COORDINATED MOVEMENT AND RAPPORT IN TEACHER-STUDENT INTERACTIONS

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ABSTRACT: High school students in 19 teaching dyads were measured for their degree of interpersonal coordination and rapport. Two types of movement coordination were identified and rated by a group of untrained judges: the degree of perceived *movement synchrony,* and the extent of *behavior matching.* Ratings of movement synchrony in true interactions were significantly greater than similar ratings in pseudo interaction control clips (i.e., video clips that appeared to be of the teacher and student interacting but were, in fact, a combination of video clips of each interactant recorded from *different* points within their interaction). Self-ratings collected from interactants indicated a strong relationship between participants' rapport and the degree of movement synchrony perceived by raters. This relationship remained even after observer ratings of each interactant's friendliness, a possible confound, were partialled out. This result provided empirical evidence for the hypothesized relationship between rapport and interpersonal coordination (Tickle-Degnen & Rosenthal, 1987). Ratings of behavior matching did not differ significantly between the true interactions and pseudo interaction control clips. Behavior matching failed to correlate significantly with dyadic rapport. It was, however, significantly predictive of self-reported anxiety.

The observation of a busy street corner in a large city or a train station at rush hour provides a striking example of how smoothly individuals can mesh their flow of behaviors with each other. Interpersonal coordination is present in nearly all aspects of our social lives, helping us to negotiate our daily face-to-face encounters (Kendon, Harris, & Key, 1975). It is probably

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due to its ubiquity that we rarely regard interpersonal coordination as a target of our concern or study. Studies involving the physical manifestations of rapport have rarely gone beyond the identification of specific individual behaviors reflective of positive emotional affect (e.g., proximity, gaze, smiling, etc.). A more complex relational approach to the physical aspects of interaction that considers the interaction itself as the unit of analysis is necessary for a better understanding of the processes involved (Baron & Boudreau, 1987). The study of the coordinated behaviors between people interacting is one such approach. This study examined two types of interpersonal coordination in teaching dyads and determined their relationship to interactant rapport.

Coordinated Movement and Rapport

The importance of similarity to interpersonal attraction is well documented in social psychology (Byrne, 1971). It has been suggested that movement similarity can provide a common backdrop to the ongoing interaction (La France, 1979), or in the case of mimicry, it may be used to show sympathy and understanding for another's state or perspective (Bavelas, Black, Lemery, & Mullett, 1986). Scheflen (1964) suggested that people in a group often mirror one another's posture and this reflects a shared viewpoint.

In a recent review of the literature, Tickle-Degnen and Rosenthal (1987) theoretically linked coordinated movement to rapport. While rapport commonly may be more strongly associated with positive emotional affect or attitude, descriptive references to coordinated aspects of behavior are common in our everyday descriptions of social events. High states of rapport are often associated with descriptive terms such as harmonious, smooth, "in tune with," or "on the same wavelength." Likewise, states of low rapport are often associated with terms such as awkward, "out of sync," or "not getting it together."

Presently, there are many ways to measure coordinated behavior in human interaction (Bernieri, Reznick, & Rosenthal, 1988). A recent review of the interpersonal coordination literature has grouped the various research methodologies into two broad categories (Bernieri & Rosenthal, in press): (a) those that study *movement synchrony* (i.e., the precise timing and coordination of movements to coincide with the timing or rhythm of the movements of another) and (b) those that study *behavior matching* (i.e., mirroring and mimicry). While the latter emphasizes the similarity of appearances at a given moment in time, the former focuses on the temporal aspects or timing of movements during an interaction.

Movement Synchrony

It has been suggested that the coordination and precise timing of movements (as opposed to simple similarity in appearances) during social interaction is very important in establishing and maintaining rapport (Kendon, 1970). Unfortunately this movement synchrony hypothesis has proved difficult to test. Ambiguities present in some of the early operational definitions of coordinated movement, along with the difficulties inherent in its measurement, have inhibited the establishment of the compelling empirical evidence needed to justify this claim (Cappella, 1981; Rosenfeld, 1981).

A general absence of practical and appropriate statistical controls for the movement synchrony hypothesis has greatly undermined the general acceptance of work in this area. Specifically, Cappella (1981) took issue with the notion that any change in any part of a person's physical motions occurring at the same instant as a change in any part of the other's motion could be evidence of interpersonal coordination. Cappella claimed that with so many possible discrete events occurring in normal social interaction, there is a certain baseline of coordinated (simultaneous) movements that would be expected by chance. Without a statistical control for this baseline of chance synchrony, a micro-analysis method of measurement would bias observations to appear synchronous (Cappella, 1981, p. 119).

