RESEARCH ARTICLE

WILEY

Within and between associations of nonverbal synchrony in relation to Grawe's general mechanisms of change

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Funding information
Open access funding enabled and organized by
Projekt DEAL.; German Research Foundation,
Grant/Award Number: LU 660/10-1

Abstract

The examination of nonverbal synchrony has become a promising line of psychotherapy research. Although several studies have found between-dyad associations between nonverbal synchrony and multidimensional outcomes, the findings remain heterogeneous, and within-dyad effects remain to be investigated. The present study examines within and between effects of nonverbal synchrony on mastery, resource activation, problem actuation, and motivational clarification (Grawe's general mechanisms of change). Four-hundred and twenty-three videotaped sessions of 175 patients were analysed using motion energy analysis (MEA), providing values to quantify nonverbal synchrony in the patient–therapist dyad. Grawe's general mechanisms of change in psychotherapy were rated using the Inventory of Therapeutic Interventions and Skills (ITIS). On average, patient–therapist nonverbal synchrony was greater than chance. Hierarchical linear modelling revealed that nonverbal synchrony was significantly associated with higher mastery and less resource activation on the within-dyad level. Nonverbal synchrony was not associated with problem actuation or motivational clarification, and in general, no associations were found on the between-dyad level. The results demonstrate the importance of disentangling within and between effects of nonverbal synchrony and provide initial evidence that nonverbal synchrony is tied to the specific therapeutic strategies observed in psychotherapy sessions.

KEYWORDS
CBT, general change mechanisms, Inventory of Therapeutic Interventions and Skills, motion energy analysis, nonverbal synchrony

1 | INTRODUCTION

Nonverbal synchrony, commonly defined as movement coordination between interacting partners, has received growing attention as a process variable in psychotherapy research (Kolden, Klein, Wang, & Austin, 2011). Whereas early research assessed nonverbal synchrony via observer ratings, Bernieri and Rosenthal (1991) introduced the concept of automatic video analysis. Motion energy analysis (MEA) is an automated method to measure simultaneous and slightly time-lagged movements of patient–therapist dyads (quantifying a synchrony index based on pixels changes) and the most commonly applied approach in psychotherapy research (Altmann et al., 2019; Ramseyer & Tschacher, 2011; Schoenherr, Paulick, Strauss, et al., 2019). Despite the growing number of studies that have begun to examine nonverbal synchrony, results remain inconsistent, and the dynamics and clinical meaning of nonverbal synchrony remain unclear.

Several studies have shown a positive association between nonverbal synchrony and therapeutic outcome (Galbusera, Finn, & Fuchs, 2016; Kupper, Ramseyer, Hoffmann, & Tschacher, 2015; Ramseyer & Tschacher, 2011). However, Lutz et al. (2020) found a negative association between nonverbal synchrony and multidimensional outcome. Furthermore, results on process variables also remain heterogeneous. Whereas Ramseyer and Tschacher (2011) found a positive association between nonverbal synchrony and therapeutic alliance, in a following study, these findings were not replicated when synchrony was assessed from an idiographic perspective (Ramseyer, 2019). In a sample with comparable characteristics to Ramseyer and Tschacher (2011), Paulick, Deisenhofer, et al. (2018) found no significant association between nonverbal synchrony and therapeutic alliance.

Multiple aspects may contribute to these mixed findings. First, as mentioned above, study design differences likely affected the results. The majority of studies analysed the initial 15 min (or less) of a therapy session, which were then used as a synchrony index for the entire session (e.g., Paulick, Deisenhofer, et al., 2018; Ramseyer & Tschacher, 2011; Schoenherr, Paulick, Strauss, et al., 2019). However, it can be assumed that synchrony is a dynamic construct (i.e., a process variable; see Zilcha-Mano, 2019) that changes not only over the course of therapy but also within a session. Second, most studies have investigated nonverbal synchrony based on a single session (Paulick, Deisenhofer, et al., 2018) or two sessions (initial and final phase, Ramseyer & Tschacher, 2011). However, to distinguish within from between effects, multiple sessions are necessary. It is possible that nonverbal synchrony has both within ("state-like") and between-dyad ("trait-like") variability. Nonverbal synchrony may vary within a dyad over time (i.e., from session to session) and be associated with within-dyad changes or fluctuations in other process variables such as the alliance, for example. Simultaneously, it is also possible that stable average differences in nonverbal synchrony between dyads are associated with average differences between dyads regarding the alliance.

