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Author(s): Coutinho, Joana F.; Penttonen, Markku; Tourunen, Anu; Seikkula, Jaakko; Peräkylä, Anssi; Tschacher, Wolfgang; Kykyri, Virpi-Liisa

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1 **Electrodermal and respiratory synchrony in couple therapy in distinct therapeutic**
2 **subsystems and reflection periods**

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5 Authors: Coutinho, Joana F.; Penttonen, Markku; Tourunen, Anu; Seikkula, Jaakko;
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3 **Abstract**
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5 **Objective:** Synchrony in the multi-person context of systemic therapy is a complex and
6 understudied phenomenon. We analyzed respiratory and electrodermal synchronies
7 within a couple therapy system with two therapists to determine whether dyadic
8 subsystems between each client and therapist synchronized differently. We also studied
9 synchrony in reflection periods, in which the therapists discussed the therapy process with
10 clients listening. Finally, we examined the association of synchronies with alliance and
11 outcome. **Method:** A sample of 22 therapy sessions in which electrodermal activity
12 (EDA) and respiration were recorded were analyzed. Self-report measures of session
13 alliance and outcome were obtained. Synchrony computation was based on windowed
14 cross-correlation using surrogate synchrony and segment-wise shuffling of physiological
15 time series. **Results:** The results supported the presence of EDA synchrony for the client-
16 therapist and therapist-therapist dyads but not client-client dyads across entire sessions.
17 No significant synchronies were found for respiration behavior. A similar picture was
18 found in reflection periods. Clients' well-being as well as therapists' alliance ratings were
19 significant predictors of client-client EDA synchrony. **Conclusion:** Our results point to
20 the relational meaning of synchrony and its importance for understanding couple
21 psychotherapy, particularly the reflection periods. Challenges involved in extending
22 synchrony computation to multi-person settings were highlighted.

23
24 Keywords: Couple Therapy; Physiological Synchrony; Respiration; Electrodermal
25 Activity; Surrogate synchrony (SUSY)
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30 **Clinical or methodological significance of this article:** This study analyzed both
31 respiratory and electrodermal synchrony in a couple therapeutic system composed by
32 two therapists. The results highlight the complex nature of synchrony in multi-actor
33 settings, and its importance for the process of mutual regulation between the actors in
34 systemic therapy. Therapist-therapist and client-therapist synchronies in EDA alert
35 clinicians to the importance of a strong working alliance and a shared agenda between
36 the co-therapists and of their alliance to both spouses.

1 **Introduction**

2 *Interpersonal Synchrony and its Relevance for Human Interaction*

3 Interpersonal synchrony refers to the temporally coordinated dynamics of the
4 body movement, vocal quality, physiological signals, or other nonverbal indicators of
5 two (or more) interacting individuals (Butler & Randall, 2013). Synchrony is present
6 across a wide range of interactions and contexts of social life and appears to fulfill
7 important social functions (e.g, Jackson et al., 2018; Mogan et al., 2017; Vanutelli et al.
8 2017). The prevalence and conservation of synchrony in situations as diverse as singing
9 or dancing together, maternal attachment, romantic interaction, empathy towards
10 significant others or strangers (Reddish, Fischer, & Bulbulia, 2013) point to the
11 evolutionary benefits of this phenomenon (Henrich, 2015).

12 Synchrony may be seen as an indicator of affective alignment and a precursor of
13 deeper emotional understanding, being intimately associated with key dimensions of
14 empathy such as emotional contagion (Ax, 1964; Kaplan & Bloom, 1960). Synchrony
15 thus reflects the process of automatic and unconscious emotional resonance with other's
16 inner states simulated in one's own body (Hatfield, Cacioppo, & Rapson, 1994;
17 Hatfield, Rapson, & Le, 2011), allowing to "feel" the other's experiences. This makes it
18 a key phenomenon for significant human interactions, and particularly for helping
19 relationships such as the psychotherapeutic interaction. Indeed, during dyadic
20 psychotherapy, client and therapist tend to synchronize in nonverbal responses and
21 physiological processes (Koole & Tschacher, 2016). Moreover, there is substantial
22 evidence that in individual therapy synchrony is associated with key aspects of the
23 therapeutic alliance and ratings of the therapy process (Marci et al., 2007; Marci & Orr,
24 2006; Mende & Schmidt, 2021; Gernert, Nelson, Falkai & Falter-Wagner,2023;
25 Tschacher & Meier, 2020). Thus, the dynamics of synchrony constitute an important

1 aspect of therapeutic interaction and mutual responsiveness and may additionally be
2 understood as a marker of the therapist's ability to access the patient's internal state and
3 co-regulate his/her emotional arousal (Koole & Tschacher, 2016).

4 Psychophysiological measures such as electrodermal activity (EDA), respiration
5 or heart rate seem to constitute important markers of the implicit interpersonal processes
6 that occur in therapy (Avdi & Seikkula, 2019) and started to be analyzed in a set of
7 studies conducted in the 1950s by Dimascio, Boyd and Greenblatt (1957). Since these
8 seminal studies the literature in the field has substantially grown, yet most of this
9 research on physiological synchrony in psychotherapy has focused on a single modality
10 and on individual therapy (dyadic setting of client and therapist).

11 12 *Synchrony in Multi-Person Settings*

13 Thus, more research is needed that considers synchronies in different modalities
14 and to examine synchronies in multi-person settings (e.g., couple therapy with two
15 clients and one or two therapists). The present work aims to contribute to fill this gap in
16 the literature by examining respiratory and electrodermal synchrony within a couple
17 therapy system, consisting of two clients (spouses) and two therapists (co-therapists).

18 Interestingly, the context of couple therapy encompasses two types of
19 interpersonal relationships in which synchrony dynamics are central: the adult
20 attachment relationship (that corresponds to the couple's romantic relationship), and a
21 corrective attachment relationship (that corresponds to the therapeutic relationship).

22 Thereby the research on synchrony cuts across different attachment relationships
23 throughout a person's life cycle, which suggests that this phenomenon is continually
24 present across development. In the same way that the development of baby's affect
25 regulation capacities and attachment security depends on repeated experiences of

1 adaptative forms of biobehavioral synchrony between infants and their parents
2 (Feldman, 2012; Ham & Tronick, 2009), also in adult attachment relationships
3 synchrony is likely the basis of the individuals' emotional regulation capacity. In this
4 process of mutual co-regulation each member of the dyad regulates his/her own and the
5 other's inner states (Butler & Randall, 2013; Timmons, Margolin & Saxbe, 2015).

6 There are several reasons to assume that physiological synchrony exhibits more
7 complex forms in multi-person settings, such as couple or family therapy, than in
8 dyadic settings. The multi-person context of systemic approaches brings complexity to
9 interactive transactions occurring in therapy and consequently to synchrony phenomena.
10 This complexity derives from the need to establish and maintain several alliances at the
11 same time (Friedlander, Escudero, & Heatherington, 2006): the couple allegiance (the
12 pre-existing trust and alliance between spouses), the working relationship between the
13 two co-therapists, and the dyadic therapeutic alliances between each individual spouse
14 and each therapist (in case two therapists are working with the couple). In couple
15 therapy, the therapist has the challenging task of establishing an alliance both with the
16 individuals (spouses) and with the couple as a unit, as well as with his/her co-therapist
17 (Pinsof & Catherall, 1986). This task of negotiating multiple alliances may get even
18 more difficult because in multi-person settings participants also observe the alliances of
19 other participants (Friedlander et al., 2006). For example, other elements of the system
20 may observe the presence of a "split alliance," that is, when one spouse's alliance with
21 therapist is significantly closer than the other spouse's, and this might lead to poorer
22 outcomes in couple therapy (Pinsof & Catherall, 1986) or even to dropout (Muñiz de la
23 Peña, Friedlander, & Escudero, 2009).

