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CHAPTER 20

SYNCHRONY IN DYADIC PSYCHOTHERAPY SESSIONS

Fabian Ramseyer & Wolfgang Tschacher

Department of Psychotherapy, University Psychiatric Services
Laupenstrasse 49, 3010 Bern, Switzerland
E-mail: ramseyer@spk.unibe.ch; tschacher@spk.unibe.ch

Synchrony is a multi-faceted concept used in diverse domains such as physics, biology, and the social sciences. This chapter reviews some of the evidence of nonverbal synchrony in human communication, with a main focus on the role of synchrony in the psychotherapeutic setting. Nonverbal synchrony describes coordinated behavior of patient and therapist. Its association with empathy, rapport and the therapeutic relationship has been pointed out repeatedly, yet close evaluation of empirical studies suggests that the evidence remains inconclusive. Particularly in naturalistic studies, research with quantitative measures of synchrony is still lacking. We introduce a new empirical approach for the study of synchrony in psychotherapies under field conditions: Motion Energy Analysis (MEA). This is a video-based algorithm that quantifies the amount of movement in freely definable regions of interest. Our statistical analysis detects synchrony on a global level, irrespective of the specific body parts moving. Synchrony thus defined can be considered as a general measure of movement coordination between interacting individuals. Data from a sequence of N=21 therapy sessions taken from one psychotherapy dyad shows a high positive relationship between synchrony and the therapeutic bond. Nonverbal synchrony can thus be considered a promising concept for research on the therapeutic alliance. Further areas of application are discussed.

1. Introduction

When people celebrate a special occasion, they often organize a gathering where guests interact in a pre-structured manner. It is during

interactive behavior that phenomena of synchrony can be observed. The occasion that marks the launch of this book is an anniversary and the form of the gathering is a collection of papers assembled in a book. Now, if we imagine a more traditional birthday party, we may easily detect various examples of synchronized behavior. These behaviors usually occur in different modalities and under a variety of conditions. This paper focuses on nonverbal behavior, so a very prominent display of nonverbal synchrony would be a dancing crowd at such a birthday party. Other manifestations could be observed from the beginning of the festivities e.g. the imitation of postures during small-talk at the *apéro*[1], the simultaneous sipping of champagne[2], similarities of hand gestures between speakers[3] or the convergence in prosodic peculiarities when guests with different accents begin a dialogue[4]. Further examples of synchrony could be detected towards the very end of the party such as contagious yawning[5,6], which would signal that the end of the evening is drawing near. A primary question that pops up when considering such examples is whether we may recognize a specific function or purpose in these synchronized actions or not. In this chapter, we will attempt to clarify the connection between synchronized movement and 'rapport' (i.e. relationship formation). To support the hypothesis that such a connection exists, we will focus on the specific setting of psychotherapy and will present as an empirical example of synchrony the patient-therapist dyad.
Our questions thus indirectly address possible functions of imitative behavior, the synchronization to a shared rhythm, be it at a birthday party, in everyday social interaction or in psychotherapy sessions.
"Monkey see, monkey do …"[7] and "Imitation is the sincerest form of flattery"[8] are proverbs that point to the importance of imitative behavior for human beings. As a starting point, we can pick an arbitrary social situation (such as the birthday party described above), because there is a very high likelihood that we will be able to observe phenomena of synchrony on various levels and in different sensory modalities.
In neuroscience, the so-called mirror neurons – first discovered in macaque primates[9,10] – have inspired numerous studies dealing with imitation in primates as well as humans. This has finally resulted in a body of evidence in humans that has associated neurobiological structures with concepts such as empathy, theory of mind and autism[11].

Coordinated nonverbal behavior made its appearance in psychotherapy research in the late 1960s. The seminal work of Condon & Ogston[12,13] was the starting point for empirical research dealing with synchronized (imitative) behavior during human interaction. Several psychotherapy schools have subsequently pointed out the significance of nonverbal attunement (e.g. NLP, Hypnotherapy) and there seems to be a consensus among practitioners that nonverbal coordination plays an important role in the development of the therapeutic relationship. We have set out to empirically clarify whether signs of synchronized nonverbal behavior can be detected in videotaped sessions of dyadic psychotherapies and how they relate to the perceived quality of the relationship between patient and therapist.