Finally, several authors have examined associations between patient characteristics such as diagnosis (Paulick, Rubel, et al., 2018) and childhood trauma (Ramseyer et al., 2019) and nonverbal

Key Practitioner Message

- In therapy, patients and therapists tend to spontaneously synchronize their body movements.
- Nonverbal synchrony showed significant within-dyad ("state-like") but no between-dyad ("trait-like") variability.
- Nonverbal synchrony is tied to specific therapeutic strategies.

synchrony, assuming that the patient's ability to interact and synchronize with the therapist may be related to these traits. However, nonverbal synchrony is a dyadic phenomenon, likely related not only to patient characteristics but also to therapist implementation of particular treatment strategies and processes during the session. To our knowledge, no studies have examined the association between nonverbal synchrony and therapeutic strategies. Importantly, an experimental study has shown evidence of an association between nonverbal synchrony and affectivity, specifically, a positive association with positive affect and a negative association with negative affect (Tschacher, Rees, & Ramseyer, 2014). Assuming that affectivity is associated with therapeutic strategies, we propose to examine nonverbal synchrony in relation to treatment strategies.

Within the context of the so-called third wave, modern cognitive behavioural therapy (CBT) refers to a whole family of evidence-based therapeutic methods and techniques (Hofmann & Hayes, 2018). This development has increased the heterogeneity of treatment content. Further, recent efforts have intensified to use prediction models to make personalized treatment recommendations and therefore better tailor treatment to the individual patient (e.g., Trier Treatment Navigator; Lutz, Rubel, Schwartz, Schilling, & Deisenhofer, 2019). Thus, the field is shifting from a largely standardized application of "evidence-based treatments" (disorder-specific treatment manuals; Goldfried, 2016) to the flexible adaptation of treatment strategies to patients' characteristics and progress (Lutz, Zimmermann, Müller, Deisenhofer, & Rubel, 2017). These developments are accompanied by an increase in psychotherapy process research, which tries to identify processes, mechanisms, and strategies of change (Boswell, 2013; Grawe, 2004; Hofmann & Hayes, 2018; Kazantzis et al., 2018; Wampold & Imel, 2015).

Grawe (1997) defined four general mechanisms of change (GMC) in psychotherapy in his theoretical framework that focus on changing emotional and motivational factors. First, *mastery* refers to the therapist's ability to assist the patient to cope with past situations and to support the realization of particular intentions. To implement this objective, a general and specific understanding of psychological disorders as well as knowledge on how to build expectations, promote volitional processes, and develop the necessary skills is required. Second, *motivational clarification* refers to the therapist's ability to guide the patient through a process of exploration to gain insight into needs and motives. The clarification process should result in the patient's ability

to independently implement newfound intentions. Third, to effectively modify the patients' problems, the activation of avoided experiences and behaviour is essential. This mechanism, guided by the therapist, is called *problem actuation*. It is important to point out that the three mechanisms of direct therapeutic change described above all depend on the presence of the fourth mechanism of change called *resource activation*. This mechanism describes patients' becoming acquainted with their own positive and healthy potential, characteristics, abilities, and motivation via therapist interventions.

Grawe's (1997) transtheoretical framework is one empirically based categorization of therapeutic change mechanisms across various psychotherapy approaches (Grawe, 2004; for other models, see, for example, Castonguay, Constantino, & Beutler, 2019). Grawe's GMC have been associated with therapy outcome in several studies (e.g., Flückiger, Grosse Holtforth, Znoj, Caspar, & Wampold, 2013; Gmeinwieser, Hagmayer, Pieh, & Probst, 2019; Mander et al., 2015). The associations between GMC and outcome have depended on the selected GMC. For instance, Mander et al. (2015) examined 457 patients over the course of a 6- to 10-week inpatient treatment. The results showed no association between problem actuation and outcome. However, motivational clarification was associated with changes in interpersonal problems. In addition, mastery was positively associated with symptom reduction. Similarly, in a sample of 524 patients, Gmeinwieser et al. (2019) analysed GMC in an early phase of therapy and also found no association between problem actuation and outcome. In contrast, mastery and motivational clarification were associated with outcome. However, Gassmann and Grawe (2006) demonstrated that the combination of GMC may also be important. They found successful sessions to be characterized by therapists first activating resources before actuating the patient's problems. Thus, Grawe's GMC have shown various, complex relations with treatment outcome.

