specified therapist behaviors to subsequent session-to-session symptom change early in CT for depression. We assessed therapist use of Socratic questioning, and also therapist adherence to three dimensions of CT for depression (i.e., Cognitive Methods, Behavioral Methods/Homework, and Negotiating/Structuring) identified by Strunk and colleagues (2012). More specifically, we examined within-patient variability in these process variables (i.e., Socratic-within, Cognitive-within, Behavioral-within, Negotiating-within) as predictors of symptom change, ruling out all stable between-patient characteristics, as such an association would be consistent with what one would expect given a true causal relationship.

To our knowledge, our study provides the first empirical support for the relationship of therapist use of Socratic questioning and subsequent change in depressive symptoms, where greater use of Socratic questioning is significantly predictive of decreases in symptoms. More specifically, greater than expected Socratic questioning at a given session (i.e., Socratic-within) significantly predicted a reduction in depressive symptoms (BDI-II) in the following session ($r = -.33$), controlling symptom severity at the current session. If Socratic questioning has a true causal relation on outcome, one would expect a within-patient Socratic-outcome relation to be evident. Our results
provide such evidence as the relations identified were driven by patient-specific variation in therapist use of Socratic questioning across sessions.

In a separate model, Cognitive-within also emerged as a significant predictor of subsequent symptom change ($r = -.26$). To compare, Strunk and colleagues (2010) found a significant relation of Cognitive Methods and subsequent session-to-session symptom change using a similar model, but yielded a larger effect size ($r = -.44$). While there does appear to be a relation of within-patient variability in Cognitive Methods and subsequent symptom change, one possible explanation for this discrepancy is that the results obtained by Strunk and colleagues were partially driven by stable between-patient differences inherent in the raw scores that were used as predictors. Whereas, these stable between-patient differences were ruled in the current study. Finally, the remaining two within-patient adherence components (i.e. Behavioral-within and Negotiating-within) were not predictive in their respective regression models.

Following the individual predictor models, we conducted a series of multiple predictor regression models. In the first, we entered Socratic-within, Cognitive-within, Behavioral-within, and Negotiating-within as predictors (in addition to current session BDI-II score as a covariate). Socratic-within predicted symptom change at the level of a non-significant trend in the expected direction ($r = -.23$), holding all 3 within-patient components of therapist adherence constant. In the same model, Cognitive-within no longer predicted subsequent change, nor did the other two within-patient dimensions of adherence (holding all other remaining variables constant in each case). While the relation of Socratic questioning and symptom change was no longer significant, it remained a non-significant trend with a similar effect size. Thus, this difference in
significance likely has as much to do with the loss of statistical power due to the addition of the remaining variables of interest as to any loss of predictive power attributable to the shared predictive ability of the additional predictor variables examined.

As the therapeutic alliance has been found to predict symptom change (Horvath et al., 2011), we also examined the 4 process variables of interest as predictors while controlling for two facets of the alliance identified by Andrusyna and colleagues (2001; Relationship and Agreement). We disaggregated each of the Relationship and Agreement alliance facets into scores reflecting the within- and between-patient variability in the raw alliance scores, and entered the Relationship-within and Agreement-within factors as covariates into the model outlined in the previous paragraph. In this model, Socratic-within remained a predictor of symptom change at a non-significant trend in the expected direction \( r = -0.23 \), holding the within-patient variability in the three dimensions of adherence and two dimensions of the alliance constant. None of the other process variables were predictive. Although the Socratic-outcome relationship shifted to a non-significant trend in these multiple predictor models, this relationship appears to be rather robust in terms of the effect size, which decreased only slightly with the addition of the adherence variables, and did not decrease further with the addition of the alliance variables as covariates.

Limitations

There are several limitations to this study. First, the study is a naturalistic observational design in which there was no experimental manipulation of the predictor variables. Even though we have established that there is significant covariation between Socratic questioning and subsequent symptom change (BDI-II), and ruled out time-
invariant patient characteristics, we cannot rule out the possibility that time-variant third variable confounds are driving the observed relation.

