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RESEARCH ARTICLE

Exploring the role of emotions and conversation content in interpersonal synchrony: A case study of a couple therapy session

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ABSTRACT

Objective This exploratory study investigated the association between interpersonal movement and physiological synchronies, emotional processing, and the conversational structure of a couple therapy session using a multimodal, mixed-method approach.

Method The video recordings of a couple therapy session, in which the participants' electrodermal activity was recorded, were analyzed. The session was divided into topical episodes, a qualitative analysis was conducted on each topical episode's emotional aspects, conversational structure and content. In addition, movement and physiological synchrony were calculated in each topical episode. Regression models were used to discover the associations between qualitative variables and synchronies.

Results Physiological synchrony was associated with the emotional aspects of the session and to episodes in which the spouses' relationship was addressed, while movement synchrony was only related to emotional valence. No association between synchrony and conversational structure was found.

Conclusion The findings suggest that physiological and movement synchrony play distinct roles in psychotherapy. The exploratory study sheds light on the association between momentary synchrony, emotions, and conversational structure in a couple therapy session.

Keywords: interpersonal synchrony; physiological synchrony; movement synchrony; couple therapy; emotion; conversation

Clinical and methodological significance: This exploratory mixed-methods case study demonstrates the potential of a systematic multimodal investigation of synchrony in shorter episodes for identifying various meanings of synchrony. The emotional aspects observed in the session were found to be related to physiological and movement synchrony, but not to the conversational structure. The results indicate a relationship between emotions and synchrony. From a methodological perspective, this study exemplifies the importance of calculating synchrony in shorter segments during therapy sessions, given that therapeutic processes and emotional aspects can change within sessions.

Introduction

Increasing evidence suggests that interpersonal synchrony has beneficial consequences for social interaction, as it enhances prosocial behavior, bonding, and positive affect (Mogan et al., 2017).

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Interpersonal synchrony refers to rhythmically and timely coordinated actions, emotions, behaviors, and responses between two or more people (Palumbo et al., 2017). Interpersonal synchrony is closely linked with experienced empathy and collaboration and works as a social glue, increasing affiliation, liking, and rapport (Chartrand & Van Baaren, 2009; Chartrand & Lakin, 2013; Valdesolo et al., 2010). Interpersonal synchrony has been studied in, for example, movements (Ramseyer & Tschacher, 2010), physiological responses (Palumbo et al., 2017), and even brain activity (Kinreich et al., 2017).

Recent systematic reviews on synchrony in psychotherapy have concluded that movement synchrony was associated with psychotherapy outcomes and physiological synchrony with empathy (Wiltshire et al., 2020), and that both movement and physiological synchrony were related to both session-level effects and treatment effects (Atzil-Slonim et al., 2023). It has been proposed that interpersonal synchrony between client and therapist facilitates the therapeutic alliance, which promotes the client's emotion regulation skills (Koole & Tschacher, 2016). In individual psychotherapy, synchrony between clients and therapists in movements (Ramseyer & Tschacher, 2011) and skin conductance responses (Marci et al., 2007) has been linked to a strong alliance and a good outcome. The majority of studies on synchrony have been conducted in dyadic settings, but here we study synchrony in a multi-person situation with four persons present. This increases the complexity of the data but allows exploration of emotions and conversational structure between clients, in client–therapist dyads and between co-therapists, leading to a richer and more ecologically valid data set. Studies on synchrony in couple therapy have reported that participants' sympathetic nervous system responses and movements synchronize during the sessions, and the synchronies were associated with the therapeutic alliance and outcome (Nyman-Salonen et al., 2021; Tourunen et al., 2020).

Despite these promising findings in psychotherapy interactions, the field of synchronization studies remains empirically fragmented, conceptually ambiguous, and theoretically underdeveloped, and studies have shown somewhat mixed findings (Palumbo et al., 2017). For example, there is no clear answer as to whether and under what circumstances positive or negative synchrony (correlation) would be better, and whether synchrony in different modalities is related to different situational and emotional factors within the session (cf. Kleinbub, 2017).

In this paper, we begin to address these questions by applying a mixed-method, multimodal approach to one emotionally intense couple therapy session. The aim of this exploratory and mixed-methods study was to identify the different roles of the dynamic and momentary dyadic synchronies in electrodermal activity (EDA) and movements in conversationally and emotionally varying episodes of one session. The findings of this study will contribute to the research and conceptualization of interpersonal synchrony in shorter conversational episodes and will provide relevant new knowledge to practitioners.

Movement Synchrony

Movement synchrony refers to the rhythmic and temporal coordination of body movements. In a meta-analysis, it has been related to prosocial behaviors, social bonding, and positive affect (Mogan et al., 2017). Motion Energy Analysis (MEA) has been used a great deal in the study of dyadic synchrony in psychotherapy. In a recent review by Atzil-Slonim et al. (2023) found 12 studies using MEA in individual psychotherapy, a search in the EBSCO PsychInfo database (21.2.2024) yielded 34 studies using MEA in psychotherapy. MEA is method for motion capture that detects movements from changes in pixels from frame to frame from regions of interest, often the head and trunk (Ramseyer & Tschacher, 2011), and synchrony is calculated based on the time series depicting movement energy. Movement synchrony has on a session-level been related to the therapeutic alliance and outcome (Ramseyer & Tschacher, 2011): head movement synchrony to the global outcome of therapy, and body movement synchrony to the patient's evaluation of the alliance (Ramseyer & Tschacher, 2014).

Studies concerning the momentary fluctuation of synchrony in different parts of the session are scarcer. A study on one therapy process found that movement synchrony increased as the therapy progressed (Ramseyer & Tschacher, 2008). Another study found a temporal pattern of movement synchrony in a session (Nagaoka & Komori, 2008). Synchrony was relatively low for the first 20 min (of a 50-min session), after which it increased, and then slowly decreased toward the end of the session. Momentary changes in synchrony during a session are related to the two opposing tendencies of synchrony in relationships: to synchronize to each other and to de-synchronize (Mayo & Gordon, 2020). This exploratory study is grounded on the assumption that synchrony changes from one moment to the next.

Studies comparing movement synchrony between different types of relationships (spouses, co-

workers) do not to our knowledge exist, except for our own study on movement synchrony in couple therapy (Nyman-Salonen et al., 2021), in which we found differences between how the spouses and therapists synchronized to each other.