We view embodiment and embodied cognition as the larger framework of the investigation of synchrony and like phenomena[14]. Cognitive functions as well as interpersonal attributions are not sufficiently understood as computation or information processing and, therefore, the computer metaphor of the mind has been found to be ill-advised. Modern psychology has proceeded towards acknowledging the intrinsic embedding of the mind in its body and in its environment: Lewin's *Lebensraum*[15] concept. Contemporary systems theory[16] with its emphasis on self-organization provides the formal foundation of a dynamical system approach to the mind[17], which may shed a new light on attributes of cognition such as intentionality[18] as well as attributes of interpersonal functioning, which is the topic of this chapter.

2. Synchrony in nonverbal behavior

The significance of synchrony for human interaction is exemplified in the following citation: “Behavioral synchronization is a form of coordinative interaction which is thought to be present in almost all aspects of our social lives, helping us to negotiate our daily face to face interaction.“[19]. Considering human interaction globally, it is evident that some form of coordination or mutual influence plays a crucial role. Cappella[20] makes the following summary: “Coordination is arguably the essential characteristic of every interpersonal interaction. ... Interpersonal communication requires the coordination of behavior.” This usually

subtle form of coordination which tends to operate outside conscious awareness[21,22] has been given many different names that all share a similar higher-order meaning. Terms such as interactional synchrony[12], nonverbal mirroring[23], shared rhythmicity[24], motor mimicry[3] or chameleon effect[21] embrace the underlying dimension of coordination between two or more individuals in the domain of nonverbal action. Because of the diversity in terminology, we prefer to briefly clarify various uses and meanings of coordinative behavior. According to Bernieri & Rosenthal[25], we may classify most of the manifestations of synchrony in the human domain using the term *interpersonal coordination.* This expression is loosely defined as "... the degree to which the behaviors in an interaction are nonrandom, patterned, or synchronized in both timing and form."[25]. Since there are many different labels or descriptions for such behavior, a basic categorization of interpersonal coordination is needed. Such an attempt can be based upon the focus of the observer – the classical distinction between quantitative versus qualitative measurements. Studies that emphasize temporal aspects like simultaneous movement, rhythm, or meshing of nonverbal behaviors, mainly regard quantitative characteristics. Because of this stress on kinetic qualities, we classify this type of synchrony as *movement synchrony.* It deals with " ... the precise timing and coordination of movements between individuals ... while the nature or similarity of movements is irrelevant."[26]. An illustration of movement synchrony would be a therapist who matches his speed of movement to that displayed by the patient. Irrespective of the specific parts of the body that are involved, global, quantitative elements such as speed, duration, or complexity of movement are synchronized between the two interacting individuals. Alongside these quantitative elements, we may say that *movement synchrony* always contains a *dynamic* element.

If, in contrast, the focus lies on static or mostly qualitative features of an interaction such as postures, mannerisms, or facial displays, we classify these behaviors under the general term of *behavior matching*. While matching is a very global term seldom used in studies concerned with synchrony, it can be viewed as the core meaning of terms like postural mirroring[27], mimicry[28], congruence[1], or the chameleon effect[21].

Unfortunately, the proposed distinction is not easy to make, because these two categories are not disjunctive. In real interactions it is common to observe a mixture of both: If patient and therapist share the same posture (i.e. static synchrony, behavior matching) and then change their bodily configuration with a coupled timing (dynamic synchrony, movement synchrony), we see synchrony on the quantitative as well as on the qualitative level. Such an instance is depicted in Figure 1, where on the level of dynamics we can see nonverbal synchrony because of the simultaneous movement of patient and therapist and, on the other hand, we see the patient imitating the postural configuration of the therapist's arm position (frame number 1 vs. frame number 8). This simultaneity makes it evident that either the concept is insufficiently defined or there is no such thing as a single-faceted occurrence of synchrony.

The majority of empirical studies concerning synchrony in adulthood have dealt with two similar phenomena: empathy and emotional contagion or rapport in general. Most research efforts have been invested on the link between emotional closeness and imitation. This connection has a historical tradition and can be found in the scientific writings of Charles Darwin[29], who used the term "sympathy" to refer to imitation, and Gordon W. Allport[30] who stated that " ... our understanding of other people is derived from our capacity to imitate, usually in imperceptible ways, the behavior of the person we are trying to understand ... " "Empathy becomes simply 'kinesthetic inference'." The connotation of synchrony and empathy remains very strong these days, maybe due to the fact that a better understanding of this connection proposes possible benefits during interpersonal encounters or could even be used as a form of manipulation strategy. Condon – who coined the term "interactional synchrony" – stated that "synchrony and other forms of behavioral sharing express degrees of closeness or distance between interactants."[31].

