STEPPING TOWARD COLLECTIVE MINDSETS: AN INVESTIGATION OF GROUP- AND LEADER-BASED SYNCHRONY IN WORK TEAMS

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ABSTRACT

TANYA VACHARKULKSEMSUK: Stepping toward Collective Mindsets:
An Investigation of Group- and Leader-based Synchrony in Work Teams
(Under the direction of Dr. Barbara L. Fredrickson)

The keys to creating effective team performance have long been under investigation by researchers. Past research identifies social cohesion as an important precursor, but how to achieve social cohesion is lesser understood. This dissertation proposes that at the core of an effective team is *synchrony*—the act of moving together "as one"—which has been shown to predict a variety of psychological and social outcomes. The question of whether—and if so, how—synchrony's benefits extend to the domain of team performance, however, remains untested. This multilevel study consists of two studies examining real undergraduate student teams working together over an academic semester.

First, Study 1 tests for construct validity of a synchrony-based relational leadership skill, called *synchrony detection,* hypothesized to be related to unlocking greater team synchrony. Synchrony detection is proposed to be comprised of two latent factors: pattern recognition style and emotional competency, each with three and four measures, respectively. In addition, I developed a novel measure for this dissertation called "AccuSync", which aims to gauge an individual's synchrony detection ability. Results of a confirmatory factor analysis in Study 1 indicate that the battery of measures used here do not support synchrony detection as a construct. AccuSync also demonstrates low scale reliability. Taken together, results of Study 1 warrant more construct validity studies, including development of more

refined synchrony detection measures. Future considerations, promising exploratory correlations, and significance of synchrony detection are discussed in light of the null results.

Second, Study 2 tests a series of predictive links between synchrony, entitativity, and cohesion as team-level characteristics and their relationship to team performance. Results of structural equation models in Study 2 reveal that synchrony unlocks team performance, as measured by instructor-assigned project grades. Specifically, synchrony enables a social process of greater team entitativity and cohesion to emerge within teams, in turn predicting better team performance. In light of significant Study 2 results, analytical alternatives for considering team-level emergent processes are provided, along with implications for leaders, managers, and educators wishing to extract the benefits of synchrony to build cohesive, yet effective, teams.

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INTRODUCTION

The keys to creating effective team performance have long been under investigation by researchers. Past research identifies social cohesion as an important precursor, but how to achieve social cohesion is lesser understood. I propose that at the core of an effective team is *synchrony*, in which people move together "as one". In this multilevel investigation, I examine synchrony in a sample of student work teams. Study 1 tests the development of a new synchrony-based construct, *synchrony detection,* which I hypothesize to be a relational leadership skill. Then, Study 2 examines synchrony as an emergent property of teams that unlocks a social process toward greater team performance. Each of these studies builds off one another, so both will be discussed in tandem throughout each chapter of this dissertation.

I begin below with an introduction to synchrony—what it is, its function—and follow with explaining its role in unlocking a beneficial social process in work teams. Then, I will introduce synchrony detection, focusing specifically on its potential value as a leadership skill. These reviews inform my hypotheses, all of which are summed at the end of this introduction chapter.

Synchrony: Its Form and Function

A casual look around one's environment typically does not reveal any remarkable patterns of behavior: friends chat in a café, cars pull in and out of a parking lot at various

moments, and a pigeon hops around in search of crumbs. A further examination, however, reveals that amidst this backdrop of randomness, instances of orderliness are abound: a flock of birds fly in formation, ants march together in their quest for food, a group of runners seemingly glide as their common pace puts them in-step with one another, and a crowd of fans shout and jump in unison cheering at a little league game. In each case, there are rich amounts of similar physical movements occurring at a common tempo, a group-level phenomenon known as *synchrony.* Synchrony is coordination of movement that occurs between individuals, featuring similarity of 1) *form,* the manner and style of movements, and 2) *time,* the temporal rhythm of movements (Bernieri, Reznick, & Rosenthal, 1988; Kimura & Daibo, 2006). More specifically, synchrony is movement among a dyad or group of people in-phase with one another and/or is matching in frequency (Richardson, Garcia, Frank, Gregor, & Marsh, 2012; Clayton, Sager, & Will, 2004). So although physical movements originate from individual people, it is through interaction and holistic consideration of those movements that synchrony exists as a higher-level, collective phenomenon (Katz & Kahn, 1966).

Synchrony is similar to the more widely studied phenomenon of human mimicry, which is when one person imitates the behavior of another person (Chartrand & Bargh, 1999). Like synchrony, mimicry involves a match in behavioral *form* (e.g., an interviewee crosses his legs after the interviewer does so, a friend scratches her head after seeing her friend do the same). However, mimicry involves a temporal lag between an action and its imitation, and as such, is unmatched in *tempo*, occurring out-of-phase with each other. Synchrony, on the other hand, is rhythmically and temporally organized—a manifestation of anticipation rather than imitation (Sebanz & Knoblich, 2009).

Critically, a host of empirical studies demonstrate that moving in synchrony with others carries psychological consequences across a variety of domains: rowers who row in synchrony have elevated pain thresholds (Cohen, Ejsmond-Frey, Knight, & Dunbar, 2010), infants who show behavioral synchrony with their caretakers' speech and emotional display patterns show more successful language acquisition (Condon & Sander, 1974) and self-control emergence (Feldman, Greenbaum, & Yirmiya, 1999) later in life, and volleyball players who practice to fast-tempo music synchronized to their movements report reduced perception of effort during practice (Szabo & Hoban, 2004). It is also known that experimental manipulations of synchrony breed prosocial outcomes, including compassion (Valdesolo & DeSteno, 2011) and cooperation in adults (Wiltermuth & Heath, 2009; Cohen, Mundry, & Kirschner, 2013), and even preschoolers (Kirschner and Tomasello, 2010). By simply moving in a coordinated temporal fashion with others, desirable psychological and behavioral outcomes for dyads and groups arise.

Furthermore, people report greater social connection and rapport (Vacharkulksemsuk & Fredrickson, 2012), affiliation (Hove & Risen, 2009), and emotional support satisfaction (Jones & Wirtz, 2007) with people with whom they experience synchrony, thereby highlighting the socio-relational consequences of synchrony. What's more, in a study comparing preschool children's ability to synchronize their drumming behavior to an external medium, they synchronized more *and* more accurately to a social cue (i.e., an adult human), compared to a non-social cue (i.e., audio only from a speaker or a drumming machine), further highlighting the uniquely social basis of synchrony (Kirschner & Tomasello, 2009). And, in line with research showing that positive emotions are more likely to be experienced in the presence of other people (Vittengl & Holt, 2000), it is reasonable to

expect that experiencing collective synchrony is associated with greater positive affect, as reported by sociological accounts (Ehrenreich, 2006). Given synchrony's fundamentally social roots, examining its function across a variety of social relationship types has expanded our knowledge about the collective phenomenon in humans greatly.

Synchrony Unlocks a Social Process in Teams

A practical extension of synchrony's function and consequences—both psychological and social—is to that of work teams, a context whereby a collection of three or more individuals share a common goal, work interdependently toward it, and are mutually accountable for or are all invested in accomplishing it (Hackman, 1987; Sundstrom, DeMeuse, & Futrell, 1990). Research on the link between explicitly measured synchrony and a team's performance is nonexistent, yet highly implicative. An overarching aim of this dissertation is to fill this research gap. As defined, synchrony is tempo-based. Less obvious, however, is the role of tempo in teams. At a macro level, time organizes the various stages of teamwork formation and maintenance, beginning from the initial stages of establishing norms to later routinized stages (Gersick, 1988). Put another way, the development process of a team takes place over a time course rather than in one isolated instance.

Upon closer inspection at a micro level, teams are guided by rhythm and tempo. For example, crew teams coordinate their rows to a tempo provided by the coxswain on board shouting commands. By rowing in perfect synchrony, the team maximizes their power and efficiency as a unit. Similarly, historical records describe how field workers would coordinate their sowing and hoeing to the common beat of a cappella-style "work songs" that not only increased productivity but also reduced boredom (Gioia, 2006). Countless other historical accounts describe the same phenomenon among sailor crews performing shipboard

labor, and factory workers during the Industrial Revolution. In a series of studies, Kelly and McGrath (1985) demonstrated that work teams indeed entrain production speed to the amount of time provided for completing a task. Teams were allowed either five, ten, or twenty minutes to solve anagrams; teams given less time to work accordingly solved their anagrams at a higher rate. It appears that in the same way that rowers entrain to the tempo provided by their coxswain, or the field workers to the work song tempo, Kelly and McGrath's teams attuned their rate of work behavior to the temporal conditions imposed upon them. And more recently, Pentland (2012) shows that conversations among team members with balanced amounts of turn-taking, listening, and nonverbal expressivity—conceivably a proxy for synchrony among the group—predict greater team success. Historical and empirical evidence thus suggests that rhythmic coordination—or, as I specifically propose, synchrony—underlies team performance.

But how? That is, as team members' behaviors fall into rhythm with one another during the teamwork process, how are their judgments and feelings altered? The current study aims to investigate synchrony's operative role in unlocking a social process that leads to greater team performance. Drawing on past research, I propose entitativity and social cohesion as two psychological emergent team properties—that is, group-level characteristics resulting from interaction among lower-level individual units—stemming from synchrony, that ultimately lead to greater team performance.

Achieving Greater Team Performance via Entitativity and Cohesion

Entitativity is the perception of a group as a single entity rather than a collection of several entities, or individuals (Campbell, 1958); as such, experienced entitativity is the psychological perceptions of interconnectivity between oneself and other members of the

group (Gaertner & Schopler, 1998). Inspired by Gestalt psychology, research demonstrates that certain perceptual cues, such as similarity and proximity, signal entitativity perception. For example, similarity in physical attributes like skin color among a group of people is known to increase attributions of entitativity (Dasgupta, Banaji, & Abelson, 1999): it's no surprise, then, that groups like marching bands or sports teams wherein each individual dons a uniform, are more likely to be perceived as entitative. There's also evidence that movement-based cues are associated with entitativity. Across four studies, Lakens (2010) demonstrates a strong linear relationship between entitativity and synchronous movement, wherein participants judged videos of stick-figure pairs waving either in perfect synchrony or to one of six different rhythms deviating from perfect synchrony. Results showed that the degree to which an observer perceives entitativity of the stick-figure pairs is highly influenced by cues of movement tempo, an effect that may be mediated by increased perceptions of common goal pursuit (Ip, Chiu, & Wan, 2006; Brewer, Weber, & Carini, 1995) or perceived similarity (Lakens, 2010, Study 3). The examples of bands marching in-step and sports teams executing plays with temporal precision again fit the bill for being entitative, given their shared movement characteristics.

To the extent that perceiving synchrony *of* others is associated with perceiving entitativity of others, as Lakens (2010) suggests, then it is quite plausible that experiencing synchrony *with* others can facilitate experiencing entitativity with others as well, such that physically moving as a single unit results in psychologically conceptualizing a more interconnected group schema rather than one focused solely on the self. Historian McNeill (1995) terms this process "muscular bonding", and psychological research on embodiment confirm that activating muscles associated with emotional expressions (e.g., smiling muscles

and joy) or suggestive of a particular mindset (e.g., arm muscles and lifting activity) influences people's perceptions (e.g., Neal & Chartrand, 2011; Jostmann, Lakens, & Schubert, 2009). Important for relational outcomes, past research also shows that when people experience higher degrees of psychological overlap with another person, they report higher levels of satisfaction and commitment within the assessed relationship (Aron, Norman, Aron, McKenna, & Heyman, 2000). A common measure of relational strength in work teams is known as cohesion, which I propose to be a relational consequence of entitativity. Specifically, I propose that experiencing group synchrony represents a physical embodiment of "oneness" which enables greater perceptions of entitativity with one's group, in turn leading to more felt cohesion[1].

Importantly, social cohesion—broadly defined as positive feelings about one's team—is associated with greater team performance (Gully, Devine, & Whitney, 1995; Losada & Heaphy, 2004). This effect is observed particularly on tasks that involve high levels of interdependence (Sundstrom, De Meuse, & Futrell, 1990), including those in virtual environments (Mason & Clauset, 2013). Furthermore, people who are more enmeshed, or "central", in an informational advice network report greater individual job performance and satisfaction, compared to people who remain peripheral to such networks (Sparrowe, Liden, Wayne, & Kraimer, 2001; Baldwin, Bedell, & Johnson, 1997). Such feelings of cohesion can function to bolster group morale and team empowerment (Kirkman, Tesluk, & Rosen, 2004), both of which can then foster greater performance. Liking among team members also tends to lead to more open communication and agreeableness, in turn producing less conflict

[1]Although highly related, I keep entitativity and cohesion as separate constructs, in line with previous work investigating them separately. Throughout this study, I define entitativity as the psychological perception of unity, or oneness. Cohesion is a feeling of liking or rapport for others in the group. By separating the two constructs, I have the expectation that they each have distinct roles in predicting performance.