Physiological Synchrony

Physiological synchrony refers to the rhythmic and temporal coordination of physiological processes, such as covariation in autonomic nervous system (ANS) activity, as measured through EDA as skin conductance, heart rate (HR), or common neural activity in time across participants (cf. Palumbo et al., 2017). Meta-analyses have pointed to physiological synchrony, especially EDA synchrony, as being related to the quality of the relationship (Mayo et al., 2021). In psychotherapy and psychological interactions, interpersonal synchrony has been related to empathy (in EDA: Marci et al., 2007; see also Finset & Ørnes, 2017 for a theoretical model of the relationship between synchrony and empathy), and decreased EDA synchrony to emotional distance (Marci & Orr, 2006). To make the picture even more complicated, increased EDA synchrony has also been related to marital conflict (Levenson & Gottman, 1983). In contexts outside psychotherapy, physiological synchrony has been reported to increase when the intensity of the situation increases, such as during competitive interactions (Chanel et al., 2012), and in everyday interactions, when there is higher emotional engagement (Slovák et al., 2014). The difficulty in creating an integrated picture of physiological synchrony based on the different studies lies in the diversity across the research settings and methodologies used, making it hard to generalize findings across studies (cf. Palumbo et al., 2017). Differences in EDA synchrony between the different dyad types in couple therapy (spouses, co-therapists, client–therapist dyads) have been found in our own studies (Karvonen et al., 2016; Tourunen et al., 2020), but we are not aware of other studies on the subject.

Role of Physiological and Movement Synchrony in Psychotherapy

One study suggested that synchrony in different modalities of interaction might serve separate functions and compensate for disruptions in communication (Dale et al., 2020). A single case study on physiological and movement synchrony discovered an interesting pattern: when there was an antiphase pattern of physiological synchrony (a negative correlation between the two participants' physiological measures), there was a positive association between movement synchrony and the working alliance (Tal et al., 2023). This suggests that the different kinds of synchronies have separate functions in psychotherapy; however, research on this is lacking. A recent study found the association between movement synchrony, EDA synchrony, and speech in couple therapy to be complex (Tourunen et al., 2022). Movement synchrony and EDA synchrony were correlated only in client–therapist dyads. However, when dyads with similar roles (client–client and therapist–therapist dyads) listened to others, there was more movement synchrony between them.

Emotional Processing

Emotions and emotional processing are central in psychotherapy (Neimeyer, 2009; Pascual-Leone, 2018) and couple therapy (cf. Snyder et al., 2006). Emotional processing refers to recognizing and expressing emotions, verbally addressing emotions, as well as to the (co-)regulation of emotions. Expressing vulnerable emotions in couple therapy has been related to increased trust between spouses (McKinnon & Greenberg, 2013), and emotional processing and emotional coregulation are viewed as being among the most important components for the outcome of therapy (cf. Johnson, 2007). Butler and Randall (2013) described interpersonal emotional coregulation in close relationships as a linkage of affective arousal and the dampening of it so that an optimal emotional state (homeostasis) is maintained. In couple therapy, homeostasis is often challenged, as emotions are expressed and experienced in the session, and a dysregulation in the spouses' state occurs.

Emotions affect physiological states. Different emotions have been found to have distinguishable electrodermal activity patterns: arousal increases during anger, anxiousness, disgust, embarrassment, fear, or amusement, and decreases with feelings of sadness or relief (Kreibig, 2010). Heightened arousal has been related to laughing and, especially, laughing together (Marci et al., 2004), but also to crying (Gross et al., 1994) and in relation to cognitive processing or preparing for action (Hugdahl, 1996). However, electrodermal activity has also been related to behavioral inhibition and defensive strategies. It increases if thoughts are suppressed, if traumatic experiences are not disclosed (Hughes et al., 1994), and if emotional expressions are inhibited (Gross & Levenson, 1993; Hughes et al., 1994).

In addition, the regulation of emotions can occur either intrapersonally or interpersonally (Grecucci et al., 2015). Intrapersonal regulation happens when one tries to consciously suppress the expression

of an emotion while being emotionally aroused. Interpersonal regulation of emotion occurs as participants become moved by each other's expressed emotions (Fuchs & Koch, 2014), or during activities that aim at influencing others' emotions, such as soothing, calming, or inspiring (Butler & Randall, 2013; Zaki & Williams, 2013).

When studying emotions in psychotherapy focusing only on talk (or transcriptions of sessions) falls short since nonverbal behaviors and bodily responses are central elements of emotions and need to be considered (Eteläpelto et al., 2018). For instance, touching oneself (using self-adaptors) could signal arousal or uneasiness (Burgoon et al., 1992). Talk in relation to synchrony has not been studied much. It has been suggested that nonverbal behaviors are intertwined with talking and emotions since they are used in organizing turn-taking during conversations and in signaling emotional stances toward the topics discussed (cf. Givens, 2015). In this study, we wanted to investigate the association between conversational structure and synchrony.

The association between synchrony and emotional processing is unclear. Movement synchrony has been reported to cause positive but not negative affect, and more synchrony occurs in situations that were affectively arousing (Tschacher et al., 2014). Physiological synchrony in groups has been related to a better emotional climate (Gashi et al., 2018), and physiological synchrony predicts the cooperative success of dyads (Behrens et al., 2020). But again, the picture is not as coherent, since higher EDA synchrony between spouses was found during negative interactions compared to positive interactions (Coutinho et al., 2019). There is a need to study how synchrony changes from moment to moment in the sessions, and how emotions, their expression, processing, and suppression are related to synchrony.

Talk/Speech in Couple Therapy

In almost all studies on synchrony, talk has not received much attention, even though it has been considered the core of psychotherapy. Conversations in couple therapy happen between multiple actors: two clients, and one or two therapists. From a conversational perspective, couple therapy is an interesting combination of everyday interaction and institutional interaction (cf. Heritage & Drew, 1992). The spouses come to therapy with their everyday conversational patterns and habits, but the conversational setting is institutional, meaning that participants have clear roles and tasks as clients and therapists, defined by the overall but implicit, aims, and rules.

Participants orient themselves to the session interactions according to their institutional roles. Based on these, a therapist is seen as responsible for the safety of the setting as well as facilitating the clients' processing of issues relevant to them and to their mutual relationship. Only the clients have access to their own experiences, and are responsible for addressing relevant topics and problems behind seeking couple therapy, but at the same time, the topics could be emotionally loaded and even painful.

In couple therapy, the relationship between spouses is not only addressed, but also simultaneously lived during the therapy conversations. Clients may be able to control their emotions better in therapy sessions than in their everyday lives. This requires therapists to be sensitive in observing and sensing markers of emotional regulation and suppression, since the therapy session could evoke intense emotions in the spouses; this, in turn, could even provoke safety problems outside the therapy room. All of these aspects of the conversation might affect how therapists synchronize with clients and with each other.

In this study, couple therapy was conducted with two clients and two therapists. Conversation could thus happen in six different dyads, four different triads, or between all four. The conversational structure could change often in a session, as one dyad might be talking, but then someone could be invited or enter the discussion, and the conversational structure would change. The therapists were more often responsible for the conversational structure than the clients. Talk in relation to synchrony has not been studied much. In this study, the relationship between conversational structure and synchrony was addressed.