Second, our study design and focus may have limited the generalizability of our findings to other treatments and populations, as we focused our analysis on the early treatment sessions in cognitive therapy for depression. We chose to focus on early sessions of CT for depression since the rate and degree of symptom change are greatest early in treatment (Tang & DeRubeis, 1999; Kelly, Roberts, & Ciesla, 2005), and examined these effects over session-to-session intervals to capture the relatively immediate (i.e., between session) effects of process variables identified in other studies of CT (Tang & DeRubeis, 1999). Nonetheless, our data do not speak to process-outcome relations that might be observed with assessments later in treatment, alternative treatment approaches, or any delayed effects that are not captured in a session-to-session model.

Third, a review of the literature reveals that there have been relatively few publications outlining the specific components inherent to the Socratic method in psychotherapy (Overholser, 1993). Additionally, Carey and Mullan (2004) have explained that Socratic questioning can be characterized by whether therapists ask questions with or without a desired conclusion in mind. In part because it would be difficult to make this distinction using observer ratings, our measures do not distinguish between these approaches. This distinction has been termed the “guided discovery” approach versus the “changing minds” approach to the Socratic method (Padesky, 1993), or “exploratory questioning” versus “persuasive questioning,” respectively (Carey & Mullan, 2007).
From the exploratory questioning perspective, the cognitive therapist acts as a guide, as opposed to an expert with a direction or conclusion in mind (Overholser, 1995; 2011; Padesky, 1993), to engage the patient in a process of discovering their cognitions and possible alternative explanations (Rutter & Friedberg, 1999). Additionally, this process is best accomplished by asking open-ended questions, which allow for a broad range of patient responses, ideas, and alternatives (Overholser 1987; 2010). In reference to the persuasive questioning approach, several authors describe the Socratic method as a process by which the therapist uses their expertise in conjunction with leading questions to direct the patient to desired conclusions and insights regarding their problems (see Carey & Mullan, 2004; Diaz-Guerrera, 1959). Nonetheless, this distinction in therapists’ approach to Socratic questioning will be important to evaluate and consider in future research. Our study focused on Socratic questioning implemented through open-ended questions, or a fundamental aspect of the exploratory questioning approach (Overholser 1987; 2010; Padesky, 1993) for two main reasons.

As this is an observational design, we thought it would be difficult for observers to reliably rate whether a therapist has mentally formulated a set of more adaptive or accurate beliefs to which to lead the patient, inherent in the exploratory questioning approach. Consequently, it would be necessary to design a scale to be completed by the therapist regarding their mental formulations and attempts to lead the patient to desired conclusions and beliefs. This would allow an empirical comparison of the relative utility of either approach and possibly clarify the discrepancies in the literature. Additionally, it has been shown that cognitive therapy trainees and students pursuing their doctorate in clinical psychology have difficulty distinguishing between question types such as open-
ended versus closed-ended (i.e., leading questions; James, Milne, & Morse, 2008), and may be more effective rating a single question type at a time when conducting observer ratings.

Conclusion

This study offers the first empirical support for the association between therapist use of Socratic questioning and subsequent symptom change in CT for depression. Although the observed Socratic-outcome relationship shifted to a non-significant trend in the multiple predictor models, this relationship appears to be rather robust in terms of the effect size, which decreased only slightly with the addition of the three dimensions of therapist adherence, and remained stable with the addition of the alliance variables. Also, our study offers support for the relationship observed by Strunk and colleagues (2010) of therapist adherence to Cognitive Methods in CT and subsequent session-to-session symptom change early in treatment. We focused our analyses on within-patient processes as predictors of symptom change, as such an effect would be most consistent with what one would expect given a true causal process-outcome relationship. If replicated, this association between Socratic questioning and symptom change would have important implications for dissemination and training efforts. Future research should focus on examining the relation of within-patient variation in Socratic questioning to subsequent therapeutic outcome. Finally, future research efforts should focus on examining any differences in relative patient outcome as a function of therapists emphasizing either an “exploratory questioning” approach or a “persuasive questioning” approach to the Socratic method.
References


