

EXAMINING DYNAMIC INTERPERSONAL PROCESSES ASSOCIATED WITH ALLIANCE
RUPTURE IN PSYCHOTHERAPY

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ABSTRACT

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Alliance ruptures refer to tensions and negative processes between therapist and patient. Identifying ruptures is important because research shows that ruptures play an important role in establishing therapeutic alliance and in promoting therapeutic changes. However, previous studies have not used within-person methodology to explore the dynamic and dyadic processes of interpersonal behaviors in ruptures and thus there is little evidence to guide clinicians in the identification of ruptures. The current study utilizes an intensive single-case analytic approach to examine how patients' and therapists' dominance, warmth, and interpersonal complementarity are associated with in-session confrontation ruptures and withdrawal ruptures in sixteen adult psychotherapy sessions from eight independent therapeutic dyads. Interpersonal behaviors and ruptures were coded and processed at a half-minute interval. Dynamic factor analysis models were fit to examine the relationships between interpersonal variables and ruptures for each single session. Generalizability was examined by comparing results within dyads and across dyads. Patient's increased cold or dominant behaviors, as well as the dyad's increased dominance complementarity, were related with confrontation ruptures in more than one third of the sessions. Therapist's decreased dominant behaviors and patient's increased dominant behaviors were related with withdrawal ruptures in more than one third of the sessions. The results also identified dyad- and session-specific patterns that did not generalize across cases but may be of clinical interest. These findings highlight the important roles of both therapists' and patients' behaviors as well as their synchronization on dominance in the development of alliance ruptures,

extended our knowledge on within-person interpersonal dynamics associated with ruptures, and emphasized the need to examine both idiographic and nomothetic processes of alliance ruptures.

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INTRODUCTION

Interpersonal tensions are inevitable in all kinds of human relationships, including the relationship between therapist and patient. These tensions, impasses, and negative processes between therapist and patient are often referred to as alliance ruptures (Safran & Muran, 2006). Alliance rupture is a relational concept that captures momentary fluctuations in therapeutic alliance. Safran and colleagues (1990, 1993) defined ruptures as “the negative shifts in the quality of alliance or an ongoing problem in establishing one”. Ruptures can range from “subtle, momentary misunderstanding between patient and therapist to major barriers in establishing alliance” (Safran, 1993). As alliance often refers to the relational bond and the mutual understanding of therapeutic goals and tasks between therapist and patient, alliance ruptures often describe negative shifts in either the relational bond, or the shared understanding of therapeutic goals or tasks (Safran, Muran, & Eubanks-Carter, 2011). Safran and colleagues (1996) distinguished withdrawal ruptures and confrontation ruptures as two types of alliance ruptures. Withdrawal ruptures happen when the patient “moves away” from the therapist and withdraws from the therapeutic relationship. Examples include avoiding directly talking about the difficulties, falling silent, responding minimally, changing topics, or becoming overly compliant instead of acknowledging their actual experiences. Confrontation ruptures happen when the patient “moves against” the therapist by directly expressing blame, anger, resentment or dissatisfaction towards the therapist or treatment (Eubanks-Carter, Muran, & Safran, 2010).

Alliance ruptures are prevalent in psychotherapy, occurring in about 77-100% sessions assessed by observers (Eubanks-Carter et al., 2010). Alliance ruptures often call for careful examination in clinical practice and psychotherapy research for two reasons. First, ruptures pose challenges to therapeutic alliance and thereby threaten outcomes. Unrepaired ruptures can hinder

therapeutic collaboration and even lead to premature termination (Safran et al., 2011). Repaired ruptures were associated with better therapy outcomes compared to therapy without ruptures or with unrepaired ruptures in a recent meta-analysis (Safran et al., 2011). Therefore, the degree to which ruptures are being recognized and addressed appropriately seems to be key in maintaining a strong alliance and reaching favorable treatment outcomes.

Second, ruptures can reveal maladaptive interpersonal patterns that may be useful for patients to understand and handle difficulties in their social relationships outside of psychotherapy. An assumption of many approaches to psychotherapy is that patients' maladaptive interpersonal dynamics outside of the therapy room often occur in the therapy room as well, especially in the context of dealing with misunderstandings (e.g. Levenson & Strupp, 1997; Safran et al., 1990; Butler & Binder, 1987). Therefore, ruptures are theorized to occur when the therapist's errors activate the patient's maladaptive cognitive interpersonal schema in responding, and the patient's responses in turn triggered the therapist to participate in maladaptive interaction cycles. Thus, addressing ruptures appropriately may be a mechanism of change (especially in relational therapies) through which patients gain better understanding regarding their interpersonal schema (Safran et al., 2011).

Interpersonal factors in alliance ruptures

Despite the importance of addressing alliance ruptures in psychotherapy, research focused on understanding interpersonal factors contributing to the development of alliance ruptures has been relatively limited. Contemporary Integrative Interpersonal Theory (CIIT; Pincus, 2005) offers a flexible model of interpersonal behavior and psychological assessment with considerable potential for interpersonal influences in psychotherapy. CIIT was developed based on Sullivan's (1953) proposal that personality and psychopathology should be conceptualized in terms of

recurrent interpersonal patterns. These concepts were then operationalized and developed into measurement models by Leary and others using an interpersonal circumplex (IPC) framework (Leary, 1957). The structure of IPC was derived and replicated empirically using a lexical approach to organize and provide a taxonomy for thousands of interpersonal behaviors (Kiesler, 1996; Wiggins, 1979). The IPC framework provides two fundamental dimensions, agency and communion, to describe interpersonal factors such as motivations, traits, and behaviors. The IPC organizes interpersonal behaviors into a circular structure along the dimension of dominance (from dominance to submission) and warmth (from warmth to coldness) (Leary, 1957) (Figure 1). The dimension of dominance describes the degree to which the individual's behavior takes control or to gives control to the other. The dimension of warmth describes the degree to which the individual's behavior is close or distant from the other. Various interpersonal behaviors can be understood as blends of the two dimensions. For instance, withdrawn behavior represents a blend of coldness and submissiveness, as it involves an attempt to disconnect with another and to let others take the lead.

Using this framework, previous research has focused on how interpersonal factors, including interpersonal styles, problems, or impacts, are related to the therapeutic alliance. Accumulating evidence implicates the importance of warmth in therapeutic alliance. Higher levels of warmth in patients (e.g., Muran, Segal, Samstag, & Crawford, 1994) and therapists (for a review, see Ackerman & Hilsenroth, 2003) have been consistently related with better alliance in the literature. In contrast, cold-dominant problems in patients at baseline are associated with worse alliance (Gibbons, Crits-Christoph, de la Cruz, Barber, Siqueland, & Gladis, 2003). Similarly, patients' affiliative impacts as perceived by their therapists (i.e., how warm the patient was perceived by the therapist) are also positively related with alliance (Constantino et al.,

2010). Results have been mixed regarding the dimension of dominance. Pre-treatment problems in dominance were associated with worse alliance in cognitive behavioral therapy in one study but were associated with better alliance in interpersonal therapy in another study (Constantino & Smith-Hansen, 2008; Renner, Jarrett, Vittengl, Barrett, Clark, & Thase, 2012), suggesting that dominance may play a different role in alliance depending on the treatment modules.

In addition to therapist's and patient's interpersonal factors, research has also examined how interpersonal complementarity, a measure of interpersonal synchronization, is related with alliance. Interpersonal complementarity refers to the mutual adjustment in an interaction, such that dominant behaviors tend to be met with submissive behaviors and vice versa, whereas warm behaviors (cold behaviors) in one person are linked to warm behaviors in the other (cold behaviors, respectively) (Kiesler, 1996; Sadler, Ethier, Gunn, Duong, & Woody, 2009). Instead of capturing interpersonal behaviors at the individual level, interpersonal complementarity delineates the degree of the interpersonal transaction at the dyadic level. A few empirical studies found cross-sectional relationships between lower warmth complementarity and poor patient-reported alliance (Henry et al., 1986; Kiesler & Watkins, 1989; Altenstein-Yamanaka, Krieger, & Holtforth, 2013), indicating that dyads with better synchronization on warmth may report better alliance.

Gaps in Understanding Interpersonal Processes Associated with Alliance Ruptures

Despite these efforts to examine the associations of interpersonal factors with the alliance in patients, therapists, or therapeutic dyads, there are four major gaps in understanding the interpersonal context of alliance ruptures. First, the literature has predominantly focused on examining interpersonal factors that are related with better alliance, whereas studies examining interpersonal factors contributing to alliance *ruptures* (Eubanks, Lubitz, Muran, & Safran, 2019)

have been rare. Although ruptures are defined as negative shifts in the alliance, the clinical implications differ between these two concepts. While a better alliance is almost ubiquitously related to better therapy outcomes, more ruptures are not necessarily related to worse therapy outcomes. In fact, therapy that includes an explicit identification and repair of ruptures may lead to better outcomes than therapy without ruptures (Safran et al., 2011). Therefore, the concept of alliance rupture does not equal “poor alliance”, but rather captures a dynamic through which negative shifts in the relationship may lead to poor alliance or may be transformed for better alliance and long-term therapeutic gains. Understanding the interpersonal contributions to ruptures (in addition to alliance) is thus uniquely critical in dissecting and transforming the process of negative shifts in alliance.

Second, research has primarily focused on cross-sectional between-person associations between interpersonal behaviors and ruptures, rather than longitudinal within-person associations. These studies have focused on questions such as: “Did patients who on average are colder tend to have more ruptures than patients who are generally warmer?” (e.g., Eubanks et al., 2019). However, they cannot answer questions regarding what the therapist should do during a session to detect the occurrence of a rupture in the moment. The latter question can only be addressed with designs that capture interpersonal behavior as it unfolds within a therapeutic dyad (Barlow & Nock, 2009; Kazdin, 2009). Data from studies using longitudinal within-person designs, rather than cross-sectional between-person designs, can thus provide clinically informative information regarding the momentary factors associated with alliance ruptures.

Third, no studies so far have directly tested hypotheses regarding the dyadic nature of rupture development. Alliance rupture has been conceptualized as a “two-person” process with cyclical transactions of interpersonal tension. For example, one specific hypothesis of ruptures

states that coldness in the patient is more likely to provoke coldness in the therapist (and vice versa), regardless of whether the individual is aware of the provocation or not (Binder & Strupp, 1997). This reciprocal hostility is predicted to lead to an escalation of ruptures (Kiesler, 1986; Safran, 1993; Tracey, 1993; Tracey, Sherry, & Albright, 1999; Tracey, Ryan, & Jaschik-Herman, 2001). Despite the core implication of these dyadic hypotheses for clinical practice, no studies so far have simultaneously examined both patients' and therapists' interpersonal behaviors with ruptures. Addressing this hypothesis empirically requires assessments of both patient and therapist's interpersonal behaviors, or indices of interpersonal synchronization, such as interpersonal complementarity.

Fourth, no studies so far have examined differences in interpersonal processes associated with confrontation ruptures and withdrawal ruptures. Accumulating evidence points to the possibility that withdrawal and confrontation ruptures have distinct implications for treatment outcomes and intervention strategies. Eubanks et al (2019) found that less confrontation markers but not withdrawal markers, as well as more rupture resolution, were related to better outcomes in cognitive behavioral psychotherapy. Another study showed that for patients with personality disorders, withdrawal ruptures rather than confrontation ruptures were related to worse recovery in dialectical behavior therapy (Boritz, Barnhart, Eubanks, & McMain, 2018). Furthermore, one study has shown that withdrawal ruptures are more challenging to detect than confrontation ruptures in trainees (Kline et al., 2018). These results suggest the importance of paying attention to the potentially distinguishable interpersonal processes of confrontation ruptures and withdrawal ruptures.

The current study aimed to extend our understanding of interpersonal processes underlying psychotherapy ruptures. This project addressed these four aforementioned gaps in the literature

by 1) focusing on alliance ruptures rather than alliance; 2) utilizing intensive longitudinal designs to examine the within-person changes in ruptures and interpersonal processes; 3) addressing the dyadic hypothesis of ruptures by including both therapists' and patients' behaviors in the same model and by examining the role of interpersonal complementarity as a dyadic indicator of interpersonal behavior synchronization; and 4) examining interpersonal processes separately for confrontation ruptures and withdrawal ruptures. I applied dynamic structural equation modeling to intensive within-person assessments of both therapists and patients to test hypotheses regarding how changes in interpersonal processes during a therapy session are associated with alliance ruptures.