Objective and Research Questions

The aim of this exploratory single case study was to explore the association of physiological and movement synchrony with emotional aspects and conversational structure in one couple therapy session. The aim was not to make generalizable causal interpretations, but the findings will add to our theoretical understanding of the relation between momentary synchrony and emotions and the conversational structure (Adu et al., 2022; Yilmaz, 2013). A multimodal, mixed-method research procedure was applied to one multi-actor couple therapy session. Based on the topics of the conversation, the session was divided into 18 conversational episodes. Interpersonal synchronization in six dyads in participants' movements and electrodermal activity was computed for each conversational episode. In separate analyses,

discursive and emotional interactions were analyzed in detail in the conversational episodes. The findings of the qualitative analyses were then integrated with the results of the synchrony computations, with the aim of exploring how interpersonal synchrony was related to the emotional aspects and conversational structure of the interactions. We sought to answer the following research questions:

(1) How are the emotional aspects (variable *Nonverbal Emotionality, Nonverbal Regulation, Verbal Emotionality*) related to movement and EDA synchrony in a single couple therapy session across different dyad types (client–therapist vs. client–client vs. therapist–therapist)?
(2) Are there differences in the level of movement and EDA synchrony during episodes of positive and negative emotional valence (variable *Valence*), and do these differences vary across different dyad types in one couple therapy session?
(3) How do different topics of conversation (variable *Target*) relate to movement and EDA synchrony, and do these associations vary across different dyad types in one couple therapy session?
(4) How is the complexity of conversation (variable *Conversational Complexity*) related to the level of movement or EDA synchrony in a single couple therapy session?
(5) To what extent are findings of movement synchrony related to findings of EDA synchrony within the same dyad types, and do these associations vary across different dyad types in one couple therapy session?

Methods

Data

The data for this study were obtained at the University of Jyväskylä, Psychotherapy Research and Training Centre as a part of the Relational Mind (RM) research project (Seikkula et al., 2015), which aimed to shed light on attunement and synchrony in a multi-actor couple therapy setting. In the RM project, the participants' social interactions (both verbal and nonverbal) and ANS responses were studied. All the sessions were video recorded. In the second and sixth sessions, ANS measurements and individual stimulated recall interviews (SRIs) were conducted in accordance with the research protocol of the project. Progress in the therapy was monitored by the Outcome Rating Scale (ORS), given to both clients before each session, and the alliance was evaluated by the Session Rating Scale (SRS; Duncan et al., 2003), given to the clients and the therapists after each session individually. The Human Sciences Ethics Committee of the University of Jyväskylä approved the research, and the participants gave their informed written consent to participate in the study and for the use of the data.

In the couple therapy case of this study, two experienced couple and family therapists, both of whom were male, worked as a pair. The therapy was not manualized, and the therapists mainly applied a narrative, dialogical, and reflective therapeutic approach. The data for this study came from Session 2, which was video recorded using four cameras that captured a precise facial image of each participant. In addition, two cameras covered the whole bodies of the participants (see Figure 1). Both the clients and the therapists wore equipment for ANS recordings (skin conductance, respiration, and heart rate) during the therapy session, and the SRIs were conducted within one day after each session.

The Case

Tom and Mary (pseudonyms), a couple in their forties, had been in a relationship for eight years, and were parents to a toddler, Eva (pseudonym). They were both European and highly educated. The couple had been referred to couple therapy after Mary had suffered from postnatal depression. Both spouses wanted to improve their mutual communication and sense of connection, which had weakened after the birth of the child. The couple came from a different cultural background than the therapists, who did not use their native language. The second session of this case was selected for this study because in the initial qualitative analyses, (i) all four participants were active in the conversational exchange, (ii) the session was rich in emotional interactions as the spouses were open in their emotional expression, and emotional coregulation behaviors between the participants were visible in the video recordings of the session, and (iii) there was variation in different parts of the session regarding the complexity of the conversational structure and emotional intensity. Moreover, the participants' skin conductance was measured during the session.

Electrodermal Activity

As a measure of clients' and therapists' EDA, skin conductance was recorded using two disposable electrodes (Ag/AgCl, Ambu Neuroline 710, Ballerup, Denmark), which were placed on the palm of each participant's nondominant hand. An amplifier (BrainProducts Brainamp ExG 16, Brain Products,

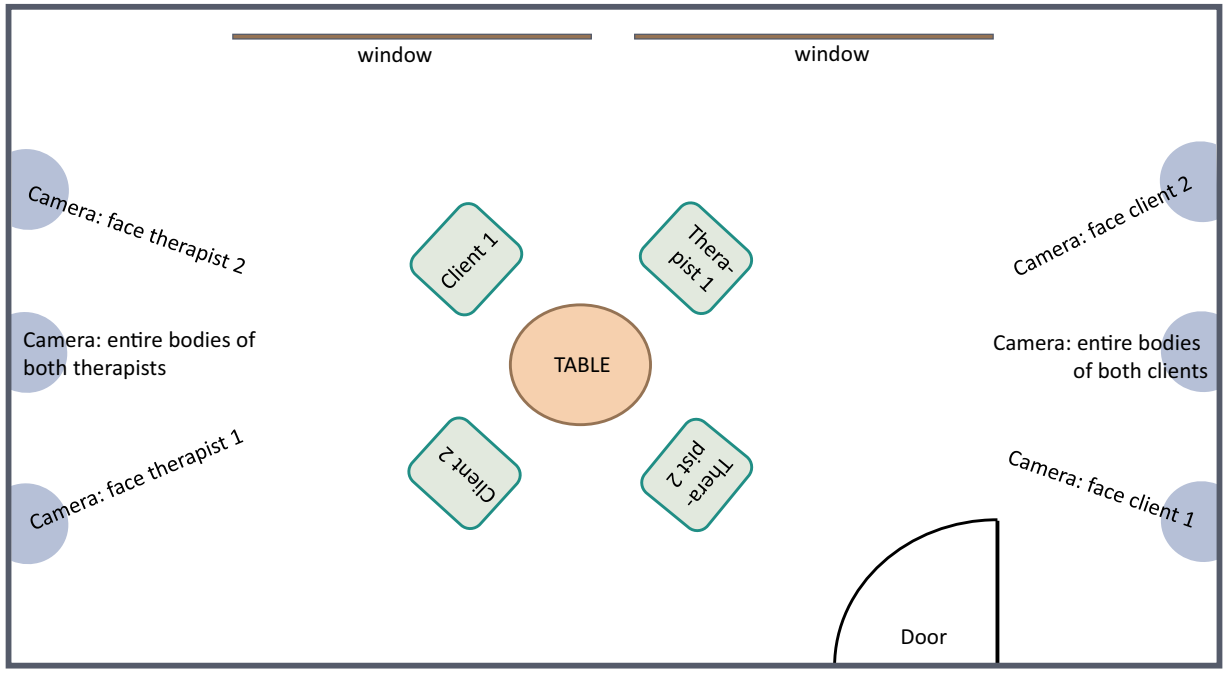

Figure 1. An illustration of the setting including camera angles.

Gilching, Germany) and a data acquisition program (BrainVision Recorder, Brain Products, Gilching, Germany) were used to record Skin Conductance (SC) with a sampling frequency of 1000 Hz. SC was determined using a 0.5 V constant voltage (GSR sensor, Brain Products, Gilching, Germany). The signal was amplified in DC mode and low-pass filtered at 250 Hz. A marker unit was used to synchronize SC with the video recordings. For the synchrony analyses, the SC signals were downsampled offline to 10 Hz using a BrainVision Analyzer (Brain Products, Gilching, Germany) and written to a text file for further analysis.