(e.g., Jehn & Mannix, 2001; Wagner, Pfeffer, & O'Reilly, 1984). And finally, Pentland (2012) reports that low-performing teams at a major bank's call center improved job efficiency by a measured 20% when managers implemented a common coffee break time for all employees, conceivably creating a structured time for socializing to arise. If, according to past research, cohesion leads to greater team performance, and my predictions that synchrony enables greater perceptions of entitativity and feelings of cohesion are supported, then synchrony may very well relate to team performance via entitativity and cohesion. The current research seeks to extend and unify these current literatures on synchrony, entitativity, cohesion, and team performance by empirically testing each link.

Synchrony Detection: A Cognitive-emotional Leadership Skill that may Unlock a Social Process

This study also examines the possibility that the benefits of synchrony are not limited to just *being* in synchrony, but also *detecting* synchrony. For leaders and managers of groups in particular, I propose that the ability to detect the presence (or absence) of synchrony makes one privy to cognitive and emotional information about the group, both of which may be useful for gauging the level of entitativity and cohesion present. Specifically, in breaking down what one "sees" when observing a group's level of synchrony, there is simultaneously a cognitive component—how the elements are physically configured, and similarity in form and tempo of the movements—and an emotional component—recognizing similarity in emotion among group members, be it positively or negatively toned. Together, the cognitive and emotional components of observing synchrony comprise an individual-level skill that I term *synchrony detection.*

Separate lines of evidence suggest that leaders are indeed managers of their group's physical configurations as well as their emotional tone—I propose that detecting synchrony unifies the use of both these skills at once. Pattern recognition—the act of integrating unorganized information and identifying patterns against a background of randomness—is an important cognitive skill for leaders (Boyatzis, 1982; Spencer & Spencer, 1993). For example, research by Wolff, Pescosolido, and Druskat (2002) on nearly 400 MBA students distributed across 48 self-managing teams finds that the cognitive skill of pattern recognition is associated with a socio-emotional ability to support and develop others in the group, which then lead to greater task coordination and perceived leadership. It is plausible that when faced with cognitive and emotional information in a work team, those who are skilled at pattern recognition are better able to usefully integrate all the information instead of ignoring it or becoming overwhelmed.

In terms of recognizing emotions among a group, emotional intelligence is a critical predictor of effective leadership, be it through a formal appointment (Rosete & Ciarrochi, 2005) or informal emergence (Cote, Lopes, Salovey, & Miners, 2010). Pescosolido (2002) finds supporting qualitative evidence that emergent leaders are skilled at facilitating situations, responses and solutions that maintain a balanced emotional tone within the group. That is, in the same way that there are benefits to one being "intelligent" with recognizing and handling one's own emotions, knowing whether one's group is emotionally "on the same page" is beneficial for knowing that everyone is focused on the same goals and tasks (Mayer & Salovey, 1997; Sanchez-Burks & Huy, 2009). Exploring synchrony detection as a leadership skill departs from past research on synchrony not only in terms of context, but also by shifting the focus from an actor's perspective to an observer's. If synchrony is predictive

of positive group behavior and social consequences, as past research finds, then being able to "see" the presence or absence of it may be a useful skill for leaders to have in order to effectively manage their teams.

Goals for the Current Research

There are two studies in the current research, each with its own set of aims. Study 1 directly tests for the existence of a *synchrony detection* construct. I predict that this proposed individual-level skill is a combination of cognitive and emotional skills, and I include a variety of established constructs in Study 1 to establish convergent and divergent validity with synchrony detection. In addition, Study 1 tests a novel measure I developed for this dissertation, called "AccuSync", which aims to gauge an individual's ability to "see" synchrony. This measure departs from static measures of pattern recognition style, such that it includes dynamic stimuli, mapping on to the construct of movement synchrony. Moreover, AccuSync departs from other measures of emotional competency, such that it includes expressivity at a group level rather than individual level.

Study 2 aims to determine predictive validity of the new latent construct synchrony detection in student work teams. Specifically, this study tests a unifying model of predictions about synchrony detection unlocking a social process toward greater team performance. I predict that individuals high on synchrony detection are more likely to emerge in their team as a relational leader, and be more likely to facilitate team synchrony. And, with synchrony representing a physical embodiment of "oneness", I predict enabled psychological perceptions of team entitativity, in turn creating feelings of cohesion, and ultimately, greater team performance. I will not be uncovering all the possible mediators in the link between synchrony detection and relational leadership emergence, nor the link between relational

leadership emergence and group synchrony. In all, results from these studies of synchrony detection will set the stage for future investigations of synchrony's impact in organizational domains, specifically around the idea that tempos underlie team success.

Synchrony Detection: Proposed Nomological Network

Figure 1 graphically represents the proposed nomological network of synchrony detection and primary aim of Study 1. I propose that synchrony detection draws on one's cognitive skill of recognizing patterns within one's group, as well as one's emotional competency skill in assessing a group's emotional tone, as conveyed through a group's physical movements. I hypothesize that:

> (H1) Synchrony detection is a construct comprised of two latent factors: *pattern recognition style* and *emotional competency*. Each of the following measurements is expected to load moderately-to-highly on synchrony detection: *field-dependent cognitive style, global visual processing, synchrony rating accuracy, emotional intelligence, emotional aperture, social sensitivity,* and *nonverbal sensitivity.*

And,

> (H2) Study 1 will explore the reliability of the AccuSync measure, developed for this dissertation project to be the most direct measure of synchrony detection.

Cognitive Aspects of Synchrony Detection

In considering strictly the cognitive aspects of detecting synchrony, it helps to imagine how synchrony appears when stripped of any audio cues. What remains are simply the physical movements occurring among the collective. Important here is that the movements are happening at a group level, involving many people's movements rather than just one person's. Thus, in order to recognize the presence or absence of synchrony, one

must be attuned to the "big picture" rather than just the details. More specifically, the movements need to be perceived as an integrated configuration or pattern of several individual elements (i.e., group-level display of movements), rather than just as several individual elements (i.e., individual-level display of movements).

I draw primarily on constructs from research on cognitive processing styles to define and develop the cognitive aspects of synchrony detection, which I term *pattern recognition style.*

Hypothesized pattern recognition style constructs

Field-dependent/-independent cognitive style. Field-dependent or -independent cognitive style refers to one's ability in perceptual functioning to see how singular elements fit and possibly move around within a larger figure (Witkin & Goodenough, 1981). Early research by Witkin and colleagues discovered individual tendencies toward either a field-dependent style, in which people rely on environmental cues and structure to make a perceptual judgment, or a field-independent style, wherein people are not influenced by the larger field. Subsequent studies have found stark differences between field-dependent and field-independent people in a variety of domains, including interpersonal functioning (Witkin & Goodenough, 1977), career choices and academic majors (Goodenough, et al., 1977), attachment style (Vermigli & Toni, 2004), degree of cultural conformity (Nisbett, Peng, Choi, & Norenzayan, 2001; Witkin & Berry, 1975), and clinical disorders (Konrath, Bushman, & Grove, 2009). Field-dependence/-independence, however, solely tests one's perceptual functioning as it relates to non-social, geometric figures. On the other hand, synchrony detection involves socio-emotional perception. As such, I hypothesize that one's field-dependence/-independence style is related to synchrony detection to the extent that it

requires one to cognitively "see" the collective as an entity rather than a group of individuals. I predict a positive moderate relationship (0.3) between field-dependence and the latent construct synchrony detection.

Global processing style. Global-local processing refers to one's scope, or breadth, of cognitive attention. Whereas global processing considers holistic features of a given stimuli (i.e., seeing the "forest"), local processing directs one's attention toward the elements of a given stimuli (i.e., seeing the "trees"). Global-local processing style is typically assessed as an outcome, with past studies showing that one's global versus local breadth of attention can be shifted via positive emotions (Gable & Harmon-Jones, 2008; Johnson, Waugh, & Fredrickson, 2010). In this study designed to establish construct validity of synchrony detection, however, global processing style will be assessed once as a trait measure. Similar to field-dependence/-independence style, however, global-local processing style tests one's perceptual functioning as it relates to non-social, geometric figures rather than socio-emotionally laden stimuli. As such, I hypothesize that one's global-local processing style is related to synchrony detection to the extent that it draws on one's tendency to "see the forest" rather than the "trees". I predict a positive moderate relationship (0.3) between global processing and the latent construct synchrony detection.

Synchrony rating accuracy. As just described, measures of both field-dependence/-independence and global-local processing capture people's perceptions of static stimuli. But the real world is rarely so, especially in terms of synchrony. Instead, synchrony is dynamic and has a time course, even if just for a few seconds. Given synchrony detection's early stage of construct development, there are no existing measures of it. I devised a new measure called AccuSync as a proxy for individuals' accuracy in rating behavioral

synchrony, which features a variety of 10-second video clips of collective groups of people and animals moving in- and out-of-synchrony. AccuSync is designed to be much more closely aligned to the definition of synchrony with use of dynamic stimuli, compared to stimuli used in tests of field-dependence/-independence and global-local processing, and can thus shed more light on the content of what people see when observing synchrony. I hypothesize that one's synchrony rating accuracy—as measured using the new AccuSync measure—is the strongest measure of synchrony detection. I predict a high positive relationship (0.5) between synchrony rating accuracy and the latent construct synchrony detection.

Emotional Aspects of Synchrony Detection

In considering the emotional aspects of detecting synchrony, what one "sees" is that each individual involved is emotionally "on the same page", or intersubjectively engaged, with others in the moment. Individuals in synchrony with one another experience uniformity in their emotions, whether positive (e.g., crowd laughter at a comedy show), or negative (e.g., an angry mob; solemn group prayer at a funeral service), and it is essential that one notices uniformity in order to detect synchrony. Similarly, one must be able to grasp when there is a *mix* of positive and negative, to detect the absence of synchrony.

Prior work shows that human body movements are a reliable vessel for conveying emotions, be it through the face (Ekman, 1993) or the whole body (de Gelder, Van den Stock, Meeren, Sinke, Kret, & Tamietto, 2010). Van den Stock, Righart, and de Gelder's (2007) laboratory studies, for example, show that participants could recognize distinct emotions from stimuli depicting different whole-body expressions. To complement, a study by Gross, Crane, and Fredrickson (2012) recorded participants walking as they relived

positive, negative, or neutral emotional memories. Data from motion capture cameras revealed that gaits while reliving positive emotions (e.g., joy, contentment) were characterized by more expansive torsos, compared to reliving neutral emotions, and more extended necks, compared to reliving negative emotions (e.g., sadness). Thus, it is evident that the body carries valuable affective information, with useful meaning when expressed in group-level movements like synchrony. Furthermore, research on individual levels of emotional intelligence, social sensitivity, and nonverbal sensitivity suggests that there is a wide distribution in individual's skill to read or perceive emotions in the face and body of other people. I draw on these existing bodies of research to define and develop the emotional aspect of synchrony detection, which I term as *emotional competency.*

Hypothesized emotional competency constructs

Emotional intelligence. Emotional intelligence is one's ability to perceive and understand others' emotions, and to appropriately regulate one's own emotions in various interpersonal situations (Mayer & Salovey, 1997). Often, emotional intelligence is linked to favorable managerial outcomes, such as greater effectiveness and likeability (Day & Carroll, 2004; Cavazotte, Moreno, & Hickmann, 2012). Given that emotions are implicated in situations of synchrony, it is expected that for one to be skilled at synchrony detection, one must also be emotionally intelligent. Emotional intelligence, however, assesses one's understanding and use of emotion more so as it relates to one's own behaviors. Synchrony detection, on the other hand, is conceived as a more specified branch of emotional intelligence, wherein perception and understanding of *group*-level emotion is required and used to motivate *group*-level outcomes. I predict that emotional intelligence will have a moderate correlation (0.3) with the latent construct synchrony detection.

Emotional apertures. Another construct that I predict to be related to synchrony detection is emotional apertures. Emotional aperture departs from prior constructs of perceiving emotion at the individual level, and instead represents one's sensitivity to emotions present among a collective (Sanchez-Burks & Huy, 2009). Thus, a person with a wide emotional aperture focuses not only on a single person's emotional displays, but broadens their visual scope to accurately capture broader affective displays of an entire group. This is analogous to global or holistic processing, which accounts for a broader view, compared to local processing; and instead of shapes and elemental figures, people are perceiving emotions in human faces. Importantly for interpersonal dynamics in the workplace, certain tendencies in perceiving group-level emotions—specifically, underestimation of the prevalence of negative emotions and overestimation of positive ones—hamper transformational leadership behavior (Huy, Bartel, Rees, & Sanchez-Burks, *under review*). Given that both emotional apertures and synchrony are inherently group-based, and that emotions are implied in synchrony, I predict a strong positive correlation (0.5) between emotional apertures and the latent construct synchrony detection. Emotional apertures would not be a comprehensive measure of synchrony detection, however, since emotional apertures focuses on emotions conveyed through static facial displays, whereas synchrony usually involves emotions dynamically conveyed through various channels as well.