Several self-report measures have been developed to assess Grawe's GMC from the patient and therapist perspectives. The Bern Post Session Reports (BPSR; Flückiger, Regli, Zwahlen, Hostettler, & Caspar, 2010) assess a range of psychotherapy process variables including the above-described change mechanisms. The Scale for the Multiperspective Assessment of General Change Mechanisms in Psychotherapy (SACiP; Mander et al., 2013) is an advancement of the BPSR with six subscales assessing the GMC and the therapeutic alliance according to Bordin's (1979) definition. The Individual Therapy Process Questionnaire (ITPQ; Mander et al., 2015) is a further development of the SACiP and the Scale of the Therapeutic Alliance—Revised (STA-R; Brockmann et al., 2011), which has shown predictive effects on outcome. However, one limitation of these studies on self-report measures is that they are designed to assess GMC in the previous session and not over the course of therapy. Further, as is generally the case with self-report assessments, the validity of these measures may be affected by subjective response bias and social desirability. Recently, a new video rating instrument has been developed that assesses Grawe's GMC alongside a range of therapeutic interventions and skills (Inventory of Therapeutic Interventions and Skills [ITIS]; Boyle et al., 2020). This inventory provides a further, observer-based approach to the assessment of GMC.

It may be hypothesized that interpersonal processes between patient and therapist are associated with GMC. For instance, a collaborative, interactive process may characterize the patient–therapist dyad during resource activation and mastery, as the dyad is likely working together towards strengthening positive, functional behaviour. In contrast, the patient may adopt a more passive and self-reflecting stance during problem actuation and motivational clarification, working through difficult emotions and gaining insight. Therefore, the degree of nonverbal synchrony between the patient and therapist may reflect the patient's focus on the collaborative interaction with the therapist versus on internal processing.

To summarize, patient–therapist nonverbal synchrony has been proposed to be a process variable in psychotherapy associated with multidimensional outcome (e.g., interpersonal problems). However, the results of former studies are heterogeneous. The current study attempts to extend the existing literature in several ways. First, videotaped sessions from 175 patients with 2–3 sessions each were analysed. Such a design can help to clarify the within- and between-dyad variability of nonverbal synchrony. The study of within and between effects is an important step towards increasing clinical relevance of nonverbal synchrony literature, for example, in the context of trainable skills. Second, nonverbal synchrony was quantified for entire sessions. Given the limited knowledge of the dynamic nature of nonverbal synchrony, synchrony indexes of entire therapy sessions—rather than the initial 15 min like in former studies—might have the potential to achieve a better representation and understanding of associations with other process variables. Third, this paper investigates nonverbal synchrony with regard to Grawe's GMC. More specifically, this work focuses on the associations between nonverbal synchrony and mastery, resource activation, problem actuation, and motivational clarification, which are common principles thought to occur in all kinds of psychotherapy. However, specific interpersonal behaviours such as nonverbal synchrony may be related to these different mechanisms. Such a focus can help to achieve a better understanding of the heterogeneous results on nonverbal synchrony.

With these aims in mind, the following hypotheses guided our work:

Hypothesis 1. Significant nonverbal synchrony is observable within psychotherapy.

Hypothesis 2. Nonverbal synchrony is associated with Grawe's general mechanisms of change.
2a) Nonverbal synchrony is positively associated with mastery.
2b) Nonverbal synchrony is positively associated with resource activation.
2c) Nonverbal synchrony is negatively associated with problem actuation.
2d) Nonverbal synchrony is negatively associated with motivational clarification.

We also provide additional analysis on the association between nonverbal synchrony and treatment outcome.

2 | METHOD

2.1 | Treatment

Treatments took place at a university outpatient clinic in southwest Germany between 2017 and 2019 within a randomized controlled trial investigating the effects of psychometric feedback and clinical support tools on outcome in outpatient psychotherapy (Lutz et al., 2017). In the intervention group, therapists had access to an extensive routine outcome monitoring and clinical support system and were therefore able to track patients' progress session-by-session. Further, they were provided with a warning signal when patients deviated from their expected recovery curve and showed an increased risk of treatment failure. In these cases, therapists were provided with personalized treatment strategy recommendations addressing barriers to successful therapy (Lutz et al., 2019). In the control group, therapists did not have access to the feedback system. The ethics committees of the university and the German Research Foundation approved the study (DFG, Grant no. LU 660/10-1). All participating patients and therapists consented to the use of therapy video recordings for research.

Within the trial, patients were treated with integrative CBT including emotion-focused and interpersonal elements. Therapists were familiar with disorder-specific CBT manuals as well as transdiagnostic third wave protocols. Individual case conceptualizations and treatment plans were completed at the beginning of each treatment and approved by certified CBT supervisors. All patients received individual psychotherapy with an average of 29.3 treatment sessions (SD = 15.3); 23.4% of patients dropped out of treatment prematurely.