Appendix A: Tables
Table 1. Demographics for the 55 Patients

<table>
<thead>
<tr>
<th>Patient Demographics</th>
<th>Frequency</th>
<th>Percent</th>
<th>Mean (SD)</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-</td>
<td>-</td>
<td>37.1 (13.9)</td>
<td>18-69</td>
</tr>
<tr>
<td>Married/co-habitating</td>
<td>19</td>
<td>35%</td>
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<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Male</td>
<td>26</td>
<td>47%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>29</td>
<td>53%</td>
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<td></td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 6 or less</td>
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<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 7-12 (No graduates)</td>
<td>1</td>
<td>2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduated HS or equivalent</td>
<td>3</td>
<td>6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part College</td>
<td>17</td>
<td>31%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduated 2 year college</td>
<td>5</td>
<td>9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduated 4 year college</td>
<td>14</td>
<td>26%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part graduate/professional</td>
<td>6</td>
<td>11%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completed grad/professional</td>
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<td>13%</td>
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<tr>
<td>Education (other)</td>
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</tr>
<tr>
<td>Income</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Not Listed</td>
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<td>13%</td>
<td></td>
<td></td>
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<tr>
<td>Under $10,000</td>
<td>10</td>
<td>18%</td>
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<tr>
<td>$10-29,000</td>
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<td>26%</td>
<td></td>
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</tr>
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<td>$30-49,999</td>
<td>6</td>
<td>11%</td>
<td></td>
<td></td>
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<tr>
<td>$50-69,999</td>
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<td>$70-89,999</td>
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<td>Over $90,000</td>
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<tr>
<td>Race</td>
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<tr>
<td>Caucasian</td>
<td>49</td>
<td>89%</td>
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<tr>
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<tr>
<td>Asian</td>
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Table 2. Factor Loadings for the Socratic Questioning Factor

<table>
<thead>
<tr>
<th>Socratic Items</th>
<th>Factor 1 Loadings</th>
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<tbody>
<tr>
<td>1. Socratic Method Overall</td>
<td>.88</td>
</tr>
<tr>
<td>2. Questions: Open-ended</td>
<td>.68</td>
</tr>
<tr>
<td>3. Questions: Alt. Perspectives</td>
<td>.92</td>
</tr>
<tr>
<td>4. Questions: Follow-up</td>
<td>.76</td>
</tr>
<tr>
<td>5. Questions: Key Cognitions</td>
<td>.92</td>
</tr>
<tr>
<td>6. Questions: Basic CBT</td>
<td>.84</td>
</tr>
<tr>
<td>Process Components</td>
<td>M</td>
</tr>
<tr>
<td>--------------------</td>
<td>-----</td>
</tr>
<tr>
<td><strong>Socratic</strong></td>
<td></td>
</tr>
<tr>
<td>Socratic-within</td>
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<tr>
<td>Socratic-between</td>
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<tr>
<td><strong>Therapist Adherence</strong></td>
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</tr>
<tr>
<td>Cognitive-within</td>
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<td>Cognitive-between</td>
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<td>Behavioral-within</td>
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<tr>
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</tr>
<tr>
<td>Negotiating-within</td>
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</tr>
<tr>
<td>Negotiating-between</td>
<td>1.58</td>
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<td><strong>Therapeutic Alliance</strong></td>
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<tr>
<td>Agreement-within</td>
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<tr>
<td>Relationship-between</td>
<td>11.60</td>
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</table>

Note: For each process measure, the mean and standard deviation was calculated for both of the within-and between-patient process variable scores across sessions 1-3. The raw score ICC values represent the inter-rater reliability estimates for each set of raw process variable ratings (i.e., process score ratings prior to disaggregating the within and between-patient components), where values closer to 1.00 indicate better inter-rater agreement for a given variable.
Table 4. Single Predictor Models: Examining within-patient process scores as predictors of subsequent session-to-session symptom change on the BDI-II