Taken together, the spectrum of findings covers many domains of human life. This multi-faceted propensity of the phenomenon of synchrony can be illustrated with an example right from the beginning of an individual's life: Mother-infant studies on imitative behavior[32] have shown that neonates and older infants imitate basic facial expressions. The same holds true for the opposite direction of influence, as was shown in mothers who opened their mouths in response to the open mouth of their

infant whom they were about to feed[33]. This finding implies that the phenomenon has the quality of bilateral influence.

There is accumulating evidence for a strong link between psychopathological phenomena, including autism and schizophrenia and deficiencies in empathy and theory of mind (ToM). "I believe that infants are given a jump-start in developing a theory of mind through their primordial capacity for nonverbal imitation"[34]. It is assumed that a deficit surrounding the mirror-neuron-system impedes a child's development[35]. Interestingly, even simple mechanisms such as the contagious nature of yawning show marked differences in healthy children versus children with autism disorder[36].

In view of this, Ramachandran[37] stated " ... that mirror neurons might do for psychology what DNA did for biology: they will create a unifying framework and help explain a host of mental abilities that have hitherto remained mysterious and inaccessible to experiments."

To summarize the role of synchrony in nonverbal behavior, we claim that embodiment, mimicry and mirror neurons are tightly interrelated. Together they constitute our social, emotional, and interpersonal space[38].

3. Synchrony in psychotherapy

The analysis of nonverbal behavior has a long tradition in psychotherapy research, dating back to the beginnings of psychology itself. Diverse authors such as Sigmund Freud and Gordon W. Allport noted the connection between nonverbal behavior and the quality of dyadic relationships. "A path leads from identification by way of imitation to empathy, that is, to the comprehension of the mechanism by means of which we are enabled to take up an attitude at all towards another mental life."[39].

If we were to ask practising psychotherapists at random, there is a high probability that many would share the opinion that nonverbal behavior plays a key role in the development and maintenance of a favorable therapeutic relationship[40,41]. In contrast to this shared undisputed practical knowledge, empirical research of *synchrony in psychotherapy* never had a real blooming phase. Although the initial work of Scheflen[1,42,43] suggested promising ways to conceptualize empathy,

rapport and the quality of the therapeutic bond, *naturalistic* studies have been very scarce. A critical review of published contributions leaves the impression that "synchrony in psychotherapy" never transcended the stage of descriptive or even solely anecdotal evidence[44]. Those empirical studies with experimental variations of diverse nonverbal features connected to the phenomenon of synchrony have either used student subjects for their therapy-analogue interaction sequences, or have taken very short clips (in the range of seconds or few minutes) of "real" psychotherapies. We conclude that in spite of the large number of studies following these traditions, a solid, baseline- and chance-controlled investigation of synchrony in "real" psychotherapy is still lacking.

Moving to the field of social psychology, the state of research is more advanced as there is clear evidence for the beneficial effect of synchrony on rapport. During the last 10 years, a large body of results that was based on good experimental designs has accumulated[21].

This state of affairs encouraged us to initiate a project in order to circumvent the methodological and conceptual problems listed above. Using new technology and a rich database consisting of thousands of videotapes from an ambulatory psychotherapy research centre[45], we have set out to clarify the relevance of nonverbal synchrony in everyday psychotherapy settings with real clients.

3.1 Motion Energy Analysis (MEA)

Summing up the methodology employed in studies of synchrony so far, a clear dominance of observer ratings is apparent. Although a human observer has several advantages insofar that 'synchrony' as a gestalt phenomenon is relatively easy to detect[46-48], we think that contemporary multimedia equipment makes computerized quantification of movement readily accessible and provides a valuable extension of the methodological arsenal.

One such simple way of measuring motion in a recorded film sequence is based upon an image-differencing algorithm[49,50]. Karl Grammer and his research group at the University of Vienna have successfully implemented this method in a number of empirical studies, e.g. of

courtship communication[26,51], physical attractiveness[52] and lovesickness[53].