2.2 | Inclusion/exclusion criteria and video selection

Patients had to meet the following criteria to be eligible for analysis with MEA: (a) availability of ITIS ratings, (b) a minimum of two available video recorded sessions, and (c) no transfer to a different therapist during therapy. ITIS ratings were available for 264 patients (these data are an extension of a dataset that was already assessed in a study on treatment integrity published by Boyle et al., 2020). Of these, 27 were excluded because of different video resolution, 10 because of ineligible video clips (technical or seating problems), and 47 because only one session was available. Five additional patients were excluded because a therapist transfer took place during therapy. Thus, the present analysis is based on a sample of 175 patients.

A total of 423 videotaped sessions were analysed. In treatments with a length of 10 sessions or less, two sessions were analysed (beginning and end phase), whereas three sessions were analysed (beginning, middle, and end phase) in treatments with a length of 11 sessions or more.

2.3 | Patients and therapists

The majority (61.3%) of the 175 patients were female and had an average age of 37.1 years (SD = 13.5; range: 16–77 years). Patients had varying primary diagnoses, most commonly affective disorders (n = 78; 44.57%), anxiety disorders (n = 71; 40.57%), personality disorders (n = 5; 2.86%), and others (n = 21; 12%; e.g., eating disorders). One hundred and sixteen patients (66.29%) received two or more diagnoses. Patients were diagnosed based on the Structured Clinical Interview for Axis I DSM-IV Disorders (SCID-I; Wittchen, Wunderlich, Gruschwitz, & Zaudig, 1997). Table 1 provides a detailed overview of patient characteristics.

Fifty-seven therapists treated between one and 11 patients each (M = 3.07 patients, SD = 2.28). Therapists either participated in a 3-year (full-time) or 5-year (part-time) postgraduate training programme with a CBT focus or were already licensed CBT therapists. Trainee therapists had at least 1 year of experience as a clinician prior to study participation and were supervised by a senior therapist every fourth session.

TABLE 1 Sample characteristics: Demographic and clinical variables

Variables	Mean	Range
Age (in years)	37.03	16–77
Number of sessions	23.29	6–68
	n	%
Sex (female)	106	60.6
Dropout	41	23.4
Primary ICD-10 diagnosis		
Mood (affective) disorders (F30–39)	77	44.0
Recurrent depressive disorder, current episode moderate (F33.1)	32	18.3
Moderate depressive episode (F32.1)	10	5.7
Others	35	20.0
Neurotic, stress-related, and somatoform disorders (F40–48)	70	40.0
Post-traumatic stress disorder (F43.1)	18	10.3
Adjustment disorder (F43.2)	7	4.0
Social phobia (F40.1)	7	4.0
Others	38	22.0
Others (F10–29; 50–69; 90–98)	28	16.0
Comorbidity (two or more diagnoses)	117	66.9
Marital status (*n* = 174)		
Single	69	39.4
In relationship	67	38.3
Married	38	21.7
School degree (*n* = 174)		
Higher education qualification	86	49.1
General certificate of secondary education	35	20.0
Basic certificate of secondary education	43	24.6
Other/no	10	5.7

2.4 | Measures

2.4.1 | Inventory of Therapeutic Interventions and Skills

The ITIS (Boyle et al., 2020) is a therapy video rating instrument that was developed to adequately assess the range of interventions and skills observable in personalized CBT. The inventory comprises 20 interventions, which are coded "0" if *not observable* and "1"–"3" if *observable*, whereby "1" reflects a low degree of *lege artis* application and "3" a high degree of *lege artis* application. Further, the inventory comprises 11 skills, which are coded on a 7-point Likert scale ranging from "0" (*poor*) to "6" (*excellent*). Intercorrelations between the intervention items have been shown to be low and largely insignificant, indicating good item discrimination. In contrast, factor analysis of the skills scale has revealed a single, global skills factor. Several ITIS skills items have been shown to be predictive of session outcome and patient-rated alliance (see Boyle et al., 2020). The inventory also includes overall adherence and competence ratings as well as ratings of treatment difficulty and patient motivation; each also responded to on 7-point Likert scales.

For the purpose of this study, we investigated the four interventions items *Motivational clarification*, *Problem actuation*, *Mastery*, and *Resource activation*. The ITIS was applied by eight raters, all of whom participated in a comprehensive 3-day training programme to learn to use the inventory before they began to rate therapy videos independently (for a detailed description of the training procedure, see Boyle et al., 2020). Raters were subsequently regularly supervised and ratings compared with counter rater drift. Average pairwise inter-rater reliability across all raters was excellent (Kendall's W = .783; N = 59 videos) for these four interventions.