<table>
<thead>
<tr>
<th>Process Variables</th>
<th>$r$</th>
<th>$t$</th>
<th>$b$</th>
<th>SE</th>
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<tr>
<td><strong>Socratic</strong></td>
<td></td>
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<tr>
<td>Socratic-within</td>
<td>-.33</td>
<td>-2.57*</td>
<td>-2.95</td>
<td>1.15</td>
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<tr>
<td><strong>Adherence</strong></td>
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<tr>
<td>Cognitive-within</td>
<td>-.26</td>
<td>-2.01*</td>
<td>-3.47</td>
<td>1.73</td>
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<tr>
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<td>.10</td>
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<td>.16</td>
<td>.52</td>
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<td>Agreement-within</td>
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<td>-.06</td>
<td>-.46</td>
<td>-.51</td>
<td>1.10</td>
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</table>

Note: SE = standard error of the $b$-coefficients. The values represent results from separate single predictor regression models, but were summarized in one table for comparison. (* $p < .05$). BDI-II score at the current session was entered as a covariate.
Table 5. Single Predictor Models: Examining within and between-patient process scores as predictors of subsequent session-to-session symptom change on the BDI-II

<table>
<thead>
<tr>
<th>Process Variables</th>
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<tbody>
<tr>
<td></td>
<td>$r$</td>
<td>$t$</td>
<td>$b$</td>
<td>SE</td>
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<tr>
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<td></td>
</tr>
<tr>
<td>Socratic-within</td>
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<td>-2.57*</td>
<td>-2.92</td>
<td>1.14</td>
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<tr>
<td>Socratic-between</td>
<td>-.17</td>
<td>-1.28</td>
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<td>.48</td>
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<td>-.72</td>
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<tr>
<td>Relationship-between</td>
<td>-.22</td>
<td>-1.64</td>
<td>-.49</td>
<td>.30</td>
</tr>
</tbody>
</table>

Note: SE = standard error of the $b$-coefficients. The values represent results from separate models in which both the within-and between-patient scores were entered for each process variable (e.g., Socratic-within and Socratic-between were entered into model 1 as predictors, etc.). Results were summarized in one table for comparison. (* $p < .05$, † $p = .067$). BDI-II score at the current session was entered as a covariate for each model.
Table 6. Correlation Matrix of Within-Patient Process Variable Components Averaged across Sessions 1-3

<table>
<thead>
<tr>
<th>Process Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive-within</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behavioral-within</td>
<td>.01&lt;sup&gt;0/3&lt;/sup&gt;</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negotiating-within</td>
<td>.30&lt;sup&gt;3/3&lt;/sup&gt;</td>
<td>.07&lt;sup&gt;3/3&lt;/sup&gt;</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socratic-within</td>
<td>.78&lt;sup&gt;3/3&lt;/sup&gt;</td>
<td>-.05&lt;sup&gt;3/3&lt;/sup&gt;</td>
<td>.40&lt;sup&gt;3/3&lt;/sup&gt;</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agreement-within</td>
<td>.18&lt;sup&gt;0/3&lt;/sup&gt;</td>
<td>.03&lt;sup&gt;0/3&lt;/sup&gt;</td>
<td>.05&lt;sup&gt;0/3&lt;/sup&gt;</td>
<td>.15&lt;sup&gt;0/3&lt;/sup&gt;</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Relationship-within</td>
<td>.04&lt;sup&gt;0/3&lt;/sup&gt;</td>
<td>.19&lt;sup&gt;0/3&lt;/sup&gt;</td>
<td>.09&lt;sup&gt;0/3&lt;/sup&gt;</td>
<td>.00&lt;sup&gt;0/3&lt;/sup&gt;</td>
<td>.49&lt;sup&gt;3/3&lt;/sup&gt;</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Note: Correlation values were averaged across sessions 1-3. Correlation r-values were first transformed into Z-scores before calculating the averages, which were then transformed back into r-values after the average values were obtained. Fractions indicate the number of sessions (out of three) at which a correlation achieved statistical significance.
Table 7. Multiple Predictor Model: Examining within-patient Socratic and adherence scores as predictors of subsequent session-to-session symptom change on the BDI-II