Such a computer-based system removes several problems commonly encountered when assessing nonverbal behavior by means of observer ratings. The most obvious advantage concerns the amount of time needed to assess synchrony: behavioral observation is very time-consuming due to the fact that a rating system has to be developed, observers have to be enrolled in intensive training and all the chosen sequences of an interaction require manual coding (see e.g. Condon & Ogston's[12] frame-by-frame analysis at 48 frames per second). In addition to such considerations, setting the appropriate time and category resolution can be an even bigger obstacle. The determination of categories may lead to an "atomization of behavioral units"[26], ultimately culminating in one behavioral category for every specific behavior. The same holds true for time resolution, but here a different problem arises: time-lagged or non-stationary phenomena can be detected only with the appropriate resolution. Changes may pass unnoticed if the time span exceeds the attentional capacity of a human observer. Another critical issue lies in the domain of measurement theory, notably in the objectivity of measurements: in order to obtain sufficient objectivity, it is indispensable to train observers in a lengthy procedure. Furthermore, the level of resolution or abstraction of rating instruments is limited by the maximal complexity an observer's mind can handle.

Image differencing in the context of motion energy analysis (MEA) is a tool that avoids most of the mentioned shortcomings inherent with human observers. The method is based on the fact that each individual picture (frame) of a black-and-white movie sequence has a fixed number of pixels that represent a distribution of gray-scale values ranging from 0 (black) to 255 (white). With a fixed camera shot and nothing moving in view of the camera, each pixel retains its gray-scale value from one frame to the next. When, however, a person or an object moves, temporary changes of the gray-scale distribution emerge and can be quantified. The amount of movement from one frame to the next equals the amount of gray-scale change from one frame to the next (thus the name 'image differencing'). Image differencing, therefore, is a simple method to quantify movement in a video stream. In spite of its simplicity

there are some caveats that have to be addressed: First, the camera shot has to remain perfectly steady throughout the sequence; second, lighting conditions should be kept stable (otherwise erroneous amounts of change would be quantified); third, the method solely quantifies movement: it is blind to its direction or location.

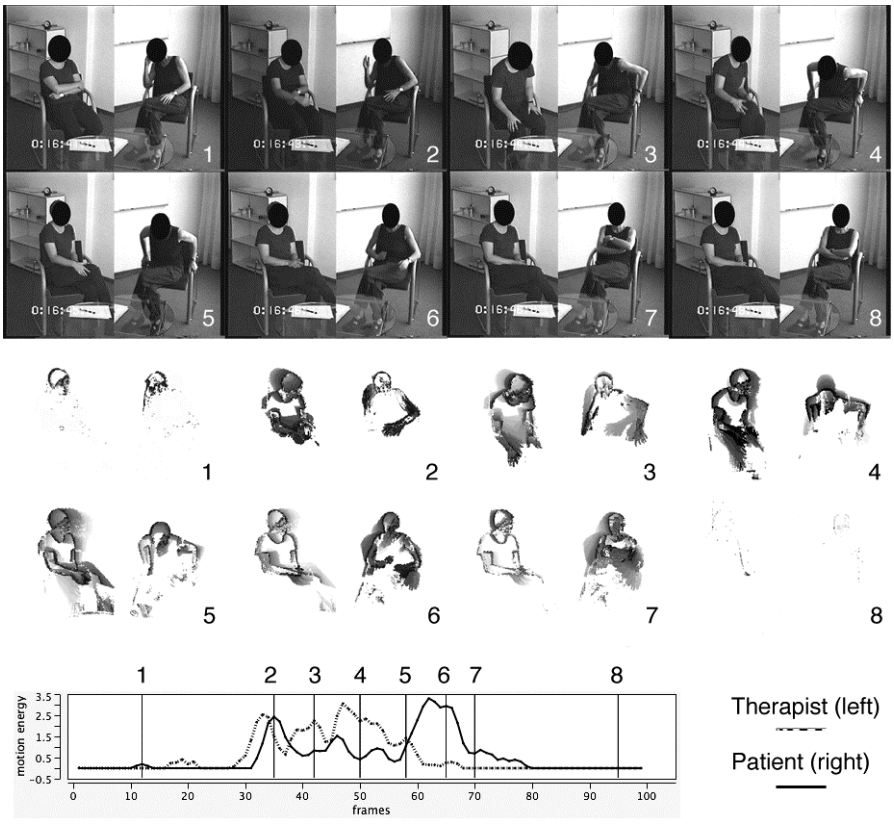

Fig. 1: A sequence (duration, 10 seconds) taken from a "natural" dyadic psychotherapy. The upper 8 pictures portray selected frames of the original movie, the lower pictures are the corresponding motion energy images, where white depicts no movement at all and black pixels show regions where changes have occurred from one frame to the next. Gray shaded areas show movement from previous frames (movement trail). Bottom graph shows amount of movement energy for the 2 interacting individuals. Numbers in the graph correspond to numbers of the pictures.

