Synchrony: A Core Concept for a Constructivist Approach to Psychotherapy

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Abstract

Synchrony is a pervasive concept relevant to diverse domains in physics, biology, and the social sciences. This article reviews some of the evidence both from natural and human systems. Our main focus is on the role of synchrony in psychotherapy research. 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 employing synchrony as a specific measure is still lacking. We suggest a new approach to studying synchrony in psychotherapies under field conditions: Image-differencing is a video-based algorithm quantifying the amount of movement in pre-selected regions. Our methodology can be compared to the approach from the seminal work of Condon & Ogston (1966). The statistical analysis we employ detects synchrony on a global level, irrespective of the specific body parts moving. Synchrony thus defined is considered a general measure of coordination of interacting individuals. Exemplary data show the feasibility of this approach and its potential contribution to psychotherapy research.

Key Words: synchrony, psychotherapy, movement, embodiment, nonverbal behavior

Introduction

"If you are in Rome, do as Romans do" (Si fueris Romae, Romano vivito; si fueris alibi, vivito sicut ibi. 'When you are in Rome live in the Roman style; when you are elsewhere live as they live elsewhere' (Titelman, 1996). This maxim captures some of the core aspects of terms such as imitation, simulation, mimicry, social modeling, social coordination, empathy or – on a broader scope – synchrony. Humans can experience synchrony - be it consciously or unconsciously - on a quotidian basis, the phenomenon itself embracing different sensory modalities. In everyday human interactions it may extend from too little synchrony (= bored teenager effect) to an exuberance of synchrony (= mime effect) (Boker, 2004).

Bearing in mind the aforementioned maxim, just imagine yourself arriving during "rush hour" on Piazza San Pietro in Rome: There is a high probability that you may unconsciously imitate kinesic features of your surroundings such as the speed of walking (e.g. Levine, 1999), adopt the bodily configurations of a person your are interacting with (Bernieri, 1989), show similar hand gestures while speaking with this person (Bavelas et al., 1988), and utilize prosodic specialties of the Italian language (Neumann & Strack, 2000). These would all be signs of such a social attunement. But what is the purpose of this behavior and what kind of mechanism might lie behind such - in most cases - unconscious and seemingly effortless imitation?

The introductory part of this article treats synchrony comprehensively, owing to the fact that the phenomenon of synchronization is not restricted to humans. Abundant evidence of synchrony can be found both in living systems and inanimate nature. Flocking birds or a school of fish are impressive examples for the behavioral manifestation of synchrony in the animal kingdom. Even in a myriad of quickly moving individuals, collisions are altogether nonexistent. An observer may marvel at the precision of the group's complex movements and swift changes of directions. In animals, the importance and stability of this perception-behavior link (Dijksterhuis & Bargh, 2001) is a well established fact. It is intriguing, however, that the very same mechanism plays a major role in human interactions. Although homo sapiens is capable of altering a simple visual percept insofar as its conveyed meaning and personal importance can be consciously (i.e. cognitively) considered, there is accumulating evidence that a huge part of our nonverbal behaviors are strongly influenced by this archaic perception-behavior link. This paper will focus on the role of nonverbal synchrony in psychotherapy, but first we will briefly overview the role of synchrony in other domains.

Synchrony in Physical Systems

In addition to systems in biology, synchronization phenomena have often been addressed by the physical sciences. It has been found that a variety of phenomena share a property of producing patterns and establishing regularities out of microscopic chaos. Patterns may appear spontaneously and often surprisingly to observers, especially when patterns are established and maintained in the absence of any directed external causation. Such phenomena seem to collide with the second law of thermodynamics which states that in any closed system entropy, i.e. disorder, must increase over time or, at least, remain constant. The second law, however, is not applicable in these cases — as we will see, it is mandatory for a system to be open to fluxes of energy or matter in order to show synchronization. Synchronization only occurs in open systems.

Well-known examples of naturally occurring pattern formation come from fluid dynamics. The Bénard system consists of a fluid layer where a temperature difference is established between the top and the bottom boundaries of the fluid, for instance simply by heating the system from below and cooling it at the top boundary. At a low temperature difference, each fluid particle behaves individually and stochastically in Brownian motion. Beyond a certain critical point of temperature difference, however, pattern formation emerges, resulting in regular honeycomb-shaped structures which consist of large numbers of particles moving in almost perfect synchrony (Fig. 1 left).

