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The Distinct Roles of First Impressions and Physiological Compliance in Establishing Effective Teamwork

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The Distinct Roles of First Impressions and Physiological Compliance in Establishing Effective Teamwork

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Teams are formed for many different reasons within organizations; multi-disciplinary teams of medical professionals may be formed to care for patients, a taskforce may be formed and made up of individuals from different departments in an organization, and global organizations may have teams of individuals working remotely to solve distribution issues. Regardless of team function, coordinated behavior has been identified as a central feature that differentiates a team of people working effectively toward a common goal from a group of people working in parallel (Berlin, 2010). Teams can be considered dynamic systems that rely on coordination between multiple individuals in order to effectively achieve task goals and maximize efficiency in task performance. The benefits of coordinated behavior for improving team effectiveness have already been documented across a wide variety of teams.

Team effectiveness is a multi-dimensional outcome that has been measured in a multitude of different ways including performance, cohesion, and satisfaction (Kozlowski & Ilgen, 2006). Studies of team effectiveness within existing organizations or in laboratory settings have identified many characteristics and factors that distinguish effective teams from ineffective teams. Reviews of team literature conclude that team effectiveness can depend on many contextual factors including organizational environment, type of task, and group composition (Cohen & Bailey, 1997; Guzzo & Shea, 1992; Mullen & Copper, 1994; Sundstrom, 1999). The present study investigates how subjective and objective measures of early team formation contribute to the development of the team as a system, coordination and overall team effectiveness.

Theoretical Framework of Team Coordination

Cybernetic theory of control systems (Ashby, 1963; Weiner, 1948) provides a scientific framework in which to study team effectiveness, especially for understanding how team members utilize feedback cues during social interaction to coordinate their behaviors. Cybernetics provides a systems perspective in which an individual continuously responds to feedback from the environment regarding task performance in order to guide behavior. According to cybernetic theory, an individual responds to feedback cues related to the discrepancy between actual and desired task performance and task outcomes. This framework is especially useful for understanding why dynamic control processes within teams related to coordination may sometimes require individuals to compromise individual behaviors in order to align with the processes of the team.

Responding to a call for more objective measures of team dynamics (Funke, Knott, & Salas, 2011), the current study explores how both objective and subjective indicators of dynamics early during team formation impact team experiences and effectiveness. The subjective indicator of early team formation that is measured is team member self-report first impressions of their partner. The objective indicator of early team formation is a physiological indicator of matched metabolic drive states, which serves as an indication of mutual behavioral control between team members as a reflection of physiological synchrony; this is measured as physiological compliance in the current study. A behavioral cybernetics approach to understanding team coordination (Smith, 1972) suggests that establishing physiological compliance, revealed as synchronous changes in physiological states among team members early in the team formation process, is likely to reflect enhanced team coordination during the mutual social control that is necessary for the coordination of team behaviors. The value of utilizing

physiological compliance as a potential measure of team coordination dynamics early in team formation, in combination with subjective indicators of team formation to evaluate the quality, process, and outcomes of dyadic interactions, has been demonstrated in a number of social contexts (DiMascio, Boyd, Greenblatt, & Solomon, 1957; Chapple, 1970; Levenson & Gottman, 1983; Warner, 1987). Specifically, researchers have linked physiological compliance with coordinated activity and positive outcomes such as improved group identity (Shtenynberg & Galinsky, 2011), positive interpersonal relationships (Lakens & Stel, 2011), and overall team effectiveness and empowerment (Henning, Boucsein, & Gil, 2001; Mathieu, Gilson, & Ruddy, 2006). By including both objective and subjective indicators early in team formation, the present study expands on current knowledge of team development by investigating whether any of these measures predict future team effectiveness. Establishing effective coordination early during the team formation process and in early team interactions is likely to be critical to the development of effective teamwork because team members must quickly find a way to align their efforts and to achieve overall team goals.

Early Team Formation

First impression. First impressions are initial perceptions of another individual based on comparison of social cues relative to personal stereotypes and interpersonal experiences (Ichheiser, 1949). The interpretation of these social cues results in either positive or negative first impressions, which impact the quality of the developing social relationship (Goffman, 1959). Early during team formation team members have been found to adjust their behaviors based on their initial impressions in order to establish congenial interpersonal relationships, which may serve as a way to set a positive tone for future team interactions (Bozeman & Kacmar, 1997; Zijlstra, Waller, & Phillips, 2012). The perceptions garnered from this adjustment process have

important implications for future team member interactions and effectiveness. Past research suggests that teams with negative impressions among team members were less effective overall than teams with more positive impressions among teammates (Mulvey, Bowes-Sperry, & Klein, 1998). There are also indications that new members of a team attempt to improve their likeability among existing members of the team through various forms of impression management such as self-promotion, and that successful ingratiation results in improved perceptions of the new team member and team cohesion (Nguyen, Seers, & Hartman, 2008). Finally, individual differences in impression management techniques, such as emotional self-regulation, were also found to result in improved individual communication and performance (Troth, Jordan, Lawrence, & Tse, 2012).

First impressions are important to consider because they may have a strong influence on future team interaction. Research suggests that processes developing early during team formation dominate the overall teamwork strategy for approximately half of a team's existence (Gersick, 1988). That favorable first impressions during team formation would have a positive impact on future team interaction (McGrath, Arrow, & Berdahl, 2000; Bettenhausen & Murnighan, 1985) is contrary to traditional stage development models of teamwork (Tuckman & Jensen, 1977). The possibility that first impressions may be indicative of future team effectiveness therefore warrants further investigation.

Physiological compliance. In addition to information gained through first impressions, research on social dynamics also suggests that individuals may depend on cues related to synchronous activity during a social interaction (Couzin, 2007). Synchronization of closed-loop systems is common in nature such as synchronous firing of neurons in the brain (Amiri, Montaseri, & Bahrami, 2011) or fireflies flashing in unison (Strogatz, 2003; for a review of

synchrony see Arenas, Diaz-Guilera, Kurths, Moreno, & Zhou, 2008). Synchronous physiological activity develops between humans when individuals engage in social interaction and their internal autonomic systems operate in tandem while they continually adjust their behavior in response to fluctuations around a preferred biological arousal state, which is often facilitated by their ability to coordinate behaviors (Goodwin, 1970). During this process, individual control of behavior is compromised in favor of a mutual control process in order for a more effective social coordination to occur. Porges' polyvagal theory (1995; 2006) describes how internal physiological systems operate as an internal closed-loop oscillating feedback system. He provides evidence that synchronous patterns between an individual's heart rate and breathing operate as a self-regulation system in response to external stressors such as confrontation with another person. Other research on synchronous physiological activity suggests that asynchronous feedback patterns during some forms of social interaction, such as passive aggressive behaviors among teammates, result in system dysfunction and stress, and so humans subconsciously strive to engage in synchronous behaviors with others in order to avoid stressful social situations. Chapple (1970) views synchrony between two people as a behavioral manifestation of internal linkages that occur between their autonomic nervous systems and result in physiological responses, such as breathing patterns and heart rhythms, that synchronize during social interaction. These theoretical ideas support the possibility that physiological compliance between individuals may reflect forms of coordination that are integral to the overall functioning of the social system.

The benefits of physiological compliance within human systems have been documented in various contexts including mother-infant relationships (Feldman, Magori-Cohen, Galili, Singer, Louzoun, 2006), romantic relationships (Levenson & Gottman, 1983), therapeutic

relationships (DiMascio et al., 1957), and dyadic task performance (Henning et al., 2001). In early human development, physiological compliance between infants and primary caregivers benefits emotion regulation for infants (Feldman et al., 2006). Infants with more attentive parents demonstrate more regulated heart rhythms in response to stress, and are more easily soothed after a stressful event (Haley & Stansbury, 2003). Furthermore, research suggests that the infant's ability to regulate behaviors and emotions during social interaction develops as a result of coordinated dyadic interaction between the infant and primary caregiver (Eisenberg, Spinard, & Eggum, 2010). In adult relationships, DiMascio et al. (1957) reported that the heart rates of both patients and therapists became more stable when 'tension release' moments occurred during a therapy session. Levenson and Gottman (1983) found that couples able to achieve physiological compliance while actively engaged in conflict during therapeutic sessions were more likely to stay together following therapy than couples who did not demonstrate physiological compliance. Additionally, social-physiological compliance was found to be associated with improved performance on a coordinated manual task (Henning et al., 2001) between two individuals with no existing relationship. Findings from this last study suggest that physiological compliance during social interaction may benefit the relationship even before an established relationship develops. Evidence of the benefits that physiological compliance has for a diverse range of social encounters through all stages of development suggests that this phenomenon may be fundamental to human social behavior and also may play an important role in early team formation and in determining team effectiveness. Physiological compliance may therefore provide a viable means for measuring mutual control and coordination early during team formation.

Overview of the Current Study and Hypothesized Relationships

The current study examines both first impressions and physiological compliance between strangers engaged in a shared decision making task to understand better how processes that occur early during team formation might affect the development of interpersonal relationships, experiences of work-related flow, development of team processes, and the quality of performance outcomes. Two-person ad hoc teams participated in a business and marketing simulation task while the breathing patterns of the participants were measured continuously. Various self-report measures were captured throughout the experiment. Planned analyses explored whether or not first impressions and physiological compliance would affect interpersonal relationships, work-related flow experiences, team processes and real and perceived performance.

The current study has four main goals: (1) examine how first impressions as well as physiological compliance early during team formation may influence future satisfaction; (2) determine if team members can differentiate individual-level work-related flow from team-level work-related flow and how these influence individual and team outcomes; (3) determine if first impressions as well as physiological compliance are predictive of team process; (4) examine the possible relationships between first impressions as well as physiological synchrony with both objective and subjective performance.

Team Satisfaction

The first goal of the present study is to examine how first impressions and physiological compliance may influence future team member satisfaction. As stated previously, positive first impressions between team members typically lead to improved team cohesion (Nguyen et al., 2008); however, interpersonal factors among teammates may have positive implications for

satisfaction with team performance as well (Castore & Murnighan, 1978). Research on team decision-making processes suggests that positive impressions of teammates improves cohesion and results in team members who are more satisfied with their fellow teammates and with decision outcomes (Rozell & Gundersen, 2003). Furthermore, satisfaction with team performance outcomes and satisfaction with team members are related concepts that both are a function of past satisfaction with team members and performance (Reinig, Horowitz, & Whittenburg, 2011). Based on these findings, first impressions of team members are expected to be predictive of future satisfaction with their teammates. Team members who have positive first impressions of their partner before actually participating in the team task may be more likely to feel satisfied with their teammate following the task. Additionally, positive first impressions are expected to have a positive impact on team member satisfaction with the decision outcome. These possibilities are supported by longitudinal evidence that current and future satisfaction are related to past satisfaction (Reinig et al., 2011), and so first impressions are also expected to interact with performance satisfaction to further explain how early team formation impacts development of team satisfaction. A model of this hypothesized relationship is depicted in Figure 1. The following hypotheses summarize these expected relationships:

H1a: Team member first impressions of the partner will have a direct effect on team satisfaction following teamwork.

H1b: Team member first impressions of the partner will have a direct effect on performance satisfaction following teamwork.

H1c: Performance satisfaction will moderate the relationship between team member first impressions and satisfaction with the team following teamwork such that a stronger

relationship between first impression and team satisfaction exists for team members who are more satisfied with the final product.

Physiological compliance is also expected to influence team member satisfaction as part of early team formation. Individuals engage in different modes of social tracking when working with one another including social feedback cues related to dynamic body movement, affective displays, and social cues; the development of mutual control in forms of social tracking improves coordination (Smith, 1972; Smith & Smith, 1987). Research suggests that coordinated (i.e., predictable) behaviors during social interaction heighten an individual's ability to track behaviors, which enhances social learning (Smith, 1971) and increases overall satisfaction with the interaction (Warner, 1987). Specifically, Warner (1987) found that individuals with rhythmic patterns in vocal activity perceived their partner more positively than those with less rhythmic patterns. Since breathing is closely related to vocal activity, a similar phenomenon is expected to occur between individuals through the consideration of breathing rhythm in the development of positive perceptions of the partner. In a more recent study, researchers manipulated the difficulty of a video game to match the physiological state of participants; participants in conditions where game difficulty was matched with physiological state were more satisfied by the game than participants in conditions where game difficulty did not match physiological state (Chanel, Rebetez, Betrancourt, & Pun, 2011). Interdependent team tasks require members to engage in social tracking in order to achieve their objectives, especially when members have different skill sets and rely on one another to complete team tasks.

Expanding further, social tracking requires individuals to respond effectively to feedback cues during an interaction in order to establish mutual control. In order to establish mutual control, members of a team would need to effectively coordinate task behaviors (Smith, 1971).

Therefore, higher levels of physiological compliance among teammates may result in team member satisfaction because these individuals' behaviors are matched and mutual control may be more readily established when needed. This would be consistent with a biological perspective that an effective social interaction is one in which individuals are better able to match physiological arousal states (Patterson, 1976). Individuals who are able to establish physiological compliance while performing an interdependent task may experience enhanced team satisfaction through an improved sense of control over team task demands. Therefore, team members who experience higher levels of physiological compliance with each other are expected be more satisfied with the team and with performance outcomes. Similar to first impressions, the level of physiological compliance is expected to interact with product satisfaction, which may explain additional variation in satisfaction with the team due to their improved control over task activities when physiological compliance is present. A model of this hypothesized relationship is depicted in Figure 2. The following hypotheses summarize the expected relationships:

H2a: Physiological compliance will predict team satisfaction following teamwork.

H2b: Physiological compliance will predict performance satisfaction following teamwork.

H2c: Performance satisfaction will moderate the relationship between physiological compliance and satisfaction with the team such that a stronger relationship between physiological compliance and team satisfaction exists for team members who are more satisfied with the final product.

Work-Related Flow Experience

The second goal of the present study is to differentiate a construct of individual work-related flow experiences from shared work-related flow experiences, and also to test whether

these two constructs impact individual- and team-level outcomes. Csikszentmihalyi and Csikszentmihalyi (1988) describe flow as a self-perception of peak performance in which individuals become completely engaged in a task and lose awareness of extraneous stimuli such as the passing of time. Flow is characterized by feelings of task absorption, elation, and intrinsic motivation, and these experiences have been reported by musicians, artists, and athletes (Martin & Jackson, 2008). Flow would be expected to occur when individuals perform at optimal levels without conscious effort. Individuals are more likely to experience flow states when the skill and ability required to complete a task is proportionate to the difficulty of the task (Ceja & Navarro, 2012). Individuals who experience flow report feelings of satisfaction and improved performance when engaged in challenging tasks; tasks during which an individual perceives a sense of flow also tend to be more rewarding (Walker, 2010). Reports of these experiences indicate that the presence of flow may be an indication of a decrease in perceived stress (Schaufelli, Bakker, & Van Rhenen, 2009) and improvement in general wellbeing (Ceja & Navarro, 2012).

There is a growing recognition regarding the importance of individual engagement and wellbeing in the workplace, specifically regarding work-related flow experiences. In order to investigate flow experiences in the workplace, Bakker (2008) developed a construct of work-related flow based on the three dimensions of flow: absorption, enjoyment, and intrinsic motivation. Bakker (2008) developed a measurement tool to assess flow experience as this specifically pertains to work tasks. These items measure the extent that individuals are intrinsically motivated to become absorbed in and take enjoyment from performing essential tasks. Engaged and satisfied employees may be more valuable to employers because they tend to invest resources into their jobs and become absorbed in their work, which often results in more innovation and creativity from employees (Bakker & Scheaufeli, 2008). Bakker's (2008)

construct provides a useful tool with which to measure engagement in the workplace; however, this instrument focuses on individual perceptions of flow that may not be salient in certain workplace scenarios involving teamwork.

There is some research evidence for a difference between individual and shared experiences of flow, and that shared experiences may be more enjoyable (Walker, 2010). Shared flow experiences may also be especially important for teams that function in demanding environments such as emergency teams or professional sport teams because peak performance over a short period of time is critical for successful team outcomes in these scenarios (Jackson, 1996; Russell, 2001). Early attempts at defining a shared flow construct have yielded some promising initial results (Heynes, Pavlas, & Salas, 2011; Walker, 2010); however, no measure of a shared flow construct yet exists in the literature beyond what can be found in some unpublished work (Cosma, 1999; Lazarovitz, 2003). Additionally, this work was limited to a general flow construct rather than a specific application such as work-related flow. The present study attempts to identify a shared flow construct in a work-related context.

Shared work-related flow experiences are important to consider in a team context because if flow experiences are not shared and only one team member experiences flow, this might actually be a source of disruption among teammates. Alternatively, flow experienced by one member of the team may increase the likelihood that a shared flow experience will develop. The current study focuses on team coordination and effectiveness; therefore, relationships between teammates are inherent to developing a concept of shared work-related flow. As stated previously, one goal of the current study is to investigate how a construct of individual work-related flow may be differentiated from a construct of shared work-related flow by comparing

how measures of individual and shared work-related flow experiences during teamwork influence outcomes such as team satisfaction and team effort.

H3a: Reports of shared work-related flow experiences will predict additional variance in team satisfaction over reports of individual work-related flow experiences.

H3b: Reports of shared work-related flow experiences will predict additional variance in overall team effort over reports of individual work-related flow experiences.

Identified as an aspect of wellbeing in the workplace as well, work-related flow experiences are associated with other aspects of workplace wellbeing including perceived stress and affective wellbeing (Orsila, Luukkaala, Manka, & Nygard, 2011). Therefore, experiences of work-related flow are expected to positively impact stress and affective wellbeing of team members. The current study conceptualizes affective wellbeing as an indicator of general wellbeing since factors related to affect, such as contentment and positive arousal, have been identified as core components of subjective wellbeing (Cummins, 2010). As stated previously, evidence suggests that shared work-related flow experiences may be more beneficial to teams than individual work-related flow experiences (Heynes et al., 2011; Walker, 2010); therefore, shared work-related flow experiences are expected to improve stress and wellbeing outcomes of team members more than experiences of individual work-related flow by only one team member. In order to test these assumptions, the relationship between reports of both individual and shared work-related flow experiences as well as both individual and shared work-related flow experiences post-task stress and post-task affective wellbeing will be investigated. The expected relationships are hypothesized below:

H4a: Individual work-related flow experience will predict team member perceptions of stress following teamwork.

H4b: Individual work-related flow experience will predict team member affective wellbeing following teamwork.

H5a: Experiences of shared work-related flow will predict team member perceptions of stress following teamwork.

H5b: Experiences of shared work-related flow predict team member affective wellbeing following teamwork.

Accounts of shared work-related flow experiences, especially by teams, are very similar to descriptions of coordination and synchrony among team members, and so early team formation may play a role in the amount of work-related flow experienced by team members. Work-related flow experiences are described in the literature as transient states of happiness related to individual- and team-level factors such as individual engagement and group affective tone (Fisher, 2010). In a study of professional musicians, Moore and Chen (2010) found that musicians' physical movements were coordinated during performance. Furthermore, Bakker and his colleagues found that for soccer teams, teams whose players and coaches reported higher levels of flow experiences were more likely to have a game end in a draw or win as opposed to a loss (Bakker, Oerlemans, Demerouti, Slot, & Ali, 2011). Positive first impressions of teammates may increase the likelihood that team members will experience shared work-related flow experiences because these individuals are more likely to become fully engaged in the social interaction and establish mutual control that promotes shared experiences.