2.4.2 | Motion Energy Analysis

To analyse the 423 videos for movement synchrony, we used an objective and automated video analysis algorithm—MEA—designed for MATLAB (by U. Altmann and D., Schoenherr, publicly available at https://github.com/10101-00001/MEA). All videos were collected with the same recording system in.mp4 format and in a size of 720:576 (with a frame rate of 50 frames/s).

Before MEA was applied, several pre-processing steps were conducted. First, in contrast to former studies that only analysed the first 15 min of each therapy session, in this study, entire sessions were analysed. Therefore, sections of video were removed in which the patient or therapist left their seats. This led to a mean video length of 41 min (SD = 13, min = 16 min, max = 70 min). Second, specific regions of interest (ROI) were defined for both patient and therapist. The ROIs covered the upper body beginning at the seat of the chair and including free space around the head. Furthermore, two background ROI (10 × 10 pixels) were drawn in the upper half of each split-screen video to measure noise

(e.g., due to light changes in the therapy room), which was subsequently controlled for (Altmann, 2013).

After these pre-processing steps, MEA was applied; that is, grayscale pixel differences between sequential video frames were computed (see Grammer, Honda, Juette, & Schmitt, 1999). First, to avoid the over/underestimation of movements, the pixel change time series was divided by the corresponding ROI size. Second, to smooth the data, a moving median with a bandwidth of five was applied. Finally, a threshold of 12 (based on the 99% quantile of pixel change, see Altmann, 2013) was implemented to filter noise and motion energy time-series were calculated.

2.4.3 | Nonverbal synchrony quantification

Nonverbal synchrony was measured using R's (R Core Team, 2013) rMEA package (function MEAccf; Kleinbub & Ramseyer, 2019). Cross-correlation functions were then calculated by splitting the time series into 5-s windows (*winSec* = 5). Next, cross-lagged correlations with a time lag of ±5 s (*lagSec* = 5) were applied, allowing us to take not only simultaneous but also slightly delayed patient and therapist movements into account. Finally, the reference window was rolled over the time series in steps of 1 s (overlapping rolling windows; *incSec* = 1). The cross correlation function (CCF) was averaged across windows, and the maximal correlation was used as the synchrony index level (for a similar approach, see Bar-Kalifa et al., 2019). These parameters (duration of windows; maximum value of correlation) were in line with those suggested by Altmann et al. (2019), while the numeric quantification of synchrony followed the steps described in Paulick, Deisenhofer, et al. (2018) and Paulick, Rubel, et al. (2018), based on cross-correlation.

2.4.4 | Outcome Questionnaire 30

Patients completed the Outcome Questionnaire 30 (OQ-30) (Lambert, Hatfield, Vermeersch, Burlingame, Reisinger, & Brown, 2001), a self-report measure to address symptomatic change, pre and post therapy. This 30-item short form has demonstrated high levels of congruence with the OQ-45 (Ellsworth, Lambert, & Johnson, 2006). Each item is rated on a 5-point Likert scale from 0 (*never*) to 4 (*almost always*). All items can be aggregated a total score.

2.4.5 | Hopkins Symptom Checklist Short Form

Patients completed the Hopkins Symptom Checklist Short Form (HSCL-11) (Lutz, Tholen, Schürch, & Berking, 2006) before each session. This 11-item self-report questionnaire assesses symptomatic distress on a 4-point Likert scale ranging from 1 (*not at all*) to 4 (*extremely*).

2.5 | Analytic strategy

We examined whether average patient–therapist nonverbal synchrony occurred to a higher extent than chance. Therefore, surrogate data were created by pairing 5,000 randomly selected time series and calculating CCF for each of these pairs. In a next step, non-parametric bootstrapping was applied with 1,000 repetitions to compare the average of the observed data with the sampling distribution of the surrogate data's average.

To test the associations between nonverbal synchrony and the GMCs, three-level hierarchical linear models with sessions nested within patients nested within therapists were used. In the first of these models, resource activation (i.e., the external rating of resource activation in session t for dyad d) was modelled as a function of both the dyad's average nonverbal synchrony (grand-mean centred), as well as nonverbal synchrony of the current session (person-mean-centred) and a Level 3 random effect (e_{tdt}—representing between-therapist variability), a Level 2 random effect (u_{0d}—representing between-dyad variability), as well as a Level 1 random effect (r_{td}—representing between-session variability).

$$\text{resource activation}_{td} = \gamma_{000} + \gamma_{101} * \text{Avg.Synchrony}_{d} + \gamma_{102} * \text{Session Synchrony}_{td} + u_{00d} + r_{0td} + e_{tdt}.$$

In the second, third, and fourth models, motivational clarification, problem actuation, and mastery served as the outcomes. In all other respects, these models were identical to the first model.