Very similar phenomena are found in numerous physical systems. One of these is the Taylor-Couette flow where the fluid layer is placed in the space between two coaxial cylinders of differing sizes which rotate relative to one another (Fig. 1 right). Again, the fluid system starts to self-organize, producing regular patterns.

Realizations and variants of Bénard and Taylor-Couette dynamics are found throughout nature. In addition, synchrony of complex systems is observed on varying scales, starting from ripples on sandy surfaces above or below water, large dune formations, or the regular patterns on surfaces of water as soon as there is steady wind. Analogous synchronizations are found in atmospheric layers, an altogether different medium. Clouds are sometimes shaped in repetitive structures, for example. Any paraglider knows that on summer days the air above warm stretches of ground synchronizes in convection cells, thus providing thermal lift in specific locations.

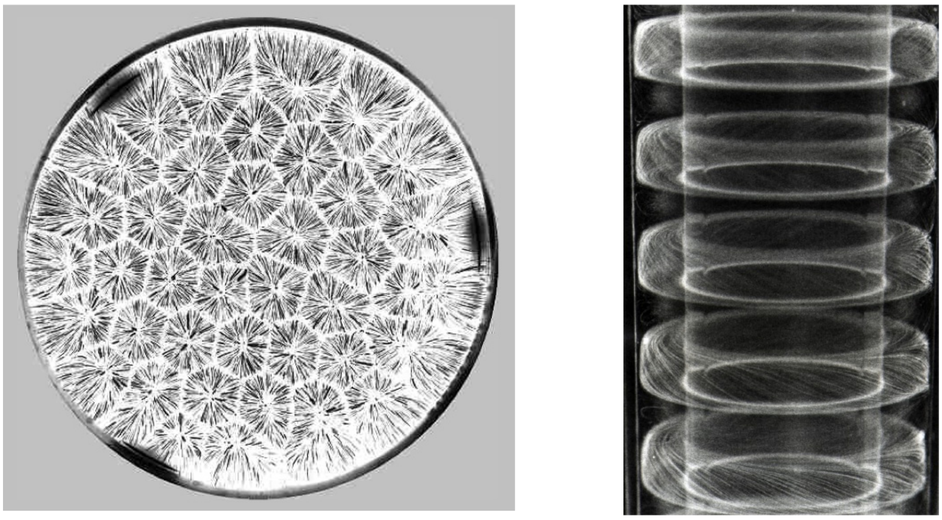

Fig. 1. Bénard convection cells forming in a fluid inside a circular container viewed from above (Jäger, 1996). Right panel: Taylor-Couette flow, viewed from the side. The two solid cylinders are visible together with the circular, belt-like flow patterns

Theories of Synchronization Phenomena

In all the mentioned examples of synchronization and pattern formation, there is but little overlap with respect to the materials and phenomenal domains in which synchrony occurs. Consequently, questions arise such as, Are these just unrelated phenomena of similar appearance? Is there a common ground, a shared functionality, in all of these synchronizing systems?

This latter question has repeatedly been answered in the positive in recent decades. Encompassing views of synchrony have been put forward repeatedly, especially in the works of the German physicist Hermann Haken (synergetics: Haken, 1977) and the Belgian chemist Ilya Prigogine (dissipative systems: Nicolis & Prigogine, 1977). Synergetics is a transdisciplinary field of research that deals with systems composed of many components. By means of their synchronous interaction, these components can produce new qualitative features on macroscopic scales. In other words: synergetics studies the emergence of novel, self-organized qualities in complex systems. For a large class of such systems synergetics has shown that processes of pattern formation become accessible to unifying mathematical and conceptual approaches.

Synergetics starts from the observation that the behavior of many systems is strongly determined by the environmental conditions. These conditions may be divided into constant (structural) conditions or constraints (e.g. that there are solid walls and containers that confine fluid systems as described above) and further environmental conditions that 'energize' or 'drive' these systems. In the case of the Bénard convection system, the temperature difference is obviously the condition that crucially governs the dynamics of the fluid. In Taylor-Couette flow, the rotation velocities control pattern formation. In the mathematical approach these latter environmental conditions are called control parameters. Interestingly, control parameters are always connected to the degree to which systems are open systems. They quantify how far a system is driven away from thermodynamic equilibrium.

Synergetics shows that the behavior of the entire system is described and determined by a few quantities, the order parameters. According to synergetics' 'slaving principle', the - in general few - order parameters enslave, i.e. determine, the behavior of the many individual components. This implies an enormous reduction of complexity, because it is sufficient to describe the order parameters instead of all the components. On the other hand, the individual components react on the order parameters and, in this way, even generate the order parameters. Thus, the relationship between order parameters and components is based on circular causality (Haken, 1977; Tschacher, 1997). Quite often order parameters induce very simple, attractor-like behavior, as is the case in the examples shown in Fig. 1.