To monitor movement of two persons in a psychotherapy session, we defined two regions of interest (ROI) where changes in gray-scale values will be detected and separately recorded as numerical streams of data. We therefore produced two continuous time series measuring the amount of movement in the regions defined beforehand. Figure 1 shows 8 frames of a nonverbally synchronized sequence within one therapy session.
Taken together, by image differencing, we have achieved a modern, fully automatic implementation of the manual frame-by-frame coding techniques used by Condon & Ogston[12].

3.2 Cross-correlation of nonverbal movement behavior

Prior to statistical computations, the two streams of raw data were edited with several procedures and filters in order to eliminate video-noise (resulting from poor tape quality). We then standardized the values in relation to the size of a ROI (thus, the data are independent of the size of each individual's ROI), smoothed the data with a moving average and finally calculated a threshold that separates genuine movement (movement bursts) from random noise (random fluctuations in the video tape). The primary statistical analysis we then implemented is based on cross-correlations. We programmed a time-lagged cross-correlation algorithm[54] that quantifies the association of the two streams in a range of +/- 5 seconds. This measure is computed windows-wise, i.e. each minute of a psychotherapy session with duration of 50 minutes is analyzed separately to take into account time-dependent changes in the associations between patient and therapist (thus allowing for the non-stationarity of the phenomenon). The resulting correlation coefficients are charted in a color-coded cell-plot (see Figure 2) that shows the direction of association for one member of the dyad. Values to the left show instances where the patient followed the therapist in her movement (= 'pacing') and correspondingly to the right where the patient was followed (imitated) by the therapist (= 'leading').
The matrix of correlation values may be considered an estimate of the total amount of structure in the sequence analyzed (i.e. the quantity of coordination between the two partners). This measure of structure is simply the absolute mean of all correlations of the graph. Additionally,

we calculated the amount of structure for pacing and leading behaviors separately (only the left or right sides of the plot).