Shared experiences of work-related flow may also manifest as underlying physiological compliance among team members improving performance through enhancement of social tracking (Chapple, 1970; Smith, 1972). Coordination via social tracking and motor sensory control may improve team member abilities to perceive subtle cues from teammates during a

performance, which might facilitate a state of absorption associated with work-related flow and lead to improved performance effectiveness and peak performance outcomes. This suggests that shared experiences of work-related flow among teammates are related to effective development of the team as a system, and may depend on process that occur early during team formation. Therefore, physiological synchrony is also expected to have an influence on shared work-related flow experiences.

H6a: Team member first impressions will impact the amount of shared work-related flow experiences reported by team members.

H6b: Physiological compliance will impact the amount of shared work-related flow experiences reported by team members.

Team Processes

The third goal of the present study is to determine how first impressions and physiological synchrony influence the development of team processes. Teamwork, in both applied and laboratory settings, has traditionally been studied under the input-process-output (IPO) model (McGrath, 1984). This model provides researchers with a generic framework in which to connect various team inputs, such as group structure, member skills, and member attitudes, with team outcomes such as performance. Research suggests that interactions among team members, also known as team processes, mediate the relationship between team inputs and outputs (Hackman, 1987). Marks and her colleagues (2001) condensed team processes into a taxonomy of three dimensions termed transition, action, and interpersonal. These processes encapsulate team member interactions such as goal specification, member coordination, motivation, and conflict management, with each of these contributing to overall team effectiveness (Marks, Mathieu, & Zaccaro, 2001). An action phase occurs when teams are

engaged in behaviors intended to accomplish team tasks and goals and a transition phase occurs during planning efforts when the team shifts focus from one set of activities to another. Additionally, teams engage in interpersonal processes throughout action and transition phases.

Members of a team may be actively involved in different processes at various stages of goal attainment, such as being involved in transition processes during planning stages and action processes during task completion. The ability of these processes to achieve task goals has been found to have a heavy influence on the development of future team processes (Ilgen, Hollenbeck, Johnson, & Jundt, 2005; Marks et al., 2001). An extension of the IPO model, the Inputs-Mediator-Outputs-Inputs (IMOI) model of teamwork, incorporates a cybernetic framework suggesting that performance outcomes provide feedback to members on the effectiveness of the team process, and this increases the likelihood that teams will engage in similar processes in future cycles (Ilgen et al., 2005; Gersick, 1988). Evidence of this cyclical phenomenon has been reported in previous literature involving various workplace behaviors related to the team process taxonomy outlined by Marks et al. (2001). The cybernetic framework suggests that team members are able to self-regulate their cognition and behavior based on feedback cues from other team member behaviors and the environment, usually in response to a discrepancy between desired and actual performance (Carver & Scheier, 1981). This work has been expanded into various theories of employee workplace behaviors such as goal setting (Campion & Lord, 1982), workplace motivation (Klein, 1989), employee wellbeing and coping (Edwards, 1992), and self-management (Manz, 1986).

A cyclical IMOI framework is important to consider when studying team dynamics because processes are intertwined with social interaction, and this consideration is especially salient when investigating the underlying processes of early team formation. As stated

previously, positive first impressions and physiological compliance are likely to offer benefits within the context of social interaction, and research suggests that these benefits would also extend to processes within a team (Eisenberg et al., 2010; Nguyen et al., 2008). Team interventions focused on improving the quality of interpersonal processes between members have demonstrated an improvement in team performance (Dyer, Dyer, & Dyer, 2007). Additionally, teams able to develop positive relationships among team members and coordinate their behaviors are able to communicate more efficiently, which has a positive impact on future team effectiveness (Guastello & Guastello, 1998; Nowak, Watt, & Walther, 2009; Mathieu et al., 2006). Engaging in interpersonal interaction is fundamental in building a foundation for future team processes because members of a newly formed team will not be familiar with each other. Team members with positive first impressions of their partner early in team formation may therefore increase the likelihood of future team effectiveness. Discrepancies in process behaviors may be most salient to team members early on in their interaction, and so this may provide an opportunity for them to determine the best way to work together. Additionally, the improved control over task activities as evidenced by higher levels of physiological compliance and social tracking (Smith, 1971) may improve the team's ability to process information and make effective decisions during a team task. Therefore, it is expected that teams with better first impressions and higher physiological compliance will be better able to coordinate their behaviors, and these coordinated behaviors will manifest in more efficient team processes.

H7: Team member first impressions of the partner will influence: (a) action processes, (b) transition processes, and (c) interpersonal processes.

H8: Physiological compliance between team members will have a positive influence on: (a) action processes, (b) transition processes, and (c) interpersonal processes.

Team Performance

The fourth and final goal of this study is to determine whether first impressions and physiological compliance each influence team performance outcomes. Ultimately, the quality of team outputs is largely expected to depend on the quality or efficiency of team inputs and processes in an IMOI framework. Similar to other indicators of team effectiveness such as team satisfaction and work-related flow experiences, evidence regarding the benefits that social tracking and coordinated behavior have on team performance provides a general consensus: higher levels of coordination improves team outputs. As mentioned previously, positive social relationships among team members improve the quality of team coordination which leads to improved identity with team goals and missions (Shtenynberg & Galinsky, 2011) and enhanced ability to retrieve, exchange, and structure information (Bahrami, Olsen, Bang, Roepstorff, Rees, & Frith, 2012; Gibson, 2001; Swaab, Galinsky, Medvec, & Diermeier, 2012). Furthermore, teams working in demanding contexts, such as professional musicians and emergency response teams, must successfully coordinate their behaviors while engaged in complicated interdependent tasks (Ishak & Ballar, 2011; Moore & Chen, 2010). Each of these studies provides evidence that coordination among team members can potentially enhance team outcomes. The close link between impressions of teammates and individual effectiveness was also mentioned previously (Mulvey et al., 1998); therefore, positive first impressions between team members are expected to predict the quality of a teams' subjective and objective performance on an interdependent task. Additionally, improvements in team processes are expected to mediate these relationships as suggested by the IMOI framework, as depicted in Figure 3. These expected relationships lead to the following hypotheses:

H9: Team member first impressions will predict individual perceptions of overall team effort.

H10: Team member first impressions will influence the amount of individual effort assigned towards completing task goals.

H11: Team member first impressions will predict objective performance on a shared decision-making task.

H12: The relationship between first impressions and objective team performance will be partially mediated through improved team processes.

Studies have also found positive associations between physiological compliance and team performance in bi-manual tasks (Henning et al., 2001) and in stress resiliency during an unpredictable tracking task (Henning & Korbelak, 2005). More recently, a direct, positive relationship was established between physiological compliance measured through heart rate variability (HRV) and respiratory sinus arrhythmia (RSA) and team performance on a combat videogame (Elkins, Muth, Hoover, Walker, Carpenter, & Switzer, 2009). Chanel, Kivikangas, and Ravaja (2012) also found evidence that physiological compliance, measured as weighted coherence of breathing patterns, is indicative of rich social interaction during challenging task periods in a maze videogame. These studies provide evidence that physiological compliance may be predictive of team performance. Following the IMOI framework described previously, team processes are also expected to mediate the relationship between physiological compliance and team performance. A model of this hypothesized relationship is depicted in Figure 4. The expected relationships are summarized below:

H13: Physiological compliance will positively predict perceptions of overall team effort.

H14: Physiological compliance between team members will improve team performance on a shared decision-making task.

H15: The relationship between physiological compliance and team performance will be partially mediated through improved team processes.

Method

Participants

A total of 122 students were recruited to form 61 two-person teams from an online pool of undergraduate students at a large northeast university. Students participated in experiments in exchange for course credit. Students who were strangers to each other were recruited to examine how first impressions and physiological compliance might influence team formation. One team was eliminated due to loss of physiological data and 5 others were eliminated because participants revealed that they had an existing relationship as reported on the pre-experiment survey (Appendix D). The final sample includes 69 females and 39 males resulting in 23 mixed- and 31 same-gender teams. Gender information was lost for one team. Information regarding age and race were not collected from participants; however, demographics of the online pool are representative of the undergraduate population at the university. All participants used in the data analysis were strangers to each other at the beginning of the study and had no previous experience with the team task.

Physiological Measures

The current study applied a novel method for measuring physiological compliance utilizing measures of ventilatory drive based on breathing patterns as opposed to more traditional physiological measures such as heart rate variability (HRV) or electrodermal activity. Breathing

patterns are a function of both the autonomic nervous system and voluntary control, and have a large influence on other physiological indicators including HRV. Furthermore, individuals control their breathing pattern for speech production during social interaction, and so breathing was expected to be a more sensitive measure of the dynamics of social interaction.

Breathing. Breathing signals were used to calculate instantaneous ventilatory drive for each person. The Respitrace System (Ambulatory Monitoring, Ardsley, NY) was used to measure the breathing of participants continuously throughout the experiment. This system measures breathing signals by transducing changes in cross-sectional area around the ribcage and abdomen through use of inductive plethysmography as a way to estimate changes in lung volume. The ribcage and abdomen signals are sampled and then summed to provide an estimate of changes in total lung volume. Use of the Respitrace System to measure physiological compliance required participants to perform two different calibrations. First, in order to ensure that each Respitrace System signal is measuring the same volume changes from each inductive band, participants performed an iso-volume breathing maneuver. During this maneuver participants were asked to shift their lung volume displacement between their chest and abdomen so that the experimenter could adjust the relative gains of the transducers.

Second, a spirometer (OMI Manufacturing) was used to measure the true volume of the participants' breaths. The volume of three separate breaths was used to determine the change in voltage recorded by an analog-to-digital converter controlled by a computer program. These calibrated values were then used to set a breath size threshold for each team member, which allowed for more reliable detection of breathing. Ventilatory drive was then calculated as a ratio; tidal volume divided by the time of inspiration for each breath.

Physiological compliance. Unlike more traditional measures of physiological compliance that use changes in breathing rhythm or amplitude of shared breathing patterns (Warner, 1996), ventilatory drive reflects the instantaneous metabolic activity of the participants. Synchronous changes in metabolic activity were expected to better reflect the amount of social tracking and mutual control team members established during the task. A FORTRAN program used algorithms to calculate physiological compliance throughout the experiment. Baseline ventilatory drive was calculated during a 15-minute pre-task period when participants were instructed to review pre-task materials individually. A baseline ventilatory drive was also calculated for each participant during both the task period. When ventilatory drive was near either baseline it was considered to be representative of the participants' preferred activity level, with deviations from this level an indication of the joint compensations made during social interaction to achieve mutual control. The program compared the ventilatory drive of each team member throughout the interaction to calculate a physiological compliance score based on root mean square (RMS) error of the participants' ventilatory drive over a two-second window. Higher RMS error scores indicated that there was a large discrepancy between the team members (i.e., low physiological compliance) while scores close to zero indicate matched ventilatory drive and thus, high physiological compliance.

In order to calculate an overall physiological compliance score over a fixed period in the experiment, a time series record of RMS error sampled at 32 hertz (Hz) was created for each team for both the pre-task study period and the task period. Disproportionate errors are common in breathing data and can potentially inflate RMS error of ventilatory drive due to noise in the breathing signals and other artifacts. In order to more selectively score physiological compliance, the threshold dividing the bottom ten percent of RMS error scores was used as an estimate of

physiological compliance over a fixed window of time during the task period. This approach allows for more selective measurement of physiological compliance consistent with the scoring procedures used with calculating compliance scores in past experiments on long periods of teamwork (Henning, Armstead, & Ferris, 2009). Another reason that more selective measurement of physiological compliance was used in this study is because short episodes of high levels of physiological compliance were expected to be more beneficial to the development of effective mutual control and team work during critical periods of early team formation and cognitive decision making than sustained periods of physiological compliance. Furthermore, all selective RMS error calculations of physiological compliance during the task were based on the first 15 minutes of the 25-min task period. The first 15 minutes were chosen in order to ensure that all teams were fully engaged in task work during this period, and in case they finished the task early and well before the end of the 25-min task period.

Management Simulation Task

The two-person team task used in this experiment was adapted from a pencil and paper task in which both participants were assigned roles as vice presidents of a movie studio but were provided with different information to use in deciding jointly which movies to publish from a list of options (Devine, Habig, Martin, Bott, & Grayson, 2004). This task was chosen because it was specifically designed to be engaging and found to be suitable for an undergraduate population, which is important for the measurement of authentic teamwork using ad hoc teams in a laboratory setting. The original management simulation was designed by Devine et al. (2004) for four participants who were assigned to one of four vice president (VP) roles: Marketing, Script Evaluation, Industry Research, and Talent Appraisal. Therefore, this task was adapted for use in the present study of two-person teams by combining the support information for four roles into

two: VP of Marketing and Research and VP of Talent and Scripts. All information was presented in the form of memos from a fictitious CEO of a movie studio, as shown in Table 1, and all task materials are provided in Appendix A. General guidelines for the task were provided to participants in binders containing descriptions of 11 different screenplays along with sample algorithms and worksheets. Participants used these to determine which movies would be most profitable -- the main performance outcome. Participants submitted a final recommendation sheet (Figure 5) indicating which screenplays and marketing strategies were selected.

Survey Measures

Various measures of team effectiveness in this study included: impression of the teammate, team process, experiences of individual work-related flow, experiences of shared work-related flow; and subjective performance.

Impression. Each participant's impression of his or her teammate was measured at two different times during the experiment. The first impression of the teammate was measured prior to starting the task and the final impression of the teammate was measured at the end of the experimental session. Impression was measured as affective liking of the teammate. Items were: "I am looking forward to talking with this person", "I could see myself being friends with this person", and "I like this person." All items were self-reported on a 7-point scale ranging from "Strongly Disagree" to "Strongly Agree." The scale used was validated in previous pilot work and demonstrated good internal reliability at both time points in the current sample ($\alpha_1 = .84$, $\alpha_2 = .89$).

Team satisfaction. Satisfaction with the team and satisfaction with the team's overall work product was measured using a scale developed by Lancellotti and Boyd (2008). This scale assesses a participant's overall interpersonal satisfaction working on a team and his or her

satisfaction with the final product, or team outcome. All responses were reported on a 7-point scale from "Strongly Disagree" to "Strongly Agree." Sample items include "I would be willing to work with this team on another class project" and "I am not satisfied with the quality of the final recommendation." The scale covers two dimensions that each demonstrates good internal reliability in the current sample: satisfaction with the team ($\alpha = .77$), and satisfaction with the final product ($\alpha = .85$). The full scale can be found in Appendix E.

Affective wellbeing. Affective wellbeing was measured using an adapted version of the Job-related Affective Wellbeing Scale (JAWS) developed by Van Katwyk, Fox, Spector, and Kelloway (2000). The items used for the present study can be found in Table 2. The scale measures state affect, which is more variable over time and related to general wellbeing, rather than trait affect, which is related to attitudes and beliefs and more stable over time. Van Katwyk and his colleagues (2000) measure affective wellbeing along a 'pleasure' and 'arousal' continuum. Each item corresponds to a quadrant of the pleasure and arousal dimensions, and the quadrants represent different aspects of wellbeing; for example, an individual with a score in the high pleasure-low arousal quadrant may be experiencing higher levels of wellbeing than an individual scoring in the low pleasure-low arousal quadrant. Each participant was asked to report his or her current level of various mood states such as "calm" and "discouraged." Responses were made on a 7-point scale ranging from "Strongly Disagree" to "Strongly Agree" before and after participation in the task in order to capture any changes in participants' affective wellbeing throughout the experiment. Responses were aggregated within each of the four quadrants for each team member. Only two quadrants demonstrated good internal consistency at both time points: high pleasure-high arousal ($\alpha_1 = .83$, $\alpha_2 = .89$), high pleasure-low arousal ($\alpha_1 = .80$, $\alpha_2 = .80$), low pleasure-high arousal ($\alpha_1 = .23$, $\alpha_2 = .65$), and low pleasure-low arousal ($\alpha_1 = .33$, $\alpha_2 =$

.30). Due to poor internal reliability for the two quadrants, negatively worded items were recoded and general wellbeing for both time points was calculated with higher scores representing more positive affect. These overall wellbeing scales demonstrated good internal reliability at both time points in the current sample ($\alpha_1 = .82$, $\alpha_2 = 82$).

Stress. Stress was measured using the Stress in General Scale (SIG) developed to measure work-related stressors (Stanton, Blazer, Smith, Parra, & Ironson, 2001). The scale asks participants to respond to what extent they feel stressed on two different dimensions: threat and pressure. Stress was also measured before and after participating in the experimental task. A sample item from the threat dimension is "During the task I was feeling hassled" and a sample item from the pressure dimension is "During the task I was feeling hectic." The response scale was altered from the original scale of yes, no, or ? to a 7-point scale ranging from "Strongly Disagree" to "Strongly Agree" in order to keep the response scales uniform throughout the surveys. The scale demonstrated good internal reliability at both time points in the current sample ($\alpha_1 = .92$, $\alpha_2 = .91$). The full scale can be found in Appendix E.

Work-related flow. The current study conceptualizes distinct work-related flow experiences at both the individual and the team level. Individual work-related flow experience was measured using the short form of the work-related flow inventory developed by Bakker (2008). Items specifically ask about work-related tasks and address each of the three dimensions of flow experience. Sample items from each dimension include: absorption, "I was completely focused on the task at hand"; enjoyment, "The experience was extremely rewarding"; intrinsic motivation, "I would enjoy working on a task like this in my free time." Responses were made on a 7-point scale ranging from "Strongly Disagree" to "Strongly Agree." Items demonstrated

good internal reliability for the current sample (α = .91). The full scale can be found in Appendix E.

To capture shared work-related flow experiences, an adapted version of the work-related flow inventory (Bakker, 2008) was included to assess perceived shared work-related flow. Chan (1998) suggests shifting the referent from an individual's perspective to a shared perspective as one strategy to distinguish team-level phenomena from individual-level phenomena. Using this approach, the referent of the original items for work-related flow was altered to ask about shared work-related flow experiences as opposed to perceptions of individual work-related flow experiences. Sample items include: absorption, "We were completely focused on the task at hand"; enjoyment, "The experience was extremely rewarding for us"; intrinsic motivation, "We would enjoy working together in our free time." A full list of the referent shift items used in the present study can be found in Table 3. Team flow items demonstrated high internal reliability in the current sample (α= .91) and responses were made on a 7-point scale from "Strongly Disagree" to "Strongly Agree." The full scale can be found in Appendix E.

Team processes. Team process was measured using the scale developed by Marks et al. (2001). Items assess perceived quality of the overall team process according to three dimensions: (1) action, (2) transition, and (3) interpersonal. Each of the process dimensions were analyzed separately because an overall process may not have time to emerge with ad hoc teams performing a 40-minute task. However, individual responses for each of these dimensions provide some indication of the quality of teamwork between members regarding their interdependent task such as goal-setting activities. Sample items from each of the subscales include: action "We discussed our vision of a successful outcome"; transition "We discussed what we could do, step-by-step, to make our vision a reality"; interpersonal "We created an

environment of openness." Responses were made on a 7-point scale ranging from "Strongly Disagree" to "Strongly Agree." The three subscales demonstrated good internal reliability in the current sample: action ($\alpha = .73$), transition ($\alpha = .74$), and interpersonal ($\alpha = .74$). The full scale can be found in Appendix E.