<table>
<thead>
<tr>
<th>Process Variables</th>
<th>$r$</th>
<th>$t$</th>
<th>$b$</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socratic-within</td>
<td>-.23</td>
<td>-1.76†</td>
<td>-3.64</td>
<td>2.07</td>
</tr>
<tr>
<td>Cognitive-within</td>
<td>.03</td>
<td>.21</td>
<td>.63</td>
<td>2.95</td>
</tr>
<tr>
<td>Behavioral-within</td>
<td>.12</td>
<td>.92</td>
<td>1.36</td>
<td>1.49</td>
</tr>
<tr>
<td>Negotiating-within</td>
<td>.13</td>
<td>.96</td>
<td>3.12</td>
<td>3.26</td>
</tr>
</tbody>
</table>

Note: SE = standard error of the $b$-coefficients. The values represent results from a single combined model in which all 4 process variables were entered as predictors. († $p = .08$). BDI-II score at the current session was entered as a covariate.
Table 8. Multiple Predictor Model: Examining within-and between-patient Socratic questioning and adherence components as predictors of subsequent session-to-session symptom change on the BDI-II

<table>
<thead>
<tr>
<th>Process Variables</th>
<th>$r$</th>
<th>$t$</th>
<th>$b$</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socratic-within</td>
<td>-.27</td>
<td>-1.96†</td>
<td>-4.04</td>
<td>2.06</td>
</tr>
<tr>
<td>Socratic-between</td>
<td>-.05</td>
<td>-.34</td>
<td>-.39</td>
<td>1.15</td>
</tr>
<tr>
<td>Cognitive-within</td>
<td>.06</td>
<td>.44</td>
<td>1.33</td>
<td>2.99</td>
</tr>
<tr>
<td>Cognitive-between</td>
<td>.05</td>
<td>.37</td>
<td>.58</td>
<td>1.57</td>
</tr>
<tr>
<td>Behavioral-within</td>
<td>.09</td>
<td>.65</td>
<td>.96</td>
<td>1.49</td>
</tr>
<tr>
<td>Behavioral-between</td>
<td>.30</td>
<td>2.14*</td>
<td>1.45</td>
<td>.68</td>
</tr>
<tr>
<td>Negotiating-within</td>
<td>.13</td>
<td>.90</td>
<td>2.94</td>
<td>3.26</td>
</tr>
<tr>
<td>Negotiating-between</td>
<td>-.26</td>
<td>-1.93†</td>
<td>-2.54</td>
<td>1.32</td>
</tr>
</tbody>
</table>

Note: SE = standard error of the $b$-coefficients. The values represent results from a single regression model in which all 8 process components were entered as predictors. ($^* p < .05$, $^† ps < .06$). BDI-II score at the current session was entered as a covariate.
Table 9. Multiple Predictor Model: Examining within-patient process scores as predictors of subsequent session-to-session symptom change on the BDI-II while controlling for within-patient variability in two facets of the therapeutic alliance.

<table>
<thead>
<tr>
<th>Process Variables</th>
<th>$r$</th>
<th>$t$</th>
<th>$b$</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socratic-within</td>
<td>-.23</td>
<td>-1.77†</td>
<td>-3.70</td>
<td>2.10</td>
</tr>
<tr>
<td>Cognitive-within</td>
<td>.04</td>
<td>.26</td>
<td>.79</td>
<td>3.00</td>
</tr>
<tr>
<td>Behavioral-within</td>
<td>.15</td>
<td>1.09</td>
<td>1.71</td>
<td>1.56</td>
</tr>
<tr>
<td>Negotiating-within</td>
<td>.14</td>
<td>1.02</td>
<td>3.39</td>
<td>3.33</td>
</tr>
<tr>
<td>Agreement-within</td>
<td>.06</td>
<td>.42</td>
<td>.19</td>
<td>.46</td>
</tr>
<tr>
<td>Relationship-within</td>
<td>-.10</td>
<td>-.74</td>
<td>-.94</td>
<td>1.27</td>
</tr>
</tbody>
</table>