Attempts at incorporating these controls into objective measurements of movement synchrony have yielded inconsistent results (Kato et al., 1983; McDowall, 1978). Before movement synchrony can begin to be studied in earnest it is crucial for investigators to develop an accepted methodology for its study.

Perceived movement synchrony. The assumption that one must rely on advanced technology and micro-codings of behavior to study interpersonal coordination validly has been questioned by Baron and Boudreau (1987). Consequently, an alternative method utilizing human perception has been operationalized by Bernieri, et al. (1988).

The method of measuring movement synchrony through the ratings of observers takes a Gestalt approach and assumes that people have the ability to perceive directly real stimulus properties in the environment. Baron and Boudreau (1987) have taken a Gibsonian perspective (Gibson, 1979), claiming that dispositional properties of entities constrain their appearance as well as their movement-action properties. In other words, the synchronous micro-behavior described meticulously by investigators such as Condon and others (Condon, 1970; Condon & Ogston, 1966,

1967; Kendon, 1970) may have Gestalt qualities that make it directly perceivable by human observers.

A series of studies reported by Newtson, Hairfield, Bloomingdale, and Cutino (1987) directly addressed and supported the validity of this assumption. They concluded that subjects were not cognitively deriving or inferring their ratings of the interaction, but were perceiving them directly.

The pseudo interaction paradigm. Bernieri et al. (1988) used untrained judges to rate directly the amount of coordinated movement they perceived in short videotaped segments of interactions. Interactions were videotaped in a manner that made it possible to construct *pseudo interaction control* clips in which the recorded behavior of two people in different interaction dyads were combined to appear as though they were interacting with each other. Judges were presented with these pseudo interaction clips mixed with true interaction clips. With the sound turned off judges did not realize there were any pseudo interactions among the video clips.

The rated movement synchrony of the pseudo interaction control clips provided a base line index of interpersonal coordination that was confounded with various measurement artifacts (i.e., judges expectations of coordination or projection) and chance coordinated movement (Cappella, 1981). By subtracting out the amount of pseudosynchrony from the true interaction clips, the level of movement synchrony due to interaction processes that was relatively unconfounded by chance or rating artifact was determined.

Bernieri et al. (1988) videotaped 14 month-old infants and their mothers. Although observers believed they were viewing genuine interaction clips, ratings of movement synchrony in the pseudo interaction control condition were significantly less than in the true interaction. Mothers and their babies were coordinating their behaviors in a way that was detectable by human raters and that was demonstrably more synchronized than would be expected by chance. Observer ratings of the interactants' emotional affect, collected independently from another group of judges, showed that movement synchrony was significantly related to the child's positive affect: The happier the child, the greater the synchrony (Bernieri, et al., 1988). Surprisingly, no significant relationship was found between the mothers' emotional affect and movement synchrony.[1]

[1]The authors suggested that this null result reflected the demand characteristics placed on the mothers. All mothers were instructed to be as enthusiastic and animated as possible to engage the child's attention. Mothers were encouraged, therefore, to keep their true states to

Importantly, ratings of movement synchrony were not correlated with the activity and emotional affect of either the mother or child within the pseudo interaction control clips. This helped to rule out the alternative explanation that raters of movement synchrony were rating, instead, the characteristics of the *individual* interactants such as their activity level or emotional state. If ratings of movement synchrony were confounded with emotional positivity, for instance, they would have remained correlated within the pseudo interaction video clips. This did not happen.

Validity considerations for the pseudo interaction control paradigm. In order to employ this experimental design validly it is essential for judges to believe they are viewing genuine interactions. If interactants frequently talked simultaneously and took conversational turns out of sequence, it would become obvious to a viewer (even with the sound turned off) that the clip was not of a genuine interaction. In such a case, the value of the pseudo interaction clip as a control is diminished since any decrease in movement synchrony could be explained by a rating bias of these pseudo interaction clips due to their apparent artificiality.

Unfortunately, not all types of social interaction will lend themselves to this methodology. It is important to use interactions characterized by one person talking while the other listens. The resulting measure of synchrony is not interpreted as the smoothness of a conversational stream, but rather a kind of rhythmic "togetherness" between speaker and listener.