Team profit. As an objective measure of overall team performance, choices from the final recommendation sheet were used to calculate the projected profit for the simulated business year using Microsoft Excel™ worksheets provided by the simulation's first author (Divine et al., 2004). Using the net profit provided by Devine et al. (2006) a profit-to-cost ratio was calculated for use as an indication of overall team performance. The ratio was used because part of the team's challenge during the task was to spend as much of the budget as possible in order to maximize the profit. The ratio calculation accounts for cost of each movie, including budget spent on each marketing strategy, as well as overall profit.

Effort evaluations. After completing the experiment and receiving feedback regarding their overall profit, participants were asked to rate the relative level of effort from each other and for the team as a whole. Participants were asked to "Please rate the amount of effort you, and the amount of effort your partner, put into this task; be sure the total effort between you and your partner is equal to 100%." Here, team members rated the amount of effort they and their teammate put forth in completing the shared decision-making task out of 100 percent effort; a response of 50 for self effort and 50 for other effort indicates that effort towards completing the task was equally shared between team members.

To evaluate team effort, each participant rated how well they performed together as a team out of a possible 100 percent full effort. Participants were asked, "Please rate the amount of

effort that you and your partner, working together as a team, put into completing this task", where 100 percent indicates maximum team effort.

Procedure

The current study was approved by the University of Connecticut's Institutional Review Board (IRB). It was listed on a university website showing available experiments that students in general psychology courses could elect to participate in to earn course credit. The experiment was presented as a business and marketing team simulation. Potential participants were told that they would work on a business task with a partner while heart rate and breathing signals were collected. Students were able to sign up for one of many posted sessions.

A standardized script and protocol for the experiment can be found in Appendix B and a timeline for the experiment is depicted in Figure 7. Following informed consent, an experimenter instructed participants on how to outfit themselves with the physiological transducers (i.e., cardiac telemetry units and Respitrace bands). Heart rate was collected but this data was not used in the current study. First, participants were provided with a diagram (see Appendix C) and verbal instructions demonstrating where to place the three surface mount electrodes (Lead-II configuration) that would eventually connect to the telemetry units for heart rate. Participants were escorted to a restroom to apply the electrodes in private. Upon return to the experiment room, the experimenter verbally instructed participants on where to position the Respitrace bands and attached electrode connections to the telemetry transmitter units. All participants wore these flexible bands and telemetry units comfortably around the torso to allow for relatively unrestricted movement between and during experimental activities. Once the physiological monitoring equipment was in place, participants were escorted to separate desks located apart from each other in the receiving area to complete the pre-experiment paper and pencil survey

(for a map of the experiment rooms see Figure 6). These surveys included initial measures of stress and affective wellbeing in addition to first impressions of the teammate. The full pre-experiment survey instrument can be found in Appendix D.

After completing the pre-experiment survey, participants were escorted to the task room to complete the iso-volume breathing maneuver calibration for the Respitrace bands and where they would receive instructions and remain seated across a small desk from each other for the duration of the task. Once calibration was complete, an experimenter read the task instructions aloud to participants. Participants were each provided with a binder containing the general task information, screenplay synopses, and information pertaining to their individual role on the team. They were also provided with scrap paper, pens, and calculators to help organize information and think through the algorithms provided to determine which movies would be most profitable. Full instructions for the calibration and task are available in Appendix B.

After reading the instructions and answering any questions unrelated to task strategy, the experimenter left the room and started a computer program that had pre-programmed timing for the task. Participants studied their individual materials for 15 minutes and then worked together for another 25 minutes to complete the task and fill out the final recommendation sheet (Figure 1). Programmed tones automatically alerted participants when to begin independent study of the binders, when to begin working together to complete the task, and when only five minutes remained to complete the task. Participants were instructed to use all available information to decide which movies to produce and how much to spend marketing each movie so as to maximize profits for the simulated business year while staying within the designated budget. Participants were asked to complete the final recommendation sheet which identified which movies they chose and how much money they elected to spend marketing each movie.

Immediately following the task, participants were asked to complete a survey assessing individual perceptions of team effectiveness including: affective wellbeing, stress, individual and shared work-related flow experiences, team satisfaction, and team process (Appendix E). While participants completed this survey, the experimenter calculated team profit using the scoring worksheets provided by Divine et al. (2004) and prepared a feedback report (Appendix F) comparing the team's earned profit to the highest possible profit for the simulation.

Following the task, participants were asked to exhale into the spirometer in order to compute the volume-to-voltage ratios needed for breath threshold calculations. Participants exhaled three breaths into the spirometer. The experimenter then assisted participants in removing the physiological transducers and escorted participants back to the separate receiving area desks to fill out the final survey. Finally, participants were given the performance feedback reports and asked to complete the final impression measure and assign effort ratings to themselves, their teammates and the team as a whole (Appendix G).

Planned Analyses

As stated previously, the teams in the current study consist of dyads; therefore, perceptions and behaviors of one team member are very likely to be correlated with perceptions or behaviors of a teammate. Mixed model regression in SPSS was used to investigate the effects of physiological compliance and individual team member first impressions on team effectiveness outcomes. First impressions were assessed using the actor-partner interdependence model (APIM; Kenny, Kashy, & Cook, 2006), which accounts for effects of the team member and the partner simultaneously. The APIM tests effects of both the actor's (i.e., team member's) first impression of their partner and the partner's first impression of the actor (i.e., team member). One advantage of the APIM is that it provides simultaneous estimates of team member and

partner effects. Potential partner effects were tested for all APIM analyses; significant partner effects are reported in the analyses and non-significant effects were trimmed from APIM models. In the following section, the term "partner" is used to describe partner effects from APIM analyses (i.e., the influence of the partner's first impression on team satisfaction) and the term "teammate" is used to describe perceptions one team member has about the other team member (i.e., the team member's first impression of the teammate). All analyses controlled for initial stress levels and gender. Finally, dyadic predictors for analyses using a team-level objective performance outcome were aggregated to the team level and tested using ordinary least squares (OLS) regression techniques.

Analyses consist of four parts: tests of non-independence were performed to determine how much variance in outcome variables resides between teams; brief tests of discriminant validity using an APIM framework were performed to distinguish a construct of individual work-related flow experience from shared work-related flow experiences; mixed regression analyses were implemented to assess for dyadic effects that first impressions and physiological compliance might have on overall team effectiveness. Estimates of ΔR^2, also known as pseudo ΔR^2 in mixed-model procedures, were calculated by comparing variance components between baseline and full models per recommendation of Kenny, Kashy, and Cook (2006). All ΔR^2 statistics reported for mixed-model regressions and APIM analyses used this method.

Results

Preliminary Analyses

Assessment of nonindependence. The present study attempts to understand team dynamics; therefore, errors of individual responses are correlated between team members. Analyses must account for potential correlated errors resulting from shared experiences on the

team and in the case of dyadic teams nonindependence of the outcome must first be established to determine the degree to which responses vary between teams. In order to calculate nonindependence, intraclass correlations (ICCs) were calculated for each outcome variable used in hypothesis testing. As displayed in Table 4, ICCs indicated that very little variance was due to team membership. Even though team membership does not statistically explain variation in outcome variables, the APIM model was still conducted using mixed-model regression in order to investigate potential partner effects in analyses. The measure of physiological compliance used in the present study was a team-level variable because a combination of both team members' ventilatory drive was used to calculate a score for each team as a whole.

Descriptives. Descriptive statistics and correlations for individual-level measures are displayed in Table 5 and team-level measures are displayed in Table 6. The nested nature of the data causes inflation in Type I error, so *p*-values for bivariate correlations are unreliable and were not reported. Table 5 shows that the correlation between team and individual work-related flow is relatively high (r = .73), which suggests that these two constructs may be redundant. Discriminant validity was tested with hypotheses 3 and 4 in the subsequent analyses to further investigate whether or not individual and shared experiences of work-related flow are distinct.

Hypothesis Testing

The present study analyses utilized fifty-five, two-person teams. One hundred ten individuals is a respectable sample size for mixed model regression analyses; however, 55 teams is a somewhat low sample size for aggregated analyses. Power analyses of anticipated small to moderate effects indicate power ranging from .60 to .95 for mixed model regressions and approximately .50 for aggregated OLS regressions with team-level objective performance outcomes. The novel and exploratory measure of physiological compliance used in the present

study limits the availability of previous research with which to compare results. Therefore, results for analyses analyzing the effects of physiological compliance are interpreted at a more liberal alpha of $p < .10$ rather than the more conservative alpha $p < .05$. As stated previously, analyses were conducted using mixed model regression procedures in SPSS and aggregated OLS regression when appropriate.

Team satisfaction. First impressions and physiological compliance were both expected to influence satisfaction with the team and the final product of the task. Hypothesis 1 tested whether team member first impressions relate to satisfaction with the team (H1*a*) and satisfaction with the quality of the final product (H1*b*). Aggregation indices suggested that satisfaction with the team and satisfaction with the final product were independent (ICC = .10, F (57, 58) = 1.22, $p > .10$ and ICC = .14, F (57, 58) = 1.33, $p > .10$, respectively) and are most appropriately analyzed as individual-level outcomes. Results indicated that the team member's first impression of the teammate had an effect on satisfaction with the team ($\beta_A = .26$, $p < .01$). A favorable first impression of the teammate resulted in future satisfaction with the team, which explained an additional 11% of the variance in team satisfaction ($\Delta R^2 = .106$). On the other hand, while tests of product satisfaction indicated that the partner's first impression had a detrimental effect on satisfaction with the final product ($\beta_P = -.23$, $p < .05$), the team member's first impression of his or her teammate had no effect on his or her own satisfaction with the final product ($\beta_A = -.01$, $p > .10$). Not only did this result provide no support for H1*b*, it also demonstrated that a partner with a more favorable first impression negatively impacted the other team member's satisfaction with the final product; the more positive the partner's first impression was, the less satisfied the other team member was with the final product.

Hypothesis 1*c* suggested that satisfaction with the final product would interact with first impressions such that team members who were satisfied with the final product would be even more satisfied with the team regardless of their first impression of the teammate. As depicted in Table 7, results from the APIM analyses demonstrated a main effect of team member satisfaction with the final product on team member satisfaction with the team (β_A = .26, p< .01), which explained approximately 11% of the variance in satisfaction with the team over team member first impression of the teammate (ΔR^2= 0.113). Full support for H2*c* was found in the significant interaction between team members' satisfaction with the final product and first impression (β_A = -.14, p< .05), which explained an additional 4% of variance in team satisfaction over main effects (ΔR^2= .037). As depicted in Figure 8, team members who were highly satisfied with the final product were satisfied with the team regardless of the first impression of their teammate. However, when satisfaction with the overall product was low, team member satisfaction with the team was more heavily influenced by first impressions. Simple slope analyses were conducted using the technique described by Aiken & West (1991); results indicated that the slopes are significant for both the lower bound (β= -.14, p< .05) of product satisfaction and the upper bound of product satisfaction (β= -.14, p< .05). Therefore, considering early team formation is important because it may serve as a buffer for the potentially powerful influence that product satisfaction has on team satisfaction.

Physiological compliance was also expected to influence satisfaction with the team (H2*a*) and satisfaction with the final product of the task (H2*b*). Even though physiological compliance had no relation with satisfaction with the team (β = .03, p> .10), physiological compliance was related to satisfaction with the final product (β = .18, p< .10). These results indicated that while physiological compliance did not relate to satisfaction in working with a teammate, the more

physiologically compliant a team was, the more satisfied members of that team were with the final product, as shown in Table 8. Physiological compliance explained an additional 3% of variance in satisfaction with the final product over a model with only participant gender and initial stress level ($\Delta R^2 = .026$, $p < .10$). These results offered support for H2*b* that physiological compliance improved satisfaction with the final product of the task. Finally, H2*c* predicted that physiological synchrony would interact with first impressions to predict satisfaction with the team. Results did not support this assumption ($\beta = -.03$, $p > .10$) and physiological compliance had only a main effect on individual satisfaction with the final product.

Work-related flow experience. The second goal of the present study was to determine whether team members would distinguish between individual and shared work-related flow experiences. Even though responses for individual and shared work-related flow correlated highly ($r = .73$), items measuring shared work-related flow specifically asked about shared work-related flow experiences as opposed to individual experiences, so tests of discriminant validity were performed to determine whether these two constructs capture different aspects of work-related flow. Hypothesis 3 tested the discriminant validity between the two flow constructs with the assumption that shared work-related flow would uniquely predict team satisfaction (H3*a*) and overall team effort (H3*b*) from individual work-related flow. Aggregation indices did not support aggregation of shared work-related flow experiences to the team level (ICC = .01, F (57,58) = 1.03, $p > .05$), and so responses were assumed to be independent.

APIM analyses, summarized in Table 9, provided support for H3 that team member shared work-related flow experiences significantly predicted team satisfaction ($\beta_A = .47$, $p < .01$) and explained approximately 21% of the variance in team satisfaction after controlling for stress and gender ($\Delta R^2 = 0.207$), while team member individual work-related flow experiences did not

significantly predict team satisfaction (β_A = .19, p> .05). Similarly, team member shared work-related flow experiences explained approximately 16% of variance in self-reported team effort (β_A = .41, p< .01, ΔR^2= .159) compared to individual work-related flow, which only predicted approximately 8% of the variance in team member self-reported team effort (β_A = .26, p< .01, ΔR^2= .078). Due to the high correlation between individual and shared work-related flow experiences, *z*-scores were calculated to test whether the observed effects were statistically significant from each other; the effects from team satisfaction were significantly different (z= -2.07, p< .05) but not for team effort (z= -.96, p> .05). Even though the observed effects were only statistically different regarding team satisfaction outcomes, the above results provided some support that team members were able to distinguish between individual and shared work-related flow experiences and that these constructs differentially predicted team outcomes, as indicated in improved explanation of variance in team outcomes through shared work-related flow.

Individual work-related flow experiences were expected to reduce team member stress (H4*a*) and improve team member affective wellbeing (H4*b*) immediately following completion of the shared decision-making task. Results provided partial evidence that individual work-related flow experiences influenced team member stress and wellbeing. As displayed in Table 10, neither the team member's nor his or her partner's work-related flow experiences were predictive of stress following completion of the task (β_A = -.11, p> .05 and β_P = .02, p> .05), two results which provided no support for H4*a*. Tests of H4*b* indicated that the team member's work-related flow experience demonstrated a positive influence on post-task affect (β_A = .37, p< .01); however, the partner's work-related flow experiences had a negative influence on post-task affect (β_P = -.10, p< .05). Team member individual work-related flow experience accounted for approximately 34% of the variance and an increase in post-task affect (ΔR^2= .337) while the

partner's work-related flow experience accounted for an additional 4% of the variance and a decrease in team member post-task affective wellbeing ($\Delta R^2 = .035$). Overall, an increase in individual work-related flow experiences improved team member affective wellbeing; however, an increase in the partner's work-related flow experience resulted in a significant, albeit small, detrimental effect on team member affective wellbeing following a shared decision-making task. These results provided partial support for H4 that tested whether individual perceptions of work-related flow would influence stress and wellbeing after completing the task, and this occurred as an improvement in post-task affect (H4*b*).

Shared work-related flow experiences were also expected to reduce team member stress (H5*a*) and improve team member wellbeing (H5*b*) following completion of the shared decision-making task. These hypothesized relationships provided some indication as to whether shared work-related flow experiences were more enjoyable than individual experiences. Results summarized in Table 10 provided partial support for H5; neither the team member's nor his or her partner's shared work-related flow experiences influenced stress levels (β_A = -.15, p> .05 and β_P = .05, p> .05, respectively) providing no support for H5*a*. However, similar to individual work-related flow experiences, the team member's shared work-related flow experiences had a positive influence on post-task affective wellbeing (β_A = .39, p< .01) but the partner's shared work-related flow experiences had no effect on post-task affective wellbeing (β_P = -.04, p> .10). Shared work-related flow experiences explained approximately 40% of variance in post-task affect, which was a 2% increase in explained variance over individual work-related flow experiences; however, comparison of the observed effects were not significant for individual (z= -2.07, p< .05) or shared (z= -2.07, p< .05) work-related flow experiences. This provided no support for H5 that shared work-related flow experiences would improve affective wellbeing and

be slightly more enjoyable than individual work-related experiences (H5*b*). Therefore, H5 was rejected.

Early team formation was expected to directly influence the development of shared work-related flow because positive impressions of the teammate and high levels of mutual control may be conducive to the enjoyment and absorption dimensions of flow experience. Hypothesis 6 tested whether first impressions (H6*a*) and physiological compliance (H6*b*) had a direct influence on shared work-related flow. More favorable first impressions were expected to result in higher reports of flow experiences by team members. Results of APIM analyses, summarized in Table 11, indicated that, as hypothesized, team member first impressions of the teammate were predictive of shared work-related flow experiences (β_A = .27, p< .01). These results provided partial support for H6*a*, with team member first impressions explaining approximately 11% of the variance in reports of shared work-related flow experiences (ΔR^2= 0.111). Hypothesis 6*b* tested whether physiological compliance had a positive influence on shared work-related flow. Results indicated that physiological compliance did not have any influence on shared work-related flow experiences (β= .04, p> .10), showing a lack of support for H6*b*.

Team processes. The third goal of the present study was to investigate whether first impressions and physiological compliance would influence team action, transition, and interpersonal processes. Team members who had positive perceptions of their partners and better physiological compliance were expected to be more likely to establish effective coordination in completing task goals as measured by action, transition, and interpersonal processes. Hypothesis 7 tested whether first impressions of the partner had a positive influence on action processes (H7*a*), transition processes (H7*b*), and interpersonal processes (H7*c*). Results from APIM

analyses displayed in Table 12 indicated that the team member's first impression of the teammate did not influence team action (β_A = .14, p> .05) or transition processes (β_A = .17, p> .05), but did have a positive influence on team interpersonal processes (β_A = .21, p< .01). This provided partial support for H7; H7*a* and H7*b* were rejected, but support was provided for H7*c* with team member first impressions explaining 7% of the variance in interpersonal team processes (ΔR^2= .067). Overall, more positive team member first impressions of the teammate resulted in higher quality interpersonal team processes.

Hypothesis 8 tested whether physiological compliance had a positive influence on action (H8*a*), transition (H8*b*), or interpersonal (H8*c*) team processes. Both transition and action processes had non-significant ICCs (ICC = .10, F (57, 58) = 1.22, p> .10 and ICC = -.01, F (57, 58) = .99, p> .10, respectively) and interpersonal processes varied significantly between teams (ICC = .24, F (57, 58) = 1.65, p< .05); the mixed model regression procedure accounted for the significant variation between teams for interpersonal processes. Regression analyses indicated that physiological compliance had no effect on action (β= -.03, p> .10), transition (β= .07, p> .10), or interpersonal processes (β= -.01, p> .10). These results provided no support for H8; physiological compliance did not predict team processes.

Team performance. The influence of early team formation on team performance was examined with both objective and subjective measures. The first set of hypotheses investigated the impact of first impressions on subjective and objective performance outcomes. The second set investigated the impact of physiological compliance on subjective and objective performance outcomes. Analyses investigating the influence of early team formation on objective performance were all aggregated to the team level in order to accommodate the use of profit ratio as a team-level objective performance outcome.