3 | RESULTS

3.1 | Synchrony in psychotherapy

Patient–therapist dyads showed average synchrony scores of Fisher's $Z = 0.066$ with a SD of 0.04. The distribution is provided in Figure 1. In addition, Figure 2 shows the sampling distribution of the means constructed from the surrogate data of randomly paired MEA segments ($M = 0.05$; $SD = 0.02$). The observed mean synchrony level (marked by a dash vertical line) was higher than the upper limit of the 95% confidence interval of the sampling distribution (marked by solid vertical lines). Thus, patient–therapist dyadic synchrony was, on average, greater than chance, with an effect size of Cohen's $d = 0.72$.

3.2 | Psychotherapy process

Hierarchical linear modellings (HLMs) were calculated to examine the association between the hypothesized process variable (within and between level nonverbal synchrony) and four outcome variables (resource activation, motivational clarification, problem actuation, and mastery). With resource activation as outcome, only same-session (within level) synchrony was a significant predictor and negatively associated with resource activation ($b = -3.18$, SE = 1.55, $p < .05$). The same was true for mastery; however, same-session (within level) nonverbal synchrony was positively associated with mastery ($b = 2.92$, SE = 1.39, $p < .05$). With motivational clarification and problem actuation as outcomes, neither dyad-level (between level) nor same-session (within level) synchrony were significant predictors. Table 2 presents the complete results of the HLMs.

3.3 | Additional analysis

To test whether nonverbal synchrony was associated with post-treatment outcome, we ran a general linear model with the post-treatment OQ-30 total score as the dependent variable and the pre-treatment OQ-30 total score as well as average nonverbal synchrony as covariates. Post-treatment data were not available for all patients. Therefore, the analysis is based on a smaller sample. Nonverbal synchrony showed no significant association with outcome. ($F(2,130) = 21.34$, $p = .54$).
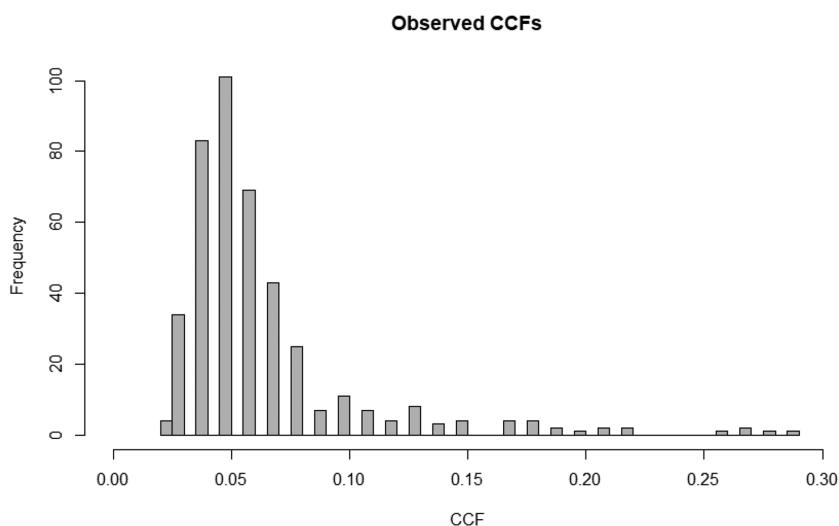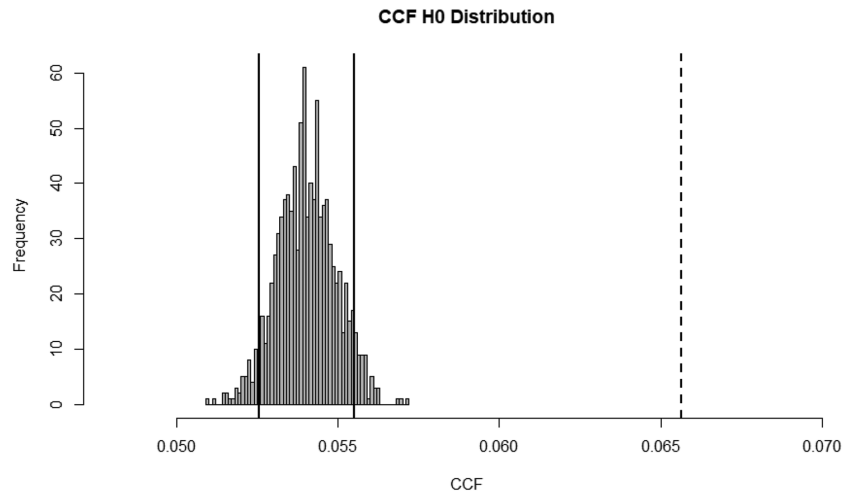
Observed CCFs