Care was taken when choosing the nature of the present interaction reported in this investigation. The act of teaching lends itself nicely to the pseudo interaction paradigm. While a teacher talks continually throughout the interaction, a student listens and speaks rarely, if at all. The *asymmetric* quality of verbal behavior renders the resulting pseudo interactions difficult to detect to the unsuspecting rater.

Behavior Matching and Rapport

Unlike movement synchrony, the measurement of posture similarity and mirroring has a fairly well accepted set of objective criteria (La France, 1982). La France has studied systematically the relationship between posture mirroring and rapport in classrooms (La France, 1979; La France & Broadbent, 1976). In both cases La France has found a significant relationship between self-reported rapport and posture mirroring.

themselves. As a consequence, mothers appeared to be consistently happy across the clips which decreased the chance of uncovering a relationship between synchrony and their apparent emotional state.

The above findings suggest a possible relationship between interpersonal coordination and rapport but there is insufficient evidence to establish a robust relationship. The link between posture mirroring and positive rapport has been the most strongly documented, but posture mirroring is only one specific case of interpersonal coordination and there has been at least one failure to replicate. In one study of getting-acquainted dyads the correlation between posture mirroring and rapport was not found (La France & Ickes, 1981).

Overview

In the present study, judges viewed silent video clips of high school students teaching each other a list of imaginary words and rated the degree of interpersonal coordination. The ratings attempted to reflect each of the two general categories of coordinated movement, *movement synchrony* and *behavior matching*. The addition of a behavior matching measure made it possible to compare it directly to movement synchrony. It has yet to be determined whether behavior matching and movement synchrony are different manifestations of the same thing, namely interpersonal coordination, or distinct phenomena, reflective of different interactional processes.

Pseudo interaction control clips were constructed for each recorded genuine interaction segment and were presented to raters as genuine interaction recordings. It was hypothesized that: a) raters would perceive greater degrees of movement synchrony and behavior matching in the genuine interaction video clips than in the pseudo interaction controls, and b) both movement synchrony and behavior matching would be correlated with interactant rapport.

Method

Subjects

Thirty-eight high school juniors and seniors served as subjects. Subjects who knew each other very well were prevented from being in the same dyad. Participation was voluntary and subjects received no monetary compensation.

The Teaching Session

Volunteers reported to the experimental location in pairs. The sex composition of the 19 dyads were as follows: 15 mixed-sex dyads, 3 female dyads, and 1 male dyad. Upon arrival subjects were randomly assigned the roles of "teacher" and

"student." Subjects in the role of teacher were given a deck of 24 index cards containing 24 words and definitions. All cards contained imaginary words and definitions. The teachers' goal was to teach the student as many words as possible in 10 minutes. Teachers were not restricted to reproduce verbatim the definitions and were encouraged to use their own words during the lesson. Typically, teachers read aloud a word and its definition verbatim or would rephrase it slightly. If teachers finished early, they were instructed to review the lesson. Students remained relatively quiet while attending to the teacher.

Teachers and students sat facing each other on stools approximately two feet apart. This arrangement provided both interactants a large range of movement. Cameras recorded their entire bodies. Prior to the beginning of the teaching session, teachers and students were given a few minutes to acclimate themselves to each other, to the experimental situation, and to the video equipment.

Self-Report Questionnaires

Immediately following the teaching session subjects moved to opposite corners of the room, sat facing away from each other, and filled out a self-report questionnaire. The questionnaire was a 27-item, eight-point unipolar rating scale covering various dimensions of emotional affect and rapport. For each item, subjects responded to the question "Exactly what were you experiencing during this brief interaction?" Subjects were encouraged to be as honest and accurate as possible and were assured of the complete confidentiality of their responses. One dyad was called away from the experimental session before they were able to provide their self-reports.

Interpersonal Coordination Measurement

Stimulus clips. One-minute video segments of the student and teacher were extracted from three points in each interaction: (a) the first minute, (b) the midmost minute, and (c) the last minute. A split-screen special effects generator allowed the construction of video clips that paired the recorded image of the teacher in one time-period with the image of the student recorded in any other time period.[2]

Recordings were edited to produce two types of stimulus video clips: a) *true interaction* clips and b) *pseudo interaction* clips. True interaction clips were reconstructions of the genuine interaction. The pairing of the student's behavior with the teacher's behavior was achieved manually by forwarding two video recorders to a time-zero point and starting both simultaneously. Images were combined via a special effects generator. The sound track provided a criterion for evaluating the temporal resynchronization. Imperfect synchronization of the sound tracks was indicated by an audible echo. After editing, *the sound was removed* from the clips.