Hypothesis 9 investigated the relationship between team member first impressions and self-reported overall team effort. A response of 100 indicated that team members judged that they and their teammates performed to the best of their ability. Specifically, significant team member effects were hypothesized where better first impressions from team members would result in improved perceptions of overall team effort. Results indicated that team member first impressions did not influence overall team effort (β_A= .02, p> .05). Thus, first impressions had no impact on whether or not team members worked to their full potential.

Hypothesis 10 investigated whether team member first impressions had an influence on the individual effort assigned to him or herself relative to the teammate. Results indicated that first impressions had no influence on how team members rated their teammates in relation to themselves (β_A = .08, p> .05). Additionally, team member first impressions had no impact on ratings of the teammate's effort (β_A = .01, p> .05).

Hypothesis 11 investigated the relationship between first impressions aggregated to the team level and profit ratio. Results indicated that first impression did not influence the profit ratio (β= -.17, p> .10). Therefore, team member first impressions were not predictive of how team members performed together on a shared decision-making task. This provided no support for H11, and the hypothesis was rejected.

Hypothesis 12 tested whether team processes would mediate the relationship between first impression and team performance. The first step in testing this mediation hypothesis would be to establish a direct relationship between first impression and profit ratio. Results of H11 indicated that the relationship between first impression and profit ratio was non-significant; therefore, continuing testing of a partial mediation was no longer appropriate. Thus, H12 was

rejected and team processes did not mediate the relationship between first impression and profit ratio.

The final set of hypotheses (H13-H15) tested whether physiological compliance had an impact on subjective and objective team performance outcomes. Hypothesis 13 investigated whether physiological compliance had a positive influence on overall team effort. Aggregation indices did not justify aggregating team effort to the team level (ICC = .01, F (54,55) = 0.98, p>.05) so reports of team effort were analyzed as independent of each other. Results of mixed-model regression analyses indicated that physiological compliance did not predict overall team effort (β= -.01, p> .10); providing no support for H13. Therefore, physiological compliance had no influence on subjective team performance.

Hypothesis 14 investigated whether physiological compliance would have an impact on team performance. As displayed in Table 13, results of aggregated OLS regression indicated that physiological compliance did predict team performance on a shared decision-making task (β= .25, p< .10). Thus, higher levels of physiological compliance between team members resulted in final recommendations earning higher profit ratios. This provided support for H14 with better physiological compliance explaining approximately 6% of variance in performance on this interdependent task (ΔR^2= .061).

Following an IMOI framework, team processes were expected to mediate the relationship between team inputs and performance outcomes. Hypothesis 15 tested whether team processes would partially mediate the relationship between physiological compliance and objective task performance. The direct relationship between compliance and performance was previously demonstrated in the test of H14 (β= .25, p< .10); however, the direct effect of compliance on team processes was previously rejected in H8. Since one pre-condition for mediation is that

physiological compliance must have a significant effect on the mediator, further testing of partial mediation was not warranted. Therefore, H12 was rejected and team processes did not mediate the relationship between compliance and team performance. A summary of all hypothesis testing described above can be found in Table 14.

Discussion

The present research investigated factors that were likely to influence the development of effective team processes because processes that develop early in team formation may impact team member satisfaction, wellbeing, and performance outcomes. Team dynamics that develop during team formation are also reported to have a lasting influence on team performance (Gersick, 1988). While existing research indicates a close link between positive social interaction and improved coordination for work and non-work related tasks (DiMascio et al., 1957; Henning et al., 2001; Warner, 1992), research on the relationship between positive team member interactions and team effectiveness is mixed, with only moderate improvements in performance as a result of improved cohesion (Mullen & Copper, 1994). Subjective reports of the quality of the relationships between team members, such as first impressions, has not provided a complete picture of the determinants of overall effectiveness of the team, and thus investigations into objective measures of team processes that might impact team effectiveness merit research attention.

The present study tested both subjective and objective measures related to team formation as potential predictors of overall team effectiveness. First impressions were chosen as a subjective measure of early team formation because early perceptions and impression management between team members were expected to have a lasting impact on the quality of the developing team relationship. As results demonstrated, first impressions were predictive of

effectiveness variables such as satisfaction and shared work-related flow. Root mean-squared error of ventilatory drive was chosen as an objective measure of physiological compliance during team formation to track the physiological compensations made by team members in their effort to achieve and maintain mutual control during task execution. The use of ventilatory drive provides a scientific basis to continuously compare team member metabolic activity. As results demonstrated, metabolic activity provided a unique and potentially more important means to assess team effectiveness than conventional measures of physiological synchrony. General patterns in the present results support the use of both subjective and objective measures to predict different dimensions of team effectiveness outcomes; team member first impressions were more predictive of subjective outcomes such as team satisfaction and wellbeing while physiological compliance was more indicative of objective outcomes such as performance, as explained in detail below.

Team Satisfaction

The first goal of the present study was to investigate the influence of early team formation on team satisfaction and task product satisfaction. Both first impressions and physiological compliance demonstrated predictive relationships with overall team satisfaction. Team member first impressions had a positive influence on team satisfaction while partner first impressions had a negative effect on team member satisfaction with the final product. The negative impact that partner first impressions had on product satisfaction suggests that positive interpersonal relationships are not the only factor driving improved overall satisfaction, which further justified the importance of examining potential moderating effects that team formation processes had on satisfaction outcomes. As hypothesized, first impressions and satisfaction with the final product did have a moderating effect on team satisfaction; satisfaction with the final

product buffered the direct relationship between first impressions and team satisfaction. As depicted in Figure 4, team members who were more satisfied with the quality of the final product were more satisfied with the team regardless of their first impressions. Previous research suggests that satisfaction is ultimately a result of previous satisfaction with the team and with the final team product (Reinig et al., 2011). The present results expand on this existing knowledge by highlighting the impact that first impressions can have on the development of team satisfaction; specifically, that positive first impressions of teammates can result in team members being satisfied with their team even if they are not satisfied with the final product.

Physiological compliance did not influence team member satisfaction with the team; however, it did explain some variance in team member satisfaction with the final product. Similar to results reported by Warner (1992), higher physiological compliance resulted in team members who were more satisfied with the results of the interaction, which was likely due to improved mutual control over the task activities that led to the final product. These results were especially interesting when considered along with results from the first impression analyses. Even though more favorable partner first impressions had a negative impact on satisfaction with the final product, the observed positive impact of physiological compliance on satisfaction with the final product suggests that physiological compliance may have provided a buffer for teams that did not have positive first impressions from the start. In other words, even if team members did not have positive first impressions of each other they were still satisfied with the team if they were able to achieve high levels of mutual control and were also satisfied with the final product that could only have resulted from successful interdependent teamwork. Therefore, negative effects of partner first impressions on team member satisfaction with the product may have been mitigated by increased physiological compliance or improved satisfaction with the team. In

practice, teams with complementary skills and the ability to coordinate task activities may be less susceptible to dissatisfaction if they are able to produce high quality products, and can be expected to be less influenced by first impressions.

Work-related Flow Experience

The second goal of this research was to determine whether team members would differentiate between individual and shared experiences of work-related flow, and whether these constructs would predict different aspects of team and individual outcomes. Even though the two constructs were highly correlated in the current study, shared work-related flow demonstrated positive prediction of team satisfaction, while individual work-related flow experiences did not. This result provided some support for two separate constructs of work-related flow despite their high correlation. Shared work-related flow also explained an additional 8% of variance in overall team effort compared to individual work-related flow; however these effects were statistically different from each other. These substantive empirical findings provided evidence that individuals have some ability to distinguish between individual and shared work-related flow experiences. Some implications of the measurement strategy used in the present study to measure individual and shared work-related flow experiences are discussed in the limitations section below.

To test whether individual and shared work-related flow had a differential impact on individual and team outcomes, the predictive capability of these constructs regarding post-task stress and post-task affective wellbeing were examined. Individual and shared work-related flow experiences were expected to reduce team member stress and enhance team member affective wellbeing while shared experiences of work-related flow were expected to be more enjoyable for team members compared to individual experiences of work-related flow. Surprisingly, neither

individual nor shared work-related flow had an influence on post-task stress. It was expected that the enjoyment and absorption experienced with work-related flow would reduce the level of stress perceived by team members. However, completing the shared decision-making task in a lab context in an ad hoc team was generally not very stressful for most participants based on their median stress value of 2.5 on a 7-point response scale. Participants were encouraged to maximize their profit on the task, but no incentive was offered to the highest scoring team, and there were no penalties for poor performance. A more competitive atmosphere may have resulted in higher variability of perceived stress.

In the case of post-task affective wellbeing, there were positive direct effects of team member work-related flow experiences for both individual and shared work-related flow. For individual work-related flow experiences, an increase in partner work-related flow experience had a negative influence on a team member work-related flow experience; however, this effect was not observed for shared work-related flow. Thus, if one team member experienced high levels of work-related flow while the other team member became disengaged there was a negative effect of partner individual work-related flow experiences on post-task affective wellbeing. On the other hand, shared work-related flow had no adverse effect on the partner, presumably because both team members were benefitting from the flow experience simultaneously. Similar to conclusions drawn by Walker (2010), these results provide empirical evidence that work-related flow experiences are more beneficial and enjoyable for team members than if one team member experiences work-related flow on his or her own. Although more investigation of this new effect is needed, these results suggest that managers of teams designed to be innovative, such as research and development teams, may benefit from structuring tasks to encourage interdependent interaction among team members rather than supporting

individualized efforts. For example, team members could be placed in task contexts to promote higher levels of shared work-related flow to prevent one or more team members from feeling disengaged.

The role of early team formation in the development of shared work-related flow was also investigated in tests of Hypothesis 6. Support for Hypothesis 6*a* indicates that positive first impressions result in higher reported shared work-related flow experiences. However, physiological compliance had no effect on shared work-related flow experiences. This suggests that relationships among team members may be very important to develop if the team is expected to engage at high levels when performing challenging interdependent tasks for long periods; for example, in surgical teams where shared work-related flow experiences would be most beneficial.

Team Processes

The third goal of the study was to use an IMOI framework (Ilgen et al., 2005) and determine whether early team formation would influence the development of future team processes. Team inputs are known to influence processes that develop between team members, and in the present study positive first impressions and high levels of physiological compliance were hypothesized to have a positive impact on the quality of team processes (H7 and H8). The only significant effect between early team formation and subsequent team processes was between first impressions and interpersonal team processes. In the original taxonomy, Marks and colleagues (2001) posited that team processes emerge through continued interaction among team members while completing team goals. Teams engage in action and transition processes at different stages of goal attainment; therefore, there was some concern in the present study that ad hoc teams performing a 40-minute task in a lab setting may not have had enough time to develop

salient action and transition processes regardless of the first impressions or physiological compliance that occurred early on. Interpersonal processes, on the other hand, describe the relationship between team members, and these interpersonal processes happen in tandem with action and transition processes throughout all stages of goal attainment and team interaction. With this understanding, it is not surprising that first impressions was the only factor that predicted the development of interpersonal team processes for the present team task. This logic also suggests that there is still some potential for physiological compliance to influence action and transition processes, but this influence may need more time to develop than was available during a 40-minute task.

Team Performance

The fourth and final goal of this research was to investigate whether early team formation would influence performance outcomes and, following an IMOI framework, whether team processes would mediate these relationships. First impressions demonstrated very little effect on performance. Although there were no statistically significant effects of first impression on team effort, partner first impressions of a team member had a negative trend-level predictive relationship with the amount of self-effort reported by that team member ($\beta = -.17$, $p = .08$). This suggests that a more negative partner first impression results in the other team member reporting that he or she did more of the work. While not statistically significant, this finding suggests that interpersonal relationships between teammates might have influenced interdependent task performance; however, more investigation is needed. Team members may have been able to pick up on the fact that their teammate did not like them, and this may have caused team members to become less engaged with each other, which would result in one team member feeling as though he or she completed most of the work.

Finally, physiological compliance demonstrated improved objective performance on the shared decision-making production task, and even though the effect size was modest, physiological compliance did predict objective performance (β= -.25, *p*= .07). This finding is especially important because physiological compliance did not predict any of the subjective measures of team processes, wellbeing, or subjective performance; yet, it demonstrated small and consistent effects on objective performance outcomes and satisfaction with the final product. These findings support a cybernetic explanation of the importance of closed-loop physiological systems that are necessary to achieve effective mutual control among the participants and for coordinated efforts in completing interdependent team tasks. The objective measure of physiological compliance used in the present study also offers an ability to continuously assess team process and function.

The positive influence that physiological compliance had on objective task performance has important implications for research and practice. Although the results of the current investigation indicate that it is important for team members to develop positive relationships early on, there is also evidence of the need to establish other important team processes. Physiological compliance, as measured in this study, would be possible to calculate for multiple team members in applied settings since collection of breathing patterns is relatively simple, non-invasive, and can be monitored continuously. Ventilatory drive measures could provide an indication of whether certain individuals are capable of working well with each other, which could improve selection practices of teams where effective coordination is crucial and task performance has major consequences, such as selection for astronaut teams or emergency response teams. Additionally, team training could be designed to improve the skill and ability of team members to achieve higher physiological compliance during stressful situations. Teams

could be instructed in process exercises designed to assist team members in achieving high levels of physiological compliance in order to benefit team effectiveness and overall performance. Finally, team tasks and task environments could be designed or redesigned to promote the development and maintenance of physiological compliance. For example, some team members may need to be located in close proximity to each other so that the physiological compliance is easier to establish and maintain. Additionally, preparation time could be provided for teams before a demanding mission or a brainstorming session in order to give their physiological systems time to align and to allow team members to establish a prime state of synchronous physiological activity.

Limitations

The present study investigated how two aspects of early team formation impacted team member experiences and perceptions as well as overall team effectiveness utilizing ad hoc, two-person teams performing a shared decision-making task in a controlled lab setting. This context may have limited the extent to which the reported results generalize to real-world teams in other settings. However, the experimental task did simulate business decisions like those that are made in real-world settings by project teams, and participants generally reported that the task was highly engaging and interactive. Furthermore, use of the objective physiological measures improved generalizability of the results since biological effects of synchronous physiological activity have been demonstrated in many different contexts including mother-infant relationships, therapist-client relationships, and between strangers. Nonetheless, it is likely that the short-term task interactions between team members in the present context made it harder to detect strong effects of physiological compliance on team effectiveness. The effects found in the

current investigation may have been more pronounced had the teams worked together over a longer period of time.

Another limitation in the present study was the simultaneous measurement of individual work-related flow items and the introduction of a shared measure of work-related flow that has not been examined specifically with work-related flow items. A previously validated scale was used to measure individual experiences of work-related flow (Bakker, 2008), and this same scale was adapted to measure shared work-related flow by referring to the team in place of the individual in each item. Although these two flow scales were separated in the post-task survey by other items to minimize confusion due to item similarities, it is possible that redundancy between items still resulted in some confusion. Although a high correlation between these two constructs provided some evidence of this redundancy, APIM analyses indicated that the scale of shared work-related flow predicted team satisfaction outcomes while individual work-related flow had no predictive effect on satisfaction. Overall, the results of the current study suggest that a construct of shared work-related flow at the team level is viable and warrants further investigation.

The nature of data collection in the present study design prevents drawing strong causal conclusions; however, causal inference is slightly improved because measures were collected at various time points in an effort to capture different stages of team process development. First impression measures were collected before team members participated in any equipment calibrations or were introduced to the task; team members were together for approximately 15 minutes before first impression was measured. It was approximately 75 minutes later when the post-task measures were completed. Physiological compliance measures used in analyses were from the first 15 minutes of the 25-minute task period, while participants were asked later on to

report perceptions of team satisfaction, work-related flow, wellbeing measures, and subjective performance. In most analyses, predictor variables temporally preceded outcome variables, thereby improving the ability to test for causal effects and also reducing potential bias due to common method variance. Furthermore, early team formation was measured using a multi-method strategy, combining self-report measures with objective physiological measures, which improves the causal inferences between factors of early team formation, team member experiences, and team effectiveness outcomes.

Finally, the large number of mixed-model and OLS regression equations tested in the present analyses poses a risk of inflating Type I error. However, hypotheses were tested in four distinct areas: satisfaction, work-related flow experiences, team processes, and team performance. Consistent patterns regarding relationships between first impressions and subjective outcomes and between physiological compliance and performance outcomes throughout these four areas alleviate concern that the reported findings are spurious.

Future Directions

Results of the current study provided evidence that both subjective measures of first impressions and objective measures of physiological compliance predicted team member experiences and team effectiveness outcomes; however, more research in this area is certainly needed. The development of interpersonal relationships and physiological compliance between individuals in social situations is a fascinating phenomenon that has stimulated research in many areas, but not much has been done with long-term monitoring of teams. This study focused on newly formed teams; therefore, the reported effects may apply to teams only early on in team formation and development. In the current study, first impressions demonstrated a generally positive influence on individual outcomes; however, there was some evidence that impressions

of the partner had a negative influence on team outcomes. Longitudinal research that follows teams beyond formation could shed light on how impressions change over time and whether partner influences fluctuate as members of the team become more familiar with each other. Additionally, some research suggests that physiological compliance may manifest differently between individuals who are more familiar with each other as opposed to individuals who just met (Cappella, 1996). Future research implementing longitudinal designs could demonstrate (1) how impressions change over time and whether partner influences fluctuate as team members become more familiar with each other and (2) the influence that physiological compliance has on existing teams to study the potential effects that greater familiarity has on physiological compliance.

Another fruitful area of future research would be to investigate potential individual differences that may influence team member first impressions and the ability of a dyad or team to establish physiological compliance. Individual differences in collective orientation, emotional intelligence, social intelligence, social skills, social styles, and personality among team members could impact how team members perceive their teammates and whether the team is likely to be able to establish physiological compliance. For example, team members with higher collective orientation may be more able to adjust their behavior to align with any teammate, which would require less physiological compensation overall and also facilitate the development of mutual control. On the other hand, a team member with low social intelligence may struggle to align their behavior or resist compensation, which could disrupt team processes and prevent goal attainment.

The controlled atmosphere of the present study may have influenced first impressions and the level of physiological compliance that developed between team members. Future studies

might consider exploring ways in which task design or the task environment may influence the development of physiological compliance between team members. For example, if the task was more competitive initially and the best performing team was promised a prize, team members may be more critical of their teammate and their perceived ability to perform well, and this could motivate team members to work harder to establish physiological compliance. This would be a very different atmosphere from the relatively neutral task environment used in the present study. Also, if individuals were allowed to interact or ask each other questions during the pre-task study period, they might have achieved higher levels of physiological compliance later during the shared decision-making task.

Research on physiological compliance would also benefit from further investigation into whether or not synchronous physiological activity is beneficial for all aspects of social interaction. Even though the effects of physiological compliance on subjective performance outcomes were not statistically significant in the present study, the apparent direction of these non-significant effects on team outcomes, such as process and work-related flow, indicates that higher levels of physiological compliance might be detrimental. Some researchers suggest that synchronous physiological activity may be an indication of rigidity or even pathology in social interaction (Gottman, 1979), and though our research indicates that compliance improves objective performance there is still the possibility that these effects are a result of rigid social interaction that only improves objective performance while not benefitting other aspects of effectiveness such as satisfaction. This could relate to potential differences between outcomes of sustained high levels of physiological compliance as opposed to the episodic moments of physiological compliance that were scored in the current study. Sustained high levels of physiological compliance over long periods of time may result in negative social outcomes due

to the demands for high levels of compensation and rigidity in the social interaction, which could cause individuals involved in the interaction to eventually become distressed. On the other hand, well-timed moments of episodic physiological compliance may lead to positive social outcomes such as the improvement in performance satisfaction and performance outcome observed in the present analyses. Therefore, a fruitful area for future research would be the examination of sustained versus episodic physiological synchrony.