FIGURE 1 Patient–therapist observed nonverbal synchrony

In addition, we ran a three-level HLM, where the HSCL reported at the next session was modelled as a function of average nonverbal synchrony, previous session synchrony, and the HSCL reported by the patient at the previous session. Neither average synchrony ($b = -0.06$, $p = .92$) nor session synchrony ($b = -0.08$, $p = .88$) were significantly associated with next session symptoms.

4 | DISCUSSION

The present study examined the association between nonverbal synchrony and the GMC: We were interested in the specific effect of nonverbal synchrony on mastery, resource activation, problem actuation, and motivational clarification, assessed by independent raters after having watched the entire therapy session. Whereas previous investigations have predominantly explored nonverbal synchrony in the first 15 min of a session, the current study extended the examination of synchrony to entire sessions and did so for multiple sessions per dyad to disentangle within and between effects.

As expected, average patient–therapist nonverbal synchrony was greater than chance, with a high effect size. This result indicates that in therapy, patients and therapists tend to spontaneously synchronize their body movements to a degree that cannot be observed in dyads that never interacted in real life (surrogate data). This finding is in line with prior studies (e.g., Altmann et al., 2019; Paulick, Rubel, et al., 2018, Ramseyer & Tschacher, 2011) and demonstrates the statistical relevance of the general phenomenon.

To further investigate the association between nonverbal synchrony and GMCs, we used multisession data, which allowed us to differentiate within and between dyad effects. Whereas a within effect was found for mastery and resource activation, the between level did not serve as a significant predictor, regardless of the GMC. These results therefore show that within-dyad variability of patient–therapist nonverbal synchrony was associated with within-dyad change mechanisms, whereas dyads' average nonverbal synchrony levels were not associated with their average change mechanisms. Process analyses revealed that within-level nonverbal synchrony was indeed predictive of same-session resource activation and mastery interventions initiated by the therapist. No association was found for problem actuation and motivational clarification.

In contrast to our hypothesis, same-session nonverbal synchrony was negatively associated with resource activation. In other words, in sessions with lower patient–therapist nonverbal synchrony, more resource activation occurred. At first glance, this result seems counterintuitive given the positive associations between resource activation and alliance (Gassmann & Grawe, 2006) and between synchrony and alliance (Ramseyer & Tschacher, 2011). One plausible explanation for the negative association between resource activation and synchrony is the fact that patients and therapists are in different states during resource-oriented work (Gassmann & Grawe, 2006). Whereas patients may often be focused on problems and deficits and less aware of resources, it is the therapists' task to exceed the patients' system of thought and shift the perspective to resources (Flückiger, Zinbarg, Znoj, & Ackert, 2014). These different positions are likely

TABLE 2 Complete results of the HLMs for the general mechanisms of change

Outcome	Within level			Between level		
	b	SE	*p*	*b*	SE	*p*
Resource activation	−3.18	1.55	<.05	1.77	1.64	0.28
Mastery	2.92	1.39	<.05	0.73	1.52	0.63
Motivational clarification	−1.79	1.44	.21	−0.50	1.48	0.74
Problem actuation	0.49	2.01	.81	0.74	1.74	0.67

observable on the nonverbal level in the form of less synchronized body movement: During resource activation, it is the therapist's aim to directly increase the patients' positive emotional experience, which may manifest in therapists being more active and dominant than their patients (also with regard to their body movements).

As expected, same-session nonverbal synchrony was positively associated with mastery. In other words, more mastery was observed in sessions with higher patient–therapist nonverbal synchrony. A comparable association was reported from the patient's perspective in a previous study, where patient's self-efficacy (self-reported after the session) positively predicted the same session's synchrony (Ramseyer & Tschacher, 2011). In the rating system used here, during the process of mastery, the therapist assumes that the patient is not able to change dysfunctional behaviours on their own. However, instead of looking for deeper meaning behind behaviour patterns, therapists choose to focus on supporting the patient to learn coping and problem-solving strategies in the here-and-now (Grawe, 1997). When therapists guide patients through behavioural change, it can be assumed that this process is characterized by a supportive, active, and engaging interaction, which occurs on multiple channels (e.g., vocal, gestural, and facial expressive). The results of this investigation suggest that high levels of nonverbal synchrony are associated with the process of mastery.