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[2]Pseudo interactions which combine video images taken within the same interaction preserve the tempo, style, or tone that may be unique to those people in that interaction. Another way of constructing pseudo interaction clips combines video images from totally different interactions (Bernieri, et al., 1988). Since interactions involving different people have potentially different "tones", the degree of perceived dissynchrony should be inflated. Therefore, pseudo interaction controls constructed from images recorded within a given interaction provide the most stringent control of the synchrony hypothesis.

Pseudo interaction video clips *appeared* to be of a genuine interaction, but combined the recorded image of the teacher at one point in time with the image of the student at a different point within their interaction. Since video segments were recorded from three time periods, each true interaction video clip generated two pseudo interaction video clips. For example, the behavior of the teacher recorded toward the beginning of an interaction was paired with the behavior of the student recorded during the middle of the interaction, and again with the student's behaviors toward the end of their interaction. The different types of pseudo interaction clips were analyzed separately with no differences in the results. The results of the two pseudo interaction clips were combined for ease of presentation.

Judges. Independent judgments of interpersonal coordination were collected from ten female college students. Raters attended three sessions, each occurring at least 48 hours apart, and were paid approximately $12.00. The ten raters were divided randomly into three groups that saw the same set of stimulus clips, but in different sequences. The sequences of clips were arranged such that only one type of interaction clip (i.e., true or pseudo) for a given dyad was presented to the judges in any one session. For example, in one session, one group saw the three clips of teaching dyad 1 (i.e., first, midmost, and final) in the true condition, the three clips of dyad 2 in one of the two pseudo conditions, and the three clips of dyad 3 in the other pseudo condition. Judges never viewed clips from the same dyad in any two of these conditions on the same day. This precaution helped to prevent the judges from becoming aware of the pseudo interaction control clips. Judges eventually rated all clips in all conditions.

Rating form. Judges used a rating form that described four aspects of interpersonal coordination. A cover sheet explained what each rating was designed to measure. Each rating was made on a 9-point Likert scale. The four rating scales provided to the judges were designed to measure: (a) *simultaneous movement*, (b) *tempo similarity*, (c) *coordination and dance-like smoothness*, and (d) *behavior matching*.

It was expected that movement synchrony would produce an increase in "simultaneous movement." That is, there would be points in time where changes in movement would start, stop, change speed, or change direction at the same instant, as if they were occurring on the down beat of a measure in a musical score. Raters were instructed that the nature or similarity of movements were irrelevant. The defining criterion was the *timing* of the movements. The following example was provided: "If one person kicks their foot at the precise instant another swings their arm it is to be considered a simultaneous movement."

The second judgment involved the similarity of the interactants' tempos of behavior. Raters were told to assume that all people have built in tempos and rates of speed with which their behaviors occur, such as the tempo an orchestra follows at a concert. They were asked to rate: "the degree to which the interactants seemed to be 'marching to the beat of the same drummer.'"

The third judgment, *dance-like coordination*, was a Gestalt-like perception of the degree of behavior unity or "smoothness" achieved by the interactants. It was the extent to which the behaviors of the two fit together evenly. Raters were provided with the following: "Assume you are viewing a choreographed dance rather than a social interaction. How smoothly do the interactants' behaviors intertwine?

Are there any false starts or hesitations? Do they act *at* each other or *with* each other? To what extent do their behaviors mesh or combine evenly and smoothly?"

The fourth judgment, initially called posture similarity, asked them to rate the degree to which the movements of one interactant matched the other. Specifically they were asked to consider the following: "Are they both sitting upright? Do they both have one leg crossed over the other? Are they both smiling? Do they both have their hands resting on their lap?" Although this item was labelled posture similarity on the actual rating forms, its definition more accurately describes the more general measure of *behavior matching* and will be referred to as such from this point on.

Judges were introduced briefly to the concept of coordinated movement before beginning the task but were not given additional coaching once the rating sessions began. They were instructed to make independent judgments and to refrain from making any comments during the rating procedure. The aim of the rating procedure was to keep judges from becoming aware that they were viewing artificially constructed pseudo interactions. Past research utilizing the above procedure has shown that judges do not notice the pseudo interactions, if the proper precautions are taken.