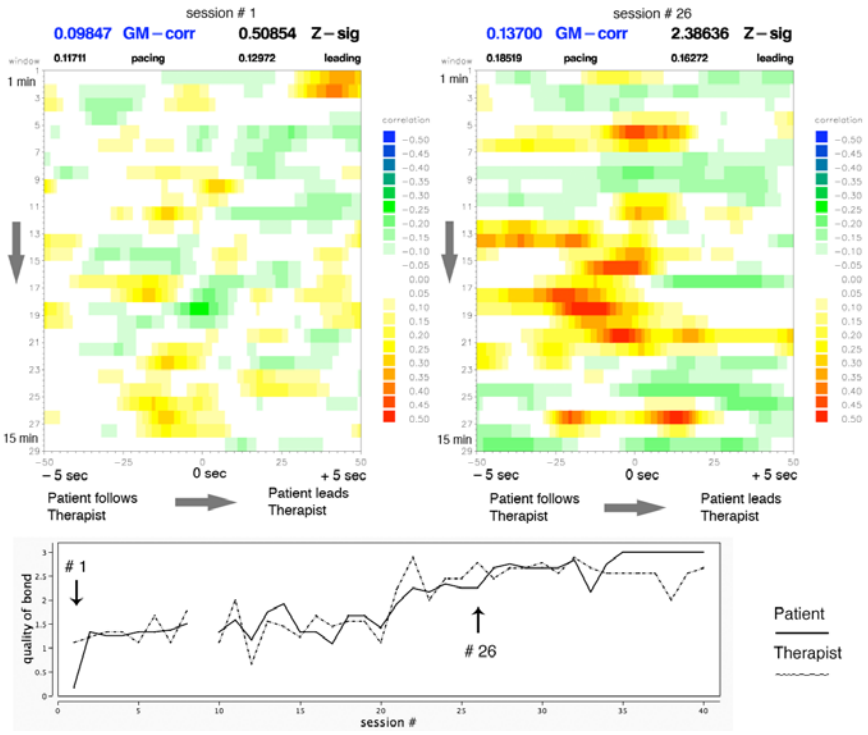

Fig. 2: Color-coded cross-correlations of two psychotherapy sessions (sessions 01 & 26 of 40) taken from the same therapy dyad. Different amounts of movement synchrony are visible: more regions with dark values indicate a higher degree of synchrony. The direction of entrainment is shown with values being either to the left (patient follows the movements of the therapist) or right side of the center. Instantaneous synchrony shows up in the center region (i.e., 0 seconds delay, middle of the graph). GM-corr, grand-mean-correlation; Z-sig, standardized individual significance. Bottom graph shows evolution of the factor "quality of therapeutic bond" for both patient and therapist. Arrows indicate chosen sessions.

A final, quite important step in our analysis is to rule out that the detected movement synchrony may have occurred solely by chance. We therefore corrected for random contingencies between the two movement streams. There has been a short debate about the genuineness of Condon

& Ogston's[12] findings on interactional synchrony in the 1970s[55,56]. We fully support this critical consideration of synchrony findings and thus implemented a novel statistical mechanism that would prevent falsely positive detection of synchrony in psychotherapy sessions. To accomplish this, for each therapy session, we generated N=100 surrogate datasets by shuffling the genuine data. In order to not destroy the original structure of movement bursts, we shuffled each time series windows-wise. In this way, the original structure inside one window remains intact, but due to the shuffling of the windows' position, it is paired with another window from a random position in the therapy. In such a way, the motion energy values of the therapist's behavior from e.g. the 5th minute are paired with the movements of the patient from e.g. the 9th minute of this same session. The genuine cross-correlation coefficients were ultimately contrasted with the absolute mean of the shuffled coefficients and considered significant if they exceeded 2 standard deviations from the randomized means.

3.3 Evolution of synchrony in dyadic psychotherapy.

The psychotherapy research centre at the University of Bern offers a unique opportunity to study synchrony under field conditions. The centre is an ambulatory psychotherapy clinic open to the general public that serves two purposes: an educational purpose, because psychotherapists in training and under close supervision work there as part of their psychotherapy training, and a community service purpose, because of the services delivered to the community. The therapeutic principles are independent of classical psychotherapy schools and based on Grawe's consistency theory[45,57]. Predominantly, diagnoses are from the neurotic-affective spectrum. Each therapy session held in this setting is recorded by two video cameras that are joined into a split-screen image of full-body views of patient and therapist. Owing to the habitual recording of therapy sessions, we were able to select therapies that were conducted completely independent of our scientific study. The selected therapy took place during the year 1999/2000 and neither patient nor therapist had any knowledge of the concept of synchrony whatsoever. Our post hoc test of the relationship between synchronized movement and session outcome is

therefore free of any possible influences on the normal behavior of the dyad.

Another special feature of the psychotherapy research centre of the Institute of Psychology at the University of Bern consists of the regular administration of post-session evaluations both of patient and therapist. Evaluation forms are completed immediately after the termination of every single therapy session. They consist of 22 items (patient) and 27 items (therapist), respectively. Individual items (e.g. “My therapist and I understand each other well”; “Today, I felt comfortable with the patient”) are rated on a 7-point Likert scale. In this analysis, we focused on the factors “Quality of therapeutic bond Patient” rated by the patient (8 items) and “Quality of the therapeutic bond Therapist” rated by the therapist (8 items).

To test if global synchrony shows changes during dyadic psychotherapy and whether the total amount of “structure” is correlated with micro-outcome, we have chosen a single therapy course from a large sample of recorded psychotherapies. This therapy had a duration of N=40 sessions. It was characterized by a gradual increase of both patients’ and therapists’ factors assessing the quality of the therapeutic bond. We limited this pilot study to one female same-sex dyad. The patient was 37 years old and suffered from recurrent major depression (DSM-IV: 296.3).