Social sensitivity. I am also including various measures of one's ability to accurately perceive emotions, which aims to capture the proposed importance of understanding emotional displays when detecting synchrony. One of these measures is the Reading the Mind in the Eyes Test (RMET; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001), a

widely used measure of social sensitivity, or ability to accurately perceive the emotional states of others. Past work demonstrates that autistic individuals who tend to have difficulty understanding others' minds are lower in social sensitivity, compared to non-autistics (e.g., Baron-Cohen, 1995). I predict a positive moderate correlation (0.3) between social sensitivity and synchrony detection.

Nonverbal sensitivity. In addition, I will be including an individual difference measure of accurately recognizing emotions expressed through multiple channels to establish construct validity of synchrony detection. Although the Reading the Mind in the Eyes Test is a widely used and valid assessment of social sensitivity, it is limited for my current purposes, such that the static stimuli only convey emotions through the eyes, yet in actuality, multiple channels are used in communicating emotion. Thus, I will include a measure of nonverbal sensitivity in multiple channels, and predict a positive moderate correlation (0.3) between nonverbal sensitivity and the latent construct synchrony detection.

A Social Process Model of Synchrony Detection, Synchrony, and Team Performance

Study 2 and its corresponding hypotheses test the predictive validity of synchrony detection in the domains of leadership and team process. In terms of leadership, I hypothesize that if one is skilled at detecting synchrony, then one is more likely to act to extract its team-level benefits for the team; for those who can't see synchrony, then perhaps they are more attuned to other, non-relational aspects of team functioning. I propose that being high on synchrony detection will lead to greater relational leadership emergence because of the emotional and cognitive skills associated with leadership. Relational leaders may be perceptive of when a group of individuals demonstrates coordination and smoothness in their movements and actions; in contrast, when subunits of a group are behaving in a

disjointed, multi-minded manner, such leaders may detect that the team is functioning at a suboptimal level. Second, in terms of team process, I predict that experiencing alignment of one's own behavior with the temporal rhythm of the rest of the group leads to psychological perceptions of entitativity and social feelings of cohesion, that ultimately affect group performance. Figure 2 summarizes the hypothesized paths for a multilevel model of a synchrony-driven process that leads to better team performance:

(H3) The proposed construct *synchrony detection* will significantly predict the likelihood of an individual emerging as a relational leader in their team.

(H4) Individuals who emerge as relational leaders in their teams will facilitate more team-level synchrony.

(H5) More team-level synchrony will lead to greater levels of team-level entitativity.

(H6) More team-level synchrony will lead to better team performance.

(H7) Greater levels of team-level entitativity will predict greater team cohesion.

(H8) Greater team cohesion will predict better team performance.

CHAPTER II

METHOD

This chapter provides details of the measures and procedures used to collect data for testing the list of hypotheses described previously. Studies 1 and 2 build off one another, and participants are the same, although considered at different levels of analyses, in each study.

Study 1

Participant Descriptives

Participants were 233 undergraduate students (140 male, 89 female, 4 unreported) enrolled in a Marketing course. Of 217 valid self-reports, 167 were White, 19 were East Asian, 12 were South Asian, 9 were Black, and 10 belonged to a bi-racial or other category. Participants' mean age was 20.39 years.

Each enrolled student had the option to participate in up to three hours in the laboratory to fulfill a course research requirement, wherein they received one credit of research activity toward their requirement for each hour completed. Students' alternate option for completing their research requirement was a writing assignment from their instructor. Of the total 233 students enrolled in the course, 205 (88.0%) participated in all three laboratory hours offered, 21 (9.01%) participated in two hours, four (1.72%) participated in one hour, and three (1.29%) participated in zero lab sessions. Due to

administration of different measures across multiple sessions, there are varying sample sizes reported in analyses.

Procedure

At each laboratory session, participants were seated at individual computers to complete various measures and tasks in private. All measures utilized online computer data collection procedures, except for the Group Embedded Figures Test and Profile of Nonverbal Sensitivity

which were administered as paper-and-pencil tasks.

Pattern Recognition Measures

Field-dependent cognitive style. The Group Embedded Figures Test (GEFT; Witkin, Oltman, Raskin, & Karp, 1971) measured field-dependent cognitive style. For each item of the GEFT, participants were to find a simple geometric figure within a more complex figure (example provided in Appendix A). Participants were guided through examples, and then completed two 5-minute sections, each comprised of 9 items. Lower scores represent a more field-dependent cognitive style, such that participants were unable to quickly and accurately identify the simple figures from the larger complex figure. Conversely, higher scores represent a more field-independent cognitive style, such that participants were able to identify the simple figures.

Global processing style. A global-local processing task measured global processing style (see Gable & Harmon-Jones, 2008, 2010). Participants sat 50 centimeters away from a computer monitor and saw images of large letters made up of smaller letters (e.g., an *F* made of small *H*s; Navon, 1977; see Appendix B). For each image, participants had to judge as quickly and accurately as possible if a *T* or *H* was present in each figure. Global targets were

images in which a *T* or *H* is made up of smaller letters, whereas local targets were those in which a *T* or *H* made up a larger letter. A small fixation cross was presented for a half-second between each target. I recorded reaction times (in milliseconds) for each of 64 total trials, then calculated a global bias score based on average reaction times to identifying global targets subtracted from average reaction times to identifying local targets.

Synchrony rating accuracy. A new measure called AccuSync was developed for this dissertation, to assess individuals' accuracy in rating behavioral synchrony. In this task, participants watched eight different 10-second video clips of collective groups of people or animals moving in- and out-of-synchrony, such as flocks of birds, marching bands, and rowers (example screenshots provided in Appendix C). Participants rated each video on the three aspects of behavioral synchrony (Bernieri, Reznick, & Rosenthal, 1988), including simultaneous movement, tempo similarity, and coordination and smoothness. I summed ratings to represent a total synchrony score for each video. Then, I computed the absolute difference between participants' synchrony score for each video and a group mean rating from a separate sample of 176 individuals. Finally, I calculated the average absolute difference across all eight videos to represent the participant's final AccuSync score, with smaller scores (i.e., smaller absolute differences) representing greater synchrony rating accuracy.

Emotional Competency Measures

Emotional intelligence. To measure emotional intelligence, I used the Wong and Law Emotional Intelligence Scale (WLEIS; Wong & Law, 2002), a validated and widely-used self-report measure that maps onto Mayer and Salovey's (1997) model of emotional intelligence. The WLEIS contains four items for each of the four dimensions of emotional

intelligence: *identifying emotions* (e.g., "I have a good sense of why I have certain feelings most of the time"), *understanding emotions* (e.g., "I have good understanding of the emotions of people around me"), *using emotions* (e.g., "I would always encourage myself to try my best"), and *managing emotions* (e.g., "I have good control of my own emotions"). Participants used a 7-point scale (1 = "strongly disagree", 7 = "strongly agree") to rate themselves on each item. The average across all 16 items represented individuals' emotional intelligence score (α =.89).

Emotional aperture. The test of emotional apertures (Sanchez-Burks & Huy, 2009; Sanchez-Burks, Bartel, Huys, & Rees, *under review*) presents participants with static images of groups of four people from the torso up. For each item, an image of the group is shown for two seconds, followed by another two-second presentation of the group hearing about an organizational change event. Participants judged how much positive and negative emotions appeared in the group's reactions using a 5-point scale ("none of the group", "about a quarter of the group", "about half the group", "about three quarters of the group", "all of the group") for each emotion valence type. There were 17 stimuli total, ranging in emotional expression types, gender, and ethnic composition present among the group. One's overall emotional aperture score is represented by a total percentage of the total 17 judged correctly.

Social sensitivity. Participants also completed the Reading the Mind in the Eyes Test (RMET; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001), a widely used measure of social sensitivity, or social intelligence. In this test, participants saw panoramic images of pairs of eyes, and selected one of four feelings listed they believed the eyes convey (e.g., "jealous, panicked, arrogant, hateful"; "playful, comforting, irritated, bored"; "terrified,

amused, regretful, flirtatious"). One's overall social sensitivity score is represented by the number of the total 36 was judged correctly.

Nonverbal sensitivity. I used the short-form version of the Profile of Nonverbal Sensitivity (PONS; Rosenthal, Hall, DiMatteo, Rogers, & Archer, 1979), called the miniPONS (Banziger, Scherer, Hall, & Rosenthal, 2011) to measure nonverbal sensitivity. The miniPONS consists of 64 items (compared to 220 in the full version), is highly correlated with, and demonstrates similar construct validity with the full version. In this task, participants saw a variety of video clips (lasting 2-seconds or less) of a woman communicating using various channels, including the face, body, and/or voice only (non-English, without picture). For each video clip, participants selected between a pair of descriptions that they believed best described the woman's action (e.g., "admiring nature" vs. "helping a customer"; "expressing jealous anger" vs. "criticizing someone for being late"). One's overall nonverbal sensitivity score is represented by how many items of the total 64 were judged correctly.

Personality Variables

Since synchrony detection is being conceptualized as a skill, each of the constructs within its nomological network (and corresponding measures) is measured as an ability rather than a value, trait, motive, or orientation. However, it would be useful for construct validity to also know the extent to which synchrony detection is related to individual traits found in prior research to be associated with these various abilities. To explore these relationships, the following measures were included in this study:

Analytic-holism cognitive style. Participants completed a 24-item measure of analytic-holism cognitive style (AHS; Choi, Koo, & Choi, 2007) using a 7-point agreement scale.

Example items (by subscale) include: “Everything in the universe is somehow related to each other” (causality); “It is more desirable to take the middle ground than go to extremes” (attitude toward contradictions); “Future events are predictable based on present situations” (perception of change); “The whole, rather than its parts, should be considered in order to understand a phenomenon” (locus of attention). Overall scores are an average of 24 total items (α =.74).

Social approach motive. Participants completed a 4-item measure of social approach motivation, a subscale drawn from the Social Approach and Avoidance Motives Scale (SAAMS; Elliot, Gable, & Mapes, 2006), in terms of their friendships using a 7-point scale. An example item of social approach is “In general, I am trying to move toward growth and development in my friendships”. Overall scores are an average of the four items (α = .83).

Positivity resonance. Participants completed a 12-item measure of tendency towards positivity resonance, or positive social connection, with classroom work groups (Vacharkulksemsuk & Fredrickson, *in prep*). Participants were asked to think of all their experiences in work groups for classes, and indicated how much of the time (0-100%) they generally experienced with their colleagues “flow of conversation”, and “smooth coordination”, for example. Overall scores are an average of 12 total items (α = .88).

Emotional contagion. Participants completed a 15-item measure of emotional contagion (EC; Doherty, 1997), one’s tendency to “catch” the emotions of those around them. They used a 1 (“never true of me”) to 4 (“always true of me”) scale to rate items like “I tense when overhearing an angry quarrel” and “When someone smiles warmly at me, I smile back and feel warm inside.” Overall scores are an average of 15 items (α =.83).

Perspective-taking. Participants completed the perspective-taking subscale of Davis's interpersonal reactivity index (IRI; Davis, 1980) using a 5-point agreement scale. Example items include: "I try to look at everybody's side of a disagreement before I make a decision" and "I sometimes find it difficult to see things from the 'other guy's' point of view [reverse-scored]". Overall scores are an average of 7 total items (α =.82).

Self-monitoring. Participants completed a measure of one's tendency to self-monitor in social interactions (Snyder & Gangestad, 1986) by agreeing or disagreeing to items such as: "At parties and social gatherings, I do not attempt to do or say things that others will like." and "I guess I put on a show to impress or entertain others." Overall self-monitoring scores are a total number of self-monitoring-descriptive items that participants endorsed (α =.71).

Collective self-construal. Participants also completed the relational-interdependent self-construal scale (RISC; Cross, Bacon, & Morris, 2000), a measure of the degree to which one considers his/her social groups as part of one's self-identity. They used a 7-point agreement scale to rate items such as "The groups I belong to are an important reflection of who I am" and "I usually feel a strong sense of pride when a group I belong to has an important accomplishment" (α =.90).

Big five personality traits. Finally, participants completed the Ten-item Personality Inventory (TIPI; Gosling, Rentfrow, & Swann, 2003), a measure of the Big Five personality traits. Participants used a 7-point agreement scale to indicate agreement to pairs of descriptors for trait extraversion (e.g., "extraverted, enthusiastic"), agreeableness (e.g., "sympathetic, warm"), and openness (e.g., "open to new experiences, complex").