A quantitative single-case approach to examine interpersonal processes in rupture

I use single-case quantitative analysis to explore within-person and within-dyad interpersonal process associated with rupture. Single-case methodology has a long history in psychotherapy process and outcome research. It has been described with different terms such as *N* of 1, case study, idiographic, intensive, intrasubject, and time-series, even though these different terms may be misleading in understanding the design of single-case research (Hilliard, 1993). Briefly, Hilliard (1993) described single-case research as “a subclass of intrasubject research in which aggregation across participants is avoided and the generalizability of one’s findings is addressed through replication on a case-by-case basis (*pg. 1*)”.

Single-case research can be categorized into a) single-case experimental designs that involve quantitative data and direct manipulation of the independent variable; b) single-case analyses that apply quantitative techniques to analyze the temporal unfolding of variables without direct manipulations; and c) qualitative case studies. Single-case experimental designs are usually used to determine the causal relationship between a manipulated independent variable

and clinically indicated dependent variables. While well-designed single-case experimental methods have the advantage of excellent internal validity, they are challenging to apply to variables that are expected to occur continuously and naturalistically, such as interpersonal behaviors and alliance ruptures. In contrast, qualitative case studies are often used to describe therapy based on the therapist's interpretation of qualitative data. While this approach can provide rich information on interesting phenomena, it cannot be used to draw quantitative conclusions about functional relationships between the therapy process and clinical targets. Given the interest of this study in delineating functional relationships between ruptures and interpersonal processes as they unfold naturally in therapy sessions, this study utilized the method of single-case quantitative analyses. This approach can integrate the quantitative aspect of experimental designs and the naturalistic aspect of the qualitative case studies to examine associations between continuously occurring process. This allows for tests of the statistical significance of hypothesized effects, the use of model fitting strategies to identify meaningful associations, and the computation of effect sizes.

A bottom-up approach to generalizability

Another potential advantage of single-case methodology is its capacity to examine idiographic processes. Meanwhile, a potential disadvantage is that results only apply to the case or the session that was examined, leaving open the possibility that they do not generalize to other cases or sessions. However, it is possible that both idiographic processes (which are relevant only to specific cases) and nomothetic processes (which are general principles that apply across cases) are important for understanding rupture. Unlike purely nomothetic models that assume any process applies equally well to all cases, single-case methods allow for the identification of a process or pattern within a case, whose generality across cases can then be tested empirically. To

inform in-session clinical practice, it is often important to know the extent to which a certain kind of relationship (e.g., association of complementarity with ruptures) is specific for a single patient or generalizable across patients. Therapy researchers have noted the importance to integrate nomothetic and idiographic knowledge about patients and therapy processes in clinical practice (Barlow & Nock, 2009).

The quantitative single-case method addresses the idiographic versus nomothetic question by examining within-person processes within each case to establish an idiographic relationship and then replicating the observed idiographic relationship across cases and sessions (usually 3 or more; Hilliard, 1993). This approach keeps a close focus on the idiographic process while allowing exploration of nomothetic effects across sessions or cases. As such, it has been suggested that the quantitative single-case approach should be used at earlier stages in a systematic program of research. Information from single-case studies can then inform future nomothetic studies with larger sample sizes to examine generalizability to the broader population (Barlow & Nock, 2009).

In contrast to the quantitative single-case method, an alternative approach in the literature to model within-person variability is through multilevel modeling, which often assumes that all cases share a nomothetic process, and that individual differences exist as variability around that nomothetic process. However, this assumption can be problematic when the functional relationships between variables differ across cases (Hilliard, 1993), leading to a situation where an average is modeled, which does not accurately represent the process underlying one or more of the individual cases (Tight, 2017). Molenaar and colleagues (Molenaar, 2004; Molenaar & Ram, 2009) have argued that it is only appropriate to generalize results from aggregated longitudinal analyses to address questions concerning intra-individual variation when data from

each case in the sample are stationary with a constant mean and variance structure over time. However, such criteria are rarely satisfied in dynamic psychological research, which highlights the necessity of using single-subject and replicated time series models to directly examine idiographic processes and set the foundational step for examining generalizability (Molenaar & Ram, 2009).

Given the advantages of single-case methods in articulating idiographic versus nomothetic processes, I chose the intensive quantitative single-case design to examine hypotheses of associations between interpersonal processes and ruptures. The generalizability for the whole sample (i.e., whether the observed patterns are idiographic to specific dyads or generalizable across the entire sample) was examined through replications of the significant associations in all the sixteen sessions. The generalizability within each dyad (i.e., whether the observed patterns are idiographic or session-specific) was determined by replicating the significant results in both of the two sessions within the same dyad. Given the exploratory nature of this research as well as the small number of cases ($N = 16$), inferences regarding generalizability in the whole sample occurred through tabulation of effects and qualitative judgment (Kennedy, 1979; Ram, Brose, & Molenaar, 2013). Specifically, generalizability was determined using the following a priori algorithm: 1) a pattern of significant association that is observed in more than 12 out of 16 sessions indicates a *relatively nomothetic* effect, 2) a pattern of significant association observed between 5-11 times in the 16 sessions indicates a *hybrid effect* that may generalize to some but not all people in the population; 3) a pattern of significant association observed in less than 4 out of 16 sessions but replicated within the same dyad (i.e., the association was significant in both of the sessions within the same dyad), indicates an *idiographic* effect that is consistent and unique for this specific dyad but not for other dyads; 4) a pattern of significant association was observed

in less than 4 out of 16 sessions and did not replicate within the same dyad indicates a *session-specific* effect that may potentially be informative about one session but is not consistent within or across cases.

Hypotheses for the current study

In summary, the current study aims to examine dynamic interpersonal processes in alliance ruptures using an intensive quantitative single-case approach. I examined interpersonal processes in two separate models. In the first set of models, I examined how therapist and patient warmth and dominance are related to confrontation and withdrawal ruptures. In the second set of models, I examined how interpersonal complementarity on warmth and dominance are related to confrontation and withdrawal ruptures.

Overall, this study has three aims:

Aim 1: Evaluate how changes in the patient's dominance and warmth are related to confrontation and withdrawal ruptures within sessions. The theories on cyclical transaction of hostility in rupture development hypothesized that decreases in warm behaviors (or increases in cold behaviors) in both the patient and the therapist, as well as a decrease on the interpersonal complementarity of warmth should be associated with alliance ruptures. However, there may also be interpersonal differences for confrontation ruptures and withdrawal ruptures. Theories suggested that confrontation ruptures are associated with cold dominant behaviors that move against the therapist, whereas withdrawal ruptures are related to submissive interpersonal behaviors that move away from the therapist (either cold submissiveness in withdrawal or warm submissiveness in over-compliance) (Eubanks, et al., 2010; Harper, 1989a, 1989b). Therefore, I hypothesized that cold, dominant behaviors in patients are associated with confrontation ruptures whereas submissive behaviors in patients are associated with withdrawal ruptures. *Hypothesis*

1.1 is that the patient's coldness and dominance are positively related with confrontation ruptures over time. *Hypothesis 1.2* is that the patient's submissiveness is positively related with withdrawal ruptures over time.

Aim 2: Determine how changes in therapists' warmth and dominance are related to confrontation and withdrawal ruptures within sessions. Regarding therapists' behaviors, given that prior cross-sectional studies suggest that therapist's warmth is positively related to alliance, I hypothesize that when a rupture occurs, the therapist's warmth will decrease as well. Given that there was no specific theoretical hypothesis regarding therapist's dominance and ruptures, I do not have a specific hypothesis regarding the role of therapist's dominance in ruptures. *Hypothesis 2.1* is that the therapist's warmth will be negatively related to the occurrence of confrontation ruptures. *Hypothesis 2.2* is that the therapist's warmth is negatively related to the occurrence of withdrawal ruptures.

Aim 3: Examine the dynamic relationship between interpersonal complementarity and withdrawal and confrontation ruptures within each therapist-patient dyad. Cross-sectional studies suggest a relationship between lower warmth complementarity and rupture. Associations between rupture and dominance complementarity were less clear based on previous research. I accordingly predict that lower warmth complementarity will relate to rupture and intend to explore the association of dominance complementarity and rupture without making a specific hypothesis. *Hypothesis 3.1* is that lower warmth complementarity is related to more confrontation ruptures. *Hypothesis 3.2* is that lower warmth complementarity is related to more withdrawal ruptures.

METHODS

Participants

This study used existing outpatient psychotherapy video data collected from the Interpersonal Problems Clinic (IPC) at Michigan State University (MSU) (Levendosky & Hopwood, 2017a, 2017b). The study was approved by the Institutional Review Board (IRB) at MSU. Participants were therapists and patients who consented that their sessions can be videotaped and used in the study. Thirteen therapists were initially recruited for this study. Four therapists were excluded because of insufficient number of therapy tapes ($N < 5$) in the database at the time of selection. One therapist was excluded because I was unable to obtain the retrospective rupture ratings from the therapist. Thus, eight therapists were included in the final sample (75% females, 25% males; age: $M = 25.88$, $SD = 3.80$; 75% White, 25% Asian). All therapists were clinical psychology graduate students or pre-licensed staff clinicians who were trained to use a relational/interpersonal psychodynamic therapy approach, emphasizing the importance of the therapeutic relationship as a mechanism of therapeutic change (for details about the training goals and treatment rationales, see Levendosky & Hopwood, 2017a, 2017b). Six of them were novice therapists while two of them were senior trainees. Each therapist received one hour of individual supervision weekly and all therapists received two hours of group supervision every two weeks.

Patients were selected based on the sampling strategy to maximize the frequency and variability in rupture variables. Sufficient frequency and variation in ruptures are critical for conducting statistical analyses and examining the associations between interpersonal variables and ruptures. Therefore, I asked therapists and their supervisors to rate all of their patients in the database (Mean numbers of available patients per therapist = 2.38, $SD = 1.41$) on ruptures and

selected one patient per therapist. Specifically, therapists and their supervisors were asked to rate each of their patients on two questions on a 1-5 Likert scale: “How often do you feel that you have ruptures in the relationship with the patient?”, with 1 being “very infrequent, rarely” and 5 being “very frequent, almost all the time”; and “On average, to what extent do you think the ruptures are intense with this client?”, with 1 being “not intense at all” and 5 being “very intense” (Muran et al., 2009). The total score for each patient was calculated by adding the scores of two questions from both the therapist and the supervisor. The patient with the highest total score was selected for each therapist.

Eight patients in total were selected into this study (62.5% male, 12.5% female, 25% identified as gender non-binary; age: $M = 36.50$, $SD = 17.11$; 87.5% White, 12.5% African American; 62.5% identified as heterosexual, 12.5% identified as gay man, 25% identified as queer). Two patients had attended college while the other six patients had attended or graduated from high school. All patients self-referred to the clinic from the local community with primary concerns regarding difficulties in relationships, self-esteem, and emotion regulation. Five patients (62.5%) had a personality disorder as their primary diagnosis while three patients (37.5%) had a primary diagnosis of major depressive disorder or dysthymia. Seven patients stayed in therapy for at least six months, while one patient terminated therapy after three months.

Session selection

Two sessions per dyad were selected based on the highest scores of ruptures within each dyad (ratings presented in Appendix Table A1). To identify these sessions, I watched and conducted rupture coding (the 3RS coding that were described in the measures section below) for 30% of each session. Specifically, I watched every first 3 minutes in each 10-minute segment of the sessions (e.g., watching the first 3 minutes, and then watching minute 10-12, minute 20-22,

minute 30-32, and minute 40-42) and then rated withdrawal and confrontation ruptures for each 3-min segment (Eubanks et al., 2011). The ratings for each segment allowed for the estimation of the frequency and significance of ruptures across the entire session. The two sessions with highest total scores of confrontation and withdrawal ruptures were selected for each dyad. If the total score was equal for two or more sessions, the session with the closest balance of scores for both confrontation and withdrawal ruptures was selected because this study examined the interpersonal associations for both confrontation and withdrawal ruptures for each session. Overall, a total of 16 sessions were selected for further coding. The ratings indicated at least a moderate level of withdrawal ruptures and a varying degree of confrontation ruptures in the selected tapes.

Measures

Interpersonal Dominance and Warmth

The current study used the Continuous Assessment of Interpersonal Dynamics (CAID) to measure dominance and warmth relatively continuously for each therapist and patient separately during the entire therapy session. The details of CAID were described in previous studies (Lizdek, Sadler, Woody, Ethier, & Malet, 2012; Sadler et al., 2009; Thomas et al., 2014, Hopwood et al., 2018). Briefly, trained coders use a computer joystick device to assess dominance and warmth moment-to-moment for each person separately. When coding the therapy sessions, the computer monitor displays the target video as well as a Cartesian plane depicting the interpersonal circumplex dimensions of dominance and warmth. A dot moves within the Cartesian plane in accordance with joystick movements, allowing coders to view the placement of their ratings as they watch videos. By using the joystick to move this dot, coders can indicate shifts in interpersonal behaviors. CAID data are scaled from -1,000 to 1,000 on both dimensions,

with 1,000 on the y-axis representing extreme dominance and 1,000 on the x-axis representing extreme warmth. The dominance and warmth scores are captured every half second by the computer program DARMA (Girard & Wright, 2017).