3.4 Analysis

Our main objective was to collect a sample of therapy sessions that would give us access to nonverbal synchrony in its purest form. We wished to rule out extraneous influences or affordances within the therapy situation to a maximal extent. This meant that out of 40 sessions of this particular dyad, we selected 21 sessions that met our rigorous criteria. These minimal conditions for inclusion in the study were the following:

Technical considerations:

- Clear, full body view of both patient and therapist (optimal camera positions, no occlusions due to e.g. disfunctional split-screen adjustments)
- Stable conditions in light source
- No movement of cameras
- Acceptable quality of VHS signal (camera image not too noisy)

Thematic prerequisites:

- Seating position throughout sequence, i.e. not leaving the room
- No discussion of questionnaires
- No joint filling-out of forms
- Exclusion of arranging for next meeting (taking out personal agendas, planning next session)

These criteria were quite strict in order to capture 'pure' synchronized interaction that occurred during 'normal' verbal interaction only. We chose such rigorous measures because we had noticed, in a previous pilot study, that the amount of synchrony tended to be exaggerated by situational affordances, such as the finding of a new appointment or the discussion of the results of a questionnaire.

3.5 Results

Global movement characteristics were calculated for each 30-seconds window, resulting in a total of 630 values for the N=21 therapy sessions. The analysis of these movement patterns showed that the patient moved significantly more than the therapist ($T_{(629)}=2.14$; $p<.05$). The corresponding relative amount of time with movement behavior was 41.5% for the patient and 36.6% for the therapist. Complexity, maxima and speed of movement, however, did not differ significantly between patient and therapist, indicating that, except for time spent in movement, patient's and therapist's movement characteristics were comparable.

The amount of synchronized movement (grand mean of cross-correlations) was positively correlated with the patient's evaluation of the quality of the therapeutic bond ($r = .60$; $p<.01$; $R^2=35.5$; $F_{(19)} = 9.9$) and the therapist's evaluation of the therapeutic bond ($r = .69$; $p<.001$; $R^2=48$; $F_{(19)}=16.6$). A comparison of pacing and leading indicated that the patient's predominant pattern was the imitation of the therapist, i.e. there was more pacing than leading ($T_{(20)}=2.64$; $p<.05$).
As the therapy progressed from session 1 to 40, so did the amount of synchronized movement. These findings are illustrated in Figure 3.

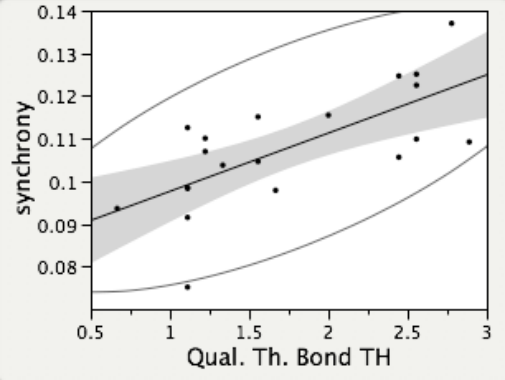

Fig. 3: Correlation between synchrony and "quality of the therapeutic bond" from the therapist's perspective.

For the evaluation of genuine synchrony versus synchrony as a chance occurrence, we pooled all 21 therapy sessions to conduct the surrogate test. The amount of synchrony was significantly higher in genuine therapy sessions compared to the surrogate samples with windows shuffled ($T_{(20)}=2.31$; $p<.05$).

4. Discussion

Our results show that nonverbal synchrony is a highly promising concept for psychotherapy research in general. It offers a new way to look at the therapeutic bond. We could also demonstrate that interactions in this

setting are embodied in the sense that simple motor parameters reflect psychological variables that are fundamental for psychotherapy.

We have to bear in mind, however, that for the field of clinical psychology and psychotherapy, the evidence does not yet justify a general acknowledgment of the synchrony concept in the way that has been claimed by some practicing psychotherapists of e.g. NLP[58,59]. Although synchrony is an intriguing concept for psychotherapy research, it would be premature to claim for it an exclusive role in the formation of empathy and in the development of the therapeutic bond. Further well-controlled empirical research will be necessary before such steps can be taken. Primarily the question of causality should be addressed in the near future, because our correlative measures do not allow inference about the causal direction of synchrony. It is thus still a hypothesis that the mechanism of "imitation breeds liking" that has been found in social psychology[21,60] may also be at work in psychotherapy.

It is our hope that novel methodological approaches such as motion energy analysis may help reevaluate the interesting findings of the 1960s and the encouraging results in other fields of research. An accumulation of solidly based empirical evidence should, therefore, inspire the revival of nonverbal research of psychotherapy process in naturalistic settings.

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