MEA

MEA (Ramseyer & Tschacher, 2011) is frame-differencing software that detects the number of pixel changes in researcher-defined regions of interest (ROIs). The video recording of the session displaying the participants' entire bodies was used in the MEA analyses. The video was converted to 10 frames/s, and movement time series were obtained for each participant's ROI (head and body separately). To simplify the design, the sum of MEA_head and MEA_body (MEA_all) was used in the synchrony computations.

Qualitative Analyses

Topical episodes. Conversations of the 77-min session were first manually transcribed verbatim, the speech turns were separated, and overlapping speech, pauses and the most obvious nonverbal behaviors (laughing, crying, or shouting) were marked in the transcription. The transcription was done by an undergraduate psychology student and checked by the first author. Based on the thematic focus of the conversation, two researchers (Laitila and Vall) divided the session into 19 topical episodes (TEs) based on the theme discussed in the episode. The discussion in the session centered around the spouses' work, their different experiences of the time after their child was born, and their experience of disconnectedness with each other. A detailed description of the contents of each TE and the procedure of dividing the session into TEs is provided in Laitila et al. (2019). In this study TEs 2 to 19 were analyzed. The first TE was omitted due to technical difficulties. The beginning and the end of each topical episode were defined in seconds. Since the content of the conversation was a determining factor in defining the TEs, these differed in length. The average length of the TEs was 257 s, the range being between 167 and 443 s.

Complexity of the conversational structure. The complexity of the conversational structure was rated for each TE separately based on the following scale: Conversation mainly in one dyad = 1; Conversation mainly in one triad = 2; Conversation in changing constellations, one participant out of four is outside = 3; Conversation in changing constellations,

all four participate = 4. The values of the scale were used as predictors in the regression models.

Targets of talk. Targets of talk—that is, what was talked about—were coded for each speech turn by using the following categories: Female client (Mary); Male client (Tom); Relationship/Both spouses; Family; and Other issues. Only speech turns comprising at least one word were coded, whereas turns comprising merely minimal responses, such as "mm" and "uh," were not coded. The sum of the number of speech turns in each target category was then calculated for each TE, and used as a predictor in the regression models.

Nonverbal emotionality. Nonverbal emotionality refers to intense emotional expression, such as weeping and laughter. This was chosen as a variable because both weeping and laughter have been related to heightened arousal (Gross et al., 1994; Marci et al., 2004). The instances were first rated by observing all weeping and laughter incidents for each participant (0 = no weeping or laughter; 1 = weeping or laughter or both). After that, the percentages of intense emotional expression were calculated for each TE (total number of weeping and/or laughter seconds per the total number of seconds in a TE). Based on these, the intensity of emotional expression for each TE was rated according to the following scale: 1 = 0–19% = very low; 2 = 20–39% = low; 3 = 40–59% = moderate; 4 = 60–79% = high; and 5 = 80–100% = very high. The values were used as a predictor in the regression models.

Nonverbal regulation. Nonverbal regulation refers to emotion regulation behaviors, such as self-touch (head, face, and mouth regions) behaviors, as well as lip compression and lip biting. These behaviors have been related to emotional suppression and were chosen because they have been related to both arousal (Hughes et al., 1994) and body movements (Burgoon et al., 1992). The frequency of nonverbal regulation behaviors was observed for each participant in each TE by one rater. The sum of nonverbal regulation, defined as the sum of all emotion regulation behaviors of four participants per TE (range: 11–38), was then formed. Since TEs differed in length, the sum of nonverbal regulation was divided by the length of the TE to create the Nonverbal Regulation density index per minute (range: 3.2–8.9), which was classified as follows: 0 (0–1.9) = very low; 1 (2–3.9) = low; 2 (4–5.9) = moderate; 3 (6–7.9) = high; 4 (8–9.9) = very high in which the values were calculated and divided into sample-specific quintiles. These values were used as a predictor in the regression model.

Verbal emotionality. Verbal emotionality refers to how emotions are addressed in a session. This variable was chosen because of our interest in seeing how emotions are related to synchrony. Three categories were coded: (i) "Emotions addressed directly" was coded when a specific emotion word, such as happy or sad, was mentioned. (ii) "Emotions addressed indirectly" was coded when the content of the conversation indirectly pointed to emotions, but the word for an emotion was not mentioned, for example, "went to pieces" as referring indirectly to the feeling of sadness. (iii) "Emotional style or emotional processing" was coded when it was being addressed, for example, "I show my emotions openly." Frequencies were calculated separately for these variables. The sum of the frequencies of all the variables (emotions addressed directly, indirectly, and emotional processing addressed) was calculated to form Verbal Emotionality: 0 = none (0); 1 = once (1); 2 = twice (2), 3 = three times (3); 4 = four times (4); and 5 = five or more (5–6). The coding was carried out by one rater. The frequencies in each TE were used as a predictor in the regression models.

Valence. The emotional valence of the conversation was chosen as a variable because it has been related to movement synchrony (Tschacher et al., 2014). The valence was observed in each TE using the following scale: 0 = neutral; 1 = positive; 2 = negative; 3 = mixed. The values for each TE were used as a predictor in the regression model. Valence was rated positive when expressions of happy, pleased, and satisfied emotions were observed. Negative valence was rated when expressions of sad, nervous, angry, and upset emotions were observed in a TE. Mixed valence was rated when both positive and negative emotional expressions were observed to approximately the same extent. Neutral valence was rated when no specific valence could be defined for the TE. In the neutral episodes, no intense emotional expression was observed.

Coding of the qualitative variables. Coding of the qualitative variables was done using the videorecording and the transcription. The division of the session into the TEs was previously done by two senior researchers (Laitila and Vall). Complexity of the Conversational Structure, Targets of Talk, Nonverbal Regulation, Verbal Emotionality, and Emotional Valence were coded by an experienced senior researcher (first author). The Nonverbal Emotionality was coded by two undergraduate psychology students, who compared their evaluations to

each other, and all coding was checked by a senior researcher (first author).

Quantitative Analyses

Quantification of synchrony. Interpersonal synchronies for the participants' movement and EDA signals were computed for each TE in six dyads (C1–C2, C1–T1, C1–T2, C2–T1, C2–T2, and T1–T2) using the Surrogate Synchrony (SUSY; Tschacher & Haken, 2019) algorithm, which computes synchrony as windowed cross-correlation based on two-dimensional time series. The time series were first divided into 20-s segments. Cross-correlations were computed in each segment with a time lag of ±3 s, by shifting one of the time series stepwise relative to the other one (in 0.1-s steps in both movement and EDA due to their sampling rate of 10 Hz). The cross-correlations were standardized using Fisher's Z and then aggregated within each segment. Synchrony was computed using the non-absolute values of Z, which differentiates between instances when the time series correlate positively (in-phase synchrony) or negatively (anti-phase synchrony). Finally, the cross-correlations were aggregated across all segments, giving a single value of synchrony for each dyad and TE. To test the strength of the empirically obtained synchronies, segment shuffling was used to create surrogate time series on which the same computations were run. The number of available surrogate time series depends on the duration of a TE. An episode lasting 5 min, for instance, comprises 15 segments, which allow computation of $15 \times 14 = 210$ different surrogates. Then, for each dyad and TE, the effect size (ES) for each synchrony was calculated by the difference between the "real" *Z* and the mean of all available surrogate *Z*, divided by the standard deviation of the surrogate *Z*. The nonabsolute effect size (ESnoabs) was obtained. Overall, this procedure yielded 216 ESnoabs (18 TEs, 2 measures (movement, EDA), and 6 dyads per TE). These synchrony values (ESnoabs) in each TE were used in the regression models.