Study 2

Participant Descriptives

Participants were the same undergraduate Marketing students from Study 1. During this particular academic semester, there were two instructors covering a total of five different course sections. As part of the standard course curriculum, students worked in teams comprised of 4-5 individuals over the course of an academic semester to complete three case studies and one final project together. Teams were formed either by random assignment, had their request to work with certain teammates fulfilled, or a combination of both.

Determination of Sample Size

Analyses of Study 2 include data collected in laboratory sessions (i.e., self-report ratings of team dynamics), in the classroom (i.e., individual students' evaluations of their teammates and team experience submitted to their course instructors), and from course instructors (i.e., performance grades). As reported above, 230 of the 233 students (98.7%) enrolled in the course participated in at least one laboratory session overall. Of those 230 students, 16 (6.96%) of them were not at the laboratory session that asked students to rate their team on various characteristics. In terms of team-level response rate at this particular laboratory session, the average within-group response was 93.12% (e.g., there was a 100% response rate for a high majority of the teams). In all, there were 13 (out of 49 total) teams with missing laboratory data from at least one team member. Analyses were re-run excluding missing-data teams and results are similar, thereby indicating no bias in the data due to non-response (Maloney, Johnson, & Zellmer-Bruhn, 2010). As such, no teams were excluded from analyses due to missing laboratory data. Note also that for individuals' team evaluation data submitted to course instructors, there was an overall individual response rate

of 94.4% (13 out of 233 missing), creating a total of 11 teams with missing data about who these particular individual non-respondents would have nominated as relational leaders. I relied on nominations provided by other team members, so teams missing these data were included in analyses.

Data exclusions, however, were made based on individuals who did not provide permission to link their team evaluations and performance grades with their laboratory data. There was an individual permission rate of 95.3% (11 out of 233 did not provide permission, across eight total teams), resulting in a final total sample size of 41 teams (10 all-male, 8 all-female, 23 mixed-gender; 13 all-White, 28 mixed-race).

Procedure

As part of the course curriculum, each team worked together over the course of an academic semester to complete three case studies and one final project. Self-reported measures of team dynamics were collected in the laboratory toward the end of the semester, during the week of their final presentation. Individual students' evaluations of their teammates and team experience were administered by and submitted to course instructors at the end of the academic semester, after groups completed all their projects together. And, finally, project, exam, and final course performance grades were provided to me (by agreement before data collection began) from course instructors. Students were reassured that their course and project grades would not be affected by participation in the laboratory sessions, and vice-versa. The two course instructors were never present at any laboratory sessions, I was never present at any classes, and all laboratory data were kept private from instructors.

Measures

Synchrony detection. Synchrony detection was assessed as a composite of the pattern recognition and emotional competency measures described in Study 1.

Relational leadership emergence. Leadership emergence was assessed simply as a binary (e.g., yes or no), based on open-ended responses to the prompt "Please provide any additional comments about this team member you think would be relevant in my [the instructor's] evaluation of team contribution" in team member evaluations. I took a liberal approach to coding the open-ended comments: any comment that included words like "leader", "initiative", or "delegation" was considered a leader nomination. As such, any number of team members, from none to all members of the team, can be nominated as an informal leader. Here, specific actions that characterized their leadership was not accounted for, but rather, simply whether the team member was perceived to be a leader or not. Example nominations included: "I think he really stepped up as a leader", "[she] showed leadership throughout the course of the project", and "[he] was our great organizer and always made sure everybody was on track."

Then, to determine if nominated leaders were perceived to be *relational,* I calculated the mean letter grade (i.e., A, B, C, D, F) team members assigned him/her on "recognized others' abilities/skills" and "sensitivity for others' needs/feelings", both based on the relationship management subscale of the Conger-Kunungo leadership scale (α =.84; Conger & Kanungo, 1994). Nominated leaders who received a mean grade of A- or higher were considered relational leaders.

Team synchrony. At the laboratory session toward end of the semester, participants were asked to report their opinions about their course work team whom they completed the

three team assignments and final project with. To measure synchrony, participants were asked to recall their most recent team meeting and rate their experience using Bernieri, Reznick, and Rosenthal's (1988) measure of behavioral synchrony, including ratings of simultaneous movement, tempo similarity, and coordination and smoothness using a 7-point semantic scale. I then summed ratings of each aspect to represent a total team synchrony score (α =.77).

Entitativity. Participants self-reported their perceived team entitativity using a four-item measure (adapted by Lakens & Stel, 2011, based on Postmes, Brooke, & Jetten, 2008). Participants used a 7-point scale (1= "not at all true of my work group" to 7 = "very true of my work group") to rate five statements; ratings were averaged to represent overall entitativity (α =.96). Sample items include: "In general, I feel like my group members and I are a unit" and "In general, I felt 'as one' with the other members of the group".

Team cohesion. Team cohesion was assessed using Seashore's (1954) measure of group cohesion. Participants used a 7-point scale (1= "not at all true of my work group" to 7 = "very true of my work group") to rate five statements about their group; ratings were averaged to represent overall team rapport (α =.93). Sample items include: "In general, the members of our group got along together very well" and "In general, our group was united in trying to reach its goal for performance".

Group performance. I measured group performance using instructors' assigned grades to each group for completing the final team project, which I deemed to be the most representative snapshot of each team's dynamic. For each student, the final project carries more weight (20%) in determining their overall course grade, compared to each case study (5%), and is completed toward the end of the semester when they are more accustomed to the

course and team structure. The final team project was to write a marketing plan for a hypothetical new start-up business, and deliver a 10-minute class presentation. Each team's project was scored out a total possible 20 points.

Positive affect. Affect was also measured as a covariate. Participants rated the mood valence (positive-negative) felt during their most recent team meeting using the Affect Grid (Russell, Weiss, & Mendelsohn, 1989), a single-item measure of affect valence (positive-negative) and arousal (high energy-low energy). For this study, only the 9-point scale measuring affect valence is considered, with higher scores indicating more pleasant affect.

CHAPTER III

RESULTS

This chapter provides details of descriptive statistics of all measured variables in Study 1 and 2, along with analytic technique and results of each tested prediction. Results indicate that the current data do indeed support some of the stated predictions about synchrony and synchrony detection in work teams.

Study 1

Descriptive Statistics

Descriptive statistics and correlations of all measured variables are reported in Table 1. All scores reported are raw, although it is worth noting that subsequent analyses included the following score transformations due to non-normal distributions: a log transformation of field-dependent cognitive style scores, and square roots of global-local processing and emotional apertures. First, in examining relationships among just the pattern recognition style measures, there is a marginally significant relationship between field-dependent cognitive style and global-local processing ($r = .12$, $p < .10$), such that the greater one demonstrates a field-dependent cognitive style, the greater their global bias too. Second, in examining the correlations among just the emotional competency measures, there is a significant correlation between social sensitivity and nonverbal sensitivity ($r = .35$, $p < .01$), and between social sensitivity and emotional apertures ($r = .23$, $p < .01$). These associations

are expected, given that they are similar in content of judging emotions in face and body. However, no significant correlations exist in the hypothesized direction between pattern recognition and emotional competency measures to comprise synchrony detection.

Confirmatory Factor Analysis of Proposed Synchrony Detection Model (H1)

Hypothesis 1 states that synchrony detection is a construct comprised of two latent factors: pattern recognition and emotional competency. Each of the following measurements was predicted to load moderately-to-highly on synchrony detection: field-dependent cognitive style, global visual processing, synchrony rating accuracy, emotional intelligence, emotional aperture, social sensitivity, and nonverbal sensitivity. To test my proposed model of synchrony detection, I ran a confirmatory factor analysis (CFA) with two factors—pattern recognition style and emotional competency—each with its three and four respective measured variables. Based on a model estimated using maximum likelihood, the specified model did not converge, confirming the observed non-significant correlations and suggesting that—as measured—these ability scores do not occupy the same shared variance space.

I followed up the CFA with an exploratory factor analysis (EFA) to further investigate whether the seven ability scores are related in some other fashion, without imposing predicted constraints or factors to it. Table 2 shows the pattern matrix of extracted factors using an oblique direct oblimin rotation. Consistent with the pattern of correlations found in Table 1, two main factors arise: 1) social sensitivity and nonverbal sensitivity, and 2) the negative association between field-dependent cognitive style and emotional aperture. Results are also similar using an orthogonal varimax rotation. Although potentially useful for future research on emotional competencies, these two resulting factors are not directly

relevant to the current investigation of synchrony detection, and will not be discussed further here.

In-depth Analysis of Measuring Synchrony Rating Accuracy (H2)

Hypothesis 2 explores the reliability of the eight-item AccuSync measure I developed for this dissertation project, predicted to be the most direct measure of synchrony detection. Based on the scores calculated—which reflect an average deviation score for each participant, regardless of whether participants over- or under-estimated the synchrony present—an inter-item reliability analysis reveals an unacceptably low alpha ($\alpha = .427$). Reliabilities are similarly poor when I create subgroups of videos based on various other characteristics (e.g., animals only, $\alpha = .150$; humans only, $\alpha = .227$; synchronous behaviors only, $\alpha = .275$; asynchronous behaviors only, $\alpha = .404$; situations of expected synchrony, $\alpha = .385$; situations of unexpected synchrony, $\alpha = .370$; large masses, $\alpha = .370$). In its current state, then, this newly-developed measure is demonstrating poor psychometric properties. Given the low reliabilities and concerning features of AccuSync, I reran the CFA and EFA of the construct synchrony detection with just scores measuring field-dependent cognitive style, global processing bias, emotional intelligence, emotional aperture, social sensitivity, and nonverbal sensitivity (i.e., without synchrony rating accuracy), and results again do not validate synchrony detection as a construct.

Study 1 Summary

Results of Study 1 indicate that the proposed battery of measures used here do not support synchrony detection as a construct. More research and construct validity studies are necessary, including refinement of AccuSync as a measure of synchrony detection that departs from similar constructs such as social and nonverbal sensitivity. In light of Study 1's

results about synchrony detection, I could not test the hypothesized pathways labeled H3 and H4 shown in Figure 2. Instead, I started with testing the hypothesized pathways stemming from team-level synchrony, as they relate to performance. Then, I returned to investigate the individual-level contributors of leadership and synchrony detection skill.

Study 2

Team Score Calculations

Hypotheses 5-8 state the following: more team-level synchrony will lead to greater levels of team-level entitativity (H5), more team-level synchrony will lead to better team performance (H6), greater levels of team-level entitativity will predict greater team cohesion (H7), and greater team cohesion will predict better team performance (H8). All constructs are conceptualized at the group level, with the idea that these constructs are emergent team properties resulting from an interactive process among the members (Kozlowski & Klein, 2000).

To test these hypotheses, I averaged responses from participants within each team in order to create team-level scores. Table 3 presents descriptive, intraclass correlations (ICCs), and r_{wg} statistics[2] of all measured team variables; Table 4 shows correlations among team-level mean-aggregate variables.

[2]Intraclass correlations (ICCs) and r_{wg} statistics assess the validity of aggregating lower-level measures as higher-order constructs. ICCs for each team variable were calculated using a random-effects ANOVA, with ICC(1) representing the proportion of variance an individual's score is explained by team membership, and ICC(2) representing the reliability of group means (Bliese, 2000). The r_{wg} is another measure of within-group agreement. Unlike the ICCs, which consider each construct *over the entire sample*, r_{wg} statistics report the mean degree of agreement for each construct *within each team* (James, Demaree, & Wolf, 1984). ICC(1) values typically range between .05 and .20 (Bliese, 2000), and $r_{wg} \geq .70$ is generally considered acceptable for aggregation (James, et al., 1984).

Synchrony's Pathway to Performance (H5-H8)

First, I tested Hypotheses 5-8 simultaneously as one path model using all team-level aggregate scores, wherein synchrony, entitativity, cohesion, and performance subsequently predict one another, and also included a direct pathway between synchrony and performance. Results of a structural equation model, using maximum likelihood estimates in MPlus software (Muthen & Muthen, 1998-2011), indicate that synchrony predicts entitativity (hypothesis 5; $b = .30$, SE = .06, $p < .01$), entitativity predicts cohesion (hypothesis 7; $b = .76$, SE = .07, $p < .01$), and cohesion predicts performance (hypothesis 8; $b = .65$, SE = .33, $p < .05$). Synchrony, however, does not significantly predict performance (hypothesis 6; $b = .20$, SE = .15, $p = .17$). Given these results, I ran a similar model, removing the direct pathway from synchrony to performance, and added each group's mean-level rating of affect at their most recent team meeting, course section, group size, and team formation type as control variables. As Figure 3 shows, all aforementioned pathways remain significant, and model fit[3] is excellent ($\chi^2 = 2.16$, $df = 3$, $p = .54$, RMSEA = .00, CFI = 1.00). The results of this group-level structural equation model are consistent with hypotheses, revealing that synchrony, entitativity, and cohesion as team-level aggregate scores significantly bear on one another toward team performance[4].