24 In sum, the presence of multiple individuals and multiple dyadic combinations
25 makes couple therapy an especially interesting model to study synchrony, but we must

1 take into consideration the different patterns and the different purposes that synchrony
2 may take in these different subsystems. In this study, we will address this complexity by
3 studying synchronies not only in the entire couple therapy sessions, but also in
4 reflection periods, during which two therapists address talk to each other, while the
5 clients are listening. We assume that since the conversation is organized differently in
6 these periods, this may be reflected in different synchronies between the subsystems and
7 provide new knowledge on the meaning of synchrony in multi-actor settings.

8

9 *Previous findings of Synchrony in Couple's Interactions and in Couple Therapy*

10 Romantic dyads constitute a context that has seen an increasing number of studies
11 investigating synchrony, specifically psychophysiological synchrony, has been
12 increasing in the last decade (e.g., Helm, Sbarra, & Ferrer, 2012, 2014; Liu, Rovine,
13 Cousino Klein, Almeida, 2013; Papp, Pendry, Simon, & Adam, 2013; Saxbe et al.,
14 2014; Saxbe & Repetti, 2010, Karvonen et al., 2016; Seikkula et al., 2015). The
15 phenomenon was described as physiological linkage in seminal papers (e.g., Levenson
16 & Gottman, 1983; DiMascio, Boyd & Greenblatt, 1957), which means covariation of
17 the physiological time series of the two interacting partners (Butler, 2011), reflecting
18 the process of reciprocal influence that occurs between spouses at the biological level.

19 It is important to note that different physiological signals may have different
20 biological and psychological meaning, representing different aspects of interpersonal
21 processes. For example measures such as EDA are linear indexes of sympathetic
22 activity once the eccrine glands, whose activity we are capturing in EDA, are
23 exclusively innervated by the sympathetic division of the ANS. Therefore EDA is
24 usually used as a reliable marker of the salience of a given emotional event
25 independently on its valence, that is, EDA tends to be arousal rather than emotional

1 specific (Cuthbert et al. 2000; Carvalho et al, 2012; Codispoti, Surcinelli, & Baldaro,
2 2008).). Thus EDA synchrony is likely to reflect the process of increase in sympathetic
3 arousal that occurs in the individual when he is responding to an emotional trigger
4 elicited by the person he is interacting with (Palumbo et al., 2017; Coutinho et al.,
5 2019). On the other hand, a measure like respiration is a more complex physiological
6 signal, that has both sympathetic and parasympathetic influence (Allen, Varga & Heck,
7 2023; Hameed et al., 2019). When considering the respiration cycle the process of
8 inhaling and exhaling may be respectively related with attentional processes focused on
9 the self vs on the other. Moreover this pattern of breathing in and breathing out
10 interacts with the turn taking dynamics during a conversation, so it is important to
11 consider who is talking vs who is listening at a given moment. Interestingly an
12 increasing number of studies show that the relationship between respiration and
13 emotions is bidirectional, not only the emotional state influences our respiratory pattern,
14 but that respiratory pattern influences and stimulates emotional state (Jerath &
15 Beveridge, 2020).

16 In terms of physiological synchrony between spouses, research conducted either
17 in naturalistic daily interactions or using lab-based couple's interaction paradigms
18 suggests that the association between synchrony and relationship quality is not linear:
19 both too little or too much synchrony may compromise the couple's functioning
20 (Palumbo et al., 2017; Timmons et al., 2015). While low levels of synchrony may
21 reflect disengagement between partners, very high synchrony levels may reflect
22 processes of conflict escalation and increased autonomic reactivity to the other's
23 negative affect (spiraling synchrony, Gottman, 1990). Thus, once synchrony may
24 emerge in any situation of altered joint emotional states (either caused by empathic
25 engagement or conflict), higher levels of synchrony may reflect an adaptive dyadic

1 functioning (e.g., Palumbo et al., 2017), but also processes of escalation of negative
2 emotions (e.g., Levenson & Ruef, 1992), depending on the relational context of the
3 couple and its emotional valence and degree of arousal.

4 As mentioned before, the literature on synchrony in couple therapy settings is still
5 scarce. In this domain the “Relational Mind in Events of Change in Multiactor
6 Therapeutic Dialogues” (hereafter Relational Mind) research project (Seikkula et al.,
7 2015), has put forward a set of innovative studies that analyzed different aspects of
8 interactive embodied attunement, including physiological synchrony, between the
9 different actors of couple therapy contexts. In 2015, Seikkula, Karvonen, Kykyri,
10 Kaartinen and Penttonen used a case example from the Relational Mind dataset to
11 illustrate how autonomic synchrony in multi-actor couple therapy is not a simple
12 phenomenon, but instead a complex dyadic or triadic phenomenon that changes from
13 moment to moment. In this case study, the authors showed that in a co-therapist setting,
14 one therapist will synchronize more with one client; thus, to some extent, two client-
15 therapist pairs may emerge. In another microanalytic case study on alliance formations
16 in couple therapy (Kykyri et al., 2019), simultaneous or nearly simultaneous peaks in
17 the arousal (skin conductance responses), posture and movement mirroring, as well as
18 changes in the participants’ regular breathing patterns, such as breath holding, or
19 extremely shallow breathing, were defined as synchrony and integrated in the analyses
20 of the verbal exchange. The study demonstrated that when there were clear markers of
21 alliance in a dyad in verbal exchange, there were also markers of synchrony in one or
22 several nonverbal modalities (posture, movement, SCR, respiration). In addition to that,
23 when a dyad was outside conversational exchange, markers of nonverbal alliance in the
24 form of bodily synchrony were often observed in the same dyad. More recently in
25 another single case study, Avdi and colleagues (2022) used their Partial Directed

1 Coherence (PDC) method to calculate physiological synchrony of heart rate variability
2 in the third and penultimate sessions. PDC is a frequency domain analysis grounded on
3 Granger causality, thus allowing the establishment of the direction of information flow
4 between isolated pairs of time series. Differently from the classical Granger causality,
5 which estimates interactions in the time domain, PDC estimates the frequency-domain
6 causality in physiological time series. Thus it transforms the time series into the
7 frequency domain and provides time-lagged associations between two participants'
8 multivariate signals, assessing their statistical independence or predictability. Using this
9 approach Avdi and colleagues (2022) found a reduction in physiological synchrony as
10 therapy progressed. This decrease primarily concerned the therapist–client(s) interaction
11 and was interpreted as reflecting progress, in the sense of a decrease in the intensity of
12 negative affects expressed by the clients and the need for therapist empathy, as well as
13 the couple's gradual disengagement from the process of therapy in line with the
14 termination phase.

15 Another previous work using a concordance index procedure (for an explanation
16 of the concordance procedure see Marci & Orr, 2006; Marci et al., 2007; Messina et al.,
17 2013), found that sympathetic nervous system synchrony, measured via EDA, occurred
18 between participants since the start of couple therapy (Karvonen, Kykyri, Kaartinen,
19 Penttonen, & Seikkula, 2016). The authors found that in the beginning of couple
20 therapy, specifically in the second session, the couple dyads showed the lowest level of
21 EDA synchrony, client-therapist synchrony resembled that in individual psychotherapy,
22 and the co-therapists showed the highest synchrony. Another study that also used an
23 EDA concordance approach, in which twelve different couple therapy processes were
24 analyzed (24 clients, plus 10 therapists, working in pairs; hence, 4 persons per session),
25 found that synchrony between spouses increased toward the end of therapy (Tourunen

1 et al., 2020). Moreover, this change was associated with a positive linear trend in the
2 female clients' wellbeing during therapy process, which the authors interpreted as
3 evidence that couple therapy can bring spouses closer together on a physiological level.

4 Interestingly, these results reported by Tourunen et al (2020) of lower synchrony
5 in the beginning compared to the end of therapy (when supposedly the wellbeing of the
6 spouses improved), are consistent with data on synchrony between spouses in
7 laboratory tasks, mentioned earlier. Indeed, both in the classical studies by Levenson
8 and Gottman conducted in the 80's (Levenson & Gottman, 1983), as well as in our own
9 recent research, EDA synchrony was higher during couples' interactions involving
10 negative emotions (Coutinho et al., 2019). On the other hand, physiological synchrony
11 has been linked with dyadic adjustment in studies of daily life couples' interactions
12 (Timmons et al., 2015), which again is in accordance with the findings of an increase in
13 synchrony as therapy proceeds. This should be due to the adaptive process of mutual
14 regulation of the expression of negative emotions that couple therapy is supposed to
15 foster.