To test whether the dyadic synchronies (movement and EDA) were significant, one-sample *t*-tests were used for the ESnoabs of dyadic synchrony values across all 18 TEs. *t*-tests were also performed separately for the six dyadic synchronies in each TE.

Multiple regression analyses. Multiple linear regression models were calculated to study the association between movement synchrony and EDA synchrony (ESnoabs) and the numeric qualitative predictors *Nonverbal Emotionality, Nonverbal Regulation,* and *Verbal Emotionality*. The synchronies served as the dependent variables. Analyses were repeated for the three different dyad types—client–client (C–C), client–therapist (C–T), and therapist–therapist (T–T)—to examine potential variations among the dyad types.

Second, a regression model was calculated with the predictor *Valence* (with steps "neutral," "positive," "negative," and "mixed," using "negative" as the reference value) and all dyad types on synchrony across all TEs. TE was inserted as the random effect.

Third, a multiple linear regression model was calculated to predict movement synchrony and EDA synchrony by the *target* of talk (the female spouse, the male spouse, their relationship, the family, and other topics). The regression models were repeated for the three different dyad types—client–client (C–C), client–therapist (C–T), and therapist–therapist (T–T)—to examine any variations across dyad types.

Fourth, in an analogous regression model, movement synchrony and EDA synchrony was predicted by *Complexity* (of the conversation) (with four steps: "conversation mainly in one dyad," "in a triad," "in changing constellation," and "all four participating").

Fifth, Pearson's correlations were calculated between movement synchrony and EDA synchrony for each dyad type (C–C, C–T, T–T) using ESnoabs of movement and EDA synchronies in each TE. All analyses were done using JMP Pro 15.1 (SAS Institute Inc.) (for further information see the online supplemental material).

It is important to note that the results should be considered as descriptive of this single case. We also examined the results by adding all predictors in one regression model, which yielded similar results. We decided to use the separate models since they showed the differences between the dyads and thus provided a more detailed description of the session.

Results

Results from Qualitative Analyses: Topics and Conversational Structures in Topical Episodes

Themes discussed in the session. In this therapy session, central topics for the entire therapy process were addressed. These topics included the disconnection felt between the spouses and problems related to the birth of their child. During the first third of the session, the conversation focused more on work-related issues, since Mary frequently traveled because of her job. This had led to discussions of whether the family should move closer to her

workplace and whether Tom was satisfied with his job. In TE8 and afterward, the topics of the conversation moved toward their relationship and family-related issues, and finally, in TE12, to the disconnect felt in the spouses' relationship. Disconnection between the spouses was addressed in topical episodes 12–16. In TE17, Mary addressed her feelings of guilt in relation to her motherhood. In TE 18, the conversation moved first to other people's responses to the spouses' nontraditional roles in their parenting and then to Tom's childhood.

Complexity of the conversation structure. During the therapy session, the clients (Mary = 36%, Tom = 45%) spoke more than the therapists (therapist 1 = 8%, therapist 2 = 11%). The conversation took place in one dyad, namely, Tom and therapist 1, only in TE6. Conversation in one triad was also observed in TE2 and TE18. In TEs 8, 9, 17, and 19, conversation occurred in changing dyads and triads, so that at least one of the participants was always outside the active conversation. The complexity of the conversational structure was at its highest in all the other topical episodes (3–5, 7, 10–16), in which all four actively participated in conversation in changing constellations (dyads, triads, and tetrad). Reflective conversation between the therapists (i.e., therapists address their talk to each other to reflect on the session interactions) was observed in TEs 11, 13, and 19. Episodes of dialogue between the spouses occurred in TEs 4–5, 9–10, and 12–16; the spouses were in dialogue most often in TEs 12 and 16 (3 dialogue episodes per TE).

Targets. The targets of talk (that is, who or what was talked about in each TE) are shown in Table I. Most speech turns were about Tom (105) or Mary (94), or their relationship (96).

Table I. Targets of the conversation per TE.

TE	Mary	Tom	Relationship	Family	Other
2	1	10	0	2	0
3	7	3	6	1	0
4	1	10	8	1	4
5	2	9	1	0	4
6	0	3	8	0	1
7	0	7	0	0	1
8	9	3	8	1	1
9	7	0	0	2	0
10	3	6	4	1	0
11	12	3	3	0	0
12	5	10	18	3	0
13	4	3	8	1	0
14	3	3	10	1	1
15	10	12	1	0	1
16	12	12	19	3	0
17	16	2	1	1	3
18	0	6	0	1	1
19	2	3	1	1	2
Sum	94	105	96	19	19

Results of Qualitative Analyses: Emotions in Topical Episodes

Verbal emotionality. Emotions were addressed either directly (by using specific emotion words, such as "guilt" or "compassion") or indirectly (the emotion was indirectly suggested, such as talking about a "third wheel," pointing to the possible emotional content of "envy," although that emotion was not mentioned). Emotions could also be mentioned while addressing emotional processing during the session or pointing to the emotional style of the participant (observable during the session). In four TEs (6, 13, 18, and 19), emotions or emotional processing were not addressed verbally at all. In ten TEs, the number of these incidences was very low (3, 5, 7, 10, and 15) or low (2, 4, 12, 14, and 17). In two TEs (8 and 16), more than two instances occurred when emotions were addressed verbally, and in only two TEs (9 and 11), emotions were addressed verbally several times.

Valence. The emotional valence of the conversation varied among the different TEs. Six TEs were rated as neutral (2–6, 18–19), and only one was rated as positive (TE 14). Five TEs were rated as negative (8–11, 16), and five TEs (7, 12–13, 15, 17) as mixed, meaning that both positive and negative (including tension and surprise) emotions were observed in the TE's interaction.

Nonverbal emotionality. Nonverbal emotionality refers to intense emotional expression, such as weeping or laughter. The TEs differed from each other. Weeping was observed only in the clients, while laughter was observed in all four participants. Mary wept in eight TEs (8, 9, 10, 11, 12, 14, 15, and 16), and Tom in three TEs (11, 12, 16), in which both clients wept. In TE 16, Mary spent 61% of her time and Tom spent 16% of his time in tears. Many weeping seconds were observed in TE 12 as well (Tom 37% and Mary 11%) and in TE 8 (Mary 33%).