Close to critical points of control parameter values, self-organizing systems undergo qualitative changes, so-called phase transitions. These have a number of specific properties such as 'hysteresis', 'critical fluctuations' and 'critical slowing down' which are consistent with the synergetic view that the simple patterns described by order parameters are attractors, i.e. asymptotically stable dynamical states. Phase transitions can be nicely demonstrated by ambiguous Gestalt displays, i.e. when a perceiver is allowed to enter qualitatively different states by viewing one identical external stimulus. An example from visual perception is shown in Fig. 2, a bistable Gestalt array that affords recognizing either a white vase or two opposing black faces.

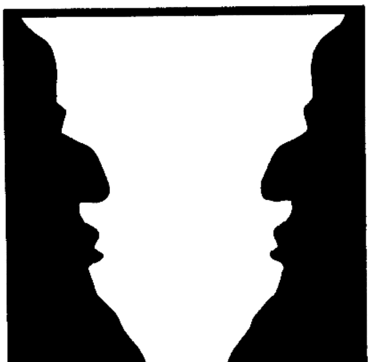

Fig. 2. The "vase/face" ambiguous figure (Rubin, 1921).

Psychology: Intraindividual Synchrony

When a gestalt is perceived, often many single properties and items of a stimulus array are integrated to form a figure whereas other items are actively neglected and thus referred to the background. It is assumed that the neurocognitive process responsible for Gestalt phenomenology is some specific sort of collective 'binding' between neurons in the brain. In their review on synchronization and integration in the brain, Varela et al. (2001) pose the problem of how the brain manages to integrate all the distributed areas of the brain which are active at any given moment. Particularly states of consciousness and awareness of a unified present and self would demand a large-scale orchestration of many different neuronal processes and loci. Varela and other neurobiological researchers (Singer & Gray, 1995; Başar-Eroglu et al., 1996; Rodriguez et al., 1999) argue that some 'neuronal glue' is needed — this they identify with the gamma frequency band (30-80 Hz) of the brain's oscillatory spectrum. In other words, long-distance synchrony in the gamma band is likely the mechanism of binding processes.

Investigating intraindividual synchrony phenomena, we again find examples on varying scales and levels of the body and the mind. The studies performed in the context of movement coordination (Kelso, 1995) have turned out to yield a rich source in this respect. The paradigmatic experiment is back-and-forth movement of one finger of each hand of a person (e.g. the forefingers). Subjects in Kelso's lab could produce basically two stable patterns of rhythmic finger movements (whose frequency was given by a metronome): in-phase and anti-phase movement. Both are strictly synchronized. No further phase relationship between the fingers could be established for any length of time. Furthermore, in-phase synchrony always became instable at increasing metronome frequencies and transited towards anti-phase movement. In such phase transitions the above-mentioned hallmarks of attractor dynamics were again found.

This prototype of intraindividual synchrony (termed the Haken-Kelso-Bunz model, after (Haken et al., 1985) can be applied to the movement of other limbs, the coordination of different limbs, and generally to many types of repetitive movement coordination (e.g. Mechsner et al., 2001). The various types of gait available to quadruped animals — walk, trot, gallop — pose examples of qualitatively different types of synchrony; phase transitions occur as one gait is exchanged for another. At a speed of 4 meters per second, for example, a horse may either trot or gallop, depending on the control parameter (here, speed): if the horse runs with decreasing speed it may well gallop at 4 m/s, whereas it may trot at this same speed if it is accelerating. Thus, we have bistability (as in Fig. 2) and hysteresis; both are typical signs of attractor dynamics. It is obvious that such observations are relevant for sports science, biomechanics and robotics, to name but a few disciplines. From a theoretical standpoint, the phenomenology of seemingly discordant types of synchrony can be ascribed to unitary models from synergetics (or more generally, from dynamical systems theory).