In debriefing the raters, only one of the ten raters suggested that some of the clips may have been "artificially reconstructed." Even after raters were told of the presence of pseudo interaction clips and asked to estimate the percentage of clips they now thought were the pseudo interaction controls, all gave estimates well under 50%, when in fact, two-thirds of all the clips they viewed were pseudo interaction controls. Together, these results supported the success of the pseudo interaction construction as going undetected.

Results

Interpersonal Coordination Ratings

Reliability of judges' ratings. Reliabilities of the judges' ratings across the 172 stimulus clips were computed by intraclass correlations (Rosenthal, 1982; 1987). The intraclass *r*'s of the four measures ranged from .24 to .30 and yielded Spearman-Brown effective reliability coefficients (based on a full sample of 10 judges) ranging from .75 to .86. These reliabilities were comparable to those of similar measures found in earlier studies (Bernieri, et al., 1986, 1988). Behavior matching was the most reliably rated and simultaneous movement was the least reliably rated.

Movement synchrony composite. Correlations among the interpersonal coordination measures appear in Table 1. They are reported separately for true interaction and pseudo interaction clips. The extremely high intercorrelations among the first three variables suggested that they be

TABLE 1

Intercorrelations of Four Synchrony Rating Variables (N = 19 Dyads)

True Interactions	1.	2.	3.	4.
1. Simultaneous movement	—			
2. Tempo similarity	.79***	—		
3. General smoothness	.78***	.84***	—	
4. Behavior matching	.43	.63**	.50*	—
5. Movement synchrony (Mean of 1–3)	.91***	.94***	.94***	.56*
Pseudo Interactions[a]	**1.**	**2.**	**3.**	**4.**
1. Simultaneous movement	—			
2. Tempo similarity	.78***	—		
3. General smoothness	.79***	.90***	—	
4. Behavior matching	.41	.66***	.61**	—
5. Movement synchrony (Mean of 1–3)	.91***	.94***	.95***	.60**

[a]Mean of pseudo interaction clips.
*$p < .05$ **$p < .01$ ***$p < .001$

combined to form a composite of movement synchrony. This composite was formed by averaging simultaneous movement, tempo similarity, and smoothness. It can be interpreted loosely as the perceived degree of movement synchrony occurring in the interaction during that minute. Behavior matching was analyzed separately.

True vs. pseudo interactions. Mean ratings of interpersonal coordination for true and pseudo interactions across the three recorded time periods appear in Table 2. An analysis of variance (time period by interaction clip type) and the accompanying contrast (Rosenthal & Rosnow, 1985) showed that ratings of movement synchrony were significantly higher within the true interaction clips, $F(1,18) = 8.43$, $r = .56$, $p < .01$. This finding supported the movement synchrony hypothesis (i.e., that there is a degree of coordinated movement between interactants occurring beyond a level that is explainable by rating artifact and chance). The effect of time and its in-

TABLE 2

Judges' Mean Ratings of Synchrony for True- and Pseudo-Interactions (N = 19 Dyads)

Movement synchrony

Type of interaction clip	Time of teacher within session			
	Beginning	Middle	End	Mean
True interactions	4.94	5.10	5.05	5.03
Pseudo interactions[a]	4.86	4.70	4.65	4.74
True-Pseudo difference	.08	.40**	.40*	.29**

Behavior matching

Type of interaction clip	Time of teacher within session			
	Beginning	Middle	End	Mean
True interactions	4.63	4.70	4.73	4.69
Pseudo interactions[a]	4.70	4.57	4.47	4.58
True-Pseudo difference	−.07	.13	.26	.11

[a]Mean of pseudo interaction clips. *$p < .05$ **$p < .01$

teraction with video interaction type did not reach significance. Apparently, in the present context, perceived levels of synchronous movement remained relatively constant throughout the 10-minute teaching interaction.

Behavior matching did not show any significant effects. Although the means appeared to be in the predicted direction with behavior matching more pronounced within the true interaction clips, the true/pseudo difference did not reach significance.

Self-Ratings

The first concern with the self-ratings was to reduce the original 27 items to a smaller, more manageable set of variables. To aid the formation of composite variables, a principal components analysis was performed on

TABLE 3

Correlations of Coordinated Movement and Individual Characteristics with Mean Self-Reported Dyadic Rapport.