Tom laughed the most during the session (in all TEs). The proportion of Tom's laughter time (laughter seconds per all seconds) was highest in TEs 14 (25%), 15 (10%), and 17 (16%). Tom laughed alone in TEs 2, 3, and 18. In other TEs, at least one of the other participants joined in laughter. Mary laughed in 13 TEs, most often in TE 14

Table II. Mean dyadic synchrony (ESnoabs) in each TE for both movement and EDA.

	Movement	Movement	Movement	Movement	EDA	EDA	EDA	EDA
Dyad type	all	C–C	C–T	T–T	all	C–C	C–T	T–T
n	108	18	72	18	108	18	72	18
all TEs	1.63***	1.24	2.07***	0.24	3.84**	6.30	1.80	9.54*
n	6				6			
TE 2	−0.52				−2.82			
TE 3	2.26				2.34			
TE 4	2.89				3.09			
TE 5	3.38				1.41			
TE 6	0.94				−1.50			
TE 7	0.37				−8.57*			
TE 8	2.90				0.97			
TE 9	1.21				4.51			
TE 10	3.57				2.65			
TE 11	2.75				2.44			
TE 12	1.85				12.89*			
TE 13	−0.01				8.04			
TE 14	5.40**				13.07*			
TE 15	2.10				12.36			
TE 16	0.94				14.94			
TE 17	−2.31				3.97			
TE 18	−0.13				−0.63			
TE 19	1.81				−0.04			

Note. p values for one-sample t-tests, two-sided: * $p < 0.05$; ** $p < 0.01$, *** $p < 0.001$. ESnoabs: synchrony effect sizes for 20s segments, lags up to +/- 3s

(12%) and TE 17 (6%). Therapist 1 laughed in four TEs, and therapist 2 laughed in five TEs. Three participants, both clients and one of the therapists, laughed in TEs 12, 13, 14, 15, 16, and 19. The proportion of laughter was largest in TE 14, in which Tom laughed 25%, Mary 12%, and therapist 1 5% of the total time. Based on these observations, the intensity of emotional expression in TEs was rated very high in TE 16, high in TE 12, and moderate in TE 14. Emotional expression intensity was low in four TEs (8, 9, 11, 15, and 17), and very low in ten TEs (2–7, 10, 13, 18, and 19).

Nonverbal regulation. Emotion regulation behaviors, i.e., self-touch (head, face, mouth), lip compression, and lip biting, were observed in all participants in most of the TEs. The density of nonverbal regulation was very high in two TEs (TE 4, TE 17), high in six TEs (10–12, 14–15, 18), moderate in six TEs (3, 6, 8, 9, 16, 19), and low in four TEs (2, 5, 7, 13). All participants displayed emotional regulation behaviors, especially both clients and one of the therapists (Mary $N = 99$, Tom $N = 128$, therapist 1 $N = 155$, and therapist 2 $N = 38$).

Results of quantitative analyses: synchronies of movement and EDA. The significances of the dyadic synchronies (movement and EDA) were calculated using one-sample t-tests on the ESnoabs of dyadic synchrony values across all 18 TEs. The mean synchronies of client–client (C–C), client–therapist (C–T), and therapist–therapist (T–T) dyads are shown in Table II. t-tests were also performed for each single TE, which was represented by six dyadic synchronies, respectively.

The mean of movement synchrony between all dyads was significant only in TE14, and the mean of EDA synchrony between all dyads was significant in TE7, TE12, and TE14. Movement synchrony across all TEs was significant between all dyads and in the C–T dyads. EDA synchrony was significant across all dyads and in the T–T dyads.

Session Level Results Based on Quantitative Analyses

Multiple regression analyses. First, multiple regression analysis was used to study the association between synchrony and the numeric qualitative variables *Nonverbal Emotionality*, *Nonverbal Regulation*, and *Verbal Emotionality*. EDA synchrony was significantly associated with the three predictors: $F(3,108) = 6.44$, $p = .0005$, whereas movement synchrony was not: $F(3,108) = 0.20$, $p = .89$. For EDA, the significant predictor was *Nonverbal Emotionality* ($t[106] = 4.12$, $p < .0001$). The regression analyses were

Table III. Mean dyadic synchrony ESnoabs across TEs for different valences.

	EDA				Movement			
Valence category	Positive valence	Negative valence	Mixed valence	Neutral valence	Positive valence	Negative valence	Mixed valence	Neutral valence
n	6	30	30	42	6	18	30	42
all TEs	13.07*	5.10*	5.74	0.26	5.40**	2.27*	0.40	1.51*

Note. *p* values for one-sample *t*-tests, two-sided: * $p < 0.05$; ** $p < 0.01$.

repeated for the three different dyad types, C–C, C–T, and T–T, again finding that EDA synchrony was associated with the predictors, but movement synchrony was not. In C–C dyads, the significant predictor was *Nonverbal Emotionality* ($t[16] = 3.65$, $p = .003$); in C–T dyads, *Nonverbal Emotionality* ($t[70] = 2.24$, $p = .029$) was also a significant predictor. T–T dyads were positively associated with both *Nonverbal Emotionality* ($t[16] = 2.31$, $p = .037$) and *Nonverbal Regulation* ($t[16] = 2.71$, $p = .017$).

Second, in the next regression analysis, synchrony was predicted by *Valence* (with steps "neutral," "positive," "negative," and "mixed;" "negative" was the reference step) across all TEs and all dyad types. TE was inserted as the random effect. EDA synchrony was significantly predicted by neutral valence ($t[14] = -2.45$, $p = .028$); thus, EDA synchrony was lower in neutral valence episodes than in negative valence episodes, and this was significant for the client-therapist dyad type ($t[88] = 3.63$, $p = .0306$). Movement synchrony was significant as a whole model ($F[3,14] = 3.58$, $p = .021$). In this movement model, mixed valence had lower synchrony than negative valence ($t[14] = -3.01$, $p = .009$), whereas positive valence was linked with higher synchrony than negative valence ($t[14] = 2.61$, $p = .021$). Specific dyad-type effects were found in T–T synchrony, where neutral valence was related to lower EDA synchrony than negative valence ($t[14] = -2.17$, $p = .048$), and mixed valence was related to lower movement synchrony ($t[14] = -2.33$, $p = .035$). The ESnoabs of the mean dyadic synchronies for the different valences are presented in Table III.

Third, a multiple regression analysis was calculated to determine whether the number of speech turns targeted at a certain person or topic (female spouse, male spouse, their relationship, family, and other topics) predicted synchrony in EDA or movement. Regressing these four numeric variables on synchrony, a significant model for EDA synchrony was found: $F(5,108) = 3.24$, $p = .009$. The significant predictor was the target "relationship" ($t[103] = 2.10$, $p = .038$), pointing to higher EDA synchrony when the spouses' relationship was addressed. Movement synchrony was not specifically linked to the targets. Repeating the analyses for dyad types (C–C, C–T, T–T) separately, it was found that the T–T dyad's EDA synchrony was increased when the target was on the female spouse ($t[12] = 2.19$, $p = .049$). No other predictors were significant.