Synchrony in Nonverbal Measures

„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." (Kendon et al., 1975, p. 3). This citation exemplifies the supposed importance of synchrony in human interaction. When we consider human interaction globally, it is evident that some form of coordination or mutual influence plays a crucial role. Cappella (2005) summarizes that "Coordination is arguably the essential characteristic of every interpersonal interaction. ... Interpersonal communication requires the coordination of behavior." (p.383). But before we concentrate on findings in social and clinical psychology, the heterogeneous terminology has to be clarified. According to Bernieri & Rosenthal (1991) we may classify most of the manifestations of synchrony in the human domain under the term 'interpersonal coordination'. This term is loosely defined as " ... the degree to which the behaviors in an interaction are nonrandom, patterned, or synchronized in both timing and form." (Bernieri & Rosenthal, 1991, pp. 403). Because of many different labels or descriptions of such behaviors, a basic categorization of interpersonal coordination is needed. This can be based upon the focus of the observer or the classical distinction between quantitative and qualitative measurements. Studies that emphasize temporal aspects such as simultaneous movement, rhythm, or meshing of nonverbal behaviors, mainly regard quantitative characteristics. Because of this stress on kinetic qualities, we may 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." (Grammer et al., 1998). When for instance a therapist matches his movement speed to the one displayed by the patient, we would speak of entrainment that leads to movement synchrony.

Irrespective of which movements with which parts of the body 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 such as mirroring, mimicry, congruence, or the chameleon effect (Chartrand & Bargh, 1999).

Unfortunately this 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 categories: If the 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 Fig. 4.

Two similar phenomena - empathy and emotional propagation / contagion - have been investigated in the majority of studies dealing with synchrony in adulthood. The link between emotional closeness and synchrony has received considerable attention. It can be found in scientific writings of Charles Darwin (1872/1965) who used the term „sympathy" to refer to imitation based on reflex or habit, and of Gordon W. Allport (1937) 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 ... " (p.531); "Empathy becomes simply 'kinesthetic inference.'" (p.532). This connotation of synchrony and empathy is still very strong and stimulates most research efforts. Even Condon - who coined the term "interactional synchrony" - stated that „Synchrony and other forms of behavioral sharing express degrees of closeness or distance between interactants." (Condon, 1980).

Taken together, the spectrum of findings covers many domains of human life. An individual's experience with the phenomenon of synchrony may be traced back to the very beginning of infancy: Mother-infant studies on imitative behavior (for a review, see Meltzoff & Prinz, 2002) have shown that even neonates imitate basic facial gestures. The same holds true vice-versa, as was shown in mothers who opened their mouths in response to the open mouth of their infant who they were about to feed (O'Toole & Dubin, 1968), a phenomenon that points in the direction of a bilateral influence.

There is increasing evidence of a 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" (Meltzoff, 1999, p. 261). These theories assume that there are psychopathological mechanisms impeding a child's development and therefore increasing the risk of the aforementioned pathological states (Williams et al., 2001).

When experiencing disgust and witnessing the same emotion expressed by the facial mimicry of someone else, an activation of the same neural structure at the same overlapping location is triggered (Wicker et al., 2003). Accordingly, Ramachandran (2000) predicted " ... 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, it is claimed that embodiment, mimicry and mirror neurons are tightly connected. Together they constitute our social, emotional, and interpersonal space (Niedenthal et al., 2005). Such theoretical notions are supported by a growing body of evidence from diverse fields. Notable progress has also been made in the field of imaging studies primarily concerning the role of mirror neurons (e.g. Gallese, 2005).

Synchrony in Psychotherapy

Psychotherapists share in the opinion that nonverbal behavior plays a key role in the development and maintenance of a favorable therapeutic relationship (e.g. Philippot et al., 2003; Philippot et al., 1999). Empirical research of synchrony in psychotherapy, however, has never fully developed. Although the initial work of Scheflen (1964; 1965; 1966) 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 really transcended the stage of descriptive or even solely anecdotic evidence (e.g. Charny, 1966), who analyzed one single dyadic encounter). To date - to our knowledge - not a single naturalistic study of synchrony in „normal" psychotherapy with a large sample and chance-correction has been published. Those empirical studies with experimental variations of diverse nonverbal features connected to the phenomenon of synchrony, have either used student subjects for their (supposedly) therapeutic interaction sequences, or have taken very short clips (in the range of seconds or few minutes) of „real“ psychotherapies.