16 In terms of the multimodal assessment of synchrony, in one of the few attempts to
17 analyze different synchrony modalities in couple therapy, a recent study by Tourunen et
18 al (2022) looked at the relationship between sympathetic nervous system synchrony,
19 movement synchrony, and the amount of speech in couple therapy. Their findings
20 showed that couple therapy participants' synchrony mostly occurred in-phase (in-phase
21 synchrony corresponds to positive correlation values, thus referring to changes in the
22 same direction, for example when one partner's electrodermal activity (EDA) increases,
23 the other partner's EDA also increases), and that anti-phase synchrony (corresponding to
24 negative correlation values, referring to changes in opposite directions - e.g. that when
25 one person's EDA increased or decreased, the other partner's EDA did the opposite)

1 was more common in movement than in sympathetic nervous system activity.
2 Importantly they also found that the extent to which synchrony modalities were linked
3 with each other depended on the roles and relationships of couple therapy, being that in
4 client-therapist dyads synchrony in arousal and movement “walked hand in hand”,
5 whereas in client-client or therapist-therapist dyads they were not linked. Finally, more
6 talk time by the therapy participants was associated with anti-phase movement
7 synchrony, meaning that the more time the dyad members talked during the session, the
8 less bodily synchrony they exhibited.

9

10 ***Synchrony in Specific Therapeutic Events: The Reflection Periods***

11 The evidence mentioned above points to the fact that when studying synchrony
12 in multi-person couple therapy settings, another layer of complexity derives from the
13 relational context and specific therapeutic tasks that are being implemented in therapy,
14 mainly through talk. This motivated us to look at this phenomenon during reflection
15 periods, in which the therapists voiced their observations and reflections of the session
16 interactions and conversations. The idea behind events of therapists’ reflective talk was
17 originally developed by Andersen (1991), who suggested that in every session, all
18 participants ought to be given opportunities to move from the position of talker to that
19 of a listener. This would both encourage multiple perspectives to be voiced in the social
20 interaction and to facilitate participants to shift between inner (personal) and outer
21 (shared with others) dialogue (Andersen, 1991). In practice this means that during the
22 session, therapists turn to face and address talk to each other, not to their clients, who
23 are invited to listen. This is important since therapeutic conversations largely consist of
24 client’s telling. Reflective talk periods provide clients brief but important moments to
25 move away from telling to listening, which creates space for reflection and private

1 meaning-making (Wahlström, 2006). Studying interpersonal synchrony in reflection
2 periods can provide new important knowledge about the meanings of synchrony, since
3 both the conversational structure (all talking or only therapists talking), the
4 conversational roles of the clients (talker or listener) and the conversational format,
5 differ from other parts of the session. For example, during reflection periods both clients
6 adopt a listener perspective which allows to evaluate whether observing the same
7 external stimuli (here, therapists' speech) manifests as synchrony between clients.

8

9 *Aims of the Study*

10 In sum the present work aims to gather a comprehensive picture of synchrony in
11 couple therapy, by accomplishing the specific goals listed below.

12 Our main aim was to analyze interpersonal synchronies both in respiration and
13 in electrodermal activity within a couple therapy system, consisting of two clients
14 (spouses) and two therapists (co-therapists). To do that, we calculated synchronies in
15 the two modalities in six dyads (C1-C2; C1-T1; C1-T2; C2-T1; C2-T2; T1-T2) per each
16 therapy case.

17 Our research questions were:

- 18 1) Are the C-C, C-T and the T-T subsystems differently synchronized in a)
19 respiration and b) in EDA?
- 20 2) Are the observed synchronies associated with a) alliance ratings of the
21 participants after the session, and b) with clients' wellbeing ratings reported
22 before each session?
- 23 3) How do the distinct dyads synchronize in a) respiration and b) in EDA in
24 reflection periods of the sessions?

25

1

2 **Method**

3 *Participants*

4 The data of this study were drawn from the Relational Mind research project
5 (Seikkula et al., 2015), in which the aim was to increase understanding of the embodied
6 qualities of couple therapy dialogues by studying attunement and synchrony in
7 multiactor settings. The sample consisted of 22 therapy sessions from 12 different
8 couple therapy cases of the Relational Mind dataset. 24 clients and 10 therapists
9 working in pairs were included in the sample. The clients' mean age was 43 (range 28 –
10 61) and therapists' mean age was 52 (range 32–63). The sample included 11
11 male/female couples and 1 female/female couple. Reasons for seeking therapy included:
12 problems in the couple's relationship, outside the relationship (e.g., with childhood
13 family or relatives), violence in previous relationships, and previous violence in the
14 current relationship. Participants committed to non-violence before the therapy started,
15 and no violence in the relationship occurred during the therapy process.

16 The mean duration of therapeutic processes was 7.75 sessions (range = 4-24,
17 SD=5.51). Couple therapy was implemented in the Psychotherapy Training and
18 Research Center, University of Jyväskylä, Finland. The seating arrangement resembled
19 a circle around a small table; the couple always sat next to each other, and the co-
20 therapists also sat next to each other (see Figure 1). The aim was to keep the design as
21 "natural" as possible, which meant following the standard procedure in the clinic. The
22 therapists were instructed to work in their normal style, which often tended toward a
23 narrative or dialogical approach. The therapy was not manualized, but it contained
24 reflective discussions between the co-therapists, usually toward the end of each session.

1 All the sessions were recorded with six video cameras, which was a standard procedure
2 in all therapies in the clinic.

3 [Insert Figure 1]
4

5 *ANS measures*

6 During the sessions (2nd and 5th or 6th session of each therapy process),
7 participants' Autonomic Nervous System responses were measured. Electrodermal
8 activity (EDA) was recorded with two pregelled disposable electrodes (Ag/AgCl,
9 AmbuR Neuroline 710, Ballerup, Denmark) from the participant's non-dominant palm,
10 below the first and fourth digits. Skin conductance was determined in microsiemens
11 with a constant voltage of 0.5 V (GSR sensor, Brain Products, Gilching, Germany), the
12 signal was amplified in the DC mode and low-pass filtered at 250 Hz. Respiration was
13 recorded via a fabric belt (Brain-Vision BP-BM-10, Brain Products, Gilching,
14 Germany), which was fastened above the clothes, on the lower chest area.

15 An amplifier (Brain Products Brainamp ExG 16, Brain Products, Gilching,
16 Germany) was used to amplify EDA and respiration in the DC mode and low-pass filter
17 them at 250 Hz. The data acquisition program BrainVision Recorder, (Brain Products,
18 Gilching, Germany) was used to record EDA and respiration with a sampling frequency
19 of 1,000 Hz. In this study, an electrocardiogram (ECG) was acquired in addition to
20 EDA and respiration. The data for ECG are not reported here. A uniform sampling
21 frequency of 1,000 Hz was employed to ensure the capture of high-frequency
22 components in the ECG. To enhance the computational efficiency of synchrony
23 assessments for EDA and respiration, deliberate down-sampling was applied, reducing
24 the sampling rate to 10 Hz. This reduction provided a temporal resolution equivalent to
25 that achieved in a 1 kHz acquisition for EDA, thereby accommodating the slower

1 temporal dynamics inherent in respiration (Silva, Salvador, Bota, Fred & Plácido da
2 Silva, 2023). The recorded data was downsampled offline to 10 Hz using a Brain Vision
3 Analyzer (Brain Products, Gilching, Germany) and written to a text file for further
4 analyses.

5

6 *Questionnaires*

7 Self-report measures were given to clients to rate their wellbeing before each
8 session, and to clients and therapists to rate the working alliance after each session. The
9 following measures were selected, since we wished to follow the standard procedure in
10 the clinic, the measures were short and easy to use, and they provided the therapists
11 immediate feedback of the progress.