Note: SE = standard error of the $b$-coefficients. The values represent results from a single regression model in which all 6 process components were entered as predictors. († $p = .08$). BDI-II score at the current session was entered as a covariate.
Table 10. Multiple Predictor Model: Examining within-and between-patient process scores as predictors of subsequent session-to-session symptom change on the BDI-II while controlling for two facets of the therapeutic alliance

<table>
<thead>
<tr>
<th>Process Variables</th>
<th>r</th>
<th>t</th>
<th>b</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socratic-within</td>
<td>-.27</td>
<td>-1.92†</td>
<td>-3.94</td>
<td>2.05</td>
</tr>
<tr>
<td>Socratic-between</td>
<td>-.01</td>
<td>-.10</td>
<td>-.12</td>
<td>1.19</td>
</tr>
<tr>
<td>Cognitive-within</td>
<td>.08</td>
<td>.52</td>
<td>1.55</td>
<td>2.98</td>
</tr>
<tr>
<td>Cognitive-between</td>
<td>.00</td>
<td>-.02</td>
<td>-.04</td>
<td>1.66</td>
</tr>
<tr>
<td>Behavioral-within</td>
<td>.11</td>
<td>.80</td>
<td>1.24</td>
<td>1.54</td>
</tr>
<tr>
<td>Behavioral-between</td>
<td>.18</td>
<td>1.27</td>
<td>.99</td>
<td>.78</td>
</tr>
<tr>
<td>Negotiating-within</td>
<td>.16</td>
<td>1.15</td>
<td>3.75</td>
<td>3.28</td>
</tr>
<tr>
<td>Negotiating-between</td>
<td>-.26</td>
<td>-1.85†</td>
<td>-2.59</td>
<td>1.40</td>
</tr>
<tr>
<td>Agreement-within</td>
<td>.06</td>
<td>.39</td>
<td>.18</td>
<td>.45</td>
</tr>
<tr>
<td>Agreement-between</td>
<td>.13</td>
<td>.94</td>
<td>.14</td>
<td>.14</td>
</tr>
<tr>
<td>Relationship-within</td>
<td>-.14</td>
<td>-1.00</td>
<td>1.26</td>
<td>1.25</td>
</tr>
<tr>
<td>Relationship-between</td>
<td>-.19</td>
<td>-1.31</td>
<td>-.77</td>
<td>.59</td>
</tr>
</tbody>
</table>

Note: SE = standard error of the $b$-coefficients. The values represent results from a single regression model in which all 12 process components were entered as predictors. († $p < .07$). BDI-II score at the current session was entered as a covariate.
Appendix B: Single Patient Example of Disaggregation Approach
To provide a more detailed example of our analytic approach, we selected a single patient at random (We will refer to this patient as Patient 1), and provided a step by step explanation of the procedure, and also important considerations throughout the process.

**Step 1: Raw Score Calculation**

First we calculated the raw Socratic questioning score at each session for Patient 1 by calculating the average of the 6 items in the Socratic Questioning Scale (each item was scored on a scale ranging from 0-6), resulting in a single mean Socratic questioning score per session. The raw Socratic questioning scores at each session (i.e. S1, S2, S3) for Patient 1 are as follows:

- S1: 0.42
- S2: 1.68
- S3: 2.58

**Step 2: Assessing the Data for an Underlying Time Trend**

One way of disaggregating panel data into scores reflecting within- and between- patient variability for a given patient, is to use the person-mean centering approach (Allison, 2005; Curran and Bauer 2011). In this approach, the mean of a patient’s repeated scores on a particular variable is calculated. Next, mean difference scores are obtained by subtracting this patient-specific mean from each of the patient’s individual scores for that variable (i.e., Score 1 – Mean, Score 2 – Mean, etc.). These mean difference scores reflect the degree to which each distinct score deviates from that patient’s mean for that variable (i.e., Within-patient variability), and the mean reflects the between-patient estimate on that variable for the patient. However, this approach is only effective if there is no underlying trend in the patient’s scores for that variable across time.