The following short description of several studies that are often referenced in connection with the phenomenon shall give a brief glimpse on this state of affairs. Trout & Rosenfeld (1980) worked with six 40-second segments of „therapist-client“ interactions role-played by psychology graduate students. Maurer & Tindall (1983) had 80 healthy high school juniors meeting individually with a professional counselor for 15 minutes. Solley (1988) engaged 30 students from a Ph.D. program dividing them in 7 pairs for the control condition and 8 pairs for the experimental condition, where they performed in an interview-setting. Willis (1989) presented clips of 25-30 seconds from three counselor-client dyads. McDowall's (1978) measurements of synchrony in a group discussion setting is one of the few empirical studies to date, that made corrections for chance events. 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. Notwithstanding this criticism of research in psychotherapy there is clear evidence from social psychology with good experimental designs and promising results (see e.g. Chartrand & Bargh, 1999). Furthermore, the study of nonverbal behavior irrespective of synchrony has a long standing tradition in psychotherapy research, offering numerous connections where synchrony as a core concept fits well (e.g. Altorfer, 2002; Manusov, 2005; Hermer & Klinzing, 2004)). It is conceivable that in the near future, synchrony may play an integrating role for the entire field of nonverbal interaction research.

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 video-tapes from an ambulatory psychotherapy research centre (Grawe, 2004), we have set out to clarify the relevance of nonverbal synchrony in psychotherapy.

Motion Energy Image (MEI) Based Synchrony Measures

Focusing on the methodology used in existing studies of synchrony, a clear dominance of observer ratings over alternative methods is apparent. We think that this poses a shortcoming, because contemporary multimedia equipment makes computerized quantification of movement much more accessible. One such simple way of measuring motion in a recorded film sequence is based upon an algorithm called image differencing (e.g. Sonka et al., 1993; Bobick & Davis, 2001). The research group of Karl Grammer from the University of Vienna has successfully implemented this method in several empirical studies, e.g. of courtship communication (Grammer et al., 1998; Grammer et al., 1999), physical attractiveness (Grammer et al., 2003) and lovesickness (Bechinie, 1998).

This computer-based system eliminates several problems commonly encountered when assessing nonverbal behavior by means of observer ratings. An obvious advantage concerns costs: behavioral observation is very time consuming, due to the fact that a rating system has to be developed, observers are in need of intensive training, sequences require manual coding (e.g. Condon & Ogston's (1966) frame-by-frame analysis at 48 frames per second). In addition to such considerations, setting the appropriate time- and category resolution is an even bigger obstacle. The determination of categories can lead to an „atomization of behavioral units" (Grammer et al., 1998), ultimately cumulating in one behavioral category for every specific behavior. The same holds true for time resolution, but here another problem arises: Time-lagged or nonstationary phenomena can be detected only if the resolution has been set to the appropriate value. Changes may not be detected if the time-span exceeds the capacity of the human observer. Another critical issue evidently lies in the objectivity of measurements: In order to obtain a sufficiently high objectivity, one has to extensively train observers; the rating instruments' level of resolution is limited by the maximal complexity an observer can handle.

Image differencing and its resulting motion energy detection is a tool that evades the aforementioned issues inherent with human observers. The method is based on the fact that each individual picture (frame) of a movie has a fixed number of pixels that represent a distribution of grey-scale values ranging from 0 (black) to 255 (white). With a fixed camera shot and nothing moving, each pixel retains its gray-scale value from one frame to the next. However, when anything 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 (i.e. image differencing). Image differencing hence is a simple method to quantify movement in a video stream. In spite of its simplicity there are some caveats that have to be considered: First, the camera shot has to remain perfectly steady throughout

the sequence; second, lighting conditions should be kept stable; third, the method solely quantifies movement, it is blind to its direction or location.
To monitor movement of two persons in a psychotherapy session, we define two (or more) regions of interest (ROI) where changes in grey-scale values will be detected and separately recorded in numerical notation. We therefore produce two continuous time series measuring the amount of movement in the regions defined beforehand.
Figure 4 shows a sequence (duration, 3 seconds) taken from a „natural“ dyadic psychotherapy. The upper 16 pictures portray every fifth frame of the original movie, the lower pictures are the corresponding motion energy images, where black depicts no movement at all and white pixels show regions where changes have occurred from one frame to the next.