12 *Outcome Rating Scale* (ORS; Miller, Duncan, Brown, Sparks, & Claud, 2003)
13 was used to assess clients' well-being before each session. We defined the mean of the
14 sum (SUM of both clients as an outcome measure of their overall well-being, with a
15 possible total SUM score of 40, and a clinical cutoff of SUM=25.

16 *Session Rating Scale* (SRS; Duncan et al., 2003) assessed the working alliance
17 experience of the participants after each session. The subscales are relationship with the
18 therapists/clients, goals/topics of the session, assessment of the therapeutic approach,
19 overall feeling of the session, and SUM (sum of all scales). The SUM scores reflect the
20 quality of the therapeutic alliance: 39–40 is good, 35–38 is fair, 34 or below represents a
21 poor alliance (Duncan & Miller, 2008). We considered the mean SUM of both
22 therapists, and both clients respectively, as predictors in process-outcome analyses.

23

24

25

1 *Synchrony computation*

2 Interpersonal synchronies for the participants' EDA and respiration (RESP) time
3 series were computed for each therapy session and each of the six dyads of a session
4 (C1-C2; C1-T1; C1-T2; C2-T1; C2-T2; T1-T2) by using the SUSY (Surrogate
5 Synchrony) algorithm (Tschacher & Haken, 2019; available as R-package SUSY).
6 SUSY computes synchrony as windowed cross-correlation based on the two time series
7 of each dyad. The time series were first divided into 60-second segments. The reason
8 for segmentation is firstly to deal with possible non-stationarities such as trends in the
9 time series, and secondly to allow creating surrogates as a control condition. Cross-
10 correlations were computed in each segment in a time lag of ± 5 seconds, by shifting
11 one of the timeseries stepwise (in 0.1 second steps because of the sampling rate of 10
12 Hz) in relation to the other one. The cross-correlations were transformed using Fisher's
13 Z and then aggregated within each segment. Synchrony was computed by using the so-
14 called non-absolute values of Z, which differentiates between instances when the
15 timeseries correlate positively (indicating in-phase synchrony) or negatively (anti-phase
16 synchrony). Finally, the cross-correlations were aggregated across all segments of a
17 session yielding a single value of synchrony for each dyad and session. To test the
18 strength of the empirically obtained synchronies, segment shuffling was used to create
19 surrogate time series (i.e. time series composed of randomly shuffled segments) on
20 which the same computations were run. These pseudo-synchronies computed from
21 surrogates establish a control condition. For example, in a session lasting 70 minutes, 70
22 segments are available, from which $70 \times 69 = 4,830$ different surrogates can be derived.
23 The cross-correlations of surrogates thus provide 4,830 surrogate Z values for this
24 session. Based on such data, for each dyad and session, an effect size (ES) of synchrony
25 was calculated, defined as the difference of the 'real' Z and the mean of all surrogate Z,

1 divided by the standard deviation of the surrogate Z. This procedure generated our final
2 measure of synchrony ESnoabs. In other words, our measure of synchrony has
3 integrated the multiple comparisons with surrogates, as it is standardized by the mean
4 and variability of its control values, obtained from the segment-shuffled surrogates. This
5 synchrony measure has the shape of an effect size. As the dataset consisted of 22
6 sessions, two measures (EDA, RESP), and six dyads, 264 values of ESnoabs were
7 obtained. The dyadic synchrony values can be aggregated per session by averaging over
8 the six different dyadic synchronies of each session, respectively.

9 Using the SUSY algorithm, the synchrony of the reflection periods was also
10 computed. To account for the shorter durations of these periods, we used shorter
11 segments of 20 seconds for the cross-correlations and the surrogate tests but kept the
12 maximum time lag at ± 5 seconds. Again, synchrony of reflection periods is
13 represented by the effect sizes ESnoabs against surrogate controls.

14
15

16 ***Defining, locating, and describing the reflection periods***

17 Three research assistants (psychology students) were trained to identify in each
18 session's videos all periods in which the co-therapists oriented towards each other and
19 had a short conversation in which they voiced their observations and reflections of the
20 session interactions and clients' telling. During reflection periods, clients were listening,
21 and they did not actively participate in verbal exchange. These periods were easy to
22 identify since the structure of the conversation was changed markedly, and most often
23 the therapists also changed their posture, turned their head to better see and to be able to
24 gaze the co-therapist, and in other ways showed that their orientation was changed from
25 clients to address and listen to a colleague. The end of reflection period was also easy to

1 observe, since the therapists turned back to face clients and indicated with their verbal
2 and nonverbal behaviors that now it was the clients' turn to comment on what therapists
3 just said.

4 Starting and ending time of each reflection period were carefully marked to an
5 Excel file, and these time stamps were then aligned to correspond the time of respiration
6 and EDA signals, to enable synchrony computations in reflection periods. All time
7 stamps were double checked before these were used in synchrony computations. In the
8 22 sessions, 31 reflection periods were identified. Their mean duration was 210 seconds
9 (range 48–912).

10 Although the conversational structure in reflection periods was clear, we
11 assumed that there would be variation in what the therapists addressed in reflective
12 talks, as well as how the clients responded to these. We also assumed that this variation
13 might be relevant for interpreting synchrony findings in reflection periods. Therefore,
14 for more detailed analysis we selected two reflection periods which seemed to differ
15 from each other. We first looked at the contents and targets of the therapists' talk in
16 these two reflection periods. After that, we used a microanalytic turn-by-turn approach
17 to look at how the spouses relate with the therapists' sayings both during the reflection
18 periods and immediately after these. We looked at both verbal and nonverbal markers of
19 agreement and disagreement. To illustrate some of the variation, transcripts of the
20 conversation and findings of the qualitative analysis were presented in two tables, in
21 which synchrony findings were added, too. Finally, in the integrative phase of the
22 analysis, we compared the two reflection periods and looked at possible connections
23 between the synchrony values and what was observed in the interaction.

24

25

1 ***Calculation of session-wise synchronies***

2 Synchrony computed by the SUSY algorithm is a dyadic measure. To obtain
3 session-wise synchronies, we averaged the synchrony across all dyads of a session,
4 separately for respiration and EDA. This means, the session synchrony of client-
5 therapist (C-T) synchronies is the average of four dyadic synchrony values, and overall
6 session synchrony the average of six dyadic synchrony values. C-C and T-T
7 synchronies are based on one value per session and thus did not undergo averaging. The
8 significance of synchrony across all 22 sessions was assessed using one-sample *t*-tests
9 of the session-wise synchronies against the expectation value of zero (i.e., no
10 synchrony). This procedure was chosen as all synchronies are expressed as effects sizes
11 ESnoabs, which may obtain positive, negative or zero values, indicating in-phase, anti-
12 phase or no synchrony. It is therefore meaningful to test a sample of synchronies
13 (ESnoabs) against zero to decide if there is significant in-phase ($t > 1.96$), anti-phase ($t <$
14 -1.96) or no synchrony. This procedure was validated in a methodological study (Meier
15 & Tschacher, 2021).

16

17 ***Calculation of process-outcome relationships***

18 Session-wise synchrony values were given the role of dependent variables in
19 hierarchical regression models with the ORS and SRS self-report scores as predictors.
20 Synchrony was given in four variables: C-C and T-T synchronies were expressed as
21 ESnoabs-C-C and ESnoabs-T-T, and C-T-synchronies by the ESnoabs of all four client-
22 therapist dyads of each session, and session synchrony (ESnoabs-all) by the mean of all
23 six dyad synchronies of a session. The outcome rating scale (ORS, sum score) and the
24 Session Rating Scale (SRS, clients' and therapists' sum scores) were regressed
25 separately on the C-C, T-T, and C-T synchronies.

1 The ratings of clients C1 and C2 were aggregated by averaging because C1 and
2 C2 refer to different individuals across sessions, and the ratings of therapists T1 and T2
3 were aggregated in the same manner, leaving one ORS score (ORS_C-SUM) and two
4 SRS scores (SRS_C-SUM; SRS_T-SUM). The regression procedure was hierarchical
5 using mixed effects models with therapy system (Therapy#) as random effect because
6 twelve therapy systems with identical clients and therapists provided the 22 sessions.
7 The fixed effects were first the clients' ORS_C-SUM sum score, then the clients'
8 SRS_C-SUM sum score, finally therapists SRS_T-SUM sum score. All computations
9 were conducted using JMP Pro 15.1 (SAS Institute Inc., 2019).