Multiple undergraduate coders underwent training for using CAID to code psychotherapy videos. They received at least 8 hours of coding training based on the protocol summarized in Sadler et al. (2009). Coders were trained by two graduate researchers who were trained CAID coders to observe markers of interpersonal behaviors including the content of speech, vocal tone, vocal volume, hand position, head gaze, facial expression, torso position, and so on. They practiced coding on the well-known videos of Three Approaches to Psychotherapy series (psychotherapy videos with Gloria and with Richard (Shostrom, 1966; 1986) as well as three role-play psychotherapy videos that illustrated dynamic/relational therapy conducted in the IPC team (Levendosky & Hopwood, 2017a). They received feedback after practice coding by reviewing their codes along with videos. The group practiced until the entire group reaching a two-way mixed, average-measures, absolute agreement intra-class correlation coefficients (ICCs) of 0.40 for all the videos, which indicating a fair inter-rater reliability (Cicchetti, 1994). Once coders showed adequate inter-rater reliability using CAID methods, they began coding the therapy videos.

At least five trained coders used CAID to code each entire psychotherapy session, separately for each patient and each therapist. Because coders needed to watch each session twice to code both therapist and patient, the order of coding either therapist or patient first was randomized across coders for each session to reduce the influence of order in coding. Each session was divided into segments of 15-20-minute lengths to reduce the potential for coder's fatigue to impact ratings. The codes in the first 5 seconds of each segment were removed to

allow time for coders to settle into the task (Sadler et al., 2009). The codes for each segment were then combined for each session for further analyses.

Each time series was visually inspected to examine significant outliers due to unexpected hand movements. The outlier time series was removed from the sample. For each time series (i.e., warmth or dominance for either therapist or patient for a session), one coder's time series with least variation and/or least item-total reliability was removed. The time series from all the remaining coders were then averaged into aggregated time series for further analyses.

The CAID scores were aggregated into 30-second windows to make them comparable to the rupture variables described below. Sadler et al. (2009) found that more than 80% of the variance in time series of warmth and dominance could be explained by cycles that occurred at a length of 30 seconds or longer. Thus, the interval of 30 seconds seems to be sufficient to capture meaningful variation in interpersonal exchanges. Since each session lasted approximately 50 minutes, this aggregation across every 30 seconds resulted in approximately 100 time points for each time series for each session. The inter-rater reliability of each time series was assessed by calculating the two-way mixed, average-measures, absolute agreement intra-class correlation coefficients (ICCs) over the entire session using moment-to-moment ratings (Hallgren, 2012). The absolute agreement ICC was used because it takes into account the agreement on both the absolute values and the rank order of CAID ratings at a given moment. Therefore, it reflects both the degree to which the coders see the same mean level of warmth/dominance and the degree to which their codes of warmth and dominance change similarly at the same time. The two-way mixed option indicates the coders were not randomly sampled in the population but purposefully selected and trained to provide the coding. The average-measures option indicates that the ICC is

used to quantify the reliability for the average coding from multiple coders rather than coding from a single coder, given that the study used aggregated time series for all analyses.

A previous study using this method to study marital interaction reported an ICC of 0.74 for dominance in husbands and an ICC of 0.73 for dominance in wives. The ICCs were lower for warmth (0.44 for husbands and 0.43 for wives) (Dermody, Thomas, Hopwood, Durbin, & Wright, 2017). In the current study, reliability indicators for most interpersonal variables reached the benchmark ($ICC > 0.40$) (Table 1), with exceptions for therapist's warmth in two sessions. The average ICCs across the sample for patient's warmth and therapist's warmth are 0.54 (0.09) and 0.49 (0.12), while the average ICCs for patient's dominance and therapist's dominance are 0.82 (0.10) and 0.84 (0.07).

Interpersonal Complementarity

Warmth complementarity was calculated as the cross-correlation between two residual series of therapist's and patient's warmth after regressing out time from each series. Similarly, dominance complementarity was calculated as the cross-correlations of therapist's and patient's dominance after regressing the time out from each variable.

Cross-correlations have been used as indicators of the momentary correspondence between partners (Sadler et al., 2009; Thomas et al., 2014). A higher positive cross-correlation for warmth indicates higher momentary warmth complementarity, suggesting that as one individual increases in warmth, the other individual also increases in warmth correspondingly at that time. In contrast, a higher negative cross-correlation for dominance indicates higher level of dominance complementarity, suggesting that as one individual increases in dominance, the other individual decreases in dominance momentarily. However, cross-correlations can be inflated in the presence of linear trends (Warner, 1998). I was interested in moment-to-moment

correspondence, rather than the degree to which two members of a dyad increased or decreased linearly over the course of the entire session. Thus, the cross-correlations of residuals, with linear trends covaried, were chosen as a primary indicator of complementarity. Consistent with the measurement interval of 30 seconds across interpersonal variables and rupture variables, each of the residual cross-correlations was calculated based on the data within each half minute.

Confrontation Rupture and Withdrawal Rupture

Alliance ruptures were measured using the Rupture-Resolution-Rating system (3RS; Eubanks, Mitchell, Muran, & Safran, 2011) modified for the current study. The 3RS system is an observer rating system designed to assess ruptures and repairs between therapist and patient. Coders use the 3RS to rate the presence of specific markers (segment level) and overall significance (whole session level) for withdrawal rupture and confrontation ruptures separately. Markers for withdrawal ruptures include denial, minimal response, abstract communication, avoidant storytelling and/or shifting topic, deferential and appeasing, content/affect split, and self-criticism and/or hopelessness. Markers for confrontation ruptures include complaints about the therapist/activities of therapy/parameters of therapy/progress of therapy, rejecting intervention, defending oneself against therapist, and efforts to pressure therapist. Trained raters assessed the presence (rated as 1) or absence (rated as 0) of each marker for both confrontation and withdrawal ruptures within a given segment. It is possible to have multiple markers present within one segment. For example, a coder could observe the occurrence of content/affect split as a withdrawal rupture marker, the presence of self-criticism (e.g., patient criticizing herself/himself) as a withdrawal rupture marker, and the presence of complaints about therapy parameters (e.g., patient criticizing the length of each session) as a confrontation rupture marker within the same segment. Raters also gave overall ratings for the significance of withdrawal and

confrontation ruptures for the whole session on a 1 to 5 Likert scale, with 1 indicating no rupture and 5 indicating a very significant rupture, across the entire session.

The 3RS was modified for the current study in two ways. First, the segment for assessing rupture markers was modified to a half minute instead of five minutes. This interval was used to code ruptures to enable analysis of the rupture and interpersonal data on the same time scale. My pilot study also suggested that variations in the intensity of ruptures occurred at an assessment interval of a half minute.

Second, instead of giving an overall score of significance for the whole session, raters were asked to code the intensity of rupture for each half minute. The scale for the intensity of rupture was modified based on the scale for the significance of ruptures, with 1 indicating no or little rupture and 5 indicating very intense rupture. Thus, rating the intensity of ruptures relies more on the rater's global sense of the degree of rupture in the segment as well as the mere occurrence of one or more ruptures during that segment. Results from the pilot study indicated that the intensity of each type of rupture was highly correlated with the sum score of rupture markers (e.g., correlations ranged from .60-.90).

Four time series of rupture codes were thus created within each segment for further analyses: the intensity of confrontation rupture, the intensity of withdrawal rupture, the sum of confrontation ruptures, and the sum of withdrawal ruptures. The time series for intensity of confrontation rupture and for intensity of withdrawal rupture were used in my primary analyses, whereas the sum of rupture markers was used in exploratory analyses.

Ruptures were rated by 4 trained coders who were either Ph.D. students in clinical psychology or licensed clinical psychologists, given that using the coding system requires training in the therapeutic alliance. All coders were trained for at least 8 hours for 3RS coding.

Two coders attended the in-person training workshop for 3RS coding from the developer of 3RS, Dr. Eubanks, at the meeting of the *Society of Psychotherapy Research*. These two coders then coded the Gloria videos of psychotherapy using the modified protocol, discussed the discrepancies of their codes by reviewing the tapes segment by segment, and re-coded the videos both separately and together. They also coded, reviewed, and discussed two other psychotherapy tapes selected in the IPC database with a similar level of rupture intensity compared to the videos in the study. Their 3RS codes were then used as criterion videos to train the other two coders. The other two coders practiced coding the Gloria videos and the two therapy videos and reviewed their codes in weekly training meetings with the trainer. The coders started coding the study videos after the group reached an ICC of 0.4 for both confrontation and withdrawal ruptures.

Each tape was coded by 2-3 coders who were not the therapists or the supervisors for the coded therapeutic dyad. The aggregated time series of rupture codes across raters were used for further analyses. Inter-rater reliability of rupture was assessed by calculating the two-way mixed, average-measure, absolute agreement intra-class correlation coefficients (ICCs) over the rupture time series for each entire session (Hallgren, 2012). Prior studies suggested an ICC of 0.73 for withdrawal ruptures and an ICC of 0.96 for confrontation ruptures (Coutinho, Ribeiro, Sousa, & Safran, 2014). However, these ICCs were calculated based on single global ratings for each session (i.e., a 1-5 significance rating of ruptures overall) and that half-minute coding usually yielded lower ICCs because the half minute interval limits the range of variabilities in rupture scores and that lower variability in “true scores” is related to higher ratios of measurement error divided by the total variance and thus lower inter-rater reliability estimates. Given that no prior studies have calculated ICCs based on scores of every half minute, a suggestive benchmark of

0.40 was used as a cut-off score for evaluating fair reliability, consistent with the literature using $ICC > 0.40$ to indicate fair inter-rater reliability (Cicchetti, 1994). Coders were asked to recode the type if the coder group has not reached a benchmark of 0.40 for both confrontation and withdrawal ruptures. One coder with the least coder-total agreement for both ruptures will be tossed out. Most of the ICCs for ruptures have reached the benchmark of 0.40, except for confrontation ruptures in two sessions and withdrawal ruptures in one session. The average ICC across the sample is 0.60 (0.19) for confrontation ruptures and is 0.50 (0.08) for withdrawal ruptures.

Statistical Analyses

Dynamic Structural Equation Modeling (DSEM) was used to model the multivariate relationships between interpersonal variables and confrontation/withdrawal ruptures. DSEM is a method developed to model individual time series, extract individualized structures, and to quantify associations between multiple variables over time using a structural equation modeling (SEM) framework. It can be used to indicate whether there are underlying common patterns/factors in the time series, whether there are interactions between variables, and how one variable impacts the other over time.

Data Preprocessing

DSEM requires each individual/dyad's time series to be 1) of considerable length (e.g., 100 measurement occasions); 2) collected on a time-scale matching the phenomena of interest and capturing meaningful changes; and 3) sampled at equally spaced intervals (Ram et al., 2013). The time interval of 30 seconds for both interpersonal and rupture variables in this study allowed for at least 100 occasions per session, measuring these phenomena at a reasonable interval, and sampling variables at equally spaced intervals.

DSEM also requires reliable temporal variation in the measures included in the analysis. Variables with no within-person variance cannot be subjected to analysis of variation and covariation in DSEM. A rule of thumb is to exclude variables with more than 80% of scores being identical (Ram et al., 2013). There was evident variation for most of the variables except for confrontation rupture for one session where 80% of the ratings were identical. The time series for confrontation rupture was removed from the DESM models for that session.

Stationarity was handled by running the same model for each session twice, one with the original scores and the other one with residual scores after regressing out time (i.e., the impact of linear trends) (Ram et al., 2013). DSEM requires weak stationarity in time series data, which refers to the same data structure (including the means, variance and covariance) across the time series. In contrast, non-stationarity in dataset (e.g., trends, cycles identified in time series) will increase the estimation errors in time series analyses. Ram and colleagues (2013) recommended carefully considering the potential theoretical meanings of the process reflected in each trend, cycle or other “noise” component in time series before removing them for stationarity. In the current study, I first visually inspected all the time series for all interpersonal behaviors and rupture variables to identify trends and cycles. Several significant trends and no cycles were identified through visual inspection. Second, I removed linear trends for all behavior and rupture variables and compared the models using the residual scores and the models using the original scores. The significance (.05) of parameters did not differ between the original models and the residual models after removing the trends for most parameters for all sessions (only 3 parameters out of the 240 parameters were different). Thus, only the results using residual scores for interpersonal behaviors and ruptures are presented.