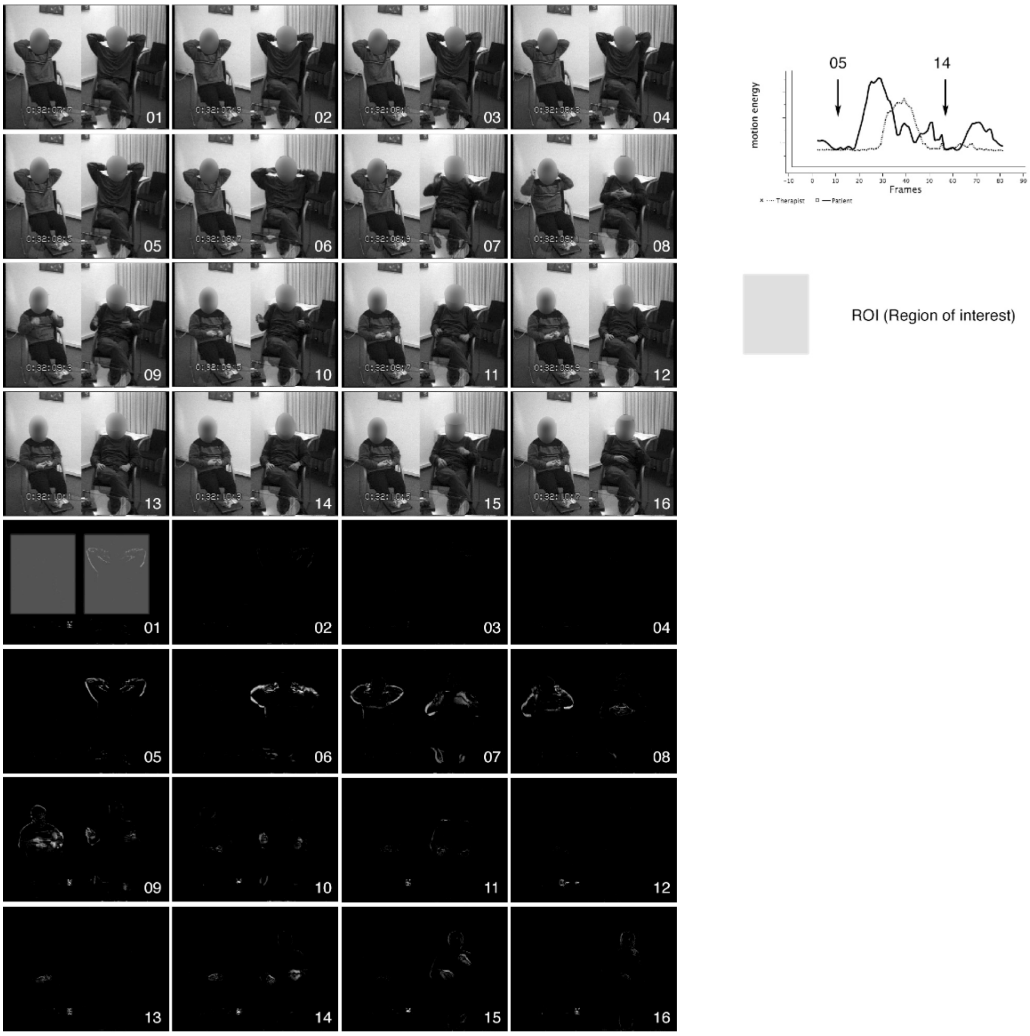

Fig. 4. Motion Energy Images (MEI) from a sequence with simultaneous posture mirroring and movement synchrony.

Taken together, by image differencing we achieved an up to date implementation of the frame-by-frame coding techniques used by Condon & Ogston (1966).

Prior to statistical computations on the two streams of raw data, these are intensively edited with several procedures that eliminate video-noise (resulting from poor tape quality), standardize the values independently of the size of a ROI (thus, the data are independent of the size of each individual's ROI), smooth the data (moving average) and finally calculate a threshold that separates genuine movement (movement bursts) from random noise (random fluctuations in the video tape). The statistical analysis we then implement is based on cross-correlations. We programmed a time-lagged cross-correlation algorithm (see e.g. Boker et al., 2002) that quantifies the association of the two streams in a range of +/- 4 seconds (or more). This measure is computed windows-wise, i.e. each minute of psychotherapy with a duration of 50 minutes is analyzed separately to allow for time dependent changes in the associations between the two interactants (thus taking into consideration the non-stationarity of the phenomenon). The resulting correlation coefficients are charted in a color-coded cell-plot (see Fig. 5.).