[3]Each fit index provides different information about a tested model. The χ^2 represents a comparison between the model-implied structure of the data and the actual data, and hence, a non-significant χ^2 value indicates a better model fit (Hu & Bentler, 1999; Barrett, 2007). The Root Mean Square Error of Approximation (RMSEA) is another common fit index, computed based on the χ^2 and degrees of freedom. In general, RMSEA values of .01, .05, and .08, indicate excellent, good, and mediocre fit, respectively (MacCallum, Browne, & Sugawara, 1996). The Comparative Fit Index (CFI) measures how much the specified model fits compared to no model at all. In general, CFI closer to 1.0 indicate better model fit, with values greater than .90 regarded as acceptable (Arbuckle & Wothke, 1999).

[4]A multilevel model whereby team performance is regressed on individual-level ratings of synchrony, entitativity, and cohesion, results in an opposite pattern (e.g., higher ratings of team cohesion results in lower team performance). Although these multilevel results reveal that individual-level variation in perceptions of group synchrony, entitativity, and cohesion covary with performance, the research questions of current interest are specifically about how groups covary with performance, rather than individuals. Comparing the structural

5 Alternative Models

I tested five alternative models, each described below and presented correspondingly as Figures 4a-4e. A summary of all model fit indices presented in Table 5. All models control for group affect, course section, group size, and team formation type.

First, I switched the order of entitativity and cohesion in the model, such that synchrony predicts cohesion, cohesion predicts entitativity, and entitativity ultimately predicts performance. Results would shed light on whether entitativity and cohesion are interchangeable with one another, as they relate to synchrony and team performance. As Figure 4a shows, entitativity does indeed predict team performance in the same way that cohesion does, and other preceding pathways are similar to the model presented in Figure 3 too. This suggests that it is plausible that a perceived sense of group entitativity coincides with feelings of cohesion, and relate similarly to synchrony and team performance. Fit indices show good fit overall ($\chi^2 = 4.25$, $df = 3$, $p = .24$, RMSEA = .10, CFI =.99), although the RMSEA is no longer in the acceptable range. Hence, this alternative model is not nearly as good as the original model whereby entitativity precedes cohesion.

Second, given a particularly high correlation between entitativity and cohesion ($r = .86$, $p < .01$), I tested a model that collapses the two constructs into one (i.e., entitativity-cohesion). Inter-item reliability of the nine total items is high ($\alpha = .96$). As Figure 4b shows, results are similar the previous model that consider entitativity and cohesion as separate constructs, such that synchrony significantly predicts entitativity-cohesion, in turn significantly predicting team performance. Overall model fit is again good ($\chi^2 = 1.62$, $df = 1$,

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equation model with group-level aggregates to this multilevel model with individual-level scores reveals that the group-level aggregate scores affect team performance in a qualitatively different way from their individual-level counterparts.

p = .20, RMSEA = .12, CFI =.99), although the RMSEA is no longer in the acceptable range. These analyses suggest that, within the current data, entitativity and cohesion may indeed be redundant constructs that operate similarly to influence team performance whether considered together or as distinct constructs[5]. In comparing whole models, though, entitativity separately predicting cohesion yields the best fit so far.

Then, I tested whether synchrony predicts entitativity and cohesion simultaneously, and if each would then in turn predict team performance. Results of this model shed light on whether entitativity and cohesion are team processes that are simultaneously active, or if order of variables really matters. As Figure 4c shows, synchrony significantly predicts both entitativity and cohesion as it did in the two models just presented. However, entitativity and cohesion now fail to independently predict team performance. Model fit is poor (χ^2 = 48.18, df = 2, p < .001, RMSEA = .75, CFI =.62). This suggests that perhaps a more appropriately fitting model is one whereby *either* entitativity or cohesion is active in affecting team performance.

Fourth, I tested the possibility of synchrony, entitativity, and cohesion all as simultaneous predictors of team performance. As Figure 4d shows, there is no direct impact of each of these variables on team performance, thus further highlighting the criticality of these processes working in an ordered fashion with one another to affect performance, rather than simultaneously. Model fit is poor (χ^2 = 65.16, df = 3, p < .001, RMSEA = .71, CFI =.49).

[5] Entitiavity and cohesion are empirically showing to be very similar constructs; yet the constructs have typically been studied separately in different research literatures. Although the data here suggest that it may be an appropriate time for researchers to either unite or further refine the differences between these constructs, it is a focus that lies beyond the scope of this paper. As such, the remainder of this paper will continue to refer to entitativity and cohesion as separate constructs.

Finally, I tested the possibility of cohesion and entitativity affecting performance through synchrony, rather than synchrony predicting the two. As Figure 4e shows, synchrony still shows no direct significant influence on team performance, nor does entitativity or cohesion. Notably, neither cohesion nor entitativity predict synchrony, again highlighting that a sequential order underlies the relationship of these three variables, rather than simultaneous occurrence. Model fit is again poor ($\chi^2 = 54.86$, $df = 1$, $p < .001$, RMSEA = 1.15, CFI =.55).

Results of these alternative models lend further support to the original model presented as Figure 3. Building off this team-level model, I added preceding pathways to test the remaining hypotheses.

Does Relational Leadership Predict the Team-level Model? (H4)

Hypothesis 4 states that individuals who emerge as relational leaders in their teams will facilitate more team-level synchrony. As described earlier, relational leader emergence was determined based on teammate nominations in team evaluations submitted to course instructors. Of the initial 41 leaders nominated, three did not receive the minimum grade average rating (A-) from their teammates on relational leadership characteristics, resulting in a total of 38 emergent relational leaders in 28 different teams, across the entire sample.

First, I added a direct pathway between relational leadership emergence and team synchrony to the previously tested model shown as Figure 3. As Figure 5 shows, results of a multilevel structural equation model (Muthen & Muthen, 1998-2011) again demonstrate that synchrony predicts entitativity ($b = .27$, SE = .09, $p < .01$), entitativity predicts cohesion ($b = .65$, SE = .06, $p < .01$), and cohesion predicts performance ($b = .77$, SE = .29, $p < .05$). Although overall model fit is excellent ($\chi^2 = 3.58$, $df = 6$, $p = .73$, RMSEA = .00, CFI =

1.00), individuals who emerge as relational leaders show no impact on their team's amount of synchrony (b = 11.93, SE = 35.52, p = .74). I also tested if *groups* characterized by relational leaders show greater amounts of team synchrony by entering a team-level sum score of relational leaders as a predictor of synchrony, and the result is similarly insignificant (b = .15, SE = .31, p = .63).

Post-hoc Exploratory Analyses

Despite null findings of relational leadership emergence predicting synchrony, the question of what predicts relational leadership still remains. Hypothesis 3 states that the proposed construct of synchrony detection will significantly predict the likelihood of an individual emerging as a relational leader in their team. However, there is no evidence for the proposed construct of synchrony detection in Study 1, thereby offering no support to H3. However, data from Study 1 can shed light on other socio-emotional individual differences that can be critical for leadership emergence. Using individual-level data collected for Study1, I tested the influence of each ability and personality variable on relational leadership emergence. In addition, since the AccuSync measure was intended to be the most direct measure of synchrony detection, I tested AccuSync scores for each video, and a composite sum score of all variables significantly correlated with the AccuSync measure (i.e., holistic perceptual style, social approach motive, emotional contagion, agreeableness; *see Table 1*). I used PROC GLIMMIX in SAS for this set of multilevel analyses because relational leadership is a binary outcome and to control for team clustering (Raudenbush & Bryk, 2002). All results are presented in Table 6.

First, in examining relationships among just the pattern recognition style measures, none significantly predict relational leadership emergence. Second, in examining the

emotional competency measures, nonverbal sensitivity (measured by miniPONS) significantly predicts relational leadership emergence (b = .14, SE = .06, p = .02). The odds ratio of 1.15 indicates that with each unit increase on the miniPONS, the odds of a person emerging as a relational leader increases by a factor of 1.15, a finding consistent with other existing evidence (e.g., Ronay & Carney, 2013). Of the personality self-report variables assessed from each individual, one's collective self-construal significantly predicts relational leadership (b = .49, SE = .21, p = .02). The odds ratio is 1.63, indicating that with each unit increase on the CSC scale the odds of a person emerging as a relational leaders increase by a factor of 1.63, which is also consistent with past research (Hackman, Ellis, Johnson, & Staley, 1999). None of the AccuSync videos individually predict relational leadership emergence, nor the combination of its significant correlates.

I then tested for other team-level predictors of team-level synchrony, given that results did not support the hypothesis that relational leadership would predict synchrony. Table 7 features promising correlations between team-level aggregate scores of all study measures with team synchrony. First, despite its low scale reliability, team-level aggregate scores of overall AccuSync and team synchrony are significantly related (r = .33, p = .04). This suggests that people who deviate more from the pilot population mean in seeing synchrony are perhaps more prone to experiencing synchrony as a team. Moreover, since they are *deviating* more from the mean (in either direction), then perhaps being "accurate" renders a relationship to synchrony in an opposite way from what I proposed: instead, non-normal perceptions of synchrony in the AccuSync videos are telling of experiencing synchrony with others. Interestingly, a similar positive association is observed between team synchrony and AccuSync scores for the "dancers in club" video (r = .37, p = .02), wherein

the level of synchrony is less obvious or expected, compared to a marching band performance, for example. Again, it is plausible that having more deviant perceptions of synchrony is telling of the degree to which teams then achieve experiencing synchrony together. Finally, there is a significant positive association between team synchrony and team levels of emotional contagion ($r = .35$, $p = .03$), thus revealing the intriguing idea that greater susceptibility to one another's emotions in a team underlies experiencing more synchrony together.

Study 2 Summary

Study 2 provides a number of useful results. First, results illuminate an indirect relationship between a team's recalled experience of synchrony with team performance, specifically through perceptions of entitativity and feelings of cohesion. Consistent with hypotheses, the featured model is notably composed of solely team-level variables, thereby providing an understanding for this process as an emergent one that is unique from processes guided by individual-level contributions and processes. Furthermore, with the testing of alternative models, there is evidence that variable order is important in this process toward greater team performance. Second, Study 2 results suggest that relational leadership does not have a significant role in unlocking team synchrony, which fails to support one of my proposed hypotheses (H4). It is possible that there are underlying mechanisms that need to be uncovered to better understand the link between leadership and synchrony. Finally, despite the insignificant link between relational leadership emergence and synchrony, there is evidence for one personality variable (collective self-construal) and one emotional competency skill (nonverbal sensitivity) that independently predict relational leadership emergence, both findings that are consistent with past research.

CHAPTER IV

GENERAL DISCUSSION

Fostering social cohesion among teams is known to predict greater team performance; furthermore, past research shows that physically moving in-time—or synchronously—with others leads to greater feelings of social connection. This multilevel investigation focused on synchrony as a key factor in facilitating team performance. I examined the role of one's ability to "see" synchrony, in addition to a team's recalled experience of synchrony, in predicting team performance of students working together over the course of an academic semester.

First, Study 1 showed that my proposed construct of synchrony detection—one's ability to detect the presence or absence of synchrony as a function of emotional and cognitive processing—does not appear to be supported by the empirical fusion of cognitive pattern recognition style and emotional competency skill measures included in the present work. The proposed hypotheses about synchrony detection was a first among existing research to empirically examine an individual difference in being able to "see" synchrony, particularly as a potentially important and useful skill for relational leaders. The explicit breakdown of synchrony into hypothesized cognitive and emotional components was also a novel approach, paving a pathway into unchartered territory that held promise to illuminate what synchrony "looks like" as a nonverbal group display.

I also developed AccuSync, a measure designed to assess synchrony detection. Despite results of Study 1 pointing toward weak validity and reliability of the measure, it provides guidance on appropriate modifications for a more refined measure and definition of synchrony detection in future research. First, it is worth noting that AccuSync in this study consisted of just eight video items that, although were all characterized by some degree of synchrony, also varied on several other dimensions (e.g., animals only, humans only, situations of expected versus unexpected synchrony). This likely contributed to the low alpha reliability, and future research will need to consider a much greater number of video items for the AccuSync measure. To illustrate, the Spearman-Brown prophecy formula (DeVellis, 2011) predicts an improved scale reliability of $\alpha = .69$ if the measure includes a total 24 items, or $\alpha = .75$ with 32 items. Scale reliability would continue to improve, of course, with the continued addition of video items.