Modeling

Mplus 8.2 was used to fit all the DSEM models. The Bayes estimation option was used to handle the zero inflated distributions of rupture variables (Muthen & Muthen, 2017; Wang, Chen, Kuo, & Dey, 2015; Yang, Cavanaugh, & Zamba, 2015) (See Table 1 for the means and variances for interpersonal behaviors and ruptures). Bayesian models have been developed for zero-inflated samples, such that the normal distribution is not required and the posterior samples are developed using Markov chain Monte-Carlo models (MCMC) for estimation. Ghosh et al. (2006) found that Bayesian estimation outperformed maximum likelihood estimation in terms of both bias and precision in zero-inflated data.

Two DSEM models were fit to each session separately. Model 1 was used to examine the question about interpersonal behaviors and confrontation and withdrawal ruptures in both patient and therapist (Hypothesis 1.1, 1.2 & Hypothesis 2.1, 2.2). This model included six variables: patient's warmth, patient's dominance, therapist's warmth, therapist's dominance, withdrawal rupture, and confrontational rupture. The model was specified to include 1) an autoregression effect for each variable, in which one variable at time t predicts its state at time $t+1$; 2) the concurrent associations between interpersonal variables (patient's warmth, patient's dominance, therapist's warmth, therapist's dominance), withdrawal rupture, and confrontational rupture (Figure 2).

I used Model 2 to examine associations between complementarity (warmth complementarity and dominance complementarity), confrontation rupture, and withdrawal rupture (*Hypothesis 3.1 & 3.2*). The models were specified to include 1) an autoregression effect for each variable, in which one variable at time t predicts its state at time $t+1$; 2) the concurrent

associations between complementarity (i.e., warmth complementarity, dominance complementarity) and confrontation and withdrawal rupture (Figure 3).

RESULTS

Descriptives of interpersonal behaviors and ruptures

The means and standard deviations for each variable are presented in Table 1. Figure 4 depicts an example of time series for one session. On the scale from -1,000 to 1,000, the average warmth of the patient in each session ranged from -327.69 to 133.07, whereas the average warmth of the therapist in each session ranged from -42.85 to 186.97. The average dominance of the patient ranged from -179.47 to 259.61, whereas the average dominance of the therapist ranged from -221.85 to 93.79. These mean values indicated diverse interpersonal presentations among the 16 sessions selected for relatively intense ruptures. There also seemed to be relatively reliable mean differences between cases that replicate across sessions for interpersonal variables, suggesting that some people are, on average, more dominant or warmer than others consistently across sessions. On the scale from 1 to 5, the mean of withdrawal ruptures in each session ranged from 1.45 to 2.50, whereas the mean of confrontation ruptures in each session ranged from 1.14 to 3.44, suggesting the presence of both withdrawal and confrontation ruptures in the 16 sessions.

Basic parameters and correlates in the dynamic structural equation modeling

Across the 16 sessions, the autoregressive correlations for dominance and warmth were all significant ($p < 0.05$), ranging from 0.46 to 0.83 for the patient's warmth, from 0.32 to 0.65 for the patient's dominance, from 0.26 to 0.90 for the therapist's warmth, and from 0.32 to 0.70 for the therapist's dominance (See Figure 5 for parameter estimates for each session). This suggested that in each psychotherapy session, both therapists' and patients' current interpersonal behaviors on warmth and dominance are highly influenced by their own behaviors in the previous moment.

Similarly, I found significant autoregressive associations in all sessions for withdrawal ruptures and in 13 out of 15 sessions for confrontation ruptures. The significant autoregressive associations ranged from 0.25 to 0.59 for withdrawal ruptures and from 0.23 to 0.77 for confrontation ruptures (Figure 5 – 8). These estimates suggested continuity of alliance ruptures such that the current state of alliance ruptures is highly dependent on the previous state.

I also modeled concurrent correlations between two types of ruptures and between warmth and dominance in patients and therapists in the dynamic equation models. I did not find generalizable, significant associations between confrontation ruptures and withdrawal ruptures (negative correlations in 2 sessions and a positive correlation in 1 session), suggesting the relative independent processes associated with these two types of ruptures.

I found significant within-person correlations between patient's own warmth with their own dominance in 11 sessions (negative correlations in 4 sessions and positive correlations in 7 sessions) and between therapist's own warmth with their own dominance in 14 sessions (positive correlations in 13 sessions and a negative correlation). This indicates that each individual's own warm behaviors and dominant behaviors may not be independent in most sessions. A negative correlation between one's own warmth and own dominance indicates that when the person became warmer (colder), he/she also became more submissive (dominant). In contrast, a positive correlation suggested the opposite pattern, such that when the person became warmer (colder), he/she also became more dominant (submissive).

Furthermore, the results indicated that the therapist's and the patient's behaviors were interconnected in all sessions. The results indicate consistent complementarity patterns: therapist's dominance was negatively related with patient's dominance in all sessions, and therapist's warmth was positively related with patient's warmth in 10 out of 16 sessions. This

indicated that even in sessions with severe ruptures, the therapist and the patient still tended to follow the interpersonal complementarity rule such that the dominant (submissive) behaviors in one person were associated with submissive (dominant) behaviors in the other person, whereas the cold (warm) behaviors in one person were associated with cold (warm) behaviors in the other person. This effect seems to be more prevalent for dominance than for warmth. I also identified a positive cross-correlations between patient's submissiveness and therapist's warmth in 13 out of 16 sessions and between therapist's dominance and patient's warmth in 7 out of 16 sessions, indicating the presence of interpersonal influences cutting across the domains of dominance and warmth.

Examining Hypotheses Regarding Interpersonal Behaviors and Ruptures

All the significant associations are depicted in individual sessions in Figure 5 - 8. The associations that reached a hybrid effect or a nomothetic effect (in ≥ 5 sessions) are depicted in Figure 9. Patient's warmth was found to be negatively associated with confrontation ruptures in 5 sessions, suggesting that when the patient became colder, there were increases in confrontation ruptures. This association reached a hybrid effect, suggesting that this might be a mild or an occasional effect and the generalizability should be examined further in the general population. This association is consistent with *Hypothesis 1.1* regarding the negative associations between patient's warmth and confrontation ruptures. Additionally, I found a negative association between patient's warmth and withdrawal ruptures in 2 sessions. However, this effect is rather session-specific and did not replicate within or across dyads.

Patient's dominance was positively related with confrontation ruptures in 5 sessions, suggesting that confrontation ruptures increased when the patient's dominance increased. This is also consistent with *Hypothesis 1.1* regarding the positive relationship between patient's

dominance and confrontation ruptures. This association reached a hybrid effect in terms of generalizability. Furthermore, I found a significant association between patient's dominance and withdrawal ruptures in 6 sessions, suggesting that when the patient's dominance increased, withdrawal ruptures also increased. This association also reached a hybrid effect in terms of generalizability. This finding is inconsistent with *Hypothesis 1.2* regarding patient's submissiveness and withdrawal ruptures. In fact, when the patient became more dominant in the session, there were more expressions of both confrontation ruptures and withdrawal ruptures.

Therapist's warmth was positively related with withdrawal ruptures in one session and was negatively related with confrontation ruptures in two sessions in separate dyads, suggesting that these effects were session-specific. These findings did not generally support the hypotheses of negative associations between therapist's warmth and alliance ruptures in *Hypothesis 2.1* and *Hypothesis 2.2*.

I found a significant negative relationship between therapist's dominance and withdrawal ruptures in 10 sessions. This suggested that therapists' increasing submissiveness may be a signal for withdrawal ruptures. This is a surprising finding given that I did not have a specific hypothesis regarding therapists' dominance and withdrawal ruptures. This pattern reached a hybrid effect in terms of generalizability. I also found a negative association between therapists' dominance and confrontation ruptures in 2 sessions in separate dyads and a positive association in 2 sessions in separate dyads, suggesting session-specific effects in these associations.

Examining Hypotheses Regarding Interpersonal Complementarity and Ruptures

No relationships were found between warmth complementarity and ruptures. These findings did not support the hypotheses regarding warmth complementarity and ruptures in *Hypothesis 3.1* and *Hypothesis 3.2*. However, the results indicated positive associations between

confrontation ruptures and dominance complementarity in 6 sessions, which reached a hybrid effect (Table A2 in the appendix). This indicated that when the dyad was more complementary regarding dominance (i.e., when one became more dominant, the other one became more submissive), there were increases in confrontation ruptures. I also found negative associations between withdrawal ruptures and dominance complementarity in 2 sessions within the same dyad, indicating a potentially idiographic effect such that for that dyad, less complementarity on dominance (i.e., when one became more dominant/submissive, the other one also became more dominant/submissive) was related to increases in withdrawal ruptures.

Between-person, Aggregated Associations

I conducted a post-hoc exploratory analysis to examine whether the aggregated score of warmth and dominance across the entire session would be related with the aggregated score of ruptures across sessions. Confrontation rupture was negatively related with therapist's warmth ($N = 16$; $r = -0.58$, $p < 0.05$) and patient's warmth ($r = -0.61$, $p = 0.01$), and positively related with patient's dominance ($r = 0.51$, $p < 0.05$) indicating that more confrontation ruptures were associated with colder therapists and patients in this sample. Withdrawal rupture was negatively related with patient's dominance, indicating that more withdrawal ruptures were correlated with more submissive patients ($r = -0.51$, $p < 0.05$). The mean of therapist's dominance and the mean of patient's dominance was negatively related ($r = -0.78$, $p < 0.001$), indicating that more submissive therapists have more dominant patients and vice versa. Interestingly, all of these between-person associations were consistent with the hypotheses from the cross-sectional literature regarding the associations between more confrontation ruptures on average and colder patients and therapists, and between more submissive patients and more withdrawal ruptures on average.

DISCUSSION

This study aimed to unpack the idiographic, moment-to-moment interpersonal manifestations of alliance ruptures in 16 psychodynamic psychotherapy sessions selected for relatively high rates and intensity of rupture. The methodology of this study allows us to examine a critical question in therapy room, which is, what kind of changes in interpersonal processes are cues of alliance ruptures. The results identified several significant associations that replicated across cases and sessions, suggesting potential generalizability of these findings. This is one of the first studies to quantitatively analyze moment-to-moment interpersonal processes in rupture dynamics. Our study is also unique in examining both idiographic and relatively nomothetic interpersonal processes of alliance ruptures using intensive single-case quantitative analyses.

Consistent with the literature and my hypotheses, the results suggested that an increase in either cold or dominant behaviors in patients may be important for identifying confrontation ruptures. However, this effect may apply to some but not all therapeutic situations, as it was only observed in about a third of the sessions in this sample. Contrast to my hypothesis, increases rather than decreases in patient's dominance marked withdrawal ruptures in one third of the sessions. It is possible that while the rupture theories hypothesized the role of decreases in dominance at the motivation level in withdrawal ruptures, these results identified the role of increases in dominance at the behavioral level (Kline et al., 2018). In other words, withdrawal ruptures may occur when the patient wanted to move away from the therapist in a relatively submissive way (submissiveness at the motivation level) through talking about irrelevant situations for a prolonged period (dominance at the behavioral level). Future studies may examine the degree to which this association replicates in the general population and the

potential distinguished roles of interpersonal motives versus interpersonal behaviors in alliance ruptures.

My study also quantitatively illustrated that *therapists'* interpersonal behaviors are at least as important as the patients' interpersonal behaviors for identifying ruptures. Although interpersonal theories have acknowledged the impacts of therapists' behaviors, few studies have examined how therapist's moment-to-moment interpersonal behaviors are related to ruptures. The results identified significant negative associations between therapist's dominance and withdrawal ruptures in more than half of the sessions. This highlights a potentially important role of therapists' increased submissiveness in withdrawal ruptures. This pattern may be particularly salient when therapists struggle to address withdrawal ruptures directly (e.g., by redirecting patients from their tangents) and fall into the default role of passively listening, which may allow the dyad to digress more from therapeutic goals and tasks. Whatever the specific processes entail, findings from this study generally support further research that considers both therapists' and patient's contributions to ruptures.

In contrast to my hypothesis, this study did not find generalizable associations between ruptures and therapist's warmth. Examinations of the raw data suggested that most therapists maintained a relatively stable, warm stance in therapy despite of intense ruptures, such that the variation and thus reliability of these time series was relatively low (Table 1). Thus, the impact of therapists' changes in observable interpersonal warmth may be too subtle to detect.

In addition to individual behaviors, I also examined the role of interpersonal complementarity in alliance ruptures. Contrary to my hypothesis, warmth complementarity was not related with any ruptures across all sessions. It is possible that while matching warmth may facilitate bonding when both people are warm, it is not as functional for the therapist to match

the patient's coldness when the patient becomes increasingly hostile and distant. Therefore, there may not be a linear relationship between warmth complementarity and alliance ruptures. It is also likely that the low variation in therapists' warmth made it difficult for the dyad to "synchronize on warmth".