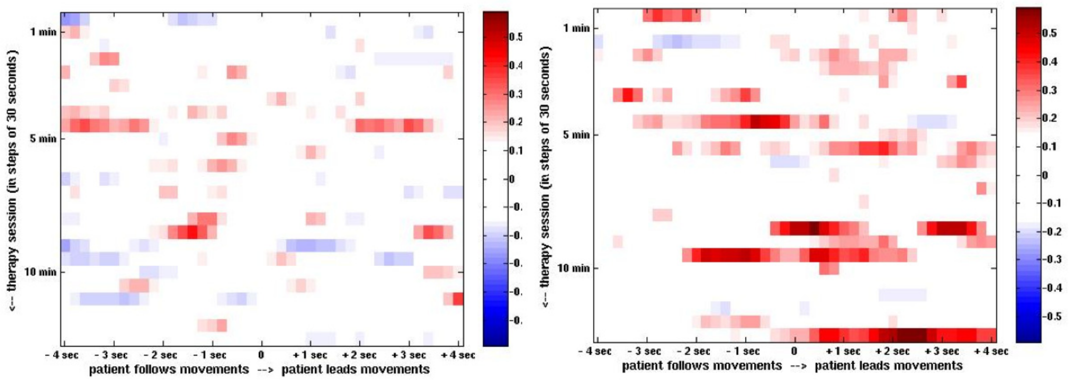

Fig. 5. Color-coded cross-correlations of two psychotherapy sessions (sessions 01 & 35 of 40) taken from the same therapy dyad with different amounts of movement synchrony. More regions with dark values indicate a higher degree of synchrony. The direction of entrainment is shown with values being either to the left (patient follows the movements of the therapist) or right side of the center. Instantaneous synchrony shows up in the center region (= 0 second delay, middle of the graph). For better viewing, only the first 15 minutes into each session are shown

A final, quite important step in our analysis is to rule out movement synchrony due to chance, i.e. random contingency between the two

movement streams. To accomplish this, we generate N=100 surrogate datasets by shuffling the genuine data. In order to not destroy the original structure of movement bursts, we shuffle 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. Thus, the motion energy values of the therapist‘s behavior from e.g. the 5th minute is paired with the movements of the patient from the 9th minute of this session. The genuine cross-correlation coefficients are finally contrasted with the absolute mean of the shuffled coefficients and considered significant if they exceed 2 standard deviations from the randomized means, with Bonferroni corrections on the alpha-level due to multiple comparisons.
At present this technique is ready to be implemented on a wider scale. Initial tests on 20 therapy sessions with a duration of 50 minutes have shown that the approach yields promising results. The project goal is to have a large sample of various therapeutic dyads allowing thorough statistical testing which can yield conclusive evidence. Additionally, it is planned to compare the synchrony measures described above with data gathered from post-session questionnaires and data from observer ratings.

Order and Pattern Formation in Psychotherapy

In addition to the above mentioned fine-grained methods, we conducted the analysis of synchrony and pattern formation on the basis of self-report measures. Such measures are not directly comparable to the visually based operationalization of interpersonal coordination described above. Nevertheless, they fit nicely into the global concept of synchrony as a crucial variable in psychotherapy.
The data of this study were post-session questionnaires (Grawe & Braun, 1994) deployed immediately after each session of dyadic psychotherapy. Our approach can be characterized as a time series approach that is complementary to so-called longitudinal studies, in that complete sequences of sessions (one questionnaire for every session) are explored instead of measuring characteristics at limited points in the course of therapy. According to our theoretical foundation in systems theory (e.g. Tschacher, 1997), we conceptualized the therapeutic alliance as a complex psychological system embedded in an environment of various parameters. Self-organized patterns typically evolve via instability points, where a system enters an new mode of behavior. The course of psychotherapy can be viewed as a

sequence of stable phases; the starting point is usually an unorganized initial state of the therapeutic alliance which finally enters a more synchronized phase.

The results reported here were derived from a dataset (Tschacher et al., 2007) that concludes a series of studies (Tschacher et al., 1998; Tschacher & Grawe, 1996; Dohrenbusch & Scholz, 2004) centered around the question of the evolution of order in the therapeutic system. The data consisted of two independent self-report questionnaires for both patient (22 items) and therapist (27 items) of a dyadic psychotherapy. The main focus concerned pattern formation. Patterns were viewed as indicators of order in the time domain, i.e. signs of synchrony in the therapeutic system as a whole.

For this task, we computed two measures of order in N=30 dyadic psychotherapies with a duration between 40 and 112 sessions (mean duration was 56, SD=16; for a detailed description see Tschacher et al., in print). The order measures were based on factor-analytical procedures ("O-technique" according to Cattell) and on Landsberg's order measure Ω (Landsberg, 1984; Tschacher et al., 1998).

The main hypothesis of this study concerned the question whether there is a difference in order between the initial phases of therapies (the first 30 sessions) and the final phases of therapies (last 30 sessions; these windows were overlapping in therapies with less than 60 sessions). Alongside this comparison of initial vs. final phase of psychotherapy, we applied a continuous calculation of the order measure Ω (moving Ω) by extracting the order from a moving window of n=20 sessions.