Nevertheless, AccuSync in its current form demonstrates promise as it relates to other measures in the current study. For example, there are several significant negative correlations between AccuSync and other personality measures shown in the bottom half of Table 1 that can help inform what AccuSync is assessing. The significantly correlated variables—holistic perceptual style, social approach motive, emotional contagion, and agreeableness—appear to revolve around a loose theme of socio-emotional absorption, or assimilation with other people. Given that smaller AccuSync scores (i.e., smaller absolute differences) represent greater synchrony rating accuracy, then according to these correlations, the more accurate one is at detecting synchrony, the greater one is on this constellation of socially-assimilative traits. It would be also be worth considering in

future studies simply the extent to which one's rating of synchrony in the various videos is associated with the other pattern recognition, emotional competency, and personality variables measured. One's synchrony rating accuracy score in the current study was an average of deviations from a pilot sample's rating of synchrony for the various videos. However, there may be value in examining participants' raw scores of synchrony instead of their correspondence to the pilot sample. Particularly for videos like "dancers in club", wherein the level of synchrony is less obvious or expected (compared to a marching band performance or crew team rowers, for instance), attributing more synchrony may be indicative of the degree to which one is watching the video with a broader lens that captures holistic movement or group emotion. In fact, a cursory examination of correlations shows that participants who rated the "dancers in club" video as more synchronous (based on raw, not "accuracy", scores) are higher on emotional intelligence ($r = .13$, $p = .05$). Similarly, high synchrony ratings of the hip-hop dance troupe performance are significantly associated with emotional apertures ($r = .17$, $p = .01$) and social sensitivity ($r = .27$, $p < .01$), and marginally significant with emotional intelligence ($r = .12$, $p = .09$). These correlations indeed show some relationship between the degrees to which one sees synchrony and level of emotional competency, and in light of them, future research should continue to reexamine participants' raw scores of synchrony ratings as they relate to other measures in this study.

At a theoretical level, it will be important to consider the current results in tandem with recent research on bodily expressions of emotion (see Van den Stock, et al, 2007; Gross, et al, 2012; Shikanai, Sawada, & Ishii, 2013). All models in Study 2 controlled for group affect, although it was indeed highly associated with and a significant predictor of

synchrony, thereby indicating that affect is active in the synchrony-teamwork process. And, despite Study 1's results not supporting my proposal for synchrony detection as a novel construct, it is evident that affect and synchronous movements are highly intertwined. It is evident from recent research that the whole body carries valuable affective information, with useful meaning when expressed in group-level movements like synchrony. For example, building directly off of Gross et al's (2012) research on emotional gaits, seeing a group's synchronous positive gait from afar may indicate a socially safe situation, whereas seeing a synchronous negative gait may indicate an oncoming attack. Moreover, in observing synchrony, one likely has to trade in access to perceiving smaller units of the body, such as facial features, in order to see the whole group's movements. This requires a fundamental shift in broadening one's visual aperture, which draws on cognitive research on visual processing styles and pattern recognition. Taken together—and only together—the bodies of research on emotional expressions and cognitive processing styles suggest a novel way of understanding synchrony from an observer's perspective. Pinpointing exactly what synchrony detection is actually comprised of in terms of individual's abilities may be a matter of discovering a more appropriate set of related constructs and measures.

Second, Study 2 supported my predictions that group-level synchrony relates to how well a team performs via socio-relational mechanisms. Specifically, greater recollections of team synchrony led to greater perceptions of entitativity, which led to greater reports of cohesion, in turn predicting better team performance, as measured by instructor-assigned project grades. Past synchrony research has focused on a variety of dyadic relationships, including caretaker-infants, teacher-student, and therapist-client, to

name a few. No empirical work has examined synchrony in groups, although it is worth noting existing sociological research that discusses the interplay and macro-level functions of collective movement and emotions (see McNeill, 1995; Collins, 2005; Ehrenreich, 2006). The current dissertation research stands as a first foray into explicitly examining synchrony in the context of work teams. For synchrony researchers, this work directly extends previous findings demonstrating the benefits of group-level experienced synchrony. For organizational researchers, this work uncovers an important factor that contributes to enhanced team outputs. And, important for both researchers of synchrony and team outcomes, the current research highlights two process variables—entitativity and cohesion—that function within the synchrony-performance link.

Data from Study 2 are also consistent with past research on the strong association between perceptions of synchrony, entitativity, and cohesion in stimuli (see Lakens & Stel, 2011). The current study advances Lakens and Stel's research by demonstrating a meaningful order of process among experiencing each of the three variables, which confirms my hypotheses that experiencing physical synchrony shifts people's psychological perceptions of their team, which then influences feelings of cohesion. The presented alternative models shed light on the possibility of other un-hypothesized orders of process as well. Specifically, when entitativity and cohesion are collapsed into a single construct, labeled entitativity-cohesion, it is significantly predicted by synchrony and significantly predicts performance. Yet when entitativity and cohesion are kept as separate constructs and tested as simultaneously active process variables, synchrony significantly leads to greater reports of each of them, but entitativity and synchrony do not each predict greater performance. Across all presented models, it is clear that

experiencing synchrony connects to performance through some combination of entitativity and cohesion. Whether a precise order of causal links exists between entitativity and cohesion, or if they are indeed redundant of one another as constructs are both empirical questions that call for more causal investigations in the future.

In terms of analytical alternatives, the current study calls into question appropriate treatment of variables measured at the individual level to represent team scores. Recall that synchrony, entitativity, and cohesion were all conceptualized in this study as emergent phenomena, with their origins resting at the group level rather than the individual level. That is, each construct is conceptualized as a complex combination of the lower-level units, and hence, qualitatively different than if considered at the individual level. My choice to use mean-aggregate synchrony, entitativity, and cohesion scores in this dissertation was theoretically-driven. The reported within-group reliability and agreement statistics of participants' self-reported ratings of their team synchrony moderately support the claim that synchrony is an emergent group-level construct. Past studies have generally met synchrony's definition as a group-level phenomenon by manipulating it at the group level, or establishing agreement among trained coders. Due to constraints of data collection and access to student team meetings, however, I administered Bernieri et al's (1988) rating scale of synchrony to individuals and aggregated scores within teams. As such, the measure of synchrony employed here relied on participants' recall of experiencing synchrony, which limits the extent to which claims can be made here about synchronous group-level behavior itself. Future research should consider measuring synchrony through different means that would lend more strength to claims about synchrony as a group-level behavior. By using trained coders, for example,

the ICCs and r_{wg} statistics would also likely improve, as trained coders would more reliably assess synchrony as a construct compared to untrained participants reading the definition about an unfamiliar construct.

Similarly, the modest agreement and reliability of entitativity and cohesion in this study could reflect a measurement issue of recall to one's team meeting. It is also possible that the agreement statistics reflect individuals' varying levels of expectation or desire for entitativity and cohesion in their course work teams. That is, some students simply do not prioritize or care to establish positive relationships with their classmates. Group affect was included in analyses as a control variable, and demonstrated the lowest ICC(1) and r_{wg}. Similar to my measures of synchrony, entitativity, and cohesion, participants may have inaccurately recalled or perceived their feelings during their most team meeting and future studies considering affect as a central variable will need to utilize more in-the-moment assessments of group affect.

There are also other models for examining emergent phenomenon based on individual-level scores, including using a group's minimum or maximum score or a dispersion score to represent the group (see Kozlowski & Klein, 2000). Whether utilizing these other summary scores yields a meaningful difference in understanding how these constructs operate with one another in a team process remains an open, empirical question. For example, is a team's performance affected by cohesion in the same way as found in this study when the team's cohesion is represented by the highest reported perception of cohesion? By considering different types of aggregate synchrony, entitativity, and cohesion scores in future research, we can expand our knowledge of how they each singly and in combination influences group processes.

Practical Application of the Current Findings

The findings reported here linking synchrony, entitativity, cohesion, and performance hold value for anyone looking to create effective teams. Data for this study were collected from real student work teams enrolled in a course together. Practically speaking, educators and instructors looking to enhance work group experiences and output can apply the findings of this study directly to their classroom and course design. For example, by facilitating synchrony-centric activities throughout the semester term, results of this study suggest that students will develop greater entitativity and cohesion as a team, which can then facilitate their performance.

Synchronous activities in one's classroom can range from small "doses" of get-to-know-you activities that necessitate clapping or tapping with teammates, to larger-scale integrations with physical or dance education programs (Hanna, 2008) already in place. Imagining an alternative situation, whereby students are simply arranged into groups and assigned graded projects, feels lacking in likelihood or even possibility of synchrony emerging.

The current findings can also apply to organizations and companies reliant on the productivity of teams. Companies are seemingly already well-aware of the benefits greater cohesion holds for the workplace, and thus an entire industry has grown rallied around offering various "teambuilders", such as ropes courses and wilderness retreats, promising to build trust and closeness among the people who participate in them (for examples, see: http://www.buildingteams.com/ or http://www.corpgames.com/). With the novel finding reported here that synchrony is a critical key in facilitating cohesion, organizations can more intelligently select activities that are likely to facilitate synchrony

among the group if their aim is to foster group entitativity and cohesion, like participating in a charity run together or attending a group dance class. Whereas previous suggested activities/interventions are typically recommended based on individual-level data, the use of group-level data on the effectiveness of synchrony expands perspectives on considering which activities are most appropriate for one's teams and organization.

Future Directions

Study limitations aside, data and results from the current investigation generates a multitude of questions and future research direction, a few of which I discuss here.

Boundary Conditions of Synchrony

Although it may be tempting to generalize the significant effects found here between team synchrony, team cohesion, and team performance, caution needs to be taken. Team cohesion can be blinding, as cohesive teams are notorious for reaching premature consensus (Van Knippenberg & Schippers, 2007) or socializing instead of focusing on task-related goals (Hardy, Eys, & Carron, 2005). With synchrony in the picture, Kirschner and Tomasello (2010) point out that having a shared goal with one's interaction partner proves important, such that it leads to more synchrony. Consistent with this idea, in a study of strangers meeting for the first time, dyads who showed higher levels of synchrony while fulfilling a work-related goal performed better on a team performance task afterward, compared to dyads who demonstrated synchrony while fulfilling a social goal (Vacharkulksemsuk, Coffey, & Fredrickson, *in prep*). The current finding that synchrony was effective for teams studied in this dissertation may be partly explained by the fact that students assessed synchrony as it arose during a team meeting prior to their project due dates, at which point there was a shared goal to complete their

project (presumably with desires for the highest grade possible). Had synchrony been assessed outside the context of their project meetings, then it is plausible that greater cohesion resulting from their more social-focused interactions would actually hinder greater team performance. Importantly for cohesion-focused teambuilders, such as the ropes course mentioned earlier, the degree to which they are effective in harnessing teamwork and performance in the office may depend on an explicit statement of goals (social versus work) during facilitation. Such conclusions are speculative, and thus, future research delving into better understanding the social processes underlying performance—particularly as a function of synchrony—should consider goal-related boundary conditions, including work goals versus social goals.

Leadership versus Cooperation

Theoretically, it also is worth considering the meaning of having no leaders in self-managed teams. One-third of the teams studied here identified no leader: the majority of these simply did not provide any justification in their open-ended evaluation responses so drawing conclusions as to why no leaders were nominated is limited. However, there were some teams who did not nominate any leaders, but supplied comments such as "There was an equal contribution of work from each team member," and "We generally contributed equally, but in different ways." So for the teams that did not provide any justification, could it have been the case that each team member was doing one's fair share of work, thereby employing a different, but nevertheless effective, route toward accomplishing their goals based on cooperation rather than leadership? That is, teams might have succeeded by means of group-level synchrony emerging, rather than an individual leader emerging. Recall that not only did leadership emergence

measured as an individual-level nomination show a null effect on team synchrony arising, but similarly insignificant results showed when leadership emergence was measured as a summed characteristic of the team. Inherent within the definition of being in synchrony is "oneness", and perhaps the mere presence of one person in charge fundamentally introduced heterogeneity into the dynamics of the group. The role of a leader, typically implying a degree of power as well, appears to disrupt a group's process of arriving "on the same page" with one another.