Notably, I observed a positive association between dominance complementarity and confrontation ruptures in one third of the sessions. This suggested that confrontation ruptures increased when there was increased synchronization on dominance (i.e., when one person became more dominant, the other person became more submissive). Interestingly, increased synchronization on dominance was shown to be more prevalent in conflictual tasks than in collaborative tasks in experimental settings as well (Hopwood et al., 2018). These consistent findings contrasted the notion that high dominant complementarity is an indicator of smooth social interactions (Hopwood et al., 2018). One speculation after reviewing the raw data is that these significant associations with dominance complementarity occurred in sessions where patients were generally submissive. Therefore, it is possible that compared to situations when neither the patient nor the therapist were taking control, confrontation may increase the alternation of control-taking for submissive dyads and thus is related with dominance complementarity. This speculation pointed to the possibility that increased confrontation may be related to increased alternation of control-taking especially in dyads with more submissive patients. Overall, these results suggest the importance to not only evaluate therapist's and patient's behaviors separately, but also to examine the dyadic interpersonal synchronization, especially on dominance, in the development of ruptures.

In summary, this study identified relatively consistent associations between patient's increased cold, dominant behaviors with confrontation ruptures that are consistent with the

hypotheses. This study also identified significant associations between patient's increased dominant behaviors with withdrawal ruptures, which are not consistent with the hypotheses. Furthermore, I observed significant associations between therapist's decreased dominance with withdrawal ruptures, and between increased dominance complementarity and confrontation ruptures, which were not hypothesized in this study. The results did not find significant relationships to support the hypotheses regarding the relationships between ruptures and therapist's warmth or warmth complementarity. In addition to the aforementioned reasons, there are at least three general reasons for the differences between this study and theoretical hypotheses in the previous literature.

First, this study examined the within-person longitudinal associations between ruptures and interpersonal processes, which distinguished these results from cross-sectional studies and hypotheses that addressed between-person associations of interpersonal behaviors and ruptures. These two types of research methods address different questions. For example, the cross-sectional studies may examine between-person questions such as "whether more cold, dominant patients will have more ruptures compared to patients who are less so" (e.g., Eubanks, 2018), whereas the longitudinal studies like ours examine within-person questions such as "whether the increase in patient's cold, dominant behaviors is related to an increase in ruptures in the session". Researchers have shown that results and conclusions from between-person data do not necessarily extend to within-person processes (Fisher et al., 2017). Therefore, this study illustrated new findings of the within-person associations that may not be captured in cross-sectional studies.

In fact, in the post-hoc, preliminary cross-sectional analyses ($N=16$), I found significant cross-sectional associations strikingly consistent with the previous theoretical hypotheses.

Specifically, confrontation ruptures were associated with patients' cold, dominant behaviors, indicating that there are significantly more confrontational ruptures with patients who are generally less warm and more dominant compared to other patients. There are also positive associations between withdrawal ruptures and patients' submissiveness, indicating more withdrawal ruptures with patients who are generally less dominant. Note that these cross-sectional analyses were post-hoc, under-powered, and preliminary, only serving the purpose to indicate the possibility that theoretical hypotheses may be based upon observations on cross-sectional relationships rather than within-person dynamics. These observations highlight the need for future studies to use within-person methodology to examine questions related to dynamic, individual processes in psychotherapy. The discrepancies between the within-person findings and the hypotheses from the previous literature also suggested that it may not be as helpful to generate hypotheses for within-person studies based on results of cross-sectional studies.

Second, previous studies and theories emphasized the patient's interpersonal contributions disproportionately to the therapist's interpersonal contribution, whereas the current study took into account both patient's and therapist's interpersonal contributions. For example, this study found more significant associations between withdrawal ruptures and therapist's dominant behaviors rather than with patient's dominant behaviors. Taking into account the therapist's impact may illustrate new patterns that are different from those emphasized in the literature.

Third, the idiographic modeling approach in this study revealed heterogeneity in the associations that are not captured by theories built on aggregated data and nomothetic hypotheses. An increased number of researchers have noted the challenges that group-level conclusions, which were derived from aggregated data, often do not extend to idiographic

patterns whereas interventions are always delivered at the individualized level (e.g., Boswell, 2016). In contrast to the nomothetic hypotheses, this study was able to examine the degree of idiographic versus nomothetic associations.

In fact, the results identified one idiographic effect between dominance complementarity and withdrawal ruptures in Dyad 4, such that for both sessions in this dyad, decreased dominance complementarity was related to increases in withdrawal ruptures. This effect suggested that for this dyad, less synchronization on changes in dominance (e.g., when one was becoming more dominant or submissive, the other's dominance did not change correspondingly based on the complementarity rule) was associated with more withdrawal ruptures. This association was consistently identified within the dyad but not in any other dyads, indicating that there may be some idiographic, dyadic effects specific to certain dyads but are not generalizable to others. Other than this effect, the study did not find other within-dyad effects that are not identified as relatively nomothetic. Thus, although these results identified one within-dyad effect indicating the possibility of idiographic effects, most of these findings suggested more nomothetic associations between behaviors and ruptures.

In addition to relatively nomothetic associations and idiographic effects, this study identified several session-specific associations that did not replicate within the dyad or across the sample (in $n < 5$). These findings should be interpreted cautiously given the lack of replication within this sample. These effects may reflect idiosyncratic patterns of ruptures specific to one session but not to the other session within the dyad. It is also possible that the different patterns between two sessions may be related to interpersonal changes in the therapist or the patient due to potential moderators such as the impacts of previous ruptures or supervision. Furthermore, the session-specific results may reflect sampling error or false-positive results. It is also possible that

some interpersonal patterns associated with ruptures may only exist in part of the session rather than the whole session, and thus were not consistently detected when the model focused on the entire session. Future research is needed to tease apart these different possibilities.

In addition to examining the associations between ruptures and interpersonal behaviors, this study also modelled the associations between interpersonal behaviors and between alliance ruptures. The results revealed constant interpersonal transactions between therapist and patient in therapeutic dyads. We found strong complementarity patterns in both warmth and dominance such that warmth of both people is often positively correlated, and dominance of both people is always negative correlated. We also found negative associations between patient's dominance and therapist's warmth in most of the sessions. Additionally, therapist's own dominance and warmth are often positively correlated. This indicates that in the current sample, the therapist's warmth was often increased when the therapist became more dominant and when the patient became more submissive. Future studies may explore if these patterns are common in other types of psychotherapy and whether these patterns are related to important therapeutic processes. Furthermore, we did not find significant within-person associations between withdrawal ruptures and confrontation ruptures, indicating that the expression of each type of ruptures may be relatively independent within each dyad. This finding supported the exploration of confrontation ruptures and withdrawal ruptures as potentially separate processes with different implications for treatment intervention and outcomes.

It is important to acknowledge several limitations in interpreting these results. This study did not test directional relationships between interpersonal dynamics and ruptures, so the results preclude conclusions about the direction or causality. Second, the study examined generalizability by replicating the within-person associations in each session. Future studies may

assess the generalizability in a larger sample using designs that can directly model both idiographic and nomothetic patterns. Third, the reliability of some of the sessions was somewhat low. This was due to the inherently challenging nature of observational coding as well as somewhat low variability in some variables (especially therapist's warmth and confrontation ruptures). These observations resonate with the nature of psychotherapy sessions, in that therapist's warmth might be expected to be relatively stable, and confrontation ruptures are relatively rare, especially in the training clinic with relatively novice therapists. Future studies should examine the interpersonal dynamics in psychotherapy sessions with more variations or may consider alternative approaches of coding moment-to-moment interpersonal behaviors (e.g., Structural Analysis of Social Behavior (SASB) (1979, 1994). Fourth, this study includes samples between trainees and patients with interpersonal problems in psychodynamic therapy. It is worth examining whether the interpersonal patterns from this study also pertain to psychotherapy using other treatments, different patient populations, or with more seasoned therapists. Additionally, this study selected patients and sessions with the most ruptures to maximize the variation in ruptures. It is possible that the interpersonal manifestations of ruptures in challenging dyads and challenging sessions may be different from those in dyads in which a relatively good alliance has been established. Future studies need to examine if the intensity/frequency of ruptures moderate the relationships between interpersonal behaviors and ruptures. Fifth, because of the nature of the single-case design, this study was not able to examine potential impacts of demographic variables such as gender, age, sexual orientation, race, ethnicity, and socio-economic status on interpersonal dynamics between patient and therapist. For example, these factors may influence the dynamics of perceived power in the therapy room and may influence dyadic interactions and rupture manifestations. Future studies utilizing between-person designs should examine how

these factors in patient and therapist may influence interpersonal expressions of ruptures. Lastly, with only two sessions per dyad selected for intense ruptures, the design of this study was not able to examine to what extent the rupture patterns replicate within each dyad. Future studies that intensively examine the series of sessions over time may be more adept to examine this question regarding whether there are dyad-specific rupture patterns that repeat over time.

This study extended theories about alliance ruptures by distinguishing the between-person interpersonal patterns and within-person interpersonal dynamics of ruptures. Particularly, the results suggested that the between-person associations *may or may not be* the same as the within-person associations between interpersonal behaviors and ruptures. An example for the same pattern for both within- and between-person associations may be that patients who are generally colder and more dominant may have more confrontation ruptures, and patients may show more cold, dominant behaviors when they develop confrontation ruptures. In contrast, an example for different patterns may be that patients who are generally more submissive may have more withdrawal ruptures, but patients may show more dominant behaviors when they develop withdrawal ruptures. Such distinctions are helpful for treatment strategies through understanding not only individual differences for ruptures but also within-person changes when rupture occurred.

This study also extended theories regarding ruptures by quantifying specific interpersonal contributions of therapists. Clinically, these results highlighted the inter-connections between therapist's and patient's interpersonal behaviors and between their behaviors and ruptures. Therapists are recommended to consider their own interpersonal influences on patients and their own interpersonal contributions to ruptures. Specifically, therapists should pay attention to the power dynamics in the session in addition to the dynamics of warmth. Therapists should also be

more aware when their submissive listening may contribute to an escalation of withdrawal ruptures. Future research may replicate these results and incorporate these findings in therapist trainings that aimed to address alliance ruptures (e.g., Alliance Focused Therapy Training). Currently, the alliance focused therapy emphasized on understanding therapist's own interpersonal contributions based on theoretical hypotheses. Examining therapist's interpersonal contributions empirically may enhance the effectiveness of such trainings.

More broadly, this study filled the gap between the common theoretical focus on interpersonal dynamics and the rare empirical examinations by demonstrating a concrete way to utilize newly developed methodology to quantitatively examine interpersonal dynamics. Future studies may use this framework to more directly examine core hypotheses in relational theories such as the maladaptive cyclical interpersonal patterns that surface both in and outside of therapy.

Lastly, this study addressed a key limitation in current psychotherapy research, that is the over-reliance on nomothetic studies and the under-utilization of examining idiographic effects (e.g., Barlow, 2009). This study demonstrated an attempt to examine both idiographic and nomothetic effects in a community-based, naturalistic sample. Few studies have examined the degree to which the rupture patterns are specific to therapeutic dyads or are more generalizable, despite theoretical speculations of idiographic interactions between therapist and each different patient. Future studies are recommended to consider designs that further parse out these effects.

Building on this preliminary exploration, future studies may further explore the directionality between interpersonal behaviors and ruptures and examine lagged effects to discriminate whether certain interpersonal behaviors contribute to the development of ruptures or vice versa. Understanding the directionality of these associations can help clarify if certain

patterns of interpersonal behaviors trigger ruptures, or if changes in interpersonal behaviors are a result of alliance ruptures. Articulating the answers to these questions may help the clinician in identifying the key factors to intervene in repair of ruptures. Second, future studies should examine how changes in interpersonal behaviors contribute to the repair of ruptures; information from those studies will further inform clinicians regarding the role of interpersonal behaviors in the effectiveness of rupture resolution. Third, future studies may benefit from further examining if particular interpersonal behaviors are associated with particular rupture markers. Such an examination can illuminate the potentially different interpersonal impacts of different rupture markers, as well as test the convergent validity between these two assessments (i.e. interpersonal behavior and ruptures) within the context of the therapeutic relationship. Lastly, future studies could examine whether certain patterns of ruptures and interpersonal dynamics within each session (rather than across sessions) may contribute to better treatment outcomes. It is possible that sessions that contain both the development and resolution of ruptures may contribute to better treatment outcomes than sessions that end with unrepaired ruptures. Examining pattern differences in how their interpersonal dynamics and rupture unfold over time may provide valuable insight for clinicians.