Self-reports of "teachers" and "students"	Observer-ratings				
	Dyadic Coordination		Individual characteristics		
	Movement synchrony	Behavior matching	Friendly[a]	Active	Attentive
1. Positive rapport[b]	.74***	−.04	.50*	−.35	.14
2. Negative rapport[c]	−.20	.01	−.12	.51*	.08
3. Anxiety[d]	.00	.50*	.08	.16	−.52*
4. Control[e]	.22	−.25	.23	.60**	.30
5. Talkative	.48*	−.21	.38	.18	.19
6. Tiredness	−.40	−.24	−.08	.62**	−.10
7. Sexuality	.23	.04	.23	.07	.21

Note. $N = 18$ dyads.

[a]Mean of observers' ratings of *friendly, happy, warm* and *talkative.*

[b]Mean of *enjoyment, enjoyment of role* (i.e., student or teacher), *liking of partner, happiness, satisfaction, friendliness, excitement, interest, enthusiasm, motivation, attentive, easy-going, cooperative,* and *humorous.*

[c]Mean of *anger, disgust, frustration,* and *boredom.*

[d]Mean of *tense, nervous,* and *self-conscious.*

[e]Mean of *controlling, dominant,* and *forceful.*

*$p < .05$ **$p < .01$ ***$p < .001$

the self-ratings.[3] Four composite variables were formed by calculating the average of all items loading most heavily on the generated factors. Three variables failed to load highly on any of these composites and were left as single variables.

The first and largest composite to be formed was called positive rapport. The fourteen items contributing to this composite appear at the bottom of Table 3. Negative rapport was composed of anger, disgust, frustration, and boredom. Anxiety was composed of tense, nervous, and self-conscious. Controlling was composed of dominant, forceful, and controlling. Talkative, tired, and sexy were left as single variables.

[3]The principal components analysis was used only as an aid to reduce the redundancy in the set of dependent variables. Its use here should not be confused with factor analysis and its usage in identifying the latent structure in a set of variables (Cattell, 1952).

Interpersonal Coordination and Rapport

Two of the seven self-rating variables, positive and negative rapport, were most closely associated with past research on interpersonal coordination. Thus, two clear predictions were made: (a) Interpersonal coordination would be positively correlated with positive rapport and (b) interpersonal coordination would be negatively correlated with negative rapport.

The correlations between dyad self-ratings (mean of teacher and student[4]) and interpersonal coordination appear in Table 3. As predicted, movement synchrony was highly correlated with positive rapport. Although not significant, movement synchrony was negatively correlated with negative rapport. Of the remaining variables, only talkative showed a significant relationship. Dyads rated higher in movement synchrony considered themselves more talkative.

Unlike movement synchrony, behavior matching failed to correlate highly with either positive or negative rapport. The only variable to correlate significantly with behavior matching was anxiety. Those subjects who manifested more behavior matching also reported more anxiety.

The Friendliness-Movement Synchrony Confound

It is possible that a confound may exist between ratings of movement synchrony and the apparent friendliness of the interactants. If so, the mean rating of friendliness (or some other judgment) for an individual may be responsible for the relationship between movement synchrony and rapport. To test this possibility the correlations between self-ratings and ratings of movement synchrony were re-computed *partialling* out observer ratings of interactant characteristics.[5]

Two additional groups of observers were recruited to view and rate the interactions on the following scales: (a) warm, (b) happy, (c) talkative, (d) friendly, (e) nervous, (f) attentive, and (g) active. Nine observers viewed the teacher with the student obscured from their view and eleven observers viewed the student with the teacher obscured from their view.

With one exception, reliabilities of the observer-ratings were generally higher than the reliabilities of the interpersonal coordination ratings. In-

[4]The arithmetic mean is only one method that can be used to form a dyad value from individual ratings of teacher and student. The analyses described in this report were performed using (a) the minimum score of the dyad, (b) the geometric mean, (c) the arithmetic mean, and (d) the maximum score of the dyad. The type of dyad score formed had little effect on the pattern of the results.

[5]Thanks go to an anonymous reviewer for suggesting this analysis.

traclass r's ranged from .29 to .58 (Median intraclass $r = .46$) and yielded effective reliability coefficients ranging from .80 to .93 (Median $r = .89$). The exception was nervousness. Ratings of nervousness yielded intraclass r's less than .12. Due to its relatively low reliability this variable was dropped from the analysis.

A principal components analysis was performed separately for teachers and students on the six remaining observer-ratings. The results from the two analyses were very similar and suggested the formation of a composite variable from the ratings of friendly, warm, happy, and talkative, which was labelled *friendliness*. As in the self-ratings described above, dyad values were computed by averaging the ratings of teacher and student.