The non-significant findings regarding motivational clarification and problem actuation are somewhat surprising. Nonverbal synchrony seems to play a role in predicting specific process variables, wheres others do not seem to be associated with the construct. These results might help explain the heterogeneous findings of prior research. This study provides evidence that nonverbal synchrony is indeed associated with the content of therapy sessions. It may thus be hypothesized that the manifestation of nonverbal synchrony is associated with therapist's specific interventions in a particular session to a stronger degree than previously expected.

The non-significant findings regarding the association between nonverbal synchrony and outcome support the idea that nonverbal synchrony is not directly correlated with outcome but rather with other within-dyad process variables. It also shows that more research is needed to understand the concept of nonverbal synchrony and that we should be cautious when interpreting findings.

4.1 | Strengths, limitations, and future research

The current study contributes to the existing literature on nonverbal synchrony by filling several gaps: To our knowledge, this is the first study to examine entire therapy sessions, instead of only the beginning section of 15 min, and the first to assess full-session nonverbal synchrony over multiple sessions. Moreover, this study extends the possible meaning of nonverbal synchrony by associating it with external ratings of GMC. This extension promises to limit the risk of subjective response bias by both patients of therapists. Nevertheless, several limitations of the present study are noteworthy.

One of the study's limitations refers to the measurement of nonverbal synchrony itself. The parameters chosen for the quantification of synchrony dramatically alter the synchrony index (Schoenherr, Paulick, Worrack, et al., 2019). Therefore, future research needs empirically based gold standard procedures for the operationalization of synchrony, which will then hopefully enable the aggregation and comparison of results across studies and might lead to a better understanding of nonverbal synchrony. Here, we adhered to previously suggested parameters (Schoenherr, Paulick, Worrack, et al., 2019), but it remains an open question whether the settings chosen are the most adequate or not.

Second, though the number of sessions analysed was higher than in most studies on nonverbal synchrony, to disentangle within and between effects, prior studies have investigated an average of four sessions (Crits-Christoph, Gibbons, Hamilton, Ring-Kurtz, & Gallop, 2011). With two to three units on Level 1, we are below this average. Therefore, we choose a large number of Level 2 units to reduce the risk of biased results. In addition, while Crits-Christoph et al. (2011) investigated within and between effects of therapeutic alliance, it remains unclear if this is comparable with nonverbal synchrony. Nonverbal synchrony consists of a great number of assessment points over the course of a whole therapy session, which have been averaged over all windows and lags. Therefore, we expect nonverbal synchrony to be a more reliable value than self-ratings. Nevertheless, the results must be interpreted with caution. Further, the measurement points were not consecutive (session by session). Future research might investigate change patterns in a series of consecutive sessions to lower the risk of dynamic processes remaining undetected. Additionally, the measurement points varied for each patient–therapist dyad and cover the beginning, middle, and end phases of treatment. It is possible that more uniform measurement points (e.g., the first, eighth, and twelfth session) would increase the comparability of the results. Importantly, technical problems with video collection made it difficult to focus on specific session numbers and would have led to a reduced sample size. Therefore, we decided to broaden the range of eligible sessions.

Third, the assessment of GMC was based on an observer-rated single-item approach. Future studies should examine the consistency of findings when multi-item patient and/or therapist self-reports of these change mechanisms are applied (e.g., SACiP).

Another shortcoming of the present study relates to the lack of control of prior symptom levels. Although, there are no studies on the association between symptom level and nonverbal synchrony existing to our knowledge, it is possible that these might be an influencing factor. Future studies might investigate the nonverbal synchrony or its changes with regard to symptom levels.

In addition, the results are based on data from a university outpatient clinic that routinely uses psychometric feedback. Future research should investigate whether the findings are generalizable to other settings.

Finally, the direction of associations between nonverbal synchrony and other process variables such as Grawe's GMC remains unclear. The patient–therapist dyad synchronizes simultaneously as

other mechanisms unfold over the course of the session, and as the analysis are correlational in nature, no causal conclusions can be drawn.

5 | SUMMARY

The results of the present study highlight the importance of investigating nonverbal synchrony while simultaneously considering GMC and offer an intriguing perspective on the dynamics and clinical meaning of nonverbal synchrony. On a methodological level, this study also indicates the importance of using multisession assessments when investigating nonverbal synchrony.

ACKNOWLEDGEMENT

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