11 Results

12 *Mean synchronies of entire sessions in two modalities*

13 The available session-wise synchrony values were tested against zero using one-
14 sample t -tests. The intra-class correlation (ICC) was assessed using random effects
15 models for synchrony with session as the random effect. EDA synchronies had an ICC
16 of 0.15, which was significant in a Wald test. Synchronies based on respiration had an
17 insignificant ICC of 0.07. Across all 22 sessions, we found evidence of in-phase
18 electrodermal synchrony for the client-therapist and therapist-therapist dyads but not for
19 the client-client dyads (Table 1). Regarding respiration behavior none of the
20 synchronies significantly deviated from zero.

21 [Insert Table 1]

22 We tested the six session-wise synchronies (ESnoabs-all of EDA and
23 respiration) also separately in each session. Performing one-sample t -tests of these
24 synchronies provided four significant in-phase sessions synchronies for EDA and one
25 in-phase session synchrony in respiration (Table 2).

1 [Insert Table 2]

2

3

4 ***Mean synchronies of reflection periods in two modalities***

5 Thirty-one reflection periods (Mean duration 210 seconds, range 48–9123) were
6 analyzed. We found significant in-phase electrodermal synchrony across all dyads and
7 for the client-therapist dyads. Regarding respiration behavior no significant synchronies
8 were found (Table 3).

9 [Insert Table 3]

10

11 Describing all 31 reflection periods separately, we tested the respective six
12 dyadic synchronies of each period against zero using one-sample t-tests. Two of the
13 EDA synchronies were significantly larger than zero, suggesting in-phase synchrony in
14 reflection periods J008_5#1 and J012_2#1. Three respiration synchronies deviated
15 significantly from zero, suggesting in-phase synchrony in reflection periods J002_2#1
16 and J007_2#1, and anti-phase respiration synchrony in J003_5#1.

17

18 ***Process-outcome analyses***

19 Of the eight mixed-effects regression models for the association between clients'
20 well-being before each session (ORS_C-SUM) and the session-wise synchronies
21 between clients (ESnoabs-C-C), therapists (ESnoabs-T-T), and client-therapist dyads
22 (ESnoabs-C-T), and all synchronies of the session (ESnoabs-all), one model showed
23 significant process-outcome associations. Clients' well-being predicted C-C EDA
24 synchrony (Table 4).

25

[Insert Table 4]

1 The associations between synchronies and alliance ratings assessed using the
2 SRS (Session Rating Scale) were estimated in analogy to the ORS. The two overall
3 alliance ratings, the clients' sum score SRS_C-SUM and the therapists' sum score
4 SRS_T-SUM were separately regressed on session-wise synchronies. Of the four types
5 of synchronies (ESnoabs-C-C, ESnoabs-T-T, ESnoabs-C-T, ESnoabs-all), one was
6 associated with alliance: electrodermal ESnoabs-C-C was predicted by therapists'
7 alliance self-report (Table 5).

8 [Insert Table 5]

9
10 ***Illustrative case vignettes: How do clients attune to what therapists say during the***
11 ***reflection periods?***

12 Next, we will present two extracts from two different couple therapy cases to
13 illustrate variations in affiliations and attunements between clients and therapists during
14 the reflection periods, as well as how clients respond to the therapists' reflective talks
15 immediately after these. We will also present synchrony findings for each dyad for both
16 reflection periods.

17 [Insert Tables 6 & 7 (Reflection period 1 and 2) about here]

18

19

20

21 **Discussion**

22 The goals of the present work were threefold: across all sessions, we intended to
23 examine the presence of synchrony in couple therapy in different modalities and
24 therapeutic subsystems across all sessions; to see whether in reflection periods such

1 synchronies also occurred; and to analyze the relationship between synchrony and
2 measures of the alliance and outcome.

3 In terms of the analysis across sessions we found electrodermal (EDA)
4 synchrony but no evidence of respiration synchrony. EDA synchrony was observed in
5 all dyads with the exception of C-C (client-client) dyads. Both C-T (client-therapist) and
6 T-T (therapist-therapist) were synchronized in the same direction (positive correlation,
7 i.e. in-phase synchrony), and T-T synchrony had the highest synchrony levels. These
8 results are consistent with previous work (Karvonen, Kykyri, Kaartinen, Penttonen, &
9 Seikkula, 2016) that also found that synchrony between co-therapists tended to be high.
10 The high synchrony level between co-therapists may reflect their shared orientation and
11 understanding of the couple's situation. In other words, when both therapists
12 deliberately direct their attention to similar features of the clients' speech and behavior,
13 it is likely to get them involved in the same kind of internal process and related patterns
14 of physiological activation. They also need to coordinate their collaboration and for that
15 reason to attune to each other in the session. Likewise, the significant in-phase EDA
16 synchrony in C-T dyads points to the relationship between physiological synchrony and
17 the alliance that is established between each client and each therapist. In sum, both T-T
18 and C-T synchronies in EDA highlight the importance of a strong working alliance and
19 a shared agenda between the co-therapists and of their alliance to both spouses.

20 At the same time, we found no evidence for EDA synchrony in C-C dyads. This
21 is in accordance with previous studies of the Relational Minds project, in which the C-C
22 values of synchrony measured using the concordance approach were the lowest
23 (Tourunen et al., 2020). A possible interpretation for this is that the feelings of
24 emotional disconnection between partners, which brought them to therapy, may be
25 reflected in the physiological disconnection between them. We think that one of the

1 goals of couple therapy is to bring spouses closer together also on a physiological level,
2 and that the values of synchrony between spouses may thus increase as therapy
3 proceeds. For example, in concordance indices, synchrony was found to be very low in
4 the beginning but higher at the end of therapy (Tourunen et al., 2020). In this sense the
5 fact that in the present study we grouped together the beginning, and the end of therapy
6 may have masked this phenomenon. In order to test this possibility future research
7 should systematically analyze the synchrony values across the course of sessions.

8 Regarding the absence of synchrony in respiration this may be related with the
9 multi-person setting under study, in which a synchronized pattern of breathing behavior
10 between partners is less likely to emerge than in dyadic settings. The respiratory pattern
11 is composed of inhaling and exhaling cycles, hence respiratory synchrony requires that
12 partner A coordinates his/her breathing-in and -out behavior in a synchronous way with
13 partner B. In previous work this type of respiration synchrony was reported in dyadic
14 therapy (Tschacher & Meier, 2020) and when an external stimulus was present, such as
15 music in choir singing (Delius & Müller, 2023; Vickhoff et al., 2013).

16 In fact, measures such as respiration rate (i.e., the frequency of inhalations per
17 minute), EDA or heart rate are more directly linked to autonomic arousal, so that
18 synchrony in such measures may be more expected to emerge each time
19 sympathetically arousing topics (either positive or negative) are discussed. On the other
20 hand, measures such as respiratory behavior which we used in this study may be more
21 affected by talking versus being quiet, and this may explain the lower probability that
22 we capture this type of synchrony.

23 Another key aspect of synchrony patterns emerging during emotionally arousing
24 topics, specifically regarding the role synchrony plays in the interaction, concerns the
25 direction of synchrony. Previous work suggested that in-phase synchrony may emerge

1 either in processes of joint positive emotions or in processes of escalation of negative
2 emotions that characterize conflictual interactions (Timmons et al., 2015). For example,
3 in our previous work we found that EDA synchrony was higher during couples'
4 interactions involving negative emotions (Coutinho et al., 2019).