Corroborating our hypothesized relations, the two measurements of order showed a significant increase (p = .018) of order from the first half of therapy (mean, 3.3; SD = 1.29) to the second (mean, 2.76; SD = 1.14). This finding indicates that there is an overall increase of order in the psychotherapeutic system. A visualization of this global effect can be gained from the graphical display of moving Ω. Although there are clear differences between the trajectories of the individual therapy courses, the global effect of an increase of order is observable.

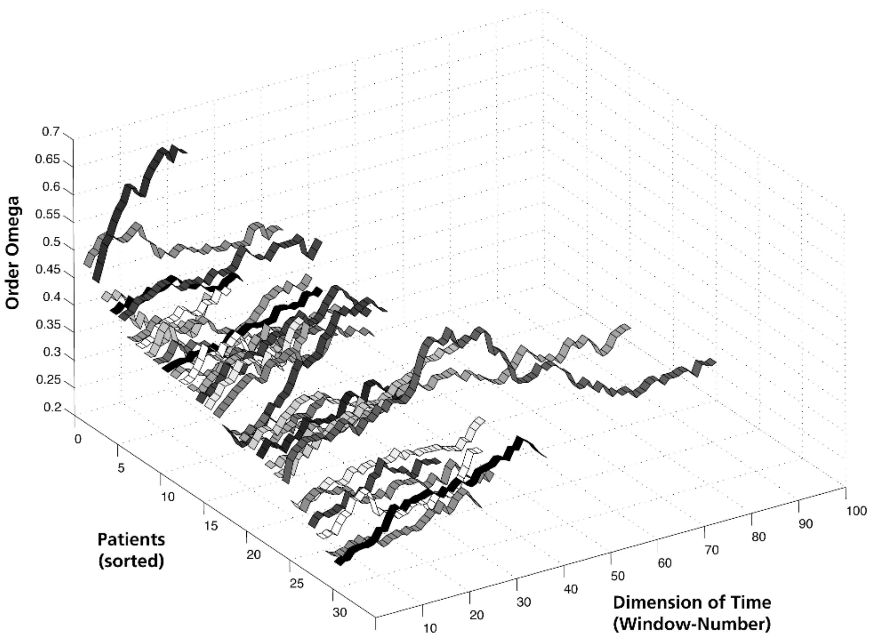

Fig. 6. Moving Ω (order) of 30 dyadic psychotherapy courses. The increase is visible in the form of ascending lines from left to right. For better viewing, the trajectories were sorted by their initial values.

Discussion

Generally, we reached the conclusion that synchrony is a promising concept for psychotherapy and psychotherapy research that offers a number of research opportunities and has great integrative value. The fact that research on synchrony is conducted in diverse fields from physical to living systems suggests a high integrative power (e.g. Strogatz, 2003). Compared to nonverbal measures employed in other fields of psychology, we reviewed the evidence of empirical studies which found that synchronized behavior influences perceived empathy and rapport. In particular, the ongoing debate on the role of mirror neurons may clarify this issue further. We have to bear in mind, however, that for the field of clinical psychology and especially psychotherapy the evidence does not yet justify a general acknowledgment of the synchrony concept in the way many practicing psychotherapists may conceptualize it.

Although synchrony as a core concept of psychotherapy research is intriguing, it would be premature to grant synchrony an exclusive role in the formation of empathy and in the development of the therapeutic bond, even though our theoretical considerations and empirical evidence especially in social psychology point that way. No definite evaluation in psychotherapy is possible at this moment, and well-controlled empirical research is indispensable.

Another strong reason for considering synchrony as a core indicator of the therapeutic dyad lies in its high face-validity. Moreover, clinical observations and personal experience with the phenomenon underline the strong relationship between nonverbal behavior and the quality of the therapeutic bond. Without questioning the validity of these observations, we have to be careful to keep in mind that the human tendency to form „Gestalten" and to construct rhythm and order may be misleading. Statements such as the following exemplify the difficulties a methodologically well balanced study may encounter when trying to investigate synchrony: „When for instance I scratch my head, it is not uncommon that I observe the patient scratching his head a few seconds or minutes afterwards; I registered the same phenomenon when I was rubbing my nose" (Geissler, 2005, pp. 170); translated by the authors, italics added). We can see that the italicized part speaks about seconds or minutes, thus an operationalization of behavioral or temporal units for the described phenomenon - be it for human observers or a computer algorithm - is not very easy.

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

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