In summary, this study examined the moment-to-moment associations between alliance ruptures and interpersonal processes. The results identified the important roles of both patients' and therapists' interpersonal behaviors as well as interpersonal complementarity in the development of withdrawal and confrontation ruptures. Patient's increased cold or dominant behaviors, as well as increased dominance complementarity, are related with confrontation ruptures in more than one third of the sessions. Therapist's decreased dominant behaviors and patient's increased dominant behaviors are related with withdrawal ruptures in more than one

third of the sessions. The study also identified idiographic interpersonal patterns of ruptures that are consistent with individualized treatment formulations. This study calls for more attention to the examination of the dyadic, dynamic aspects of therapeutic relationships and ruptures.

APPENDICES

APPENDIX A: Tables

Table 1. Inter-rater reliabilities (ICCs) and descriptives of studied variables

Dyad #	Session#	N	ICC						Mean (SD)					
			Patient Warmth	Therapist Warmth	Patient Dominance	Therapist Dominance	Withdrawal Rupture	Confrontation Rupture	Patient Warmth	Therapist Warmth	Patient Dominance	Therapist Dominance	Withdrawal Rupture	Confrontation Rupture
1	9	100	0.57	0.43	0.84	0.81	0.49	0.57	-17.17 (85.21)	50.09 (46.06)	129.89 (115.30)	-177.06 (75.84)	2.45 (0.63)	1.21 (0.34)
	11	101	0.59	0.60	0.88	0.89	0.41	0.65	-41.70 (59.82)	-20.01 (56.82)	111.40 (83.31)	-36.72 (77.84)	2.19 (0.63)	1.34 (0.45)
2	15	105	0.60	0.21	0.53	0.64	0.41	0.91	40.78 (90.21)	13.70 (43.78)	259.61 (68.21)	-221.85 (87.49)	1.67 (0.44)	2.16 (0.93)
	21	103	0.40	0.52	0.71	0.90	0.53	0.46	43.44 (44.56)	65.38 (38.70)	166.46 (45.68)	-123.96 (85.80)	2.28 (0.61)	1.51 (0.51)
3	58	91	0.43	0.43	0.83	0.91	0.60	0.52	-176.06 (38.36)	104.58 (24.03)	-120.08 (88.28)	82.14 (95.31)	2.15 (0.75)	1.46 (0.60)
	59	107	0.67	0.62	0.70	0.79	0.47	0.37	-216.14 (57.42)	44.31 (42.01)	-179.47 (60.09)	93.79 (77.20)	2.50 (0.81)	1.49 (0.51)
4	4	102	0.65	0.42	0.90	0.82	0.65	0.78	-109.36 (66.07)	142.35 (17.10)	140.87 (80.41)	-63.67 (80.26)	2.05 (0.70)	1.83 (0.80)
	7	113	0.51	0.57	0.88	0.84	0.60	0.79	-206.69 (77.63)	147.46 (41.18)	106.25 (118.84)	-10.64 (118.48)	1.78 (0.56)	1.74 (0.71)

Notes: *N* indicates the number of observations for interpersonal behaviors and ruptures in each session. ICC indicates the 2-way, mixed, average intra-class coefficients across raters. *indicates that the time series of confrontation rupture for this session was removed from the modeling because of low variation (with more than 80% ratings identical in the time series).

Table 1 (cont'd)

5	8	93	0.69	0.58	0.84	0.78	0.50	0.74	-49.13 (85.45)	78.80 (49.45)	195.57 (121.30)	-22.82 (102.78)	1.89 (0.54)	2.34 (0.65)
	9	85	0.44	0.62	0.88	0.90	0.56	0.76	-327.69 (92.36)	-42.85 (66.00)	221.51 (109.98)	-45.21 (148.98)	1.74 (0.66)	3.44 (0.73)
6	8	91	0.43	0.54	0.79	0.78	0.45	0.69	133.07 (43.90)	186.97 (22.10)	41.70 (104.64)	-56.39 (72.17)	2.19 (0.48)	1.24 (0.40)
	9	105	0.51	0.40	0.83	0.90	0.53	0.50	15.65 (43.54)	145.72 (20.16)	66.98 (82.06)	-23.37 (87.16)	2.39 (0.74)	1.14 (0.28)
7	10	104	0.63	0.66	0.92	0.92	0.54	0.35	-49.53 (74.96)	149.66 (41.52)	86.63 (99.25)	-81.72 (99.93)	2.14 (0.67)	1.38 (0.43)
	18	104	0.57	0.46	0.93	0.93	0.46	0.27	62.43 (69.79)	186.70 (25.81)	81.93 (109.71)	-36.71 (98.28)	2.44 (0.53)	1.42 (0.42)
8	5*	100	0.50	0.50	0.88	0.85	0.34	0.74	96.64 (44.24)	149.42 (25.77)	94.39 (136.88)	-26.05 (132.89)	1.45 (0.34)	1.08 (0.23)
	6	83	0.52	0.34	0.82	0.83	0.45	0.46	13.99 (57.64)	166.38 (21.11)	23.35 (106.05)	-20.38 (99.65)	2.29 (0.56)	1.18 (0.27)

APPENDIX B: Figures

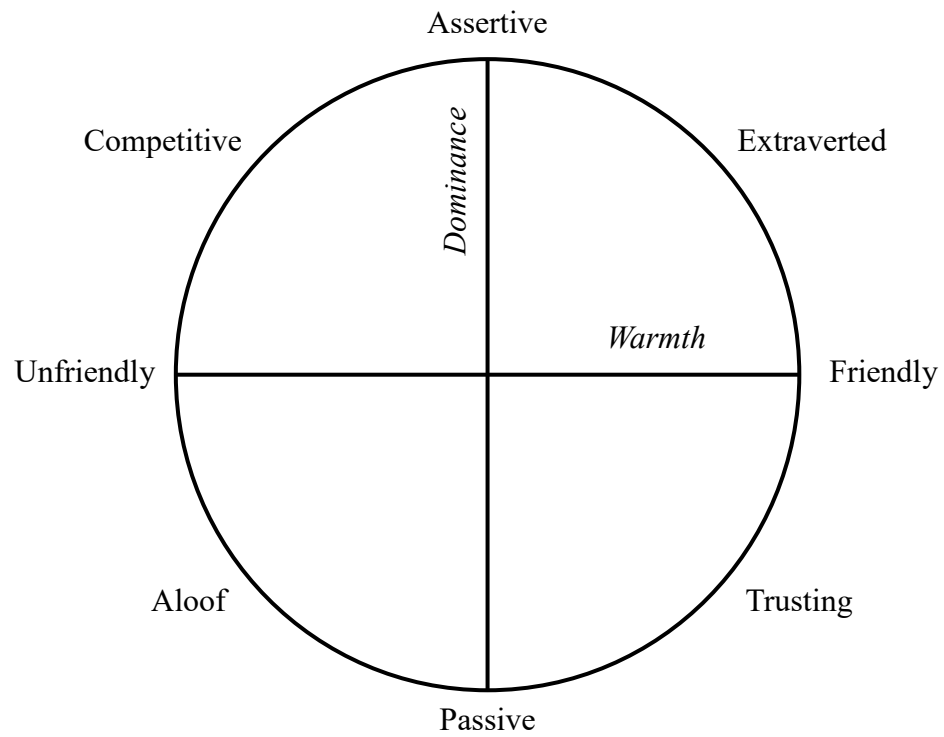


Figure 1. The Interpersonal Circumplex.

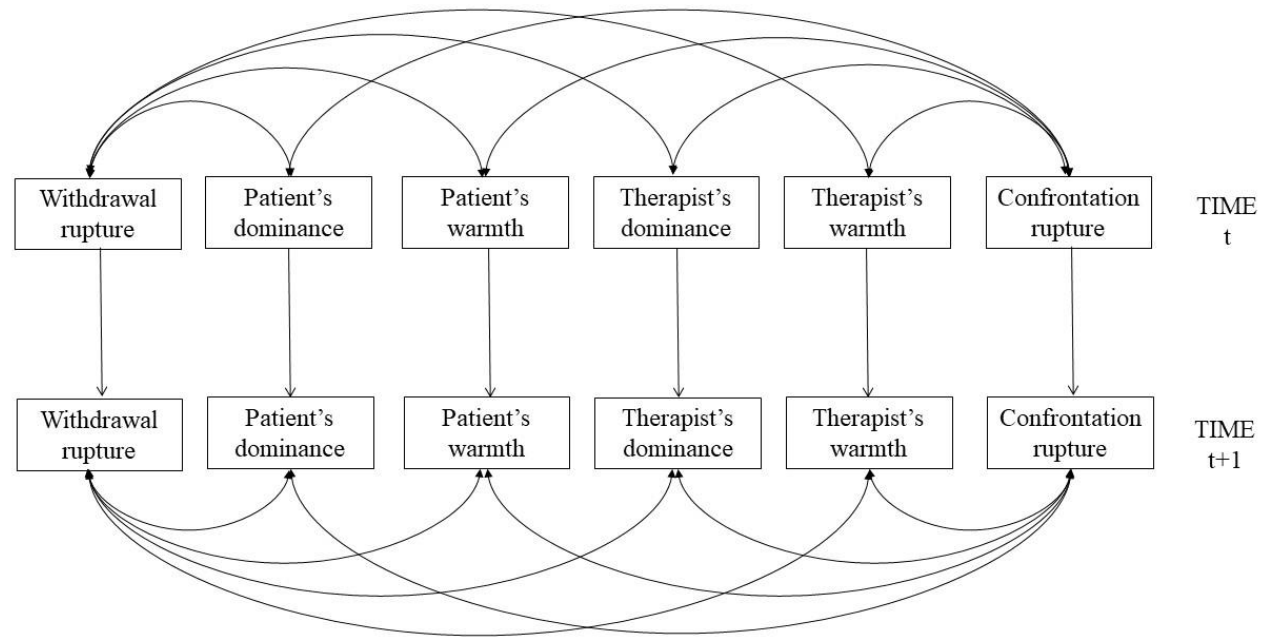


Figure 2. An illustration of the full dynamic structural equation model for Model 1.

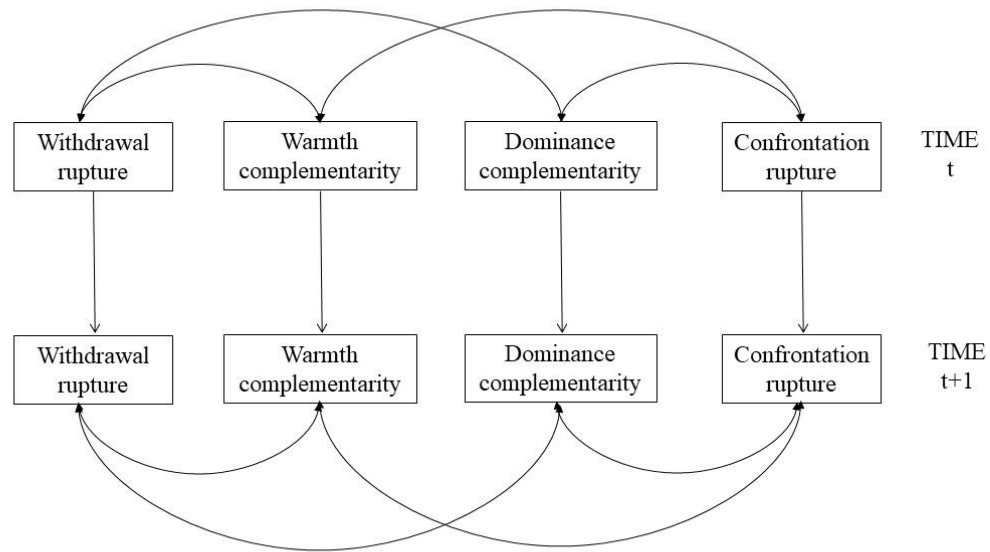


Figure 3. An illustration of the full dynamic structural equation model for Model 2.