5 In this respect our findings on the associations between session-wise
6 synchronies and both clients' well-being before each session (using the ORS scale) and
7 participants' alliance ratings after the session (assessed using the SRS scale) was
8 informative. We found that both clients' well-being as well as therapists' alliance ratings
9 were significant predictors of C-C electrodermal synchrony. Specifically, the synchrony
10 between spouses was negatively related to both the alliance (rated by therapists) and
11 clients' well-being. Considering that the values of C-C synchrony were negative on
12 average, this means that the more anti-phasic the C-C synchrony was, the higher the
13 clients' well-being and the stronger the therapeutic alliance rated by the therapists. This
14 may suggest that when partners synchronized in opposite directions, this may signal a
15 positive and adaptative process. Considering that, as mentioned before, high in-phase
16 synchrony can be a sign of competition and escalation (Coutinho et al., 2019), anti-
17 phasic synchrony may on the other hand indicate an adaptative process of mutual
18 regulation of spouses' arousal and thus be associated to clients' well-being and a good
19 alliance (Coutinho et al, 2020).

20 As for limitations, both process-outcome associations were found without
21 applying Bonferroni correction considering that we tested EDA synchronies four times
22 against the outcome rating scale and four times against the session rating scale. These
23 tests may be considered rather exploratory, given that the overall sample size was
24 likewise low. We also found no other significant relationships between synchrony and
25 measures of outcome and alliance, as for example an association between C-T

1 synchrony and therapeutic alliance may be expected. Findings of few significant
2 correlations between alliance and changes in EDA synchrony may suggest that the two
3 phenomena do not overlap to a large extent (Anderson & Johnson, 2010). The absence
4 of strong associations between synchrony and clinical outcome may be due to
5 synchrony reflecting rapidly changing interactional dynamics rather than long-term
6 relationship satisfaction (Nelson et al., 2017). It is also important to note that we did not
7 obtain relational outcome measures such as marital satisfaction or dyadic adjustment in
8 this study, instead we used individual measures of clients' well-being (Anderson &
9 Johnson, 2010). This may also explain the absence of associations with outcome,
10 considering that synchrony as a measure may be rather related with measures of dyadic
11 functioning (Timmons et al., 2015).

12 Concerning the synchronies across the 31 reflection periods, we found a similar
13 picture to that of the whole sessions. Significant in-phase electrodermal synchrony that
14 was observed only in C-T dyads, and there was no evidence for respiration synchrony.
15 The obvious limitation here was that reflection periods have largely diverging durations.
16 We therefore conducted a post-hoc test in which synchrony values were weighted for
17 the lengths of the respective reflection periods in which they were obtained. The
18 rationale of this weighing was that synchronies of longer periods can be assessed with
19 higher reliability when more segments can be used for estimating the effect sizes of
20 synchrony. Table 3 shows that this effect provided a clearer picture.

21 No synchrony was observed in C-C dyad, which indicates that listening to the
22 same external stimuli (therapists' talk) alone was not enough to cause synchrony
23 between the spouses. Most probably, this is because the therapists' sayings were given
24 different meanings by each client. The presence of EDA synchrony in C-T dyads
25 indicates that spouses may have become attuned to the content of therapists' reflective

1 conversation supporting the validity of reflective periods for the clients. Interpreting the
2 selected qualitative extracts of reflection periods allows to see more closely what
3 happened during these conversations. We note that in the extract (Extract 2) with a non-
4 affiliative response of the clients to the reflection, the synchrony values between the
5 clients and therapists were lower. In contrast, the reflection period (Extract 1) where the
6 clients were more attuned to what therapists said and commented on what they heard
7 afterwards, the EDA synchrony was increased. As mentioned before, in systemic
8 therapies such as couple therapy various therapeutic alliances are formed in different
9 subsystems, with each therapist forced to establish an alliance with his/her co-therapist
10 and with each spouse of the couple (Friedlander et al, 2011).

11 In this work we aimed to contribute to the understanding of the dynamic nature of
12 the alliance formations and related synchronies in multi-actor settings using a
13 multimodal approach by measuring both EDA and respiratory synchrony. However, the
14 complexity inherent to the meaning of synchrony and its role in couple therapy requires
15 the study of several dimensions that should be addressed in future work. For example,
16 to address this complexity, future studies should implement detailed analyses linking
17 the content of the conversation with the synchronies that are established in each dyad.
18 For example, we may see whether spouse A synchronizes with therapist A when he/she
19 is speaking about spouse B, and whether this transient synchrony pattern changes as
20 soon as this same therapist speaks about spouse A. Thus, future work should combine a
21 global macroanalytic approach using bigger samples, with the comparison between
22 different stages of the therapeutic process (initial phase of alliance formation vs last
23 phase of therapy) and the study of specific therapeutic events using microanalytic
24 analysis. We believe that reflective periods as well as other types of therapeutic events,
25 in which the structure or the format of the interaction changes, such as two clients being

1 in dialogue or rupture-repair episodes can provide new important insights into the
2 relational meanings of synchrony. Finally, from a methodological point of view it could
3 be interesting to compare the results obtained using different methods of synchrony
4 computation (for example SUSY vs concordance index developed by Marci & Orr,
5 2006 and Tschacher & Meier, 2020).

6

7 ETHICAL CONSIDERATIONS

8 All procedures performed in studies involving human participants were in accordance
9 with the ethical standards of the institutional research committee of University of
10 Jyväskylä and/or national research committee and with the 1964 Helsinki declaration
11 and its later amendments or comparable ethical standards. Informed consent was
12 obtained from all individual participants included in the study.

13

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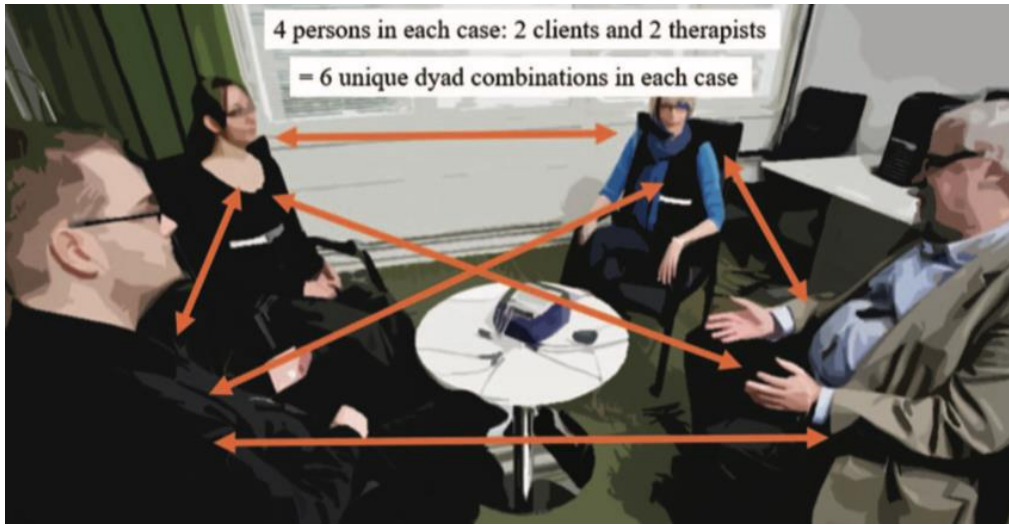
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1 **Figure 1.** Therapeutic setting under study

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5 *Adapted with permission from Tourunen et al, 2020*

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9 **Table 1.** Mean synchronies (M) and standard deviations (SD) across all 22 sessions for
 10 electrodermal activity (EDA) and respiration (RESP)

	EDA		RESP	
all dyads	M=29.65 (SD=29.42)	t(21)=4.73****	M=1.73 (SD=5.19)	t(21)=1.57
C-C dyads	M= - 7.52 (SD=53.44)	t(21)= - 0.66	M=1.97 (SD=12.59)	t(21)=0.73
C-T dyads	M=31.91 (SD=33.32)	t(21)=4.49***	M=1.21 (SD=8.47)	t(21)=0.67
T-T dyads	M=57.76 (SD=70.99)	t(21)=3.82**	M=3.59 (SD=11.28)	t(21)=1.49

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12 Note. Parameter setting for synchrony computation: Segment size=60s, maxlag= 5s.