Extra analyses reported also examined if team-aggregate synchrony detection predicts team synchrony. As based on the current AccuSync score calculations, teams with non-normal perceptions of synchrony were strongly associated with greater team synchrony. On the other hand, teams who were more normatively accurate at detecting synchrony were lower on team synchrony. Thus, in addition to the speculation that leadership emergence disrupts the process of achieving team synchrony, perhaps synchrony detection does so too: *seeing* synchrony hinders *being* in synchrony. This tension illustrates a case whereby executions of forebrain functioning—conscious awareness of synchrony—hampers the likelihood of automatic hindbrain processes—as naturally occurring synchrony is conceived to be—from arising. One possible research direction for team processes is to can glean insights from research on social colony insects, such as ants and bees, which appear to be synchronous in their own ways. The behavior of such insects maps directly on to the finding that leadership and synchrony detection appear to be hindering synchrony: no one ant or bee is actually "in charge" to provide directions or work commands, yet these insects are able to accomplish vast feats for survival (Gordon, 2010; see also Haidt, Seder, & Kesebir, 2008). These processes are

guided by basic biological and physiological systems the insects have evolved to be equipped with. Humans, too, are equipped with such systems—housing automatic social processes like synchrony—but when conscious processes like leadership or detecting synchrony become active, it appears that the system functionalities conflict. In contrast to my originally proposed model, then, perhaps leadership and synchrony detection don't even belong in a model examining synchrony. Of course, more research is necessary to confirm this speculation.

Synchrony and Team Diversity

Finally, a look into the demographic composition of the teams under study here opens up another implicative line of questions. In an increasingly diverse workforce, dependent on teams nonetheless, how does gender and ethnic composition of teams affect performance in light of what we know about synchrony? For the first time in United States history, racial minorities comprise the majority of births (Toossi, 2012). Although questions of team diversity have been addressed in past research (for a review, see Chatman, 2010) as they relate to team performance, how they relate to synchrony, entitativity, and cohesion remain empirical questions. Moreover, psychological research demonstrates that females' work performance is negatively influenced when she is the only female in the group, particularly under conditions of stereotype threat (Sekaquaptewa & Thompson, 2002, 2003). To what extent is this true for females assigned to a male-dominated team, particularly in a business context wherein females are still considered a minority? In such a team, females may feel psychologically unsafe about speaking up to express a dissenting opinion or distinctive idea. Similar to the points raised earlier about the temptation to generalize synchrony's effects to all

relationship types, synchrony may not be an all-encompassing solution—or may require a more indirect process—to fostering positive social relationships among diverse compositions. But perhaps synchrony *is* able to transcend the types of surface-level diversity discussed here, like race and gender, in which case synchrony can be wisely implemented to extract the multiple benefits diversity has to offer (in education, Gurin, Nagda, & Lopez, 2003; in work teams, Phillips, Liljenquist, & Neale, 2009). It is simply not, to date, fully understood the extent to which synchrony operates in a context of demographic diversity. Answers to these questions have managerial implications for handling team composition issues as the U.S. labor force progresses through an ever-changing demographic landscape.

Closing

In sum these studies tie together several threads of research to further understand synchrony as an integral aspect of effective team performance. By examining real student work teams over the course of a semester, this study provides rich insight into the value of experiencing synchrony within a team, as well as the theoretical implications for detecting it. Notably, it is evident that moving together "as one" unlocks other emergent social processes within a team that lead to greater performance, a finding that highlights the idea that workplace relationships rely on socio-relational processes just as does any other relationship in daily life. Moreover, it appears that introducing conscious processes of leadership and seeing synchrony hinders the nonconscious occurrence of being in synchrony with one's teammates. For researchers and practitioners alike, this study holds innovative contributions for understanding nonverbal behaviors and workplace

relationships, particularly as they relate to building effective, yet positive and social, teams.

Table 1

Descriptives and Correlations for Measured Variables in Study

	Measure	n	*M*	*SD*	1	2	3	4	5	6	7
Pattern Recognition Style											
1. Field-dependent cognitive style	GEFT	218	5.28	3.87	--						
2. Global processing bias	Global-local	217	83.06	100.95	.12†	--					
3. Synchrony rating accuracy	AccuSync	222	3.24	1.01	.01	-.10	--				
Emotional Competency											
4. Emotional intelligence	WLEIS	218	5.50	.69	-.04	.04	-.13†	--			
5. Emotional aperture	EA	224	76.63	15.33	-.34**	-.13†	.00	.08	--		
6. Social sensitivity	RMET	224	26.91	4.10	-.08	.03	.02	.06	.23**	--	
7. Nonverbal sensitivity	MiniPONS	217	50.02	3.56	.08	.03	-.07	.05	.07	.35**	--
Personality Variables											
8. Holistic perceptual style	Holism Scale	224	4.87	.51	.01	.15*	-.16*	.09	-.07	.13	-.03
9. Social approach motive	SAAMS	224	5.88	.86	-.03	.11	-.20**	.23**	.02	.16*	.09
10. Positivity resonance	PR	224	67.17	12.73	.12	.13†	-.04	.41**	-.06	.03	-.02
11. Emotional contagion	EC	224	2.84	.40	-.08	.04	-.17*	.22**	.04	-.01	.09
12. Perspective-taking	IRI	217	3.57	.69	.00	.07	-.07	.30**	-.02	.11	-.02
13. Self-monitoring	SMS	224	10.90	3.45	-.13†	-.13*	.01	.05	-.01	.00	.01
14. Collective self-construal	RISC	224	5.05	.96	-.04	.21**	-.13†	.25**	.00	.08	.14*
15. Openness	TIPI	224	4.92	1.20	.01	.04	-.02	.31**	-.07	.02	.00
16. Extraversion	TIPI	224	4.65	1.11	.01	.00	-.03	.33**	.04	.07	.03
17. Agreeableness	TIPI	224	5.18	.97	.05	-.10	-.14*	.33**	.15*	.22**	.08

8	9	10	11	12	13	14	15	16	17
--									
.32**	--								
.21**	.27**	--							
.29**	.40**	.22**	--						
.26**	.23**	.26**	.09	--					
.06	.04	.11	.04	.07	--				
.23**	.31**	.30**	.30**	.09	.17*	--			
.23**	.29**	.36**	.23**	.34**	.28**	.12	--		
.02	.28**	.35**	.16*	.10	.36**	.14*	.39**	--	
.17*	.40**	.26**	.27**	.35**	.00	.13	.14*	.22**	--

Note. GEFT = Group Embedded Figures Test; WLEIS = Wong and Law emotional intelligence scale; EA = emotional apertures; RMET = Reading the Mind in the Eyes Test; miniPONS = short-form version of the Profile of Nonverbal Sensitivity; SAAMS = social approach and avoidance motives scale; PR = positivity resonance scale; EC = emotional contagion scale; IRI = empathy subscale of the interpersonal reactivity index; SMS = self-monitoring scale; RISC = relational-interdependent self-construal; TIPI = ten-item personality inventory. ** $p<.01$. *$p<.05$. † $p<.10$.

Table 2

Pattern Matrix of Extracted Factors using a Direct Oblimin Rotation

	Factor	
	1	2
1. Field-dependent cognitive style	.03	.62
2. Global processing bias	.05	.13
3. Synchrony rating accuracy	-.18	.08
4. Emotional Intelligence	.08	-.06
5. Emotional aperture	.16	-.48
6. Social sensitivity	.73	-.10
7. Nonverbal Sensitivity	.51	.10

Note. The following eigenvalues in correspondence to each of the listed factors: 1.25, 1.10.

Table 3

Descriptives for Measured Variables in Study 2

	Individual-level			Team-level					
	n	M	SD	n	M	SD	ICC(1)	ICC(2)	r_{wg}
Synchrony	188	13.77	3.21	41	13.78	1.7	.08	.29	.74
Entitativity	188	4.77	1.53	41	4.76	.85	.11	.36	.52
Cohesion	188	5.39	1.34	41	5.39	.75	.13	.41	.63
Affect	187	1.62	1.93	41	1.63	.98	.04	.18	.49
Performance	-	-	-	41	18.24	1.41	-	-	-

Note. ICC(2) calculations based on average group size n = 4.82.

Table 4

Correlations among Measured Variables in Study 2

	1	2	3	4	5
1. Synchrony	-				
2. Entitativity	.59**	-			
3. Cohesion	.66**	.86**	-		
4. Affect	.61**	.39*	.64**	-	
5. Performance	.47**	.39*	.50**	.46**	-

Note. ** $p<.01$. *$p<.05$.

Table 5

Summary of Fit Indices for Study 2 Path Models

	Chi-square statistics				
Figure	χ^2	df	*p*	RMSEA	CFI
3	2.16	3	0.54	0.00	1.00
4a	4.25	3	0.24	0.10	0.99
4b	1.62	1	0.20	0.12	0.99
4c	48.18	2	< .001	0.75	0.62
4d	65.16	3	< .001	0.71	0.49
4e	54.86	1	< .001	1.15	0.55

Table 6

Exploring Alternative Predictors of Relational Leadership Emergence

	b	SE	t	*p*	odds ratio
Pattern Recognition Style					
Field-dependent cognitive style	-0.58	0.57	-1.02	0.31	-
Global processing bias	0.02	0.06	0.27	0.79	-
Synchrony rating accuracy	-0.09	0.18	-0.52	0.61	-
Emotional Competency					
Emotional intelligence	0.06	0.29	0.19	0.85	-
Emotional aperture	0.00	0.00	0.51	0.61	-
Social sensitivity	0.05	0.05	1.09	0.28	-
Nonverbal sensitivity	0.14	0.06	2.44	0.02	1.15
Personality Variables					
Holistic perceptual style	0.21	0.36	0.59	0.56	-
Social approach motive	0.05	0.21	0.22	0.82	-
Positivity resonance	0.01	0.02	0.75	0.45	-
Emotional contagion	0.46	0.44	1.03	0.30	-
Perspective-taking	0.35	0.28	1.23	0.22	-
Self-monitoring	0.03	0.05	0.53	0.60	-
Collective self-construal	0.49	0.21	2.27	0.02	1.63
Openness	-0.01	0.19	-0.07	0.95	-
Extraversion	-0.13	0.16	-0.81	0.42	-
Agreeableness	0.04	0.17	0.24	0.81	-
AccuSync Videos					
School of fish (in-sync)	-0.06	0.09	-0.65	0.52	-
Marching band (in-sync)	-0.08	0.12	-0.64	0.53	-
Hip-hop dance troupe (in-sync)	0.14	0.10	1.42	0.16	-
Flock of birds (in-sync)	-0.11	0.14	-0.79	0.43	-
Rowers (out-of-sync)	-0.03	0.07	-0.41	0.68	-
Marching band (out-of-sync)	0.01	0.08	0.15	0.88	-
Dancers in club (in-sync)	0.09	0.06	1.43	0.15	-
School of fish (out-of-sync)	0.02	0.06	0.31	0.76	-
Significant Correlates of Synchrony Rating Accuracy (AccuSync score)					
AHS + SAAMS + EC + agreeableness	0.05	0.09	0.57	0.57	-

Table 7

Exploring Team-level Aggregate Scores Associated with Team Synchrony

	r
Pattern Recognition Style	
Field-dependent cognitive style	.22
Global processing bias	.09
Synchrony rating accuracy	.33*
Emotional Competency	
Emotional intelligence	.01
Emotional aperture	.13
Social sensitivity	-.16
Nonverbal sensitivity	.28
Personality Variables	
Holistic perceptual style	.03
Social approach motive	.24
Positivity resonance	.20
Emotional contagion	.35*
Perspective-taking	-.12
Self-monitoring	.03
Collective self-construal	.08
Openness	.13
Extraversion	.12
Agreeableness	-.22
AccuSync Videos	
School of fish (in-sync)	.02
Marching band (in-sync)	-.07
Hip-hop dance troupe (in-sync)	.06
Flock of birds (in-sync)	-.01
Rowers (out-of-sync)	.18
Marching band (out-of-sync)	.15
Dancers in club (in-sync)	.37*
School of fish (out-of-sync)	.18
Significant Correlates of Synchrony Rating Accuracy (AccuSync score)	
AHS + SAAMS + EC + agreeableness	.07

Note. All individual-level scores aggregated to team-level mean scores, n = 41 teams.
*$p < .05$.