Future research is also needed for the development of a shared construct of work-related flow. Even though some distinction exists between individual and shared work-related flow experiences as predictors of team-related outcomes, referent shift self-report items may be inadequate to accurately capture shared work-related flow experiences that are distinct from individual work-related flow experiences. A new scale that identifies aspects of work-related flow more salient to teams may need to be developed rather than adapting a scale previously validated for individual experiences. Alternatively, focus groups could be implemented whereby all individuals in the group come to a direct consensus regarding experiences of work-related flow from the group. Ratings from this discussion could then be compared to individual self-report ratings.

Conclusions

First impressions and physiological compliance provided an interesting parallel approach with subjective and objective measures of teamwork allowing for the investigation of the impact that early team formation processes have on team effectiveness. First impressions were predictive of several subjective outcomes such as team satisfaction, team member wellbeing, and experiences of work-related flow. Physiological compliance, on the other hand, was predictive of performance outcomes including satisfaction with the final product and objective team

performance. Results of this study identify areas where more investigation is needed in order to understand how objective measures of the underlying dynamics of teamwork can be used to predict effectiveness outcomes and how these measures may differ from more traditional subjective measures of teamwork. Evidence suggests that objective measures of teamwork can be a valuable complementary tool for researchers and practitioners to use along with subjective measures in the study of teamwork, and in deciding which individuals would work together most effectively on a team and in designing training or task environments to promote more effective teams and teamwork.

References

Aiken, L. S., & West, S. G. (1991). *Multiple regression:Testing and interpreting interactions.* Newbury Park: Sage.

Amiri, M., Montaseri, G, & Bahrami, F. (2011). On the role of astrocytes in synchronization of two coupled neurons: A mathematical perspective. *Biological Cybernetics, 105 (2),* 153-166.

Arenas, A., Diaz-Guilera, A., Kurths, J., Moreno, Y., & Zhou, C. (2008). Synchronization in complex networks. *Physics Reports, 469,* 93-153.

Ashby, W. R. (1963). *An introduction to cybernetics.* New York: Wiley.

Bahrami, B., Olsen, K., Bang, D., Roepstorff, A., Rees, G., & Frith, C. (2012). Together, slowly but surely: the role of social interaction and feedback on the build-up of benefit in collective decision-making. *Journal of Experimental Psychology: Human Perception and Performance, 38 (1),* 3-8.

Bakker, A. B., & Schaufeli, W. B. (2008). Positive organizational behavior: Engaged employees in flourishing organizations. *Journal of Organizational Behavior, 29,* 147-154.

Bakker, A. B. (2008). The work-related flow inventory: Construction and initial validation of the WOLF. *Journal of Vocational Behavior, 72 (3),* 400-414.

Berlin, J. M. (2010). Synchronous work: Myth or reality? A critical study of teams in health and medical care. *Journal of Evaluation in Clinical Practice, 16 (6),* 1314-1321.

Bettenhausen, K., & Murnighan, J. K. (1985). The emergence of norms in competitive decision-making groups. *Administrative Science Quarterly, 30,* 350-372.

Bozeman, D., & Kacmar, M. (1997). A cybernetic model of impression management processes in organizations. *Organizational Behavior and Human Decision Processes, 69 (1),* 9-30.

Campion, M. A., & Lord, R. G. (1982). A control systems conceptualization of goal-setting and changing process. *Organizational Behavior and Human Performance, 30,* 265-287.

Cappella, J. N. (1996). Dynamic coordination of vocal and kinesic behavior in dyadic interaction. In J. H. Watt & C. A. VanLear (Eds.), *Dynamic Patterns in Communication Processes:* 327-352. Thousand Oaks, CA: Sage Publications.

Carver, C. S., & Scheier, M. F. (1981). *Attention and self-regulation: A control theory approach to human behavior.* New York: Springer-Verlag.

Ceja, L., & Navarro, J. (2012). 'Suddenly I get into the zone': Examining discontinuities and nonlinear changes in flow experiences at work. *Human Relations, 65 (9),* 1101 – 1127.

Chanel, G., Kivikangas, J. M., & Ravaja, N. (2012). Physiological compliance for social gaming analysis: Cooperative versus competitive play. *Interacting with Computers, 24,* 306-316.

Cosma, J. (1999). *Flow in teams.* Unpublished masters thesis, Chicago School of Professional Psychology, Chicago, Illinois.

Chapple, E. D. (1970). Experimental production of transients in human interaction. *Nature, 228,* 630-633.

Cohen, S. G., & Bailey, D. E. (1997). What makes teams work: Group effectiveness research from the shop floor to the executive suite. *Journal of Management, 23 (3),* 239-290.

Couzin, I. I. (2007). Collective minds. *Nature London, 445 (7129),* 715-715.

Csikszentmihalyi, M., & Csikszentmihalyi, I. (1988). *Optimal experience: Psychological studies of flow in consciousness.* New York: Cambridge University Press.

DiMascio, A., Boyd, R. W., & Greenblatt, M. (1957). Physiological correlates of tension and antagonism during psychotherapy. *Psychosomatic Medicine, 19 (2),* 99-104.

Devine, D. J., Habig, J. K., Martin, K. E., Bott, J. P., & Grayson, A. L. (2004). Tinsel town: A top management simulation involving distributed expertise. *Simulation and Gaming, 35 (1),* 94-134.

Dyer, W. G., Dyer, W. G., & Dyer, J. H. (2007). *Team building: Proven strategies improving team performance, 4th ed.*. San Francisco, CA: Jossey-Bass.

Edwards, J. R. (1992). A cybernetic theory of stress, coping, and well-being in organizations. *Academy of Management Review, 17 (2),* 238-274.

Eisenberg, N., Spinard, T. L., & Eggum, N. D. (2010). Emotion-regulated self-regulation and its relation to children's maladjustment. *Annual Review of Clinical Psychology, 6,* 495-525. Doi: 10.1136/annurev.clinpsy.121208.131208

Elkins, A. N., Muth, E. R., Hoover, A. W., Walker, A. D., Carpenter, T. L., & Switzer, F. S. (2009). Physiological compliance and team performance. *Applied Ergonomics, 40,* 997-1003.

Feldman, R., Magori-Cohen, R., Galili, G., Singer, M., & Louzoun, Y. (2006). Mother and infant coordinate hear rhythms through episodes of interaction synchrony. *Infant Behavior and Development, 34,* 569-577.

Fisher, C. D. (2010). Happiness at work. *International Journal of Management Review, 12,* 384-412.

Funke, G., Knott, & Salas (2011). Team workload: A critical need. *Human Factors, 54 (1),* 36-51.

Gersick, C. J. G. (1988). Time and transition in work teams: toward a new model of group development. *Academy of Management Journal, 31 (1),* 9-41.

Gibson, C. B. (2001). Me and us: Differential relationships among goal-setting training, efficacy and effectiveness at the individual and team level. *Journal of Organizational Behavior, 22 (7),* 789-808.

Goffman, E. (1959). *The presentation of self in everyday life*. New York: The Overlook Press.

Goodwin, B. (1970). Biological stability. In C. H. Waddington (Ed.), *Toward a theoretical biology* (Vol. 3, pp. 1-17). Chicago: Aldine.

Gottman, J. M. (1979). *Marital interaction: Experimental investigations.* New York: Academic Press.

Guastello, S., & Guastello, D. (1998). Origins of coordination and team effectiveness: A perspective from game theory and nonlinear dynamics. *Journal of Applied Psychology, 83 (3),* 423-437.

Guzzo, R. A., & Shea, G. P. (1992). Group performance and intergroup relations in organizations. In M.A. Dunnette & L. M. Hough (Eds.), *Handbook of industrial and organizational psychology,* 269-313. Palo Alto, CA: Consulting Psychologists Press.

Hackman, R. (1987). The design of work teams. In *Handbook of Organizational Behavior,* J. W. Lorsch (Ed), 315-342. Englewood Cliffs, NJ: Prentice-Hall.

Haley, D. W., & Stansbury, K. (2003). Infant stress and parent responsiveness: regulation of physiology and behavior during still-face and reunion. *Child Development, 74 (5),* 1534-1546.

Henning, R. A., Armstead, A. G., & Ferris, J. K. (2009). Social psychophysiological compliance in a four-person research team. *Applied Ergonomics, 40,* 1004 – 1010.

Henning, R. A., Boucsein, W., Gil, M. C. (2001). Social-physiological compliance as a determinant of team performance. *International Journal of Psychophysiology, 40,* 221-232.

Henning, R. A., & Korbelak, K. T. (2005). Social-physiological compliance as a predictor of future team performance. *Psychologia, 48,* 84-92.

Heynes, K., Pavlas, D., & Salas, E. (2011). An investigation on the effects of flow state on team processes. *Proceedings of the Human Factors and Ergonomic Society 55th Annual Meeting.*

Ichheiser, G. (1949). Misunderstandings in human relations. *Supplement to the American Journal of Sociology, 55,* 6-7.

Ilgen, D. R., Hollenbeck, J. R., Johnson, M., & Jundt, D. (2005). Teams in organizations: From input-process-output models to IMOI models. *Annual Review of Pschology, 56,* 517-43.

Ishak, A. W., & Ballar, D. I. (2012). Time to re-group: A typology and nested phase model for action teams. *Small Group Research, 43 (1),* 3-29.

Jackson, S. A. (1996). Development and validation of a scale to measure optimal experience: The flow state scale. *Journal of Sport & Exercise Psychology, 18 (1),* 17- 35.

Klein, H. J. (1989). An integrated control theory model of work motivation. *Academy of Management Review, 14 (2),* 150-172.

Kozlowski, W. J., & Ilgen, D. R. (2006). Enhancing the effectiveness of work groups

and teams. *Psychological Science in the Public Interest, 7 (3),* 77-124.

Lakens, D., & Stel, M. (2011). If they move in sync, they must feel in sync: Movement synchrony leads to attributions of rapport and entitativity. *Social Cognition, 29 (1),* 1-14.

Lancellotti, M. P., & Boyd, T. (2008). The effects of team personality awareness exercises on team satisfaction and performance: The context of marketing course projects. *Journal of Marketing Education, 30 (3),* 244-254.

Lazarovitz, S. (2003). *Team and individual flow in female ice hockey players: The relationships between flow, group cohesion, and athletic performance.* Unpublished dissertation, University of Calgary, Calgary, Alberta, Canada.

Levenson, R., & Gottman, J. (1983). Marital interaction: Physiological linkage and affective exchange. *Journal of Personality and Social Psychology, 45 (3),* 587-597.

Manz, C. C. (1986). Self-leadership: Toward an expanded theory of self-influence processes in organizations. *Academy of Management Review, 11 (3),* 585-600.

Marks, M. A., Mathieu, J. E., & Zaccaro, S. J. (2001). A temporally based framework and taxonomy of team processes. *Academy of Management Review, 26 (3),* 356-376.

Martin, A. J. & Jackson, S. A. (2008). Brief approaches to assessing task absorption and enhanced subjective experience: Examining 'short' and 'core' flow in diverse performance domains. *Motivation and Emotion, 32,* 141-157.

Mathieu, J. E., Gilson, L. L., & Ruddy, T. M. (2006). Empowerment and team effectiveness: An empirical test of an integrate model. *Journal of Applied*

Psychology, 91 (1), 97-108.

McGrath, J. E. (1984). *Groups: Interaction and performance.* Englewood Cliffs, NJ: Prentice-Hall.

McGrath, J. E., Arrow, H., & Berdahl, J. L. (2000). The study of groups: Past, present, and future. *Personality and Social Psychology Review, 4 (1),* 95-105.

Moore, G. P., & Chen, J. (2010). Timings and interactions of skilled musicians. *Biological Cybernetics, 103 (5),* 401-414.

Mullen, B., & Copper, C. (1994). The relation between group cohesiveness and performance: An integration. *Psychological Bulletin, 115 (2),* 210-227.

Mulvey, P. W., Bowes-Sperry, L., & Klein, H. J. (1998). The effects of perceived loafing and defensive impression management on group effectiveness. *Small Group Research, 29 (3),* 394-415.

Nguyen, N. T., Seers, A., & Hartman, N. S. (2008). Putting a good face on impression management: Team citizenship and team satisfaction. *Journal of Behavioral and Applied Management, 9 (2),* 148-159.

Nowak, K. L., Watt, J., & Walther, J. B. (2009). Computer mediated teamwork and the efficiency framework: Exploring the influence of synchrony and cues on media satisfaction and outcome success. *Computers in Human Behavior, 25 (5),* 1108-1119.

Orsila, R., Luukkaala, T., Manka, M., & Nygard, C. (2011). A new approach to measuring work-related well-being. *International Journal of Occupational Safety and Ergonomics, 17 (4),* 341-359.

Patterson, M. L. (1976). An arousal model of interpersonal intimacy. *Psychological*

Review, 83 (3), 235-245.

Porges, S. W. (1995). Orienting in a defensive world: Mammalian modifications of our evolutionary heritage. *Psychophysiology, 32,* 301-318.

Porges, S. W. (2006). The polyvagal perspective. *Biological Psychology, 74,* 116-143.

Preacher, K. J., Curran, P. J., & Bauer, D. J. (2006). Computational tools for probing interaction effects in multiple linear regression, multilevel modeling, and latent curve analysis. *Journal of Educational and Behavioral Statistics, 31,* 437-448.

Russell, W. D. (2001). An examination of flow state occurrence in college athletes. *Journal of Sport Behavior, 24 (1),* 83-107.

Shtenynberg, G., & Galinsky, A. D. (2011). Implicit coordination: Sharing goals with similar others intensifies goal pursuit. *Journal of Experimental Social Psychology, 47 (6),* 1291-1294.

Smith, K. U. (1971). Social feedback: Determination of social learning. *The Journal of Nervous and Mental Diseases, 152 (4),* 289-297.

Smith, K. U. (1972). Social tracking in the development of educational visual skills. *American Journal of Optometry and Archives of American Academy of Optometry, 49 (1),* 50-59.

Smith, T.J., & Smith, K.U. (1987a). Feedback-control mechanisms of human behavior. In G. Salvendy (Ed.), *Handbook of human factors* (pp. 251-293). New York: Wiley.

Stanton, J. M., Blazer, W. K. Smith, P. C., Parra, L. F., & Ironson, G. (2001). A general measure of work stress: The stress in general scale. *Educational and Psychological Measurement, 61 (5),* 866-888.

Strogatz, S. H. (2003). *Sync: The emerging science of spontaneous order.* New York,

NY: Hyperion.

Sundstrom, E. (1999). The challenges of supporting work team effectiveness. In E. Sundstrom & Associates (Eds.), *Supporting work team effectiveness:* 3-23. San Francisco: Jossey-Bass.

Swaab, R. I., Galinsky, A. D., Medvec, V. & Diermeier, D. A. (2012). The communication orientation model: Explaining the diverse effects of sight, sound, and synchronicity on negotiation and group decision-making outcomes. *Personality and Social Psychology Review, 16 (1),* 25-53.

Troth, A. C., Jordan, P. J., Lawrence, S. A., & Tse, H. H. (2012). A multilevel model of emotional skills, communication performance, and task performance in teams. *Journal of Organizational Behavior, 33,* 700-722.

Tuckman, B. W. & Jensen, M. A. C. (1977). Stages of small group development revisited. *Group and Organizational Studies, 2,* 419-427.

Van Katwyk, P. T., Fox, S., Spector, P. E., & Kelloway, E. K. (2000). Using the job-related affective well-being scale (JAWS) to Investigate Affective Responses to Work Stressors. *Journal of Occupational Health Psychology, 5 (2),* 219-230.

Walker, C. J. (2010). Experiencing flow: Is doing it together better than doing it alone? *The Journal of Positive Psychology, 5 (1),* 3-11.

Warner, R. M. (1987). Rhythmic organization of social interaction and observer ratings of positive affect and involvement. *Journal of Nonverbal Behavior, 11 (2),* 57-74.

Warner, R. (1992). Dimensions of social interaction tempo: a factor analytic study of time and frequency domain indexes of interaction structure. *Journal of Psycholinguistic Research, 21 (3),* 173-191.

Warner, R. (1996). Coordinated cycles in behavior and physiology during face-to-face social interactions. In J. H. Watt & C. A. VanLear (Eds.), *Dynamic Patterns in Communication Processes:* 327-352. Thousand Oaks, CA: Sage Publications.

Weiner, N. (1948). *Cybernetics: Control and communication in the animal and the machine.* Cambridge, MA: The MIT Press.

Zijlstra, F. R., Waller, M. J., & Phillips, S. I. (2012). Setting the tone: Early interaction patterns in swift-starting teams as a predictor of effectiveness. *European Journal of Work and Organization Psychology*, *21 (5)*, 749-777.

Table 1

Task Information by Role

	Shared	Unique
VP Marketing and Research	General Memo	Viewer Appeal Ratings
	Simulation Algorithms	MPAA Rating
	Screenplays	Expected Ticket Price
VP Talent and Scripts	General Memo	Script Quality Ratings
	Simulation Algorithms	Skill Ratings for Actors, Actresses, and Directors
	Screenplays	

Note: All task materials are available in Appendix A

Table 2

Job-related Affective Wellbeing Items

Before coming to the experiment today I was feeling:	At ease
	Bored
	Calm
	Content
	Ecstatic
	Energetic
	Enthusiastic
	Excited
	Fatigued
	Inspired
	Relaxed
	Satisfied
	Stressed

Table 3

Individual and Shared Work-related Flow Items

Individual Work-related Flow Items	Referent Shift Items
When I was working on this task, I thought about nothing else.	When we were working on this task, we thought about nothing else.
My work on the task gave me a good feeling.	Working together on the task gave us a good feeling.
I would enjoy working on a task like this in my free time.	We would be very willing to work together in our spare time.
I would want to participate in this task, even if I did not receive any credits.	We got our motivation from working together on the task, not the course credit reward for being in an experiment.
I work hard because I enjoy it.	We would work together again because we enjoy it.
I got carried away while working on the task.	We got carried away while working on the task.
I enjoyed doing this task.	We enjoyed doing this task.
When I am working on something, I'm doing it for myself.	When we were working on the task, it felt like we were doing it for ourselves.
When I was working on the task, I forgot everything else around me.	When we were working on the task, we forgot everything else around us.
I felt happy during this task.	We felt happy during this task.
I get my motivation from the work itself, and not from the course credit reward for it.	We would want to work together again, even if we did not receive course credit for it.
I was totally immersed in the task.	We were totally immersed in the task.
I felt cheerful while I was working on the task.	We felt cheerful while we were working on the task.