13 One-sample t-tests: ** p<0.01, *** p<0.001, **** p<0.0001

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Table 2. Mean values and standard deviations (SD) of session synchronies ESnoabs-all of each session, for electrodermal activity (EDA) and respiration (RESP)

session-ID	EDA	RESP
J001_2	94.49* (SD=86.49)	0.82 (SD=8.37)
J001_7	41.83* (SD=8.95)	6.15 (SD=8.95)
J001_16	59.71* (SD=43.97)	-8.06 (SD=18.82)
J002_2	-2.10 (SD=51.56)	10.12 (SD=15.41)
J002_6	37.50 (SD=109.21)	6.99 (SD=11.57)
J003_2	46.85 (SD=109.51)	4.67 (SD=16.14)
J003_5	60.95* (SD=55.63)	3.74 (SD=6.87)
J004_2	68.00 (SD=109.03)	8.05 (SD=16.17)
J004_5	4.48 (SD=20.27)	-1.67 (SD=4.12)
J005_3	2.29 (SD=14.45)	6.56 (SD=13.66)
J005_6	31.67 (SD=40.34)	4.64 (SD=29.24)
J006_2	-9.51 (SD=4.37)	7.54** (SD=3.50)
J006_7	13.60 (SD=29.43)	-0.54 (SD=15.52)
J007_2	46.98 (SD=54.64)	1.37 (SD=7.68)
J008_2	1.20 (SD=12.32)	-5.27 (SD=7.74)
J008_5	-1.10 (SD=21.97)	-4.18 (SD=11.74)
J009_2	63.50 (SD=85.92)	8.08 (SD=11.32)
J009_6	-2.86 (SD=20.03)	-2.44 (SD=9.73)
J010_2	24.96 (SD=88.24)	0.23 (SD=14.64)
J011_2	55.21 (SD=61.97)	-5.12 (SD=19.92)
J012_2	7.00 (SD=16.17)	-1.10 (SD=14.02)
J012_6	7.66 (SD=46.91)	-2.46 (SD=8.99)

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Note. Segment size=60s, maxlag= 5s. One-sample *t*-tests: * $p < 0.05$, ** $p < 0.01$

Table 3. Mean and standard deviation (SD) values of synchronies ESnoabs of reflection periods, for electrodermal activity (EDA) and respiration (RESP)

	EDA			RESP		
	<i>M</i>	<i>t</i> (30)	<i>t'</i> (30)	<i>M</i>	<i>t</i> (30)	<i>t'</i> (30)
all dyads	<i>M</i> =1.58 (<i>SD</i> =3.65)	<i>t</i> (30)=2.41*	<i>t'</i> (30)=2.55*	<i>M</i> =0.16 (<i>SD</i> =0.85)	<i>t</i> (30)=1.06	<i>t'</i> (30)=1.27
C-C dyads	<i>M</i> =0.68 (<i>SD</i> =5.07)	<i>t</i> (30)=0.74	<i>t'</i> (30)=0.02	<i>M</i> = - 0.06 (<i>SD</i> =0.92)	<i>t</i> (30)= - 0.34	<i>t'</i> (30)=0.62
C-T dyads	<i>M</i> =1.53 (<i>SD</i> =3.49)	<i>t</i> (30)=2.44*	<i>t'</i> (30)=2.61*	<i>M</i> =0.32 (<i>SD</i> =1.08)	<i>t</i> (30)=1.63	<i>t'</i> (30)=2.19*
T-T dyads	<i>M</i> =2.71 (<i>SD</i> =7.95)	<i>t</i> (30)=1.90	<i>t'</i> (30)=2.40*	<i>M</i> = - 0.24 (<i>SD</i> =2.80)	<i>t</i> (30)= - 0.47	<i>t'</i> (30)= - 0.58

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Note. Parameter setting for synchrony computation: Segment size=20s, maxlag= 5s

t=one-sample *t*-tests against zero: * $p < 0.05$, ** $p < 0.01$

t'=one-sample *t*-tests against zero, with synchronies ESnoabs weighted for the lengths of respective reflection periods: * $p < 0.05$, ** $p < 0.01$

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Table 4. Process-outcome associations: Synchrony predicted by ORS (Outcome Rating Scale) measuring clients' well-being when entering the session. Results of regression models derived from 22 couple therapy sessions

Dependent Variable ESnoabs-C-C (EDA)	<i>n</i> =22
Independent Variable: ORS_C-SUM	<i>t</i> = -2.47*
Random effect: Therapy# (% variance)	11.9
Whole model <i>r</i> ² (% variance)	43.9

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Note. Outcome Rating Scale with averaged data of both clients' sum of all aspects of well-being (ORS_C-SUM). * *p* < .05

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Table 5. Process-outcome associations: Synchrony predicted by SRS (Session Rating Scale), measuring alliance. Results of regression models derived from 20 to 22 couple therapy sessions

Dependent Variable ESnoabs-C-C (EDA)	<i>n</i> =20 ^a
Independent Variable: SRS_T-SUM	<i>t</i> = -2.32*
Random effect: Therapy# (% variance)	41.2
Whole model <i>r</i> ² (% variance)	68.5

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Note. Session Rating Scale only with averaged data of both clients (SRS_C-SUM) or therapists (SRS_T-SUM), respectively; all aspects of therapeutic relationship considered; ^atwo sessions with missing therapists' SRS items. * *p* < .05

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Table 6. Reflection Period 1: Reflective conversation focused on both clients, spouses show agreement in their responses

In the extract below, we show a reflection period from the last session of a couple therapy process consisting of altogether six sessions. In this reflection period, there is a clear structure in which the therapists first indicate that they will start their mutual talk, then they start addressing talk to each other, and after a couple of minutes of talk between the therapists, they again say that the reflective talk ends. After that, they turn to clients to ask their comments on what they heard. In the extract, we present a transcript of the discussion (Column 1), qualitative description of the interaction (Column 2) and the relevant physiological results (Column 3). Therapist 1 (T1) is female and Therapist 2 (T2) is male. The original Finnish transcription has been translated to English. The synchrony values are computed between lines 1 and 73. We however include in the extract also the discussion after that, to indicate what the clients' verbal and behavioural reaction to the reflection was. For the transcript notation, see the appendix.

Transcript of the Conversation	Description	EDA and RESP Synchrony
<p>1 T1 Well let's discuss now (1) in our turn ((clients look at the therapists; seemingly attentive))</p> <p>2 T2 What did you hear today</p> <p>3 T1 Hmmm ((sighs))(1) towards the end I was pleased to hear how safe atmosphere there</p> <p>has been in our joint discussions here (.) it is exciting (.) I hope also W has felt this (2)</p> <p>what I have noticed (.) and (2) ((H changes position, bends and looks down))</p> <p>also that (.) during this year there have been a lot of changes ((H straightens his position and looks at the therapists))</p> <p>((60 lines omitted; in these lines, the therapists, addressing each other, evaluate in positive terms the change they have seen in clients' communication skills. On</p>	<p>During the therapists' reflective talk, the spouses withhold talk or other vocal activities, treating themselves as "overhearing audience" (Goffman 1981) but not active participants of the discussion. Yet, they are attentive, as indicated by them gazing at the therapists.</p>	<p>- Client-client dyads:</p> <p>In client-client dyads, no high positive values: low positive value in EDA (0.39), as well as in RESP (0.716)</p> <p>- Client-therapist dyads:</p> <p>In EDA high value (2.76) between W and T2 (male) t; smaller positive value (1.6) between H and T2 (male) negative values between W and T1 (female) (-4.75) and between H and T1 (female) (-2.19).</p>