Dyadic friendliness, attention and activity, as judged by observers, were correlated with the self-ratings made by the interactants and appear in Table 3. Observer-rated friendliness correlated significantly with self-ratings of positive rapport, suggesting that the good feelings felt by the interactants were readily apparent in the edited video clips. Observer-rated attentiveness was negatively related to self-reported anxiety and activity was positively correlated with self-reported negativity, control, and tiredness.

Table 4 reports the partial correlations between judged interpersonal coordination and rapport, holding the possible confounding factors constant. Even after partialling out observer-rated friendliness, the correlation between movement synchrony and positivity was significant albeit not as high. Overall, none of the observer-ratings had much effect on the original set of synchrony-rapport correlations.

Discussion

The present results are significant in three ways: (a) They support the validity of the pseudo interaction rating paradigm by replicating earlier work employing this method, (b) they show that movement synchrony is strongly correlated with rapport, and (c) they provide evidence suggesting that although movement synchrony and behavior matching are correlated (see Table 1), the two should be considered separately and may reflect different interactional processes.

The Synchrony Hypothesis

The synchrony hypothesis states simply that when people interact they do not move randomly or independently from each other but coordinate

TABLE 4

Partial Correlations Between Movement Synchrony and Rapport Holding Observer Judgments of Friendly, Active, and Attentive Constant.

Self-reports of teachers and students	Correlations between movement synchrony and self-ratings with: Friendly[a] partialled	Active partialled	Attentive partialled
1. Positive rapport[b]	.64**	.81***	.75***
2. Negative rapport[c]	−.15	−.20	−.26
3. Anxiety[d]	−.05	−.01	−.00
4. Control[e]	.12	.24	.24
5. Talkative	.34	.48*	.49*
6. Tiredness[e]	−.43	−.56*	.41
7. Sexuality	.12	.22	.23

Note. $N = 18$ dyads.

[a]Mean of observers' ratings of *friendly, happy, warm* and *talkative.*

[b]Mean of *enjoyment, enjoyment of role* (i.e., student or teacher), *liking of partner, happiness, satisfaction, friendliness, excitement, interest, enthusiasm, motivation, attentive, easy-going, cooperative,* and *humorous.*

[c]Mean of *anger, disgust, frustration,* and *boredom.*

[d]Mean of *tense, nervous,* and *self-conscious.*

[e]Mean of *controlling, dominant,* and *forceful.*

*$p < .05$ **$p < .01$ ***$p < .001$

and synchronize their behaviors with each other. Three aspects of the present study are important to the validation of this hypothesis: First, pseudo synchrony ratings provide a statistically appropriate control. Second, judges were unaware they were rating pseudo interaction clips. Third, there was significantly more synchrony perceived in the true interaction clips. Considered collectively, it can be argued that subjects in this study were significantly synchronizing or coordinating their behaviors with each other.

The pseudo synchrony ratings derived from pseudo interaction control clips provided an index of the level of perceived synchrony that is due largely to rating artifact and chance. As long as judges did not identify the pseudo interaction clips as experimental controls (which might induce an expectation confound), pseudosynchrony is interpreted to be the baseline level of perceived coordinated movement whether or not true synchrony occurs.

In the present study, judges were unaware of the pseudo interaction controls. This was possible because of the nature of the teaching interaction. The teacher would read a word, give its definition, and provide an example of its use in a sentence while the student listened. The relative absence of any alternating dialogue removed the cues that would indicate the two people on-screen were not responding to each other. With no sound, the pseudo interaction clips looked like genuine interactions. Therefore the comparison of the true synchrony ratings against the pseudo-synchrony ratings constitute a valid test of the synchrony hypothesis.

Unlike movement synchrony, behavior matching did not show a significant true/pseudo difference. This might lead some to speculate that behavior matching is a chance phenomenon which is unrelated to the interaction process. This seems unlikely because the association between posture similarity, a specific form of behavior matching, and a variety of interaction processes including rapport has been well supported by past research (see Tickle-Degnen & Rosenthal, 1987 for a review). The significant rater reliabilities and correlation found between behavior matching and anxiety argues further against the hypothesis that the ratings of behavior matching collected here were just random noise. It is still possible, however, that since behavior matching was a single variable it may not have been as reliably measured as the movement synchrony composite. Although this could explain the failure to find a significant true/pseudo difference as due to a lack of power, it would not explain the near-zero correlation between behavior matching and rapport.