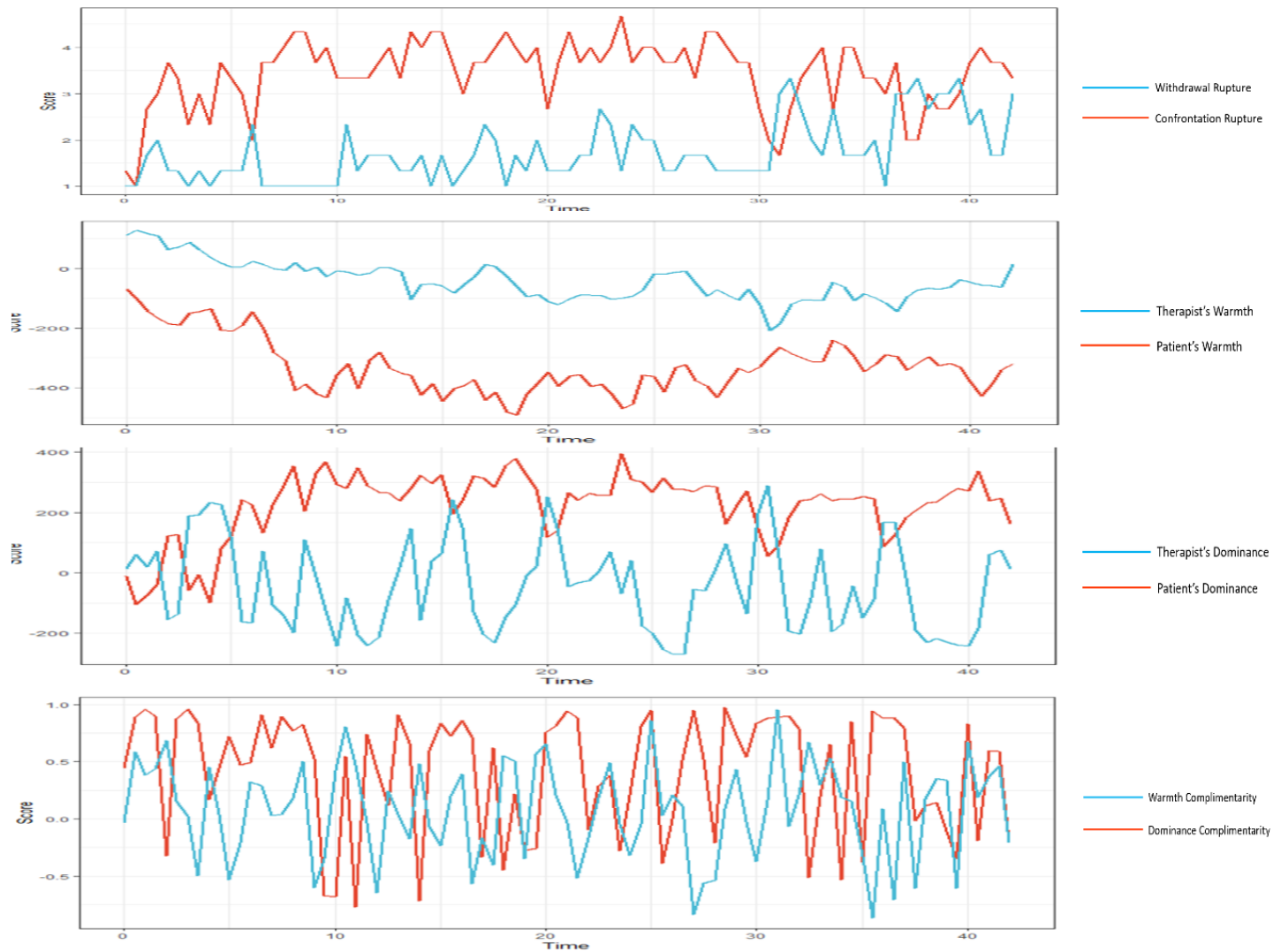


Figure 4. An example of time series of studied variables for Dyad 5, Session 9. *Note: The Y axis represents the corresponding score of each variable; the X axis represent time (min).*

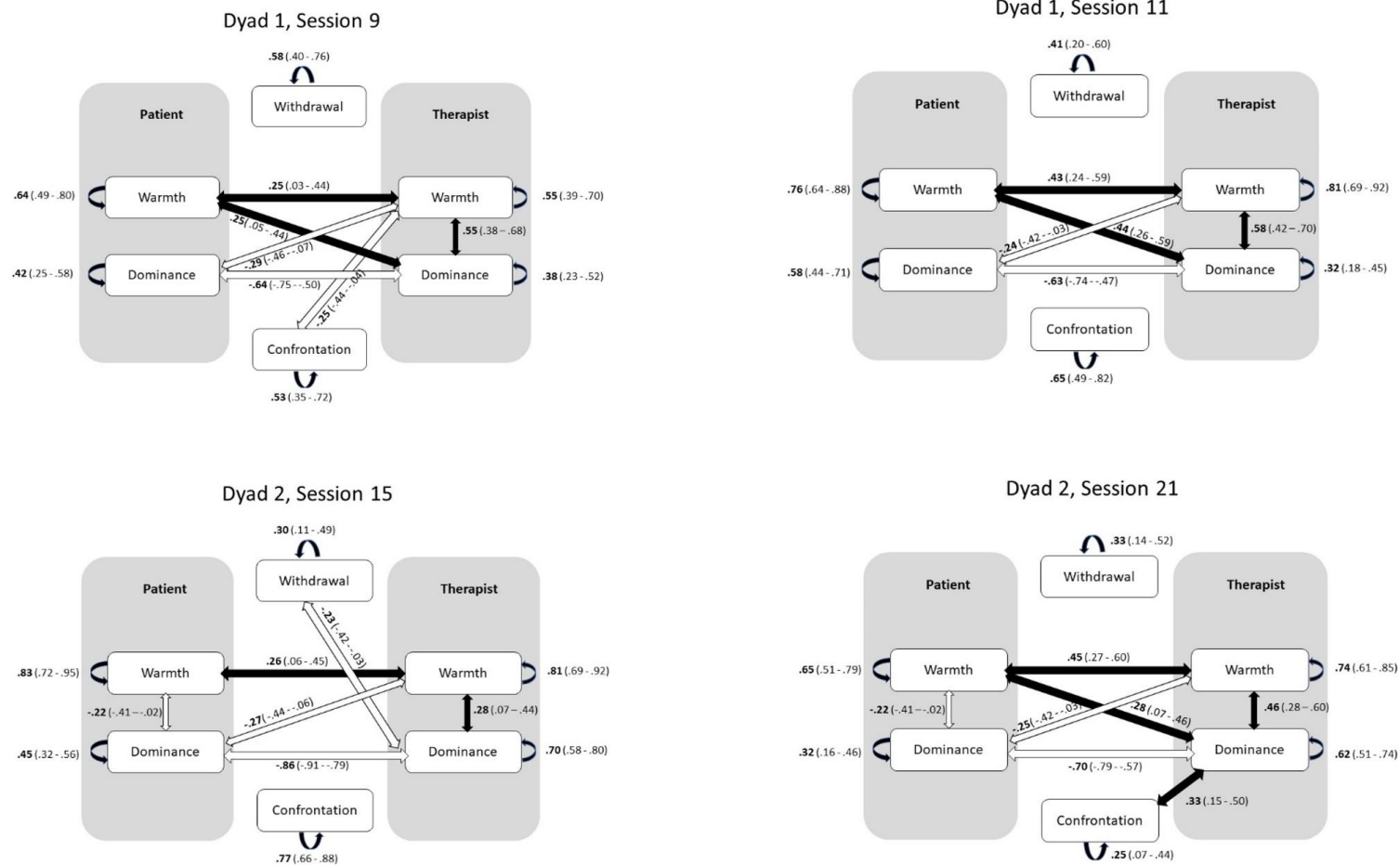


Figure 5. DSEM regression and correlation coefficients for each session for dyad 1 and dyad 2. *Note: Associations between interpersonal behaviors (warmth and dominance) and withdrawal and confrontation ruptures. Black arrows indicate significant positive associations and white arrows indicated negative associations. Curved arrows indicate autoregression between time t-1 and time t (1 lag equals to half minute). DSEM standardized regression coefficients and correlation coefficients were bolded with the 95% Confidence Intervals in parentheses.*

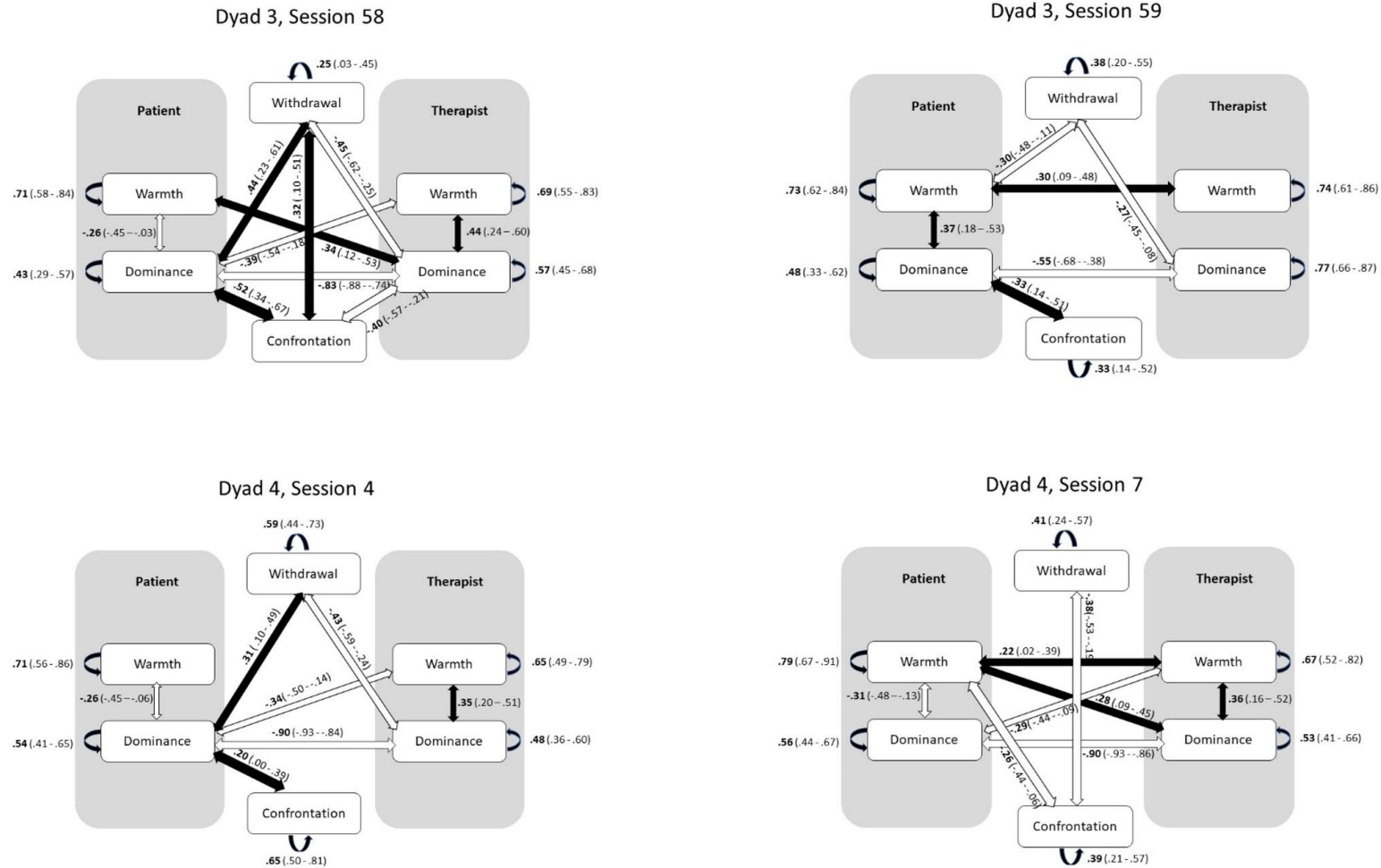


Figure 6. DSEM regression and correlation coefficients for each session for dyad 3 and dyad 4. *Note: Associations between interpersonal behaviors (warmth and dominance) and withdrawal and confrontation ruptures. Black arrows indicate significant positive associations and white arrows indicated negative associations. Curved arrows indicate autoregression between time t-1 and time t (1 lag equals to half minute). DSEM standardized regression coefficients and correlation coefficients were bolded with the 95% Confidence Intervals in parentheses.*