Following Curran and Bauer (2011), we graphed the conditional distributions of the Socratic questioning scores for all patients as a function of time (i.e., Session), to better understand whether there is an underlying time trend in the data. This graph is presented below.
Based on the above figure, it appears that the time-specific means (as indicated by the diamond symbol in each boxplot) vary as a function of time. (Note: the horizontal line represents the overall mean of the raw Socratic scores \(M = 2.00, \text{SD} = 1.08\) across sessions.

Therefore, it seems that the person-mean centering approach to disaggregating the raw Socratic scores is not ideal in this case, as it implicitly assumes that the variable of interest is independent of time (i.e., Session). Thus, this approach would fail to accurately capture within-patient variations around this time trend, and would instead ignore the trend altogether. This will become more clear in the following steps.

This time trend is not only an issue for accurately estimating within-patient variability for these scores, but it also violates the model assumption of stationarity (i.e., the
assumption of no change in the mean level of a repeated measures predictor across time.

So, why is this an issue? Well, the purpose of a time series analysis is to examine the way in which the values of time series are related to a particular variable of interest. However, when you introduce a time trend in the time series data, it is difficult to differentiate whether any observed process-outcome relations are specific to the process variable and outcome of interest, or if the observed relations are merely an artifact of the time trend in the repeated measures data.

**Step 3: Session-mean Centering**

Next we mean-centered the session variable, again for reasons that will become clear in a later step. As there were 3 sessions per patient, the mean of the session numbers was 2, and thus the mean-centered session values are -1, 0, 1.

**Step 4:**

To better understand the issues with using the person-mean centering approach in this context, we plotted the raw Socratic scores for Patient 1 as a function of time (Session mean-centered).

**Figure 2. Raw Socratic Questioning Scores for Patient 1 as a Function of Time (Session mean-centered)**
In this figure, the black points on the plot reflect the raw Socratic process scores at each session for Patient 1, and the black line is the patient-specific regression line estimating the relation of Socratic questioning and time for Patient 1. The horizontal dashed line represents the person-mean (M = 1.68) for the 3 raw Socratic scores for Patient 1.

In using the person-mean centering approach on Patient 1’s data, we examined the degree to which Patient 1’s raw observed Socratic scores (i.e. black data points) varied around the patient-specific mean (i.e. dashed horizontal line). We obtained the following mean-centered scores at each session:

\[
\text{Observed Socratic Scores (raw) - Mean (Socratic) = Mean-centered Scores}
\]

S1: \[0.42 - 1.68 = -1.26\]
S2: \[2.42 - 1.68 = .74\]
S3: \[2.21 - 1.68 = .53\]

Even before graphing these values, it is clear that the time trend remains. The graph below reflects these mean-difference scores across time for Patient 1.

Figure 3: Person-mean Centered Socratic Scores for Patient 1 across Time (Session mean-centered)
As is clearly indicated by the above plot of Patient 1’s person-mean centered scores, this approach did not take into account the trend over time, and thus a positive linear trend persists. The failure of this approach to account for the time trend leads to biased estimates of the within-patient variability in Patient 1’s Socratic scores.

Referring back to Figure 2, this approach estimates that Patient 1’s raw Socratic score at the first session (i.e., mean-centered session -1) deviates from the person-specific mean (i.e., dashed horizontal line) by 1.26 points, or an absolute difference that is nearly 2.5 times greater than the estimated deviation at mean-centered session 1 (i.e., session 3) using this method. However, if we look at the patient-specific regression line, we can see that taking into account the residuals (i.e., deviations from the patient-specific slope) at the mean-centered sessions -1 and 1 (i.e., sessions 1 and 3) are quite similar.