Table 4
Summary of Non-Independence Indices

	ICC	*F (54, 55)*
Team Satisfaction	.10	1.22
Product Satisfaction	.14	1.33
Individual Work-related Flow	.11	1.25
Shared Work-related Flow	.01	1.03
Post-task Stress	.00	1.00
Post-task Wellbeing	.19	0.69
Action Process	.01	0.99
Transition Process	.10	1.22
Interpersonal Process	.24	1.65*
Self Effort	.17	0.71
Partner Effort	.02	0.97
Team Effort	.01	0.98

Note: ICC indices only conducted for outcome variables, *p< .05.

Table 5

Individual-level Descriptive Statistics and Correlations

	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Individual Gender	.28	.97	-													
2. Pre-Experiment Stress	6.83	1.39	.00	(.92)												
3. First Impression	5.06	.91	.14	-.08	(.84)											
4. Team Satisfaction	5.89	.78	.05	-.05	.39	(.78)										
5. Product Satisfaction	5.43	1.10	.00	-.29	.01	.33	(.84)									
6. Post-Experiment Stress	2.74	1.15	.02	.61	-.06	-.19	-.40	(.91)								
7. Work-related Flow	4.56	.92	-.17	-.12	.16	.19	.15	-.16	(.90)							
8. Shared work-related flow	4.84	.82	-.11	-.09	.30	.47	.38	-.19	.73	(.90)						
9. Pre-Experiment Affect	4.16	.72	-.06	-.64	.06	.05	.22	-.35	.19	.24	(.83)					
10. Post-Experiment Affect	4.58	.66	-.19	-.34	.02	.19	.42	-.52	.59	.63	.41	(.83)				
11. Action Process	5.88	.77	.13	-.13	.20	.38	.39	-.29	.13	.36	.10	.15	(.72)			
12. Transition Process	5.50	.90	.00	-.00	.18	.32	.38	-.20	.32	.43	.05	.23	.54	(.73)		
13. Interpersonal Process	5.96	.70	.05	-.01	.28	.62	.38	-.23	.26	.51	.09	.26	.70	.51	(.74)	
14. Final Impression	5.59	.89	.05	-.03	.61	.58	.25	-.14	.13	.42	.04	.15	.36	.23	.53	(.89)

Note: N=110 individuals; Gender coded Male=-1 and Female =1; Alpha coefficients are reported on the diagonal

Table 6

Team-Level Descriptive Statistics and Correlations

	M	SD	1	2	3	4
1. Team Gender	.60	.71	-			
2. Team Stress	2.74	.81	.12	(.91)		
3. Task Compliance	.06	.01	.01	-.15	-	
4. Profit Ratio	2.09	.53	.04	-.08	-.22	-

Notes: N = 55 teams; Alpha coefficients of aggregated variables are reported on the diagonal

Table 7
APIM Results for First Impression and Team Satisfaction

	Team Satisfaction		Product Satisfaction	
	β	ΔR^{2}^	β	ΔR^{2}
Step 1				
Team Member Gender	.05		-.00	
Team Member Stress	-.04		-.33**	
Step 2				
Team Member Gender	.05		.14	
Team Member Stress	-.02		-.34**	
Team Member First Impression	.26**		-.01	
Partner First Impression	-.11	.106	-.23*	.026
Step 3				
Team Member Gender	.02			
Team Member Stress	.06			
Team Member First Impression	.27**			
Partner First Impression	-.06			
Product Satisfaction	.26**	.113		
Step 4				
Team Member Gender	-.06			
Team Member Stress	.00			
Team Member First Impression	.24**			
Teammate First Impression	-.06			
Product Satisfaction	.28*			
Team Member Impression x Product Satisfaction	-.14*			
Teammate Impression x Product Satisfaction	-.05	.037		

Note: *p< .05, **p< .01, ^ ΔR^{2} indicates additional variance explained by each step

Table 8

Regression Results for Physiological Compliance and Satisfaction

	Team Satisfaction		Product Satisfaction	
	β	ΔR^2	β	ΔR^2
Step 1				
Gender	.07		-.00	
Stress	-.05		-.30**	
Step 2				
Gender	.03		-.02	
Stress	-.03		-.32**	
Physiological Compliance	.03	.008	.18^{+}	.026
Step 3				
Gender	.03			
Stress	.06			
Physiological Compliance	.08			
Product Satisfaction	.28**	.117		
Step 4				
Gender	.03			
Stress	.06			
Physiological Compliance	.09			
Product Satisfaction	.29**			
Physiological Compliance*Product Satisfaction	-.03	.008		

Notes: *p< .05, **p< .01, $^{+}$p< .10

Table 9

Comparison of Individual and Shared Work-related Flow Experiences

	Team Satisfaction		Team Effort	
	ß	ΔR^2	ß	ΔR^2
Individual Work-related Flow				
Step 1				
Gender	.07		-.07	
Stress	-.05		-.11	
Step 2				
Gender	.15		.02	
Stress	-.02		-.10	
Team Member Work-related Flow	.19		.26**	
Teammate Wok-related Flow	-.02	.016	.15	.078
Shared work-related flow				
Step 1				
Gender	.07		-.07	
Stress	-.05		-.11	
Step 2				
Gender	.19		-.05	
Stress	-.00		-.08	
Team Member Work-related Flow	.47**		.41**	
Teammate Work-related Flow	.01	.207	.13	.089

Note: *p< .05, **p< .01

Table 10
APIM Results for Work-related Flow and Wellbeing

	Post-Task Stress		Post-Task Wellbeing	
	ß	ΔR^2	ß	ΔR^2
Individual Work-related Flow				
Step 1				
Gender	.01		-.22	
Pre-task Team Member Stress	.70**		-.22**	
Pre-task Partner Stress	.09		-.09	
Step 2				
Gender	-.03		-.12	
Pre-task Team Member Stress	.68**		-.18**	
Pre-task Partner Stress	.10		-.10*	
Team Member Wok-related Flow	-.12		.34**	.317
Partner Work-related Flow	.04	.004	-.12*	.051
Shared work-related flow				
Step 1				
Gender	.01		-.22	
Pre-task Team Member Stress	.70**		-.22**	
Pre-task Partner Stress	.09		-.09	
Step 2				
Gender	-.03		-.16	
Pre-Task Team Member Stress	.68**		-.19**	
Pre-Task Partner Stress	.08		-.07	
Team Member Work-related Flow	-.15		.38**	
Partner Work-related Flow	.06	.012	-.04	.394

Notes: *p< .05, **p< .01

Table 11

APIM Results for First Impression and Shared work-related flow

	ß	ΔR^2
Step 1		
Gender	-.19	
Stress	-.08	
Step 2		
Gender	-.19	
Stress	-.06	
Team Member First Impression	.27**	
Teammate First Impression	-.15	.111

Note: *p< .05, **p< .01

Table 12

APIM Results for First Impression and Team Processes

	Action Process		Transition Process		Interpersonal Process	
	ß	ΔR^2	ß	ΔR^2	ß	ΔR^2
Step 1						
Gender	.20		.01		.01	
Team Member Stress	-.10		.01		-.01	
Partner Stress	-.19*		-.12		-.11	
Step 2						
Gender	.19		.02		.01	
Team Member Stress	-.09		.02		.01	
Partner Stress	-.18*		-.11		-.11	
Team Member First Impression	.13		.16		.20**	
Teammate First Impression	-.05	.013	-.07	.015	-.08	.069

Note: *p< .05, **p< .01

Table 13
Regression Results for Early Team Formation and Objective Performance

	β	ΔR^2
Frist Impression		
Step 1		
Team Gender	.04	
Team Stress	-.09	
Step 2		
Team Gender	.01	
Team Stress	-.11	
Team Impression	-.17	.026
Task Compliance		
Step 1		
Team Gender	.04	
Team Stress	-.09	
Step 2		
Team Gender	.05	
Team Stress	-.14	
Task Compliance	$-.25^{+}$	.061

Note: $^{+}p < .10$

Table 14
Summary of Results

	Hypothesis	Predictor	Outcome	Result
Interpersonal Interaction	H1*a*	First Impression	Team Satisfaction	Supported
	H1*b*		Product Satisfaction	Partially Supported
	H1*c*	First Impression*Product Satisfaction	Team Satisfaction	Supported
	H2*a*	Phys. Compliance	Team Satisfaction	Not Supported
	H2*b*		Product Satisfaction	Supported
	H2*c*	Phys. Compliance*Product Satisfaction	Team Satisfaction	Not Supported
Work-related Flow	H3*a*	Individual W-R Flow and Shared W-R Flow	Team Satisfaction	Supported
	H3*b*		Team Effort	Supported
	H4*a*	Individual W-R Flow	Stress	Not Supported
	H4*b*	Shared W-R Flow	Affective Wellbeing	Partially Supported
	H5*a*		Stress	Not Supported
	H5*b*		Affective Wellbeing	Supported
	H6*a*	First Impression	Shared W-R Flow	Partially Supported
	H6*b*	Phys. Compliance		Not Supported

Table 14

Summary of Results Continued

	Hypothesis	Predictor	Outcome	Result
Team Processes	H7*a*	First Impressions	Action	Not Supported
	H7*b*		Transition	Not Supported
	H7*c*		Interpersonal	Supported
	H8*a*	Physiological Compliance	Action	Not Supported
	H8*b*		Transition	Not Supported
	H8*c*		Interpersonal	Not Supported
Team Performance	H9	First Impression	Team Effort	Not Supported
	H10		Individual Effort	Not Supported
	H11	Physiological Compliance	Profit Ratio	Not Supported
	H12		Team Effort	Not Supported
	H13			Not Supported
	H14		Profit Ratio	Supported
	H15			Not Supported

Figure Captions

Figure 1. Moderation of first impression and product satisfaction

Figure 2. Moderation of physiological compliance and product satisfaction

Figure 3. Mediation of first impression and performance relationship

Figure 4. Mediation of physiological compliance and performance relationship

Figure 5. Final recommendation sheet

Figure 6. Laboratory floor plan

Figure 7. Experiment time sequence

Figure 8. Buffering effect of product satisfaction on first impression

Figure 1

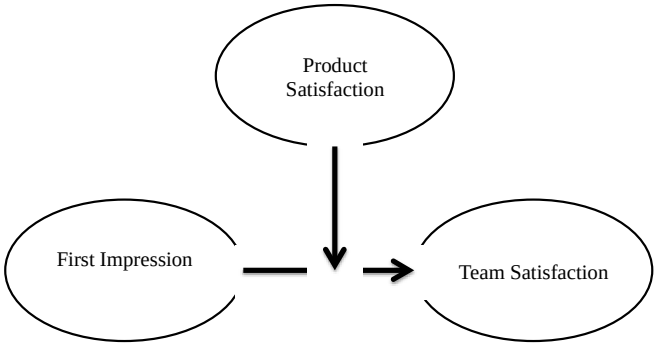


Figure 2

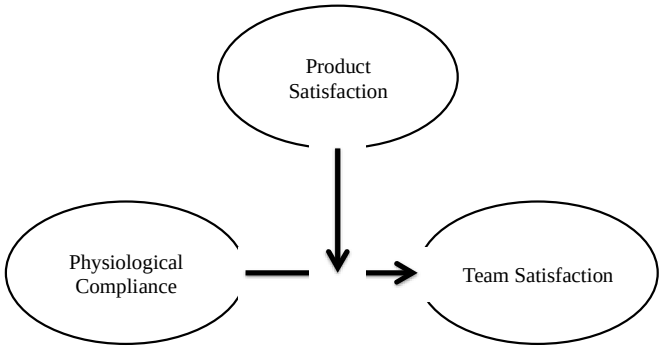


Figure 3

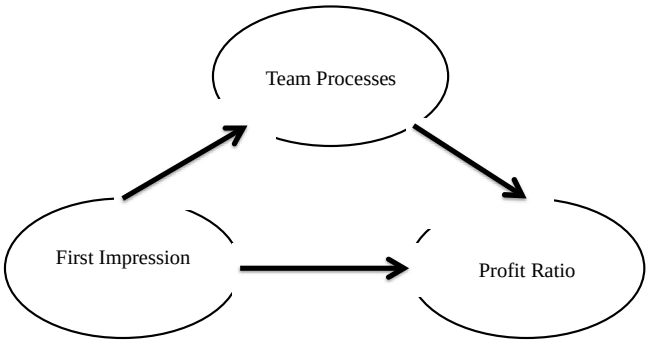


Figure 4

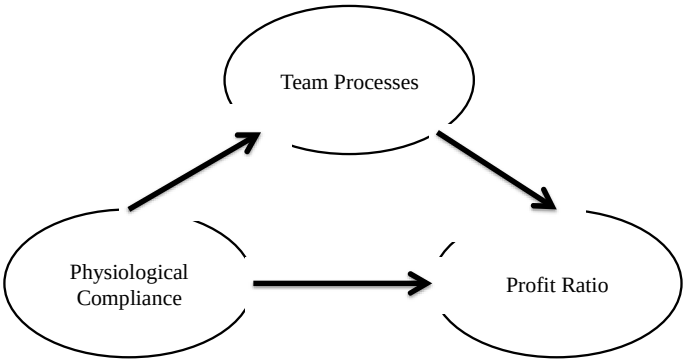


Figure 5

Final Recommendation Sheet

Title	Production $	+	Marketing $				=	Total $
	(All amounts are in millions of dollars)							
A Lifetime of Anger	$20	+	0	5	10	20	=	_____
Chosin Reservoir	$46	+	0	5	10	20	=	_____
Rikki-Tikki-Tavi	$65	+	0	5	10	20	=	_____
Degeneration	$51	+	0	5	10	20	=	_____
Fast Food	$25	+	0	5	10	20	=	_____
Light Years	$90	+	0	5	10	20	=	_____
On Campus	$12	+	0	5	10	20	=	_____
Renegade	$38	+	0	5	10	20	=	_____
Rio	$40	+	0	5	10	20	=	_____
Sex Ed.	$29	+	0	5	10	20	=	_____
Southern Accents	$23	+	0	5	10	20	=	_____
Total:								**<150**

Figure 6

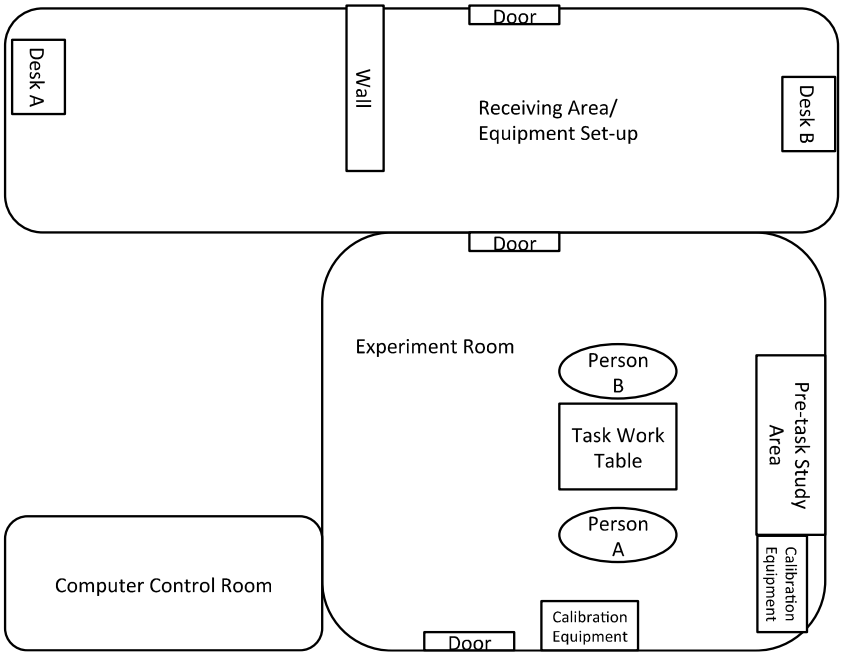
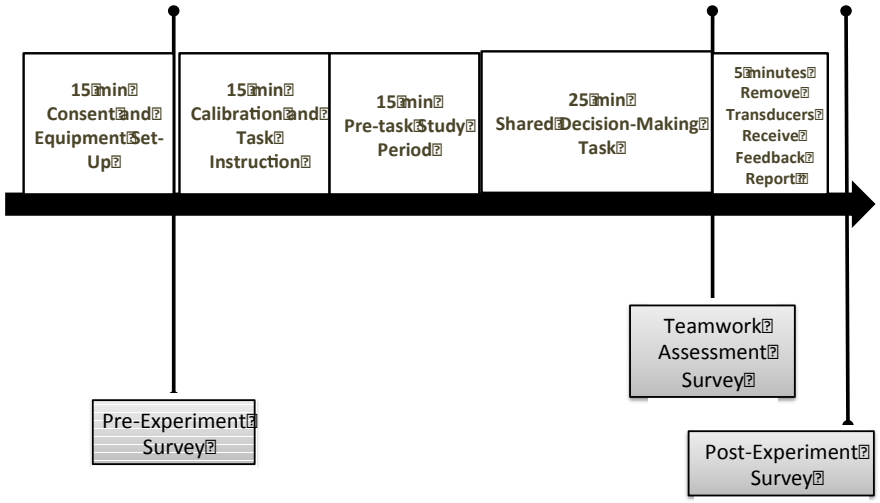
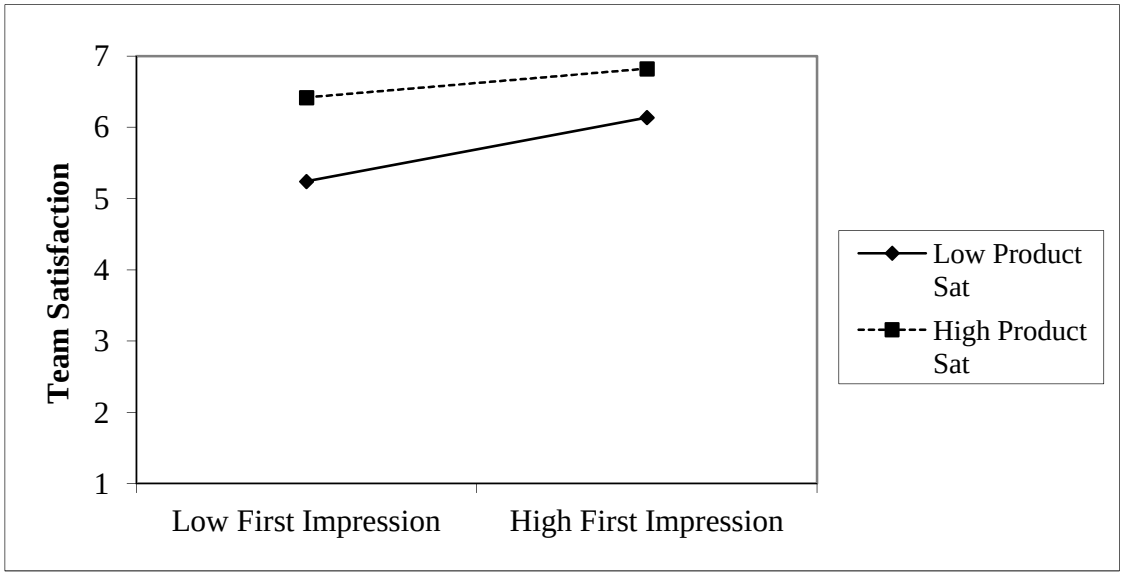


Figure 7



Note: Experiments typically lasted between 80-90 minutes depending on signal strength and any adjustments that needed to be made

Figure 8



Appendix A: Task Materials Provided to Participants

Simulation Algorithms

(1) **Movie Profit (**in millions**)** = Movie Revenue – Movie Cost

……..