Fourth, in an analogous regression analysis, we predicted synchrony by conversational *Complexity* (with four steps: "conversation mainly in one dyad," "in a triad," "in changing constellation," and "all four participating"). No significant association was found with EDA nor with movement synchrony. Fifth, Pearson's correlations between the two synchronies, movement and EDA (ESnoabs in each TE), were calculated; no significant correlations were found (see Table IV).

Summary of the Results

One couple therapy session was thoroughly examined for its content, namely, what was discussed, what the emotional climate was in the different TEs, and how complex the conversational structure was in the four-person situation. The quantitative calculations found statistically significant synchrony in movement and EDA in the different TEs.

The association between synchrony and the qualitative variables was calculated using several regression analyses (see Figure 2), which indicated

Table IV. Correlation between movement (here Mov) and EDA synchrony in each dyad type.

Variable	With variable	Correlation	*n*	lower 95% CI	upper 95% CI	*p*
Mov-C-C	EDA-C-C	−0.0673	18	−0.5179	0.4126	0.7909
Mov-C-T	EDA-C-T	0.3902	18	−0.0938	0.7250	0.1094
Mov-T-T	EDA-T-T	−0.4049	18	−0.7332	0.0764	0.0956

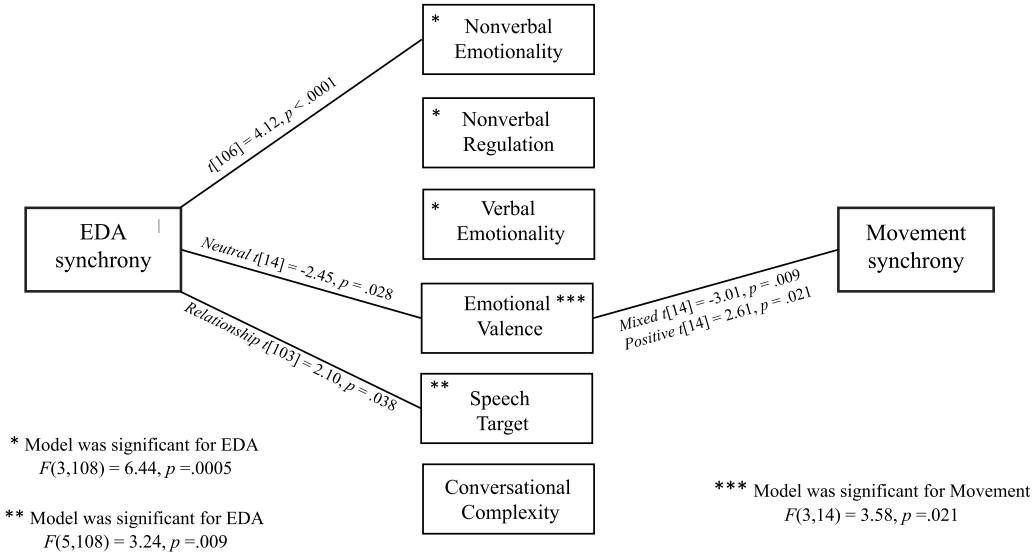

Figure 2. A summary of the findings from the regression analyses.

that EDA synchrony was significantly related to the emotional aspects of the session, especially *Nonverbal Emotionality* (weeping or laughter). No significant associations were found for movement. The associations varied depending on the dyad type (C–C and C–T for *Nonverbal Emotionality*, T–T for *Nonverbal Emotionality* and *Nonverbal Regulation*).

EDA synchrony was lower in the neutral valence condition than in the negative valence episodes. There was less movement synchrony in episodes with mixed valence compared to negative valence, and higher synchrony in episodes with positive valence compared to negative valence. When comparing the different dyad types for T–T dyad episodes, episodes with neutral valence were related to lower EDA synchrony, and mixed valence was related to lower movement synchrony.

There was higher EDA synchrony when the spouses' relationship was addressed (*Target*: "relationship"), but movement synchrony was not specifically linked to the targets. Comparing the different dyad types, EDA synchrony increased in the T–T dyad when the target of the discussion was the female spouse. No significant association was found between conversational *Complexity* and EDA or movement synchrony.

When investigating the TEs with significant synchrony, significant synchrony in both movement and EDA was found in TE 14, in which positive emotions and laughter occurred among all participants (see Table II). Significant negative EDA synchrony between all participants occurred in TE 7 when the spouses discussed the possibility of moving abroad, and positive EDA synchrony was found in TE 12 as the core reason for the spouses' need for therapy—their feelings of disconnectedness—were discussed.

Discussion

The aim of this study was to explore how physiological synchrony and movement synchrony were related to the topic discussed, to the conversational structure, and to emotional processing in one couple therapy session. We adopted a single case design with extensive qualitative analysis of the conversational content and structure, as well as what was talked about and how emotions were processed (e.g., how emotions were expressed and nonverbally regulated in the session). Emotional processing and regulation were included in the design, as they have been considered the most important factors in psychotherapy (Neimeyer, 2009) and couple therapy (Johnson, 2007). We also included the conversational structure (e.g., how many persons talked), as well as what topic was discussed (addressing either of the spouse's issues, the spouses' relationship, or other issues), since there have been suggestions that synchrony could be related to speech in general (Dale et al., 2020) and to speech in couple therapy (Tourunen et al., 2022).

One important aspect to establish when studying synchrony is whether it is just a random coincidence or a genuine phenomenon. This was established by comparing the empirically found genuine synchrony with a pseudo-dataset comprising surrogate synchrony (Moulder et al., 2018). Statistically significant dyadic physiological and movement synchrony was found within the shorter thematic episodes into

which the session was divided; the participants synchronized to each other in both their physiological responses and their movements. Movement synchrony and physiological synchrony were statistically significant among all dyads across all TEs. However, when comparing the different dyad types, movement synchrony was significant only in the C–T dyads, whereas physiological synchrony was significant in the T–T dyads. The results suggest that the different dyad types played distinct and discernable roles within the couple therapy session, which were reflected in the nonverbal synchrony patterns observed. This finding was not surprising, since differences in synchronies in physiology and movement for different dyad types have been demonstrated on a sample level in previous studies (Nyman-Salonen et al., 2021; Tourunen et al., 2020; 2022).

Interestingly, both physiological and movement synchrony were significant in one specific topical episode, which was the only episode with a positive valence. In this topical episode, there was joking and laughter among all participants. This finding is similar to the results of a previous study that reported more movement synchrony in positive situations (Tschacher et al., 2014). For physiological synchrony, joint laughter has been related to an increase in arousal (Marci et al., 2004), but no studies exist on the association between physiological synchrony and laughter. The results were in line with previous studies where physiological synchrony was reported to decrease when the felt distance between participants was larger (Marci & Orr, 2006) and to increase when the participants were performing a joint task (Mayo et al., 2021). It has been suggested that laughter serves a role in bonding between participants (Panksepp, 2007). In this study, laughter in couple therapy was possibly related to participants relieving tension via laughter after intense emotional work.

When studying the emotional variables in relation to synchrony, several interesting patterns with physiological synchrony were discovered; this indicates that physiological synchrony and the emotional aspects of the session were closely related. Physiological synchrony was generally associated with situations in which intense emotions were expressed, such as either laughter or crying, which was in line with previous findings that physiological synchrony relates to the intensity of the interaction (Chanel et al., 2012), and to higher emotional engagement (Slovák et al., 2014).