<p>T2's initiative, the therapists also acknowledge how the spouses have been able to share parenthood for the H's child from his earlier relationship.))</p> <p>67 T1 those (.) most relevant ((<i>H smiles</i>))</p> <p>68 T2 yeah (.) now I do not have anything else ((<i>smiles</i>))</p> <p>69 T1 hmm ((<i>smiles</i>))</p> <p>70 T2 to add (2) certainly there has been a lot more</p> <p>71 T1 mmmh (3)</p> <p>73 T2 ((quietly)) would you have something you would like to comment on this (2)</p> <p>75 W Nothing else but thank you (.) that sounds good at least for now (.) that what you said ((<i>H smiles</i>)) and (.) what you had noticed about the parenthood issue (1) ((<i>H gazes at W; W gazes at T1</i>)) well you have quite right noticed (1) that it is really important for me (.) at least the social parenthood (.) ((<i>W nodding</i>)) and I don't know how much for [the child</p> <p>H [(makes some sound, not words, maybe a cough))</p> <p>W also the psychological oh (1) somehow it is an important issue (.) and it is also important that (H) ((<i>gazes H</i>)) has given this space ((for taking the parenting role)) ((<i>W touches her hair; H looks down and then at W</i>))</p> <p>T1 hmm</p>	<p>After the therapists have collaboratively brought into conclusion their reflections (see lines 67-71), T2 offers the clients an opportunity to give their comments (line 73). The wife takes the turn. She first gives her thanks and expresses appreciation on the reflective talk as a whole (lines 75) and then points her focus on one issue, i.e. "parenting". She first confirms the therapists' notion that what she names as "social parenting" is important for her (line 77) and then moves on to present her own further reflections on parenting (lines 77-84). The therapists receive her talk with acknowledgement tokens (lines 81,85,86).</p> <p>After the therapists' acknowledgments the female client utters "hmm" (line 87) and then turns to her husband to ask about his view. Husband, smilingly, says that he has nothing to add. All in all, the clients' reaction to the therapists' reflection seems to convey appreciation, agreement, and affiliation. Although wife is more</p>	<p>In RESP Very high value (6.34) between W and T2 (male), lower positive value (0.94) between W and T1 (female). Negative value (-1.2) between H and T1 (female), low positive value (0.53) between H and T2 (male).</p> <p>- Therapist-therapist dyads: In EDA, negative value (-1.21) In RESP high positive value in (1,65).</p>
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<p>W and then maybe also the (.) the so that (.) like in the middle of all the conflicts ((the boy)) ((<i>W touches her hair; therapists nodding</i>)) and all the issues related with child rearing (.) is actually the issue of which we have never had any quarrels (1) and this is a big thing</p> <p>85 T1 mmh (2) yes</p> <p>T2 okay</p> <p>W hmm would you like to say something ((<i>turns to H</i>))</p> <p>H I don't have anything (1)((<i>gazes W, then turns to the therapists</i>)) to add ((smiles))</p>	<p>active in talk, the husband seemingly shares this stance.</p>	
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1 In Extract 1, W displays actively affiliation and agreement after the reflective discussion. Seemingly, this corresponds with the relatively high
2 synchrony values in EDA between her and the therapists. In female therapist (T1), the value is however negative, indicating anti-phase
3 synchrony. In respiration, W and male therapist (T2) were in high synchrony. The high positive synchrony values between W and male therapist
4 (T2) might be associated to the fact that it was T2 who brought the topic of parenthood into the reflective discussion; in her comments, W
5 showed her appreciation of this. The male client was less active in displays of affiliation, which seemingly corresponds to his lower synchrony
6 values with the therapists.

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1 **Table 7. Reflection Period 2: Reflective conversation more focused on one client's perspective, spouses' responses differ**
 2 The other reflection period shown below is from the second session of the couple therapy process consisting of four sessions altogether. The
 3 Reflective period is in the middle of the session, starting about 45 minutes after the session start. The length of the reflective period is two
 4 minutes, and it focuses mainly on the female client. The synchronies were calculated for the two-minute period. Here, we will only show the end
 5 of the therapists' reflective talk (lines 1-9), and the rest of the transcript shows how the clients' responses to it differ from each other. Both
 6 therapists (T1 and T2) are male.

Transcript of the Conversation	Description	EDA and RESP Synchrony
01 T1: all this-this and I think what they are doing now they are negotiating on those issues 02 T2: but if I would be a mother ((<i>H smiles, turns to look at T2</i>)) in a situation in which I realize that I cannot take care of everything ((<i>H changes position, stops smiling</i>)) because the baby is not sleeping and I feel myself very depressed (.) and then there is another one (.) the father taking care (.) that would mean that I could feel my myself even worse (.) in the situation because even if I have a good husband ((<i>H smiles</i>)) so-so I-I cannot manage those take care of this ((<i>W nods</i>)) so I think they are very many deep (.) questions all the time 08 T1: yea yea of course they are evoking feelings 09 T2: yes yea yea ((<i>turns to look at the clients, nodding</i>)) (3) 10 T2: mm 11 W: yea ((<i>glances briefly at H</i>)) (8) 13 H: i-i-it's ((<i>smiles, touches his neck; W smiles, turns to gaze at H; T1 bites his lip</i>)) 14 T2: yea	After T2 has discussed the wife's emotions in a hypothetical scenario ("If I would be a mother...", line 02), T1 comments on the scenario (line 08) and T2 produces acknowledgement tokens (lines 9 and 10) which may signal that T2 is ready to close the reflection. He also turns to the clients, indicating an expectation that they would take the turn. W -- whom the reflective commentary focussed on -- produces her acknowledgment token (line 11) which also may convey an understanding of the closure of the	-Client-client dyads: In EDA negative value (-1.136) In RESP, low positive values (0,24). -Client-therapist dyads: In EDA, high positive values between W and T1 (1,27), between W and T2 (0,82) and between H and T1 (0.76). Negative value (-1.1) between H and T2 In RESP Most values close to zero, only between W and T1 negative value (-0.95) and between W and T2 low positive value (0.52). Therapist-therapist dyads: In EDA, negative value (-1.38). In RESP, low value (0.23)

<p>15 H: I-I'm struck ((<i>touches his neck and head, looks up smiling, keeps hand on his forehead; W smiles and drinks water</i>)) by this conversation in some ways in terms of it's (2) I think about we came in here ((<i>making a wave-like hand movement with his palm facing to W, illustrating "we" and "here" </i>)) I guess to talk about us</p> <p>17 T2: mm hm</p> <p>18 H: yet most of our conversations hasn't been about us (.) it's about (1) ourselves and our relationship with Eva ((<i>looks at the therapists</i>))</p> <p>20 T2: yes</p> <p>21 H: and (.) yea that's interesting ((<i>turns to look at W, smiles; W smiles back, looks at H; T4 smiles</i>))</p> <p>22 W: it's interesting (.) but that's what's impacted our relationship ((<i>H stops smiling</i>))</p> <p>23 H: yea (2) ((<i>moves his head sideways, looks at W; W stops smiling; T2 smiles</i>))</p>	<p>reflection. A silence of 8 seconds ensues, whereafter the husband in line 13 takes a turn yet aborting his speech. T2 adds yet another acknowledgment token (line 14) which may convey that he is not intending to talk further. Thereafter the husband starts a commentary where he points out that the therapeutic talk has not been what he expected (lines 15-22). His comment is "prompted" by the reflection, although what he says is more related to the topics of the entire session, and not to what the therapists said in their reflection. It is also possible that the therapists' way of focusing on the wife's experiences in their reflection might have prompted the husband's critical stance; yet he does not directly indicate that. In line 22, the wife takes the turn to respond to her husband, indicating disagreement with his view, and displaying more positive evaluation of the focus of the therapy.</p>	
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2 Overall, the synchrony values between the clients and the therapists in Extract 2 are lower than Extract 1. Seemingly, this corresponds to the
3 clients' non-affiliative response to the reflection. The disagreement between the spouses might also have affected the synchronies between the
4 participants.

1	Transcript Notation	
2	Symbol	Meaning
3	yes (1) me too	Figures in rounded brackets represent inter- and mid-turn silences,
4		hand-timed in seconds.
5		
6	yes (.) me too	The period in rounded brackets represents “micro-pauses” of less than 0.2 seconds.
7		
8	((wiping tears))	Double rounded brackets contain relevant contextual and nonverbal information added by the transcribers.
9		
10	I-I thi- I think so	A single dash following a word or letter(s) indicates an abrupt cutoff in the flow of speech (stammering).
11	[and well on the whole	
12	[oh yes]	Overlapping utterances are marked by single square brackets.
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