(2) **Movie Cost (**in millions**)** = Production Cost + Marketing Cost

(3) **Movie Revenue** (in millions) = Average Ticket Price * #Viewers

…….

(4) **#Viewers (**in millions) = Viewer Appeal* Movie Quality*MPAA Rating

……..

(5) **Viewer Appeal** = (Content Appeal + Star Appeal)*Marketing Level

(6) **Movie Quality[a] =** Script Quality*Director Skill*Acting Quality[b]

For a movie with 2 Lead Roles:

(6a) **Acting Quality** = $(\text{LR Acting Skill}_1 * \text{LR Acting Skill}_2)^{.5}$

For a movie with 3+ Lead Roles:

(6b) **Acting Quality =** Σ(LR Acting Skill)/# Lead Roles

[a]Movie Quality for Animated Films = Script Quality*Script Quality*Director Skill
[b]The Acting Skill of Supporting Actors is ALWAYS ignored for the purposes of calculating Acting Quality.

GENERAL MEMO

To: Vice-President, Talent and Scripts
Vice-President, Marketing and Research

From: Stan Friedman, CEO

RE: Choosing films for production next year

Thanks for agreeing to meet on such short notice. As usual, the task in front of you is one of picking the movies that we will produce and release in the upcoming year. The fiscal solvency of our studio is riding on the decisions you make. Pick the best movies and we (as well as our stockholders) will be swimming in profit; pick the wrong ones and we may go belly up.

As you all know, profit from the movies we make is determined by taking the revenue earned by each film and subtracting its cost:

Movie Profit = Movie Revenue – Movie Cost

Movie cost is estimated by adding the production cost (which is fixed) to the marketing cost (which is under our control):

Movie Cost = Production Cost + Marketing Cost

Movie revenue is estimated by multiplying the number of viewers by the average ticket price for a particular film:

Movie Revenue = # of Viewers * Average Ticket Price

As you are well aware, the number of viewers for any given film depends on five main factors: (1) Viewer Appeal, (2) Movie Quality, (3) Marketing, (4) MPAA rating, and (5) Average Ticket Price. *Viewer Appeal* is basically a function of popular interest in the film's content (i.e., setting, plot, special effects), as well as the popularity of the talent involved (i.e., director and actors/actresses). *Movie quality* is a function of the script quality, director's skill, and actor/actress' skill. All of these things interact with one another, and each one is important. If a movie has a good script and good actors/actresses but a terrible director, the movie will not be very good. Similarly, if a movie has a good director and good stars but a poor script, it will also be bad. It probably goes without saying that a movie that is poor in all three categories will just plain stink. *Marketing* obviously increases public awareness of our movie, and the *MPAA rating* constrains the size of our audience base. The *average ticket price* reflects the age of the average viewer and, to a certain extent, the time of day that the typical viewer goes to see the movie. Movies with the highest average ticket prices draw mostly adults who go to see the movie in the evening; movies with lower average ticket prices attract younger viewers and

people who go when matinees prices are in effect. ***The point here is that all five factors must be considered when estimating how much revenue a film will bring in.***.

Our spending allowance for this year is $150 million. It is hard to tell from a brief summary how much a film is going to cost because it depends on many factors, including star salaries, shooting location and duration, and special effects. However, our screenplay reviewers are pretty good and the estimates they provide should be very close.

I would like you to examine the information at your disposal and figure out how to spend our $150 million to maximize total profit for the year. As usual, I don't care if you spend the $150 million on one blockbuster or divvy it up over 10 little art-house projects – just figure out the ones that will bring in the most profit. While a film's total revenue is important, keep in mind that it is return on investment that is critical. *In other words, the most important value to estimate is a potential film's profit divided by its cost (i.e., profit/cost, or profit ratio). Profit ratio reflects the number of dollars of profit we get for every dollar we spend.* A good film will end up making about twice as much as it cost (including marketing), and a great film may end up making three to four times as much.

And don't bother trying to save any money – it is there to be spent, so use as much as you can.

I know that picking movies isn't an easy task, but do the best you can. Your staffs have provided you with a good deal of useful information, and I think our screening team has identified a good set of potential choices for you. Feel free to use your personal experiences and gut feelings, but let the hard numbers provided by our research team have the final say. I look forward to seeing your recommendations on my desk next week. Good luck!

MEMO

To: Vice-President, Marketing and Research
From: Industry Research Staff

RE: Viewer Appeal ratings

Here is the market research that you requested on potential movies for next year. We pulled together 10 focus groups as usual to get this data. Each focus group was led by someone on our staff and involved a roundtable discussion of the movie's premise and cast, plus formal ratings of content and star appeal by each member of the focus group. We gave the focus groups the same movie capsules that your committee is using to make your decisions. See Table 1 for a summary of the findings from the focus group research.

Table 1 contains two separate estimates of a film's appeal based on its *content* and *stars*. We asked people in the focus group to discuss (and rate) Content Appeal and Star Appeal separately. **Content Appeal** concerns a movie's premise, plot, character development, and special effects; the film's genre and emergent themes play a role as well. **Star Appeal** has to do with the popularity of the actors/actresses as well as the director. Industry research suggests that content is roughly twice as important as stars in determining who goes to see a movie, so we scaled Content Appeal values from 0-200, and Star Appeal values from 0-100. Basically, a Content Appeal score of 200 means that the movie should have a very broad demographic appeal and the focus group participants were dying to see the screenplay get turned into a movie. In contrast, a Content Appeal score of 0 means that no one was interested in seeing the movie get made based solely on its subject matter. A Star Appeal score of 100 means that basically every role in the film has A-List stars that people want to see; a score of 0 means that the cast is essentially unknown to the audience. Star Appeal is based on physical attractiveness, charisma, and the success of recent films and has little to do with talent – it only reflects "popular demand."

Films with unusual situations and big-name stars tend to have more appeal to viewers. In particular, action/adventure, war, science-fiction, and suspense films tend to interest people more than dramas or comedies. Animated films almost always do well with families and often become blockbusters – they have a built-in audience if based on a book or story familiar to the audience. Horror movies do well with males (especially younger ones) and some pull in women as well. Comedies do well if the situation is right and the casting is good. Dramas are the most variable; they tend to draw discriminating viewers from all groups, but usually have much lower content appeal because their situations are more ordinary. More importantly, movies with lots of special effects are very attractive regardless of their genre – in part because of extensive repeat viewing.

To summarize, the Content Appeal and Star Appeal values quantify the appeal of a film based on its subject matter and cast, respectively. **A good overall index of the "buzz" surrounding a potential movie is to add up its Content Appeal and Star Appeal**.

Focus Group Research on Viewer Appeal of Potential Movies.

Movie Title	Content Appeal	Star Appeal	Staff Comments
Rikki-Tikki-Tavi	200.00	75.00	Families will eat this stuff up; the famous mongoose is loved by all. Focus groups liked the voices.
Light Years	185.00	30.00	Offbeat science fiction story from an A-list director. Story is intriguing, and will have great special effects.
Chosin Reservoir	150.00	50.00	Older viewers were intrigued by the history; younger viewers liked the realistic battle scenes.
Degeneration	130.00	55.00	Everyone loves a good zombie pic. Should provide nice mix of humor and special effects.
Renegade	130.00	80.00	A modern update of *Invasion of the Body Snatchers*. The huge *X-Files* fan base will love it, especially with Jessica Alba.
Rio	110.00	45.00	Mystery involving sex, murder, corruption – and the President. Should appeal to older viewers.
Sex Ed	80.00	40.00	Sex in the schools is a perfect target, and focus groups responded well. No headliners, but good cast.
Southern Accents	75.00	30.00	Gritty realism – story appealed more to women, but men really liked Eliza Dushku.
Fast Food	70.00	70.00	Spoof of typical fast food joint scored about average on content; perfect casting in this one.
A Lifetime of Anger	65.00	45.00	A biting tragedy; this may be the tear-jerker of the year. No major female roles hurts appeal some.
On Campus	50.00	0.00	Documentary-style exploration of college life. Viewer appeal will be somewhat limited to older teens and young adults.

MEMO

To: Vice-President of Talent and Scripts
From: Talent and Script Evaluation Staff

RE: Script Quality ratings for potential movies

Here is the information you requested regarding the movie screenplays that were sent to us for evaluation. We generated quality ratings by having two of our most experienced readers go through each screenplay and assign a rating on a scale of 1 to 10, then we averaged the ratings.

When we made our ratings, as always, we paid attention to the quality of the dialogue, plot coherence, pacing, and factors appropriate to each type of movie. For example, for dramas we considered character development and plot twists, whereas for science fiction films we looked for a unique vision of the future and a realistic extrapolation from current society. In other words, we took into account that what makes one kind of movie good is not necessarily the same thing that makes another kind of movie good.

We don't have to tell you that Script Quality is very important to the success of a movie – everything is riding on it. We can have all the big-name stars we want but if the script is terrible, it is not going to make back the money needed to pay all those stars! Make sure the other execs realize this.

Script Quality Ratings and Expected MPAA Ratings for Potential Movies.

Movie Title	**Script Quality**	**Expected MPAA Rating**
Degeneration	10	PG-13
On Campus	10	R
Southern Accents	10	R
Fast Food	9	PG
Sex Ed	8	PG-13
Rio	8	R
Chosin Reservoir	7	PG-13
Light Years	7	PG
Renegade	6	PG-13
Rikki-Tikki-Tavi	5	G
A Lifetime of Anger	4	PG-13

MEMO

To: Vice-President of Talent and Scripts
From: Talent and Script Evaluation Staff

RE: Skill Ratings for Actors, Actresses, and Directors

We were finally able to compile the information regarding actor and director skill values. It took quite a bit of work, but we now have the data you requested.

Basically, we surveyed a panel of movie critics and asked them to rate a list of actors, actresses, and directors for their professional skill. For directors, we asked the critics to consider things like artistic vision, ability to inspire actors and actresses, work ethic, and capturing the "feel" of situations. For those in front of the camera, skill consists of raw acting talent, intensity, emotional expressiveness, and range.

Director Skill pertains to the ability of a director to create a unified artistic vision and get the most out of the actors and actresses. Director ratings were made on a scale of 1-10, with 1 indicating a true hack with no talent and 10 indicating a director who could make an Oscar-winner with volunteers from regional theater. Some of these ratings may surprise you. Acting Skill is primarily a function of an actor/actresses' ability to credibly display a range of emotions. Some actors/actresses are very good in limited roles, but the truly great ones can yearn, pine, lust, cry and rage with amazing ability. Actors and actresses are rated on a 5-point scale, with 1 indicating an actor/actress who would be challenged to do well on a soap opera and 5 indicating an actor/actress that can do any role with convincing authority.

With regard to how the Acting Skill of the various actors/actresses affects the overall Acting Quality of the movie, here is what our research seems to suggest:

(1) The Acting Skill of supporting actors can pretty much be ignored – these people are usually not on screen long enough for their flaws to do much damage.

(2) Acting Quality can be estimated by averaging the Acting Skill ratings for the Lead Roles. When there are only two lead roles, however, it is actually a little less than average if there is a large discrepancy in the Acting Skill values of the leads. In other words, the lesser actor weighs the film down.

Table 1. Director Skill Ratings

Director	**Skill Rating (0-5 stars)**
John Carpenter	3.5
Chris Columbus	2
Stanley Eider	3
Nora Ephron	4
Milos Foreman	4.5
William Friedkin	3
Jonathan Glazer	3.5
Ron Howard	4
Jean Jacques-Annaud	3.5
Stephen King	2.5
Neil LaBute	4
Mimi Leder	3.5
Ang Lee	5
Barry Levinson	4
Michael Mann	4
Garry Marshall	3.5
John McTiernan	4
Sam Mendes	3.5
Mike Nichols	4
Wolfgang Peterson	3.5
Sam Raimi	3
Harold Ramis	3
Brett Ratner	2
Ivan Reitman	2.5
George Romero	3
Joel Schumacher	1.5
Ridley Scott	5
Bryan Singer	2.5
Steven Soderbergh	5
Oliver Stone	5
Billy Bob Thornton	3.5
Simon West	2
Robert Zemeckis	4.5

Table 2. Acting Skill Ratings for Lead Actors (0-5 Stars).

Actor/Actress	Skill	Actor/Actress	Skill	Actor/Actress	Skill
Ben Affleck	3 ½	Josh Hartnett	3	Freddie Prinze, Jr.	3
Jessica Alba	3 ½	Ethan Hawke	3 ½	Dennis Quaid	3 ½
Kevin Bacon	4	Katie Holmes	3	Daniel Radcliffe	3 ½
Alec Baldwin	4 ½	Jeremy Irons	4 ½	Len Randall	4 ½
Tom Berenger	4	Samuel L. Jackson	4	Christina Ricci	5
Halle Berry	3 ½	Angelina Jolie	3	Denise Richards	2
Sandra Bullock	2 ½	Ashley Judd	4	Chris Rock	3
Steve Buscemi	4	Nastassia Kinski	4 ½	Keri Russell	3 ½
Nicholas Cage	3 ½	Shia LaBeouf	3 ½	Kurt Russell	4
Hayden Christensen	3	Eriq La Salle	3 ½	Elisabeth Shue	4
Jennifer Connelly	4 ½	Jude Law	4 ½	Gary Sinise	4 ½
Russell Crowe	5	Donal Logue	4	Tom Skelton	4 ½
Emily Cryton	5	Jennifer Lopez	3	Kevin Spacey	5
Matt Damon	4 ½	John Malkovich	4 ½	DeWayne Stevens	4
Keith David	4	Julianna Margulies	4	Sharon Stone	3
Daniel Day-Lewis	4 ½	James Marsden	3 ½	Madeline Stowe	4 ½
Vin Diesel	3 ½	Dylan McDermott	3	Kiefer Sutherland	3
Richard Dreyfuss	4	Rose McGowan	3 ½	Mena Suvari	3 ½
Eliza Dushku	4	Tobey McQuire	4 ½	Uma Thurman	4
Charles Dutton	3 ½	Teri Miller	4 ½	Amber Valletta	4 ½
Dakota Fanning	4 ½	Bill Murray	5	Mark Wahlberg	4
Will Ferrell	4	Liam Neeson	4 ½	Denzel Washington	5
Linda Fiorentino	4	Ronda Nelson	4	Damon Wayans	3
James Franco	3 ½	Edward Norton	5	Sigourney Weaver	5
Morgan Freeman	5	Chris O'Donnell	2 ½	Elijah Wood	4 ½
John Goodman	4	Haley Joel Osment	4	Michelle Yeoh	3 ½
Gene Hackman	5	Jason Owens	5	Catherine Zeta-Jones	3 ½
Tom Hanks	5	Anna Paquin	4 ½		
Ed Harris	4 ½	Natalie Portman	4 ½		

MEMO

To: Vice-President, Marketing and Research
From: Industry Research Staff

RE: Impact of Marketing Strategy, MPAA Rating, and Expected Ticket Prices

Table 1.

Marketing Strategy Information.

Strategy	Cost (in millions)	Impact on Viewer Appeal
Word-of-Mouth	$0	+0%
Print + Outdoor	$5	+30%
Pre-Release TV	$10	+55%
Saturation TV	$20	+75%

As shown in Table 1, there are four feasible marketing strategies we can employ, each with a given cost and impact. Note that, as our marketing strategy gets more sophisticated, the costs and the positive change in viewers go up. Basically, the more expensive the strategy, the more effective it is. It is important to note, however, that marketing is most effective when there is a movie with high Viewer Appeal – marketing doesn't help much if the content of the film isn't all that intriguing or if there are no big-name stars. If we're going to produce any "small" high-quality films, it is probably better to just rely on word-of-mouth to spread the news. Overall, a good strategy is to spend money marketing a movie in proportion to its cost – cheap ones we can get away with little or no marketing; expensive ones can benefit from saturation TV marketing.

Table 2.

Impact of MPAA Movie Rating on Size of Potential Viewer Base.

MPAA Rating	Projected Impact
G	0%
PG	-10%
PG-13	-15%
R	-25%
NC-17	-40%

As you can see, "R" or "NC-17" movies take a big hit in that a good proportion of people who go to see movies are excluded from the start. Even if those movies are good, we won't get as many people coming to see them simply because the potential viewer base is smaller! Obviously, "G" films give us the largest possible base, so we should keep an eye out for any of those.

Table 3.

Average Ticket Price in Dollars for Potential Movies.

Movie Title	Average Expected Ticket Price
A Lifetime of Anger	$ 7.50
Rio	$ 7.50
Southern Accents	$ 7.50
Chosin Reservoir	$ 7.25
Degeneration	$ 7.00
Light Years	$ 7.00
On Campus	$ 7.00
Renegade	$ 6.75
Fast Food	$ 6.50
Sex Ed	$ 6.50
Rikki-Tikki-Tavi	$ 6.00

We had the bean-counters in Finance use their fancy regression models to predict the average ticket price for each potential movie based on projected demographics. These financial models take into account a host of factors and they're usually pretty accurate. As you can see from Table 3, the potential movies for next year are predicted to have average ticket prices ranging from $6.00 to $7.50.

Team Number: _____

Date: _____

FINAL RECOMMENDATION SHEET

1. You may only use the amount of money budgeted for this session, **$150 million**. You cannot spend more than $150 million; if a plan that involves overspending is mistakenly submitted, your group will not be eligible to receive the performance bonus. It is your responsibility to make sure that your plan is valid.
2. Any unused money will count towards your revenue.
3. All team members must sign the document; if any signatures are missing, the document will be returned.
4. You have 25 minutes to make your choices; if your team has not completed its selection process within the allotted time, only the valid choices you have selected will count and the unused portion of your budget will be counted as revenue.
5. TO CHOOSE A MOVIE FOR PRODUCTION, DO THE FOLLOWING:
    a. Indicate your choice by checking the appropriate box below
    b. Choose a dollar amount to spend on marketing (the default is $0)

Title	**Production $**	+	**Marketing $**				=	**Total $**
	(All amounts are in millions of dollars)							
❑ A Lifetime of Anger	$20	+	0	5	10	20	=	_____
❑ Chosin Reservoir	$46	+	0	5	10	20	=	_____
❑ Rikki-Tikki-Tavi	$65	+	0	5	10	20	=	_____
❑ Degeneration	$51	+	0	5	10	20	=	_____
❑ Fast Food	$25	+	0	5	10	20	=	_____
❑ Light Years	$90	+	0	5	10	20	=	_____
❑ On Campus	$12	+	0	5	10	20	=	_____
❑ Renegade	$38	+	0	5	10	20	=	_____
❑ Rio	$40	+	0	5	10	20	=	_____
❑ Sex Ed.	$29	+	0	5	10	20	=	_____
❑ Southern Accents	$23	+	0	5	10	20	=	_____
Total:								**<150**

Signatures:

Vice-President, Industry Research: _____

Vice-President, Script Evaluation: _____

Vice-President, Talent Appraisal: _____

Vice-President, Marketing: _____

Team Number: _____

Date: _____

REVENUE & PROFIT SHEET

Below is the list of possible movie selections for the first year. The first column shows the cost for each movie as given on the initial sheet; the second column indicates the marketing value of the movies (assumed to be $10 million for any movie your studio did not produce). The third column highlights profit generated from each movie based on the amount of marketing indicated. Please review and discuss this information with the rest of your team. (All amounts are in millions of dollars.)