Dyad Rapport

Synchrony. Rapport among teaching dyads was clearly associated with movement synchrony and replicated the results involving mothers and infants reported by Bernieri, et al., (1988). This replication was important because a different type of interaction dyad in a different interaction activity was involved. Also, self-ratings of rapport were used instead of observer ratings. Using the present methodology, the synchrony-rapport link has now been found in two contexts using different measures of rapport.

One alternative explanation for the relationship between synchrony and rapport is that when subjects were asked to assess the "smoothness" of a social interaction they might have interpreted this, in part, to reflect the apparent degree of friendliness of the two interactants. There are two reasons why this is unlikely: Bernieri, et al. (1988) established that when judges are asked to assess movement synchrony in the present fashion,

they do so independently of the apparent emotional affect or friendliness expressed within the interaction. Second, if judges' perceptions of movement synchrony were confounded with commonly observed characteristics, such as friendliness, then partialling out these characteristics would have nullified the synchrony-rapport relationship. The correlation between movement synchrony and rapport remained significant even after observer ratings of friendliness, attentiveness, and activity were partialled out. There is little evidence to indicate that judges were rating "friendliness" instead of genuine interpersonal coordination.

Of course, as with any new methodology, validity is established only after repeated checks of all the alternative hypotheses have been made. This study was not designed to test comprehensively the possibility of a rating confound between apparent friendliness and movement synchrony. Such a confound is difficult to test since friendliness and movement synchrony are hypothesized to be positively correlated in human interaction (Kendon, 1970). Future research is needed to replicate the finding that although *ratings* of friendliness and movement synchrony can be made independently, the two are strongly correlated in interaction behavior.

Behavior matching. The failure of behavior matching to correlate significantly with rapport was unanticipated given the previously obtained results supporting a posture mirroring-rapport link. In studies where the interactants were relatively familiar with one another and involved in an ongoing relationship (such as a therapeutic dyad or classroom) there is a strong positive relationship between posture similarity and rapport (Charney, 1966; La France, 1979; La France & Broadbent, 1976). The one other study that failed to replicate this result was reported by La France and Ickes (1981). In their study, as in this one, stable, relatively long-term, ongoing interactions were not examined. Other similarities between their study and this one are striking.

In addition to posture mirroring and rapport, La France and Ickes measured extent of verbalization and self-ratings of self-consciousness and awkwardness. The correlation between posture similarity and verbalization was $r = -.22$. In this study, the correlation between behavior matching and talkativeness was $r = -.21$. This study reported a positive correlation between behavior matching and anxiety. La France and Ickes reported a positive association between posture similarity and self-consciousness.

The results involving movement synchrony and behavior matching from the two studies involving unacquainted interactants seem reflective of different interactional processes. Movement synchrony may reflect an active and involved type of positive rapport associated with feelings of

high positive affect, motivation, interest, and talkativeness. Behavior matching, a relatively more static measure, appeared to be reflective of a passive and strained state within an interaction. It was associated with feelings of self-consciousness and awkwardness, and negatively related with talkativeness and expressive gestures (La France & Ickes, 1981).[6]

Importance Of Interpersonal Coordination

Behavior matching and movement synchrony may shed light on how it is that we can "hit it off" immediately with some people and never "get it together" with others. This aspect of rapport certainly would be of concern to professions dealing with intimate personal relations. The success of psychotherapists, physicians, counselors, and teachers all depend, to some extent, on the degree of rapport they can achieve in their professional interactions. Their ability to coordinate and synchronize with different people under various circumstances may have a significant effect on their professional competence and effectiveness.

The potential value of the investigation of interpersonal coordination for our understanding of social interaction and communication is considerable. One reason for the relative lack of research in this area may be that researchers have not had available reasonable and accepted methods of measuring the coordination and synchrony between people. Perhaps with the development of new techniques for measuring interpersonal coordination, such as the rating method described here, additional impetus will be given for research on this distinctively social psychological topic.

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[6]An alternative explanation, provided by Martha Davis, is that the description of the behavior matching item was made ambiguous by including the similarity of facial expressions. A common sign of anxiety within interactions is mutual smiling. This relationship could have competed with a weaker, but still present, positive relationship between posture similarity and rapport. Future research should avoid the premature combining of these different matching behaviors.

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