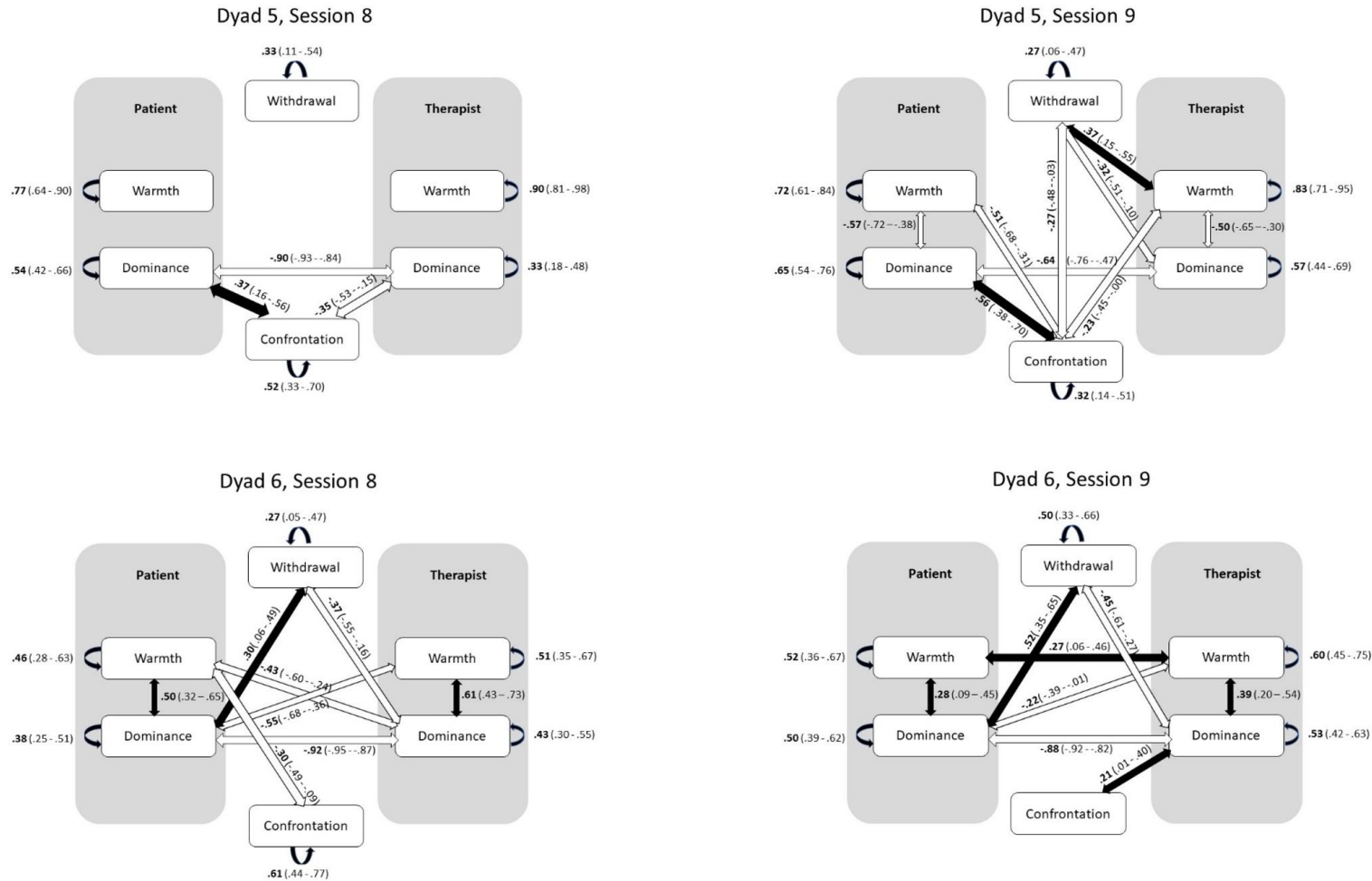


Figure 7. DSEM regression and correlation coefficients for each session for dyad 5 and dyad 6. *Note: Associations between interpersonal behaviors (warmth and dominance) and withdrawal and confrontation ruptures. Black arrows indicate significant positive associations and white arrows indicated negative associations. Curved arrows indicate autoregression between time t-1 and time t (1 lag equals to half minute). DSEM standardized regression coefficients and correlation coefficients were bolded with the 95% Confidence Intervals in parentheses.*

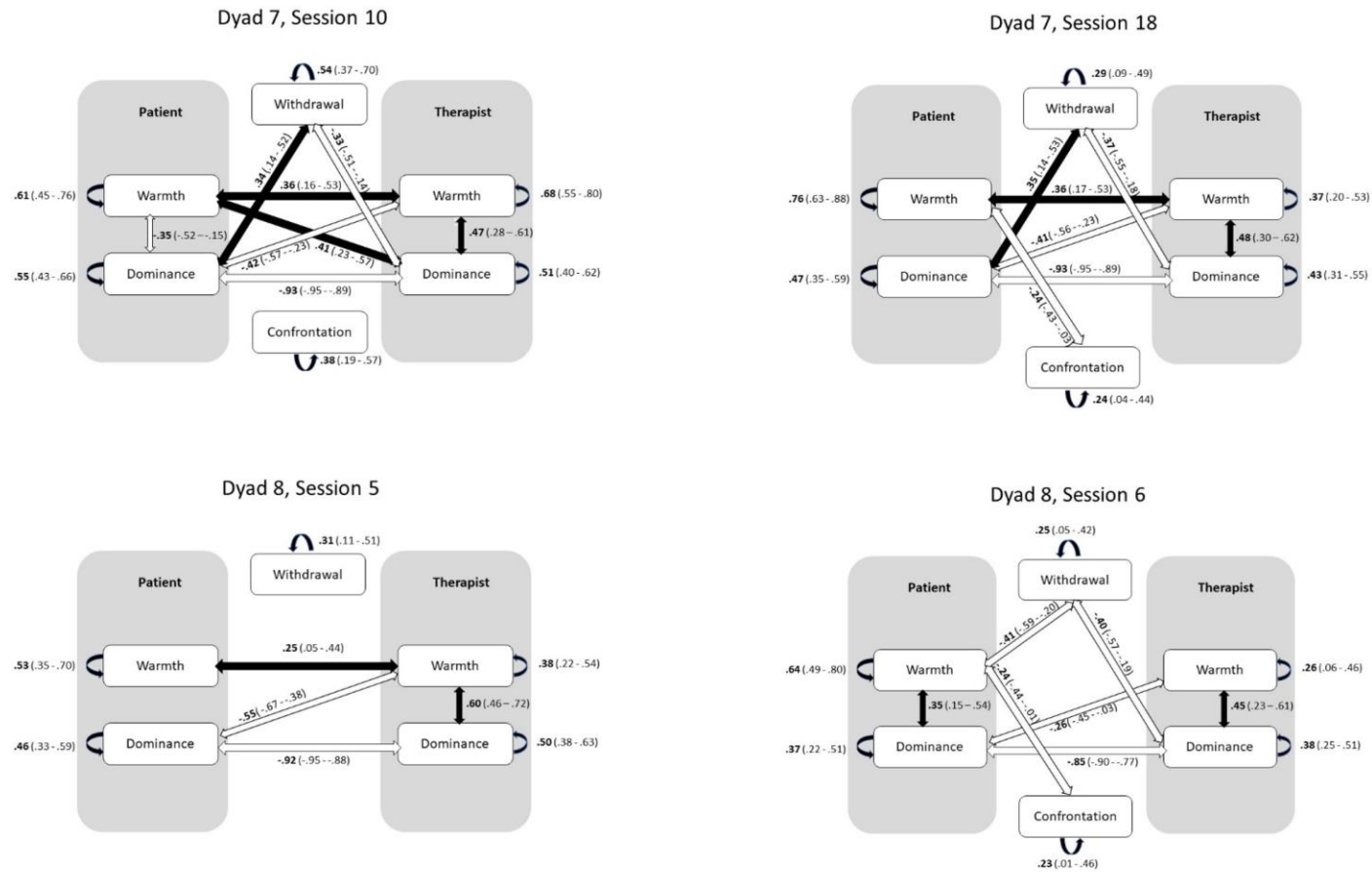


Figure 8. DSEM regression and correlation coefficients for each session for dyad 7 and dyad 8. *Note: Associations between interpersonal behaviors (warmth and dominance) and withdrawal and confrontation ruptures. Black arrows indicate significant positive associations and white arrows indicated negative associations. Curved arrows indicate autoregression between time t-1 and time t (1 lag equals to half minute). DSEM standardized regression coefficients and correlation coefficients were bolded with the 95% Confidence Intervals in parentheses.*

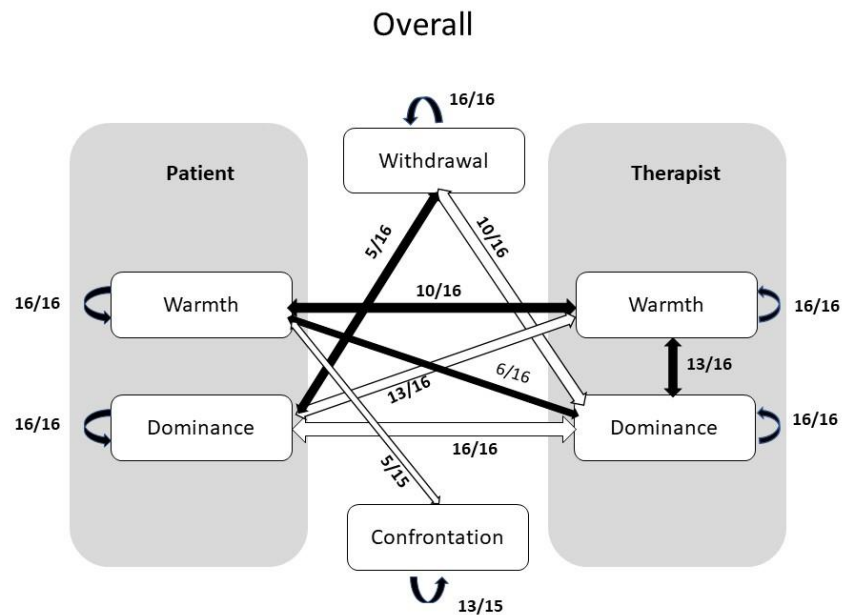


Figure 9. An overall illustration of significant associations that reached a hybrid or nomothetic effect. *Note: Black arrows indicate significant positive associations and white arrows indicated negative associations. Curved arrows indicate autoregression between time $t-1$ and time t (1 lag equals to half minute). The number (e.g., 5/16) indicates that (for example) in five out of 16 sessions there is a significant association.*

APPENDIX C: Supplementary Tables

Table S1. Dyad and session selection

Therapy Dyad #	Rupture Frequency_T	Rupture Intensity_T	Rupture Frequency_S	Rupture Intensity_S	Average Rupture Score	Session 1 #	Session 2 #	Session 1 Withdrawal	Session 1 Confrontation	Session 2 Withdrawal	Session 2 Confrontation	Average Session Withdrawal	Average Session Confrontation
1	5	5	5	3	4.5	9	11	2.5	2.5	3	2.5	2.75	2.5
2	4	4	4	3	3.75	15	21	3	2.5	3	3	3	2.75
3	4	4	4	3	3.75	58	59	3.5	3.5	3.5	3.5	3.5	3.5
4	4	4	4	3	3.75	4	7	3	3	3	4	3	3.5
5	3	4	4	4	3.5	8	9	2.5	3	3	3	2.75	3
6	4	3	2	2	2.75	8	9	3	1	3	1.5	3	1.25
7*	3	1	3	2	2.25	10	18	2.5	2	2.5	2	2.5	2
8*	2	2	3	2	2.25	5	6	2	2	2	1.5	2	1.75

Notes: Rupture Frequency_T and Rupture Intensity_T indicate the frequency and intensity of overall ruptures rated by the therapist, respectively; Rupture Frequency_S and Rupture Intensity_S indicate the frequency and intensity of overall ruptures rated by the supervisor, respectively; Average Rupture score indicates the average score across the ratings of frequency and intensity from therapists and supervisors; Session 1 # and Session 2 # indicate the numbers of sessions selected within each dyad for the study; Session 1 Withdrawal/Confrontation and Session 2 Withdrawal/confrontation indicate the rater's overall ratings of Withdrawal/Confrontation rupture after watching 30% of each session. Average Session Withdrawal/Confrontation indicates the average score of Withdrawal/Confrontation ruptures across two selected sessions; *indicates that for each of the two therapists, there was only one patient in the database, so that these two patients were automatically selected into the study regardless of their rupture ratings. All of the rupture ratings in this table were assessed on a 1 to 5 Likert scale.

Table S2. Significance of associations between interpersonal variables and rupture variables at the sample level

Dyad #	Session	Warmth complementarity with withdrawal rupture	Warmth complementarity with confrontation rupture	Dominance complementarity with withdrawal rupture	Dominance complementarity with confrontation rupture	Warmth complementarity with Dominance complementarity
1	Session 9					
	Session 11					N
2	Session 15					
	Session 21					
3	Session 58					
	Session 59				P	
4	Session 4			N		
	Session 7			N	P	

Notes: P= significant positive association, N = significant negative association. NA: confrontation rupture was removed from the model because of low variability.

Table S2 (cont'd)

Dyad #	Session	Warmth complementarity with withdrawal rupture	Warmth complementarity with confrontation rupture	Dominance complementarity with withdrawal rupture	Dominance complementarity with confrontation rupture	Warmth complementarity with Dominance complementarity
5	Session 8					
	Session 9					
6	Session 8				P	
	Session 9				P	
7	Session 10					
	Session 18					
8	Session 5*		NA		NA	
	Session 6				P	

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