As we compared the different dyad types, the association between physiological synchrony and intense emotions was significant in all dyad types. Interestingly, physiological synchrony between the co-therapists was also related to the presence of nonverbal signals of emotional regulation. This could be related to the co-therapists' dual task of simultaneously creating a safe setting and facilitating the clients' processing of relevant issues, which made them more sensitive to nonverbal signals of emotional regulation.

The emotional valence changed in the thematic episodes, being predominantly neutral, negative, or mixed. This sounds like a typical therapy session within which clients' different and often problematic experiences are discussed. The associations between physiological synchrony and the different valences were interesting. In neutral episodes, there was less physiological synchrony than in negative episodes. This could be related to the discussion of emotionally difficult and even painful topics during psychotherapy, during which emotional engagement (Slovák et al., 2014) and empathy (Finset & Ørnes, 2017) between participants is vital. For movement synchrony, there was less synchrony in the mixed valence episodes and more movement synchrony in positive episodes compared to negative ones. For positive episodes, the finding was similar to a previous study that reported more movement synchrony during positive and competitive interactions (Tschacher et al., 2014). The interpretation of the findings in relation to the mixed valence situation is more demanding. A situation of mixed valence in psychotherapy is ambiguous, and the responses of each participant (client or therapist) could be more individual, thus reducing synchrony. Interestingly, only in T–T dyads were the associations between less physiological synchrony in neutral episodes and less movement synchrony in mixed valence episodes significant. It might be that therapists are less aroused when the conversation is not centered on difficult topics. As for movement synchrony, one interpretation could be that, in an ambiguous situation, the therapists wait to see how the conversation proceeds.

In couple therapy, the spouses' relationship is an important topic. Thus, it is not surprising that there was higher physiological synchrony when the relationship was discussed. Thus, higher synchrony could be related to all participants simultaneously being aroused and actively engaged in processing relevant issues. The finding was therefore not surprising, since higher arousal (Del Piccolo & Finset, 2018) and physiological synchrony (Slovák et al., 2014) have been related to emotional engagement in previous studies.

Interestingly, physiological synchrony increased in the T–T dyad when Mary was discussed. This means that the therapists were jointly activated physiologically when the discussion was about Mary. It may be related to Mary being quite emotional in the session, and that she had suffered from postnatal

depression. The fact that the co-therapists did not work in their native language might also have made the situation more demanding for them.

No association between movement synchrony and the topics discussed was found. This indicates that movement synchrony could signal a more general adjustment to the situation at hand and was not a response to a specific topic discussed.

We found no association between synchrony and conversational complexity in the session, meaning that, in this case study, neither physiological synchrony nor movement synchrony was related to how the conversation was organized. This was an important finding, since it suggests that movement synchrony is not just a byproduct of the conversational structure and regulation of turn-taking. This might have been related to the fact that the conversational structure was quite stable across the entire session; in most episodes, three or four persons actively participated in the dialogue.

One important aspect was that the findings confirmed that synchrony in a therapy session changes from one moment to the next. Even though both physiological and movement synchrony were significant overall, the patterns of significance changed when investigating the shorter thematic episodes. This points to the need for more research on synchrony in shorter episodes.

Limitations and Future Research Directions

This study was the first attempt to decipher whether physiological and movement synchrony were related to the emotional content of the session or to the conversational structure in couple therapy. The multiperson context of couple is complex, and since this was a single case design with only one session analyzed, the findings are merely descriptive, and generalizations based on them are not possible.

Synchrony was calculated in shorter episodes, although synchrony is usually calculated in longer episodes. The fact that significant synchrony was found along with differences between physiological synchrony and movement synchrony in relation to the qualitative variables supports the possibility of using synchrony calculations even in shorter episodes.

However, when calculating synchrony for shorter episodes, the number of segments in which synchrony was calculated and on which the surrogate synchrony dataset was formed was limited. This was taken into account by using a smaller segment size of 20 s and a shorter time lag (±3 s) than is usually used in movement synchrony calculations.

Interestingly, less significant synchrony in the topical episodes was found for movement synchrony. The difference in sensitivity with regard to physiological synchrony and movement synchrony might have been related to the differences in how the EDA signal and movement energy vary across time as movement energy fluctuates more than EDA. A similar phenomenon was discovered in an unpublished pilot study (Ruhanen, 2021) in which synchrony in movement and EDA was calculated in shorter segments using the SUSY algorithm. One important discussion in the field of synchrony research is the choice of parameters that researchers should use when calculating synchrony (Schoenherr et al., 2019). We need consensus on which parameters to use when calculating synchrony in longer and shorter segments.

The extensive coding of the qualitative variables was a time-consuming task; however, it is currently the only plausible way to detect the qualitative aspects of therapy sessions, such as emotional expressions and regulation. In the future, artificial intelligence (AI) might be able to assist in these quests, since AI has been used to detect emotion (D'Mello & Kory, 2015), but the ability of AI to detect subtler emotional aspects of interactions is not yet very good (cf. de Morais et al., 2023). Another issue that needs to be solved is how AI can be used with confidential material (Renier et al., 2021).

The use of multiple regression models on data from 18 episodes in one session can be questioned, and the results should be interpreted with caution. We want to emphasize the exploratory nature of our study and encourage the readers to take this into account when considering the results implicating associations between the qualitative variables and synchrony. The results can be used when designing new studies on the relationship between momentary synchrony and emotional aspects of the session.

Conclusion

This study contributes to our knowledge of the role of emotion and conversational structure in relation to synchrony. The findings indicated that within this couple therapy session, physiological synchrony was related to the emotional content of the session, and occurred in situations in which the relationship was addressed. Higher physiological synchrony was related to emotional intensity (especially weeping and laughter), emotional valence, and addressing the relationship, whereas movement synchrony was only related to the emotional valence of the topical episode. On the other hand, no association was found between synchrony and conversational structure.

The findings of this study should be confirmed using larger and more diverse samples. The association between emotional intensity and synchrony should be further investigated as well as the association between emotional regulation, emotional valence, and synchrony. The findings support the need for additional studies in psychotherapy on moment-to-moment synchrony, where synchrony is coupled to the content of the verbal dialogue (cf. Kleinbub et al., 2020; Tal et al., 2023) to explore when synchrony in psychotherapy is beneficial.

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Author Contributions

Virpi-Liisa Kykyri: shared first authorship, responsible for the idea of the paper, qualitative analysis (design and implementation), developing the Relational Mind design and collecting the data, participated in writing the article.

Petra Nyman-Salonen: shared first authorship, main responsibility for writing, editing and revising the article, and for collecting the movement energy data.

Wolfgang Tschacher: quantitative analysis for synchrony and all statistical analyses (design and implementation), commenting on the manuscript.

Anu Tourunen, Markku Penttonen and Jaakko Seikkula: developing the Relational Mind design, collecting the data, and commented on the manuscript.

All authors agree on the publication of this article.

Supplemental Data

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