Figure 1

Proposed Model of Synchrony Detection

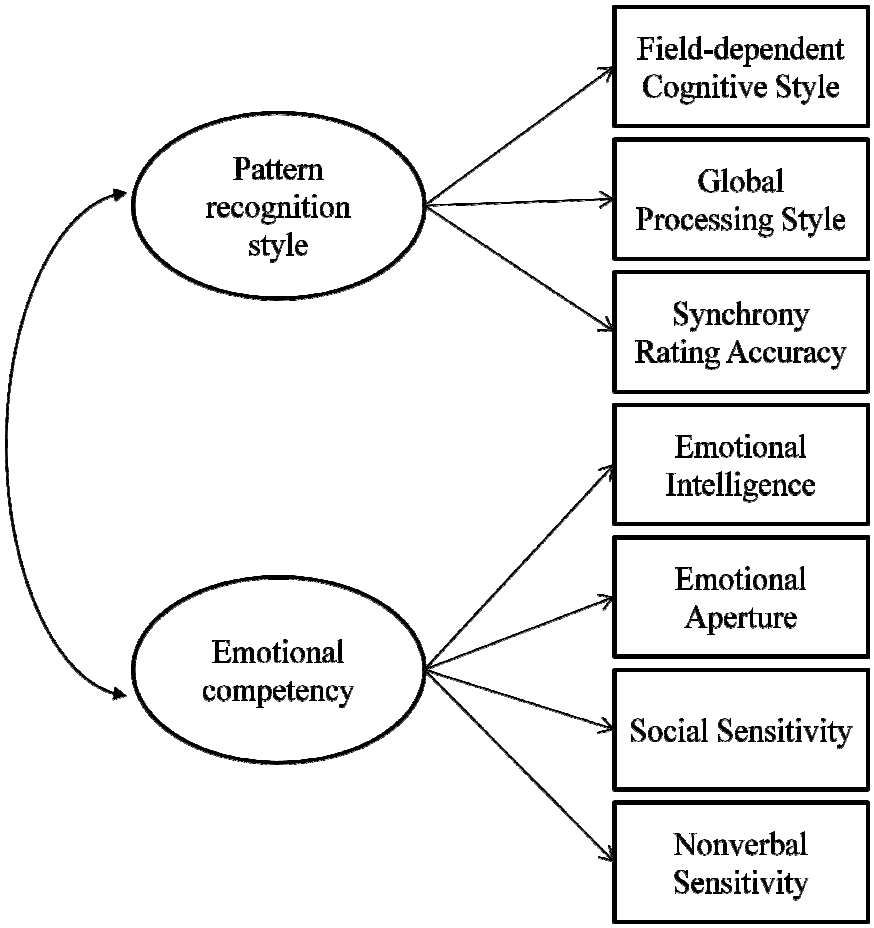


Figure 2

Hypothesized Pathways toward better Team Performance

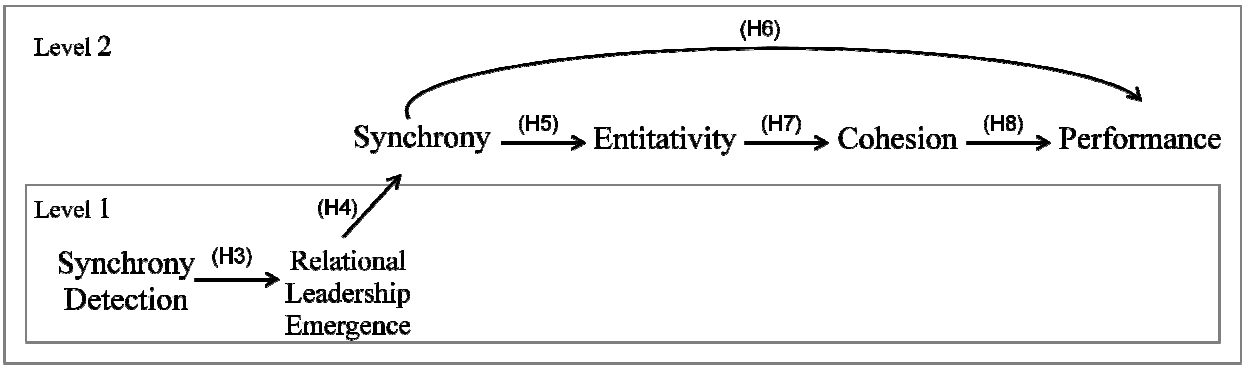
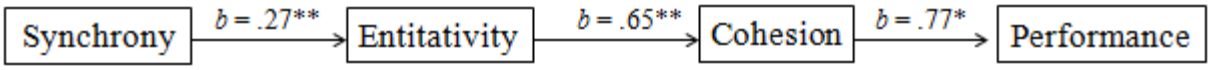


Figure 3

Synchrony's Pathway to Team Performance

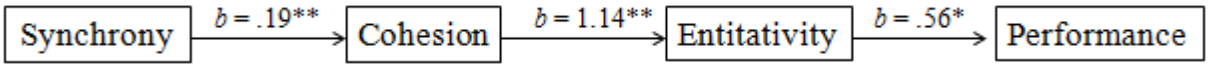


Note. Model controls for emotion, course section, group size, and team formation type. ** $p<.01$. * $p<.05$. $^{n.s.}$ non-significant. Model fit indices presented in Table 5.

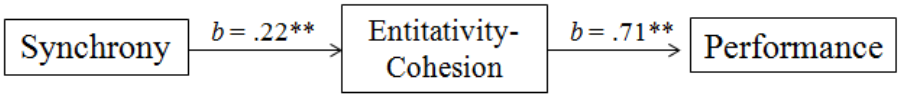
Figure 4

Alternative Models of Synchrony's Pathway to Performance

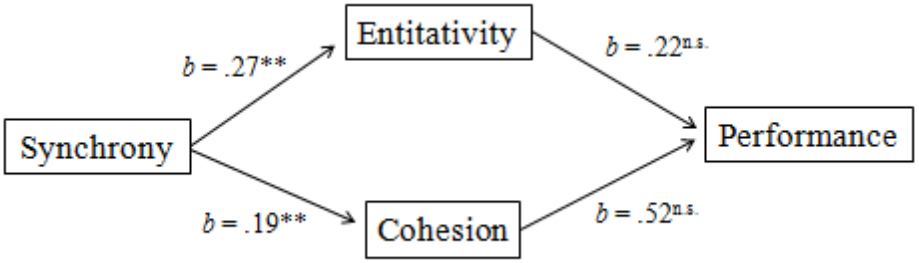
a)



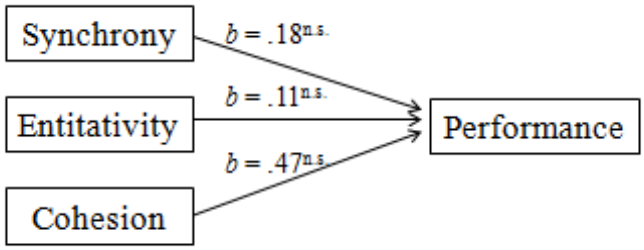
b)



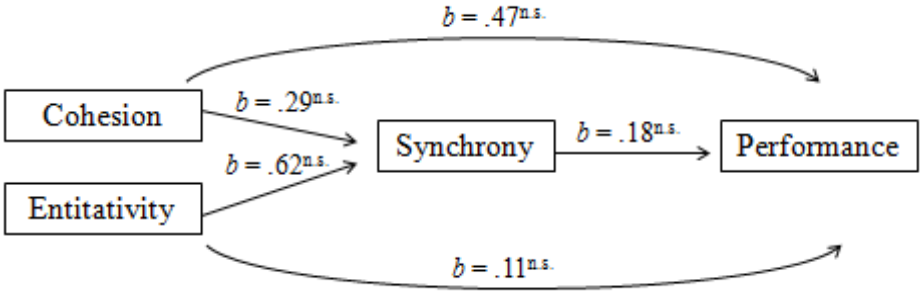
c)



d)



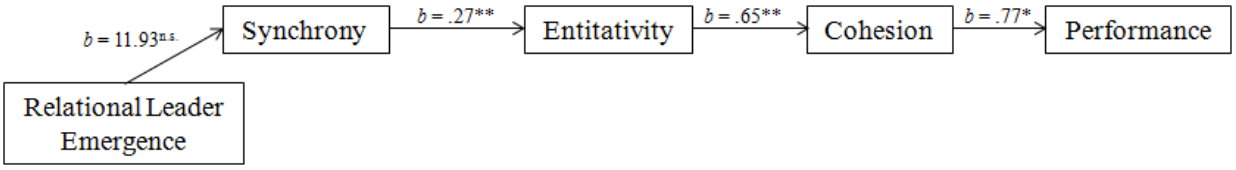
e)



Note. All models control for emotion, course section, group size, and team formation type. ** $p<.01$. *$p<.05$. n.s. non-significant. Summary of all model fit indices presented in Table 5.

Figure 5

Relational Leadership Emergence does not lead to Team Synchrony



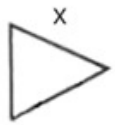
Note. Model controls for emotion, course section, group size, and team formation type. ** $p<.01$. * $p<.05$. $^{n.s.}$ non-significant.

APPENDICES

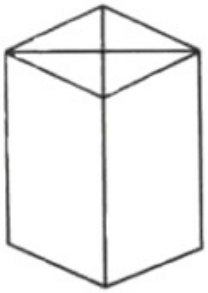
APPENDIX A

Example item from the Group Embedded Figures Test

Here is a simple form which we have labeled "X":

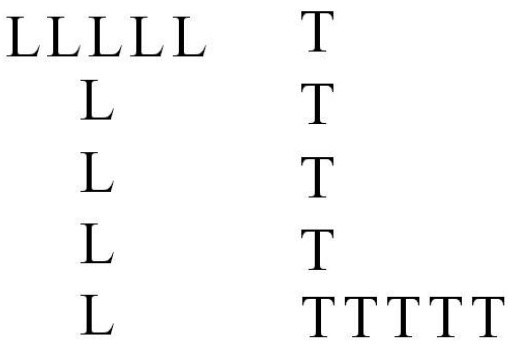


This simple form, named "X", is hidden within the more complex figure below:



APPENDIX B

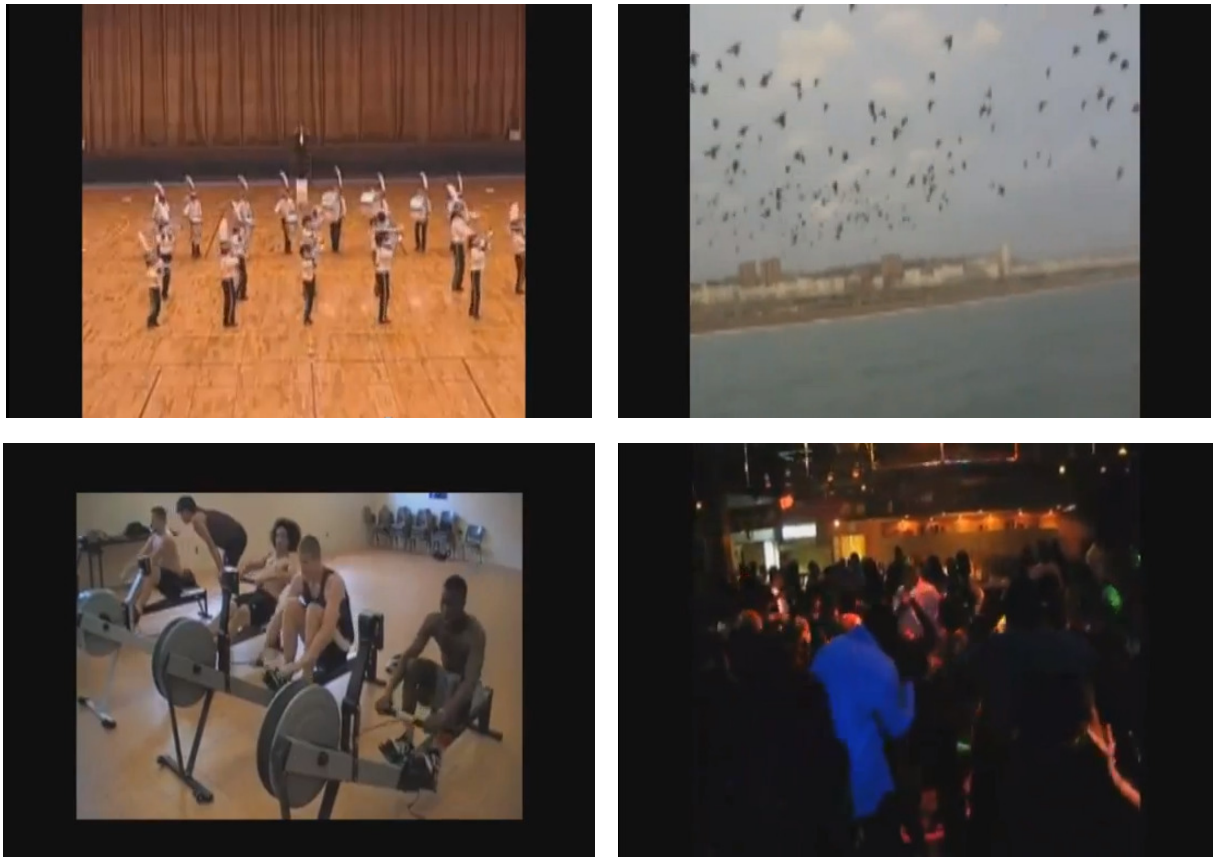
Example Images used in the Global-local Visual Processing Task



Note. The figure on the left shows a T present at the global level. The figure on the right shows a T present at the local level.

APPENDIX C

Example Screenshots of AccuSync Videos



Note. top row (left to right): marching band, flock of birds; bottom row (left to right): rowers, dancers in club.

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