Step 5:

Curran and Bauer (2011) proposed that in these situations, in which a linear trend across time is observed, it may be more appropriate to deviate the raw scores from the patient-specific regression line, as opposed to using the fixed mean estimate (i.e. dashed horizontal line in Figure 2). Such a regression based approach still assesses the individual variation in the patient’s scores respective to their mean, but it takes into account the trend across time that we observed in the data, and thus is a less biased estimate of within-patient variability as compared to the person-mean centering approach.

For this approach, we conducted a regression model using Proc Reg in SAS, in which we examined session (mean-centered) as a predictor of Patient 1’s three raw Socratic scores, resulting in the patient-specific regression line in Figure 2. We output the session-specific residuals, which reflect the deviations of Patient 1’s raw Socratic scores from the patient-specific regression line (i.e., within-patient variability). We also output the intercept from this same regression model as the estimate of between-patient variability. As session was mean centered in this model, the patient-specific intercept reflects Patient 1’s mean Socratic score at the midpoint of the sessions examined (i.e., the point at which the mean-centered session 0 meets the regression line in Figure 2). The resulting residual values for the patient-specific regression model regressing the raw Socratic scores for Patient 1 on time are as follows.

<table>
<thead>
<tr>
<th>Observed Socratic Scores (raw) - Model Predicted Values</th>
<th>Session-specific Residuals</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1: 0.42 – .79 = -.37</td>
<td></td>
</tr>
<tr>
<td>S2: 2.42 – 1.68 = .74</td>
<td></td>
</tr>
<tr>
<td>S3: 2.21 – 2.58 = -.37</td>
<td></td>
</tr>
</tbody>
</table>

As is evident from the above residual values, centering the values around the patient-specific regression line does not lead to the biased estimates in within-patient variability as seen using the person-mean centering approach. More specifically, we do not see the
large discrepancy in the deviation of Patient 1’s raw Socratic scores from the patient-specific mean at the first session as compared to the last. In fact, in taking into account the time trend in the data, the deviations from the patient-specific regression line (i.e., session-specific residuals) for the first and last session are identical (Figure 4), which is expected given the nature of the time trend that we see in Figure 2.

Figure 4: Session-specific Residuals Reflecting Patient 1’s Within-patient Variability in Socratic Scores across time (mean-centered session)

In Figure 4, we can see that not only did the patient-specific regression centering approach provide estimates of within-patient variability with respect to the trend in time, but it detrended the data such that the positive trend of the Socratic scores is no longer evident.

Step 6:

Repeat steps 1, 3, and 5 for each patient’s raw Socratic scores (and later for each of the 3-dimensions of adherence and two facets of the alliance to obtain estimates of within-and between-patient variability and also to detrend any time effects in these variables).

(Note: that if there is not a time trend in the data for a specific variable, this approach is still appropriate. This is because the patient-specific regression line would be flat across time in this case, and thus would effectively mimic the person-mean centering approach).
Step 7:

After completing Step 6 for all patients on the Socratic questioning scores. We revisited the session-specific distributions of the Socratic scores as a function of session across all patients by plotting the detrended session-specific residual estimates of within-patient variability (Figure 5) across patients. We can see that these residual values, which again reflects within-patient variability in the Socratic questioning scores, no longer violate the model assumption of stationarity in that there is no longer a difference in session-specific Socratic means across patients and time.

Figure 5. The Session-specific Distributions of the Patient-specific Socratic Residuals over Time

Step 8:

Having shown that this approach accomplishes our goals of isolating the within-patient variability in the raw scores, we entered these residual values into the session-to-session model to assess within-patient variability in these scores as predictors of
session-to-session symptom change. In a series of secondary analyses we included the estimates of between-patient variability as predictors in addition to the within-patient residual estimates.