Title	Production	Marketing	Revenue	Profit
❑ A Lifetime of Anger	$20	_____	_____	_____
❑ Chosin Reservoir	$46	_____	_____	_____
❑ Rikki-Tikki-Tavi	$65	_____	_____	_____
❑ Degeneration	$51	_____	_____	_____
❑ Fast Food	$25	_____	_____	_____
❑ Light Years	$90	_____	_____	_____
❑ On Campus	$12	_____	_____	_____
❑ Renegade	$38	_____	_____	_____
❑ Rio	$40	_____	_____	_____
❑ Sex Ed.	$29	_____	_____	_____
❑ Southern Accents	$23	_____	_____	_____

**A check mark in a box above indicates movies your studio produced.

+_____

Unspent

Total Profit for this year: _____

Percentage of Maximum Profit: _____

Screenplay Profile

Title: ***A Lifetime of Anger***

Genre: Drama

Audience: Diverse

Plot Summary:

Two brothers grew up in a dysfunctional family, learning to battle life's problems with hate and bitterness. Pulled back together for the funeral of their grandmother, the one person who truly showed them love, the two end up at a bar and all the old issues come out. Through flashbacks, the movie traces the brothers' long and troubled history, including their mother running out, their baby sister dying in a household accident caused by their father's drinking, and physical abuse by their father towards one of the brothers. The flashbacks reveal the holes in the brothers' lives that come from shutting each other out. Repressing their anger, the two end up engaging in a drinking contest, which then leads to a shouting match and an all-out fight in the middle of the bar. Enraged, one brother finally aims a gun at the other but, at the last instant, turns the gun on himself and pulls the trigger. Mortally wounded, he confesses how empty his life has been and how he knows deep-down that he has been the cause of their division. There is just enough time for the two to reconcile before the one brother dies. Several scenes then show the positive impact on the brother who lived, as he finally ends up knocking on the door to his father's house. The movie ends as the door opens.

Talent	Role	Type
Alec Baldwin	Brother	Lead
Nicolas Cage	Brother	Lead
David Morse	Bartender	Support
Liv Tyler	Waitress	Support

Director: Billy Bob Thornton

Cost: $20 million

Screenplay Profile

Title: ***Rikki-Tikki-Tavi***

Genre: 3-D Animation

Audience: Kids; families

Plot Summary:

Based on the best-selling children's stories by Rudyard Kipling. Set in India and using state-of-the-art 3-D technology, the movie follows the exploits of the beloved mongoose, Rikki-Tikki-Tavi, and his friends, Darzee and Chuchundra. At the beginning of the film, Rikki-Tikki-Tavi's curiosity nearly results in his drowning. Crawling out of a pond, he is found near death on a garden path by Anna, a little girl who belongs to an English couple who work at the British Foreign Ministry in the nearby city. Anna falls in love with Rikki and nurses him back to health. Rikki soon makes friends with Darzee, a bird that lives in the garden, and Chuchundra, a muskrat. These two tell Rikki of a great menace that has recently arrived – Nag and Nagaina, two huge cobras that have moved into the garden and view humans as mortal enemies. After Nagaina kills Anna's mother as she sits rocking their newborn baby, Rikki vows to defend the family. Several tense battles ensue, one that sees Rikki nearly killed from a bite by Nag, and another in which Nagaina is killed by Rikki as she moves to strike Anna in her sleep. The climactic scene involves a confrontation between Rikki and Nag, where it takes the combined efforts of Rikki, Chuchundra and Anna to trap and eliminate the mighty predator.

Talent	Role	Type
Cuba Gooding Jr.	Rikki-Tikki-Tavi (Voice)	Support
Hallie Kate Eisenberg	Anna (Voice)	Support
Tim Allen	Chuchundra (Voice)	Support
Roseanne Barr	Nagaina (Voice)	Support
Regis Philbin	Nag (Voice)	Support

Director: Stanley Eider

Cost: $65 million

Screenplay Profile

Title: ***Sex Ed***

Genre: Comedy

Audience: Diverse

Plot Summary:

When the class valedictorian becomes pregnant, all hell breaks loose at a small suburban high school. Instigated by a student advocate and the local Planned Parenthood, a push is made to teach sex education in the classroom and sell condoms on school property. In response, a colorful coalition of parents and community organizations unites to stop the initiative. Enjoying the uproar is an odd collection of students. One student decides to make a profit from it and comes up with increasingly hilarious ways of marketing condoms and other forms of birth control. Caught in the middle is the pot-smoking principal, who hangs out with a pack of stoner students behind the school and gets advice from them but always manages to miss their point. The clueless PTA president doesn't quite understand anything and overreacts to everything. In the end, the proponents agree to allow the students to decide and there is a vote in the gymnasium. Before the votes are tallied, the valedictorian announces that she isn't really pregnant and that the whole thing was an experiment for a term paper in her health class. To top it off, the reactionary leader of the right-wing parents is caught having an affair with a homosexual teacher at the school. The movie takes shots at moralistic zealotry on both sides of the issue.

Talent	Role	Type
Natalie Portman	Valedictorian	Lead
Christina Ricci	Student advocate	Lead
Cheech Marin	Principal	Support
Andy Dick	PTA President	Support
Richard Simmons	PE Teacher	Support

Director: Barry Levinson

Cost: $29 million

Screenplay Profile

Title: ***Fast Food***

Genre: Comedy

Audience: Diverse

Plot Summary:

Milo's is a typical fast food restaurant with the usual assortment of teenagers and retirees on their way up or down. The movie is a comic look at the slowest, most inefficient "fast food service" restaurant in the business and one thief's misfortune to come across it. There is the clueless, Gen-X counter girl; the huffing manager; and a variety of bizarre customers. Their abilities are truly tested when the restaurant is burglarized, the manager accidentally shoots himself, and the customers are taken hostage. The thief turns out to be rather distracted as he continues a running conversation with the girlfriend he's trying to impress and win back over a bad cell phone connection. Meanwhile, the staff of Milo's tries various ways to escape but each one manages to backfire in the most hilarious fashion. After several attempts to disable the robber are foiled by his dumb luck, the employees decide that food poisoning is their best bet. They finally manage to get the thief to eat something from the store and soon he is using the restroom constantly. The counter girl then convinces the thief that his constant need to use the bathroom is caused by a rare, life-threatening venereal disease that requires immediate care. In the riotous finale, the robber surrenders to the police in order to receive treatment for his "life-threatening disease."

Talent	Role	Type
Mena Suvari	Employee	Lead
Steve Buscemi	Manager	Lead
Daman Wayans	Robber	Lead
Wilford Brimley	Hostage	Support
Michael Richards	Hostage	Support

Director: Harold Ramis

Cost: $25 million

Screenplay Profile

Title: ***Rio***

Genre: Drama

Audience: Adults; couples

Plot Summary:

A couple vacationing in Rio discover a body washed up on the shore in a clump of trees. After alerting the authorities, the woman is identified as a missing Washington D.C. attorney. An investigation ensues and police begin to suspect one of her political clients may be to blame. Through a series of interwoven flashbacks, the dead woman is revealed to be a high-powered lobbyist who also defended her political friends when they got into legal trouble. One of these friends was the President of the United States. Investigators uncover a relationship between the victim and the President, one that took them both to Rio on a "political" mission. As the President emerges as a prime murder suspect, the investigators are told to return home and close the case. With the government breathing down the investigators' necks, a key piece of evidence is discovered that directly links the President to the woman's death. The investigators rush home with the crucial evidence while dodging repeated attempts on their lives. The film deals with Presidential power and one investigator's unwavering commitment to discovering the truth.

Talent	Role	Type
Sharon Stone	Lobbyist/Girlfriend	Lead
Gene Hackman	Lead Investigator	Lead
Richard Dreyfuss	President	Lead

Director: Mike Nichols

Cost: $40 million

Screenplay Profile

Title: ***Light Years***

Genre: Science Fiction

Audience: Diverse

Plot Summary:

In the year 2045, a tremendous explosion destroys the earth without a trace. A peaceful humanoid alien society, Yzizor, records the explosion and sends a ship to explore the mystery. On the journey, we learn what life is like in this alien civilization and see how many of the issues facing humanity were also faced (and dealt with) by another species. When the ship arrives in our solar system, it begins piecing together the events. Once disdainful of humanity, the aliens become sympathetic as they learn more. In a shocking moment, the investigating race discovers that the earth was destroyed on purpose by the concurrent agreement of the Federated World Government in order to pre-empt an invasion of earth by another alien society located within the earth's solar system. Eventually, the alien society is traced to one of Neptune's moons and the Yzizar ship heads there, hoping to discover what could possibly have been so awful that the earth would be blown up in self-defense. In the climax of the film, a bizarre, disjointed encounter occurs between the two alien societies, after which the Yzizarian ship is destroyed when its crew sets their computer to self-destruct. Light years later, fragments of the encounter are picked up on Yzizar by the horrified planet that knows only a little more than it did before. Will employ cutting-edge special effects.

Talent	Role	Type
Len Randall	Alien Commander	Lead
Jason Owens	Alien Security Director	Lead
Amber Valletta	Alien Anthropologist	Lead

Director: Ridley Scott

Cost: $90 million

Screenplay Profile

Title: ***On Campus***

Genre: Documentary

Audience: Older teens; young adults

Plot Summary:

Shot as a pseudo-documentary, this film follows a group of five college students from their high school graduation through four years at Southern Illinois University. We meet each individual and their families in the early part of the film as the students head off for college. Through the beginning of their experiences, we watch as they struggle with independence, relationships, choosing a career, and the temptations of the modern college campus. We see candid shots of dorm life, behind-the-scenes classroom behavior, one-night romances, drinking parties, and interpersonal conflicts. Woven into the film are frank interviews with the focal individuals discussing choices, morals, and personal growth. The movie follows these people to the conclusion of their college careers: two individuals drop out, one finishes but becomes disillusioned with life and commits suicide, one goes on to graduate school, and one graduates and gets her dream job. The movie ends with a series of comments and reactions from the students' parents and friends on how the college experience affected and shaped their lives.

Talent	Role	Type
Tom Skelton	Chad	Lead
DeWayne Stevens	Marcus	Lead
Emily Cryton	Tonya	Lead
Teri Miller	Roxanne	Lead
Ronda Nelson	Amy	Support

Director: Neil LaBute

Cost: $12 million

Screenplay Profile

Title: ***Renegade***

Genre: Science Fiction

Audience: Diverse

Plot Summary:

It is the year 2192. Todd McCullock, a CIA agent returning from a three-year overseas assignment, comes back to find that no computer files have been added or modified in several months, that no one has been hired or fired, and that everyone is just a little…different. When he tries to explain the strange events, no one believes him but he is first asked, then ordered, then almost forced to take a new psychoactive drug supposedly developed while he was away. After witnessing a bizarre mating ritual between two former friends, Agent McCullock realizes that everyone in the agency is an alien life form. Through some frantic research, he also learns that the infiltration extends to the highest levels of government. In the process, he discovers another "renegade," Agent Jones, who he rescues as she is being prepared for assimilation. Together, the two set out to publicize the conspiracy but learn that there is no chance to stop it and must flee through the streets of D.C. in order to escape with their lives. Meanwhile, the aliens, led by the mysterious Agent Palmer, steadily close in. After a tense, paranoia-inducing walk through the airport, a harrowing chase ensues across several continents. Eventually, Agents McCullock and Jones manage to flee to the mountains of Ecuador and hole up in a cave. In the final scene, we learn that the aliens can also replicate creatures, as a fly on the wall of the cave sends word of the humans' location. The movie ends with a fade-out on the first horrifying look at Agent Palmer's true face.

Talent	Role	Type
Kevin Bacon	Agent McCullock	Lead
Jessica Alba	Agent Jones	Lead
Gene Hackman	CIA Director	Support
Goran Visnjic	Agent Palmer	Support

Director: Joel Schumacher

Cost: $38 million

Screenplay Profile

Title: ***Chosin Reservoir***

Genre: War

Audience: Diverse

Plot Summary:

November 1950. Winter approaches as U.S. troops chase the fleeing remnants of the North Korean army towards the Chinese border. Without U.S. intelligence finding out, the Chinese somehow manage to sneak 300,000 "volunteer" troops into North Korea to bail out their ally, and they lay in wait in the mountains along the Chinese-Korean border. Straining to finish the war and chasing a beaten foe, U.S. troops press on into the hills as temperatures dip well below freezing. As the U.S. forces reach the Chosin Reservoir high in the mountains, the Chinese spring the trap. U.S. forces in the area are separated by the massive reservoir – Marines to the west, U.S. Army forces to the east – and outnumbered over 5:1. The Chinese armies overrun the forward U.S. outposts and swarm around the forces on both sides of the Reservoir, all but surrounding them. The Marines to the west maintain their cohesion and conduct a long retreat in the swirling snow and freezing temperatures, miraculously managing to extricate themselves in good order without leaving any dead or wounded behind. When the Marine commander is asked by the press if the Marines are actually retreating, the commander gruffly replies that they are not retreating, simply "advancing to the rear." The U.S. Army division to the east of the reservoir is not so lucky – the unit disintegrates and is overrun, the end coming as Chinese troops catch a long column of retreating vehicles filled with wounded soldiers and systematically set fire to each one. A realistic war film, the movie calls attention to one of the most ferocious and little-known battles of the Korean War.

Talent	Role	Type
Tom Berenger	Sgt. Mino	Lead
Vin Diesel	Lt. Hathaway	Lead
Chris O'Donnell	Pfc. Reynolds	Lead
Nick Nolte	General Smith	Support

Director: Simon West

Cost: $46 million

Screenplay Profile

Title: ***Degeneration***

Genre: Horror-comedy

Audience: Diverse

Plot Summary:

In 2004, the U.S. begins closing down research programs initiated at the height of desperation during the Cold War. At a top-secret research laboratory in Colorado, orders come through to suspend the activities of Project Big Bang, a biological warfare super-virus intended for covert insertion into the water supply of enemy nations as a last resort. The virus rapidly eats away exposed flesh and then moves on to the central nervous system, causing its victims to lose higher thought and reasoning processes. While shutting the laboratory down, an accident exposes members of the town to the toxin. Unfortunately, the victims don't die, but become walking zombies ruled by animalistic thought processes and characterized by extreme fury towards normal humans. A series of bizarre murders and mysterious deaths occur with increasing rapidity, until only a few brave citizens are left fighting a furious horde of infected "zombies." As the movie reaches its climax, the zombies corner the remaining citizens in the underground research facility and launch an all-out assault through sewers, ventilation ducts, windows and doors. Armed with only a few automatic weapons, the citizens fight back. The gruesome showdown leaves the winner in doubt right up to the very end.

Talent	Role	Type
Linda Fiorentino	Project Director	Lead
Kurt Russell	Vacationer	Lead
Ray Romano	Mortician	Support
Jaime Foxx	Town Barber	Support

Director: John Carpenter

Cost: $51 million

Screenplay Profile

Title: ***Southern Accents***

Genre: Drama

Audience: Couples; females

Plot Summary:

This movie shows 10 years in the life of a young Southern girl, born and raised in a town of less than 300 people by her Bible-thumping, conservative parents. The movie opens with scenes from the girl's childhood showing how her parents continually suppressed her freedom and spirit. However, the girl clearly has talent and decides to use education as a way of getting out. She distances herself from her parents and their restrictions and, although forbidden to date until she reaches 18, meets an older boy from the other side of the tracks and they eventually fall in love. They sneak around together, dreaming about another life somewhere far away from the small town. When their relationship finally turns physical, the girl gets pregnant. Terrified of her family's reaction, she ends up having an abortion, causing her boyfriend to leave. Even worse, her father discovers what has happened and immediately disowns her. Kicked out of the house, she lives in the garage of an estranged family member and struggles to put her life back together, all the while suffering intensely from hallucinations in which she sees her aborted child playing happily with a sibling. Eventually, her boyfriend realizes he has made a mistake and returns to her life. In the final scene, they confront her parents together and a grim staring contest turns into a shouting match and then into a tearful reconciliation. The movie ends with a shot of the girl delivering a second child while her husband busily scrambles to capture the happy moment on videotape.

Talent	Role	Type
Eliza Dushku	Girl	Lead
Shia LaBeouf	Boyfriend	Lead
Robert Duvall	Father	Support
Ann Margaret	Mother	Support

Director: Mimi Leder

Cost: $23 million

Appendix B: Standardized Protocol and Script

Step 1: The Lab Book

Team Number: _____
Date: Month, Day, Year
PA/ (Gender)
PB/ (Gender)

Sequence Number ____

Experiment Start Time: NPass = Time:
Experiment End Time: NPass = Time:

Calibration:
PA: PB:

Notes:

Step 2: The Computer

- Turn on the Computer
- Click on the Developer Icon

Start the AIStream

- Within Developer ->File -> Recent Workspaces
- **<Insert File Location Here>**
- Click on the file ending in "AIStream" (Click the one with the most recent date)
- In the file, go to line 27 and change the integer in the first column to 20. Be sure that all numbers line up on the left.
- Go to line 35 and change the TC# to the current TC lab number "TCXXX.DAT"
- Hit the Save button

DO NOT RUN PROGRAM AT THIS TIME

Start the MeasPulseWidth

- Click on the Developer Icon, again
- Within Developer -> File -> Recent Workspaces
- Click on the file ending in "MeasPulseWidth." (Click the one with the most recent date)
- **<Insert File Location Here>**

DO NOT RUN PROGRAM AT THIS TIME

Step 3: Equipment and Experiment Room

- Turn on the Racks: Flip Main Switch located on lower half of the right-hand rack.
- Turn on four filters on upper half of right-hand rack.

- Turn on the Small Rack (scope and calibration boxes) and bring into Experiment Room
- Turn on the three lamps in the experiment room
- In the experiment room flip on the power strip near the lamp on the table
- In the third drawer of the green file cabinet, prepare 3 sensors for each participant
- Snap 2 black wires and 1 gray wire to the sensors for each participant
- Leave these on top of the file cabinet

Step 4: Paper Materials (top drawer, green cabinet)

- 2 Pre Experiment Surveys
- 2 Team Assessment Surveys
- 2 Post Experiment Surveys
- 2 Consent Forms
- 1 Revenue and Profit Sheet
- 1 Final Recommendation Form
- Mark each survey with either A or B in the top left hand corner of the forms
- Write the team number on the top middle of each survey
- Place Pre-Experiment Surveys in respective envelopes, marked A or B, and place in the receiving room
- Keep all paperwork organized on the clip-board for easy access throughout the experiment

Step 5: Task Binders

- Make sure there is enough scrap paper for each participant in the binder
- Be sure the binders have all required materials
- Replace any materials that have markings or notes (replacements located in top drawer of the green cabinet)
- VP of Marketing and Research:
    - General memo (2 pages), task algorithms (1 page)
    - Memo: Viewer Appeal Ratings (2 pages)
    - Memo: Impact of Marketing Strategy (2 pages)
    - 11 screenplays
- VP of Talent and Scripts:
    - General memo (2 pages), task algorithms (1 page)
    - Memo: Skill Ratings for Actors/Actresses/Directors (3 pages)
    - Memo: Script Quality Ratings (1 page)
    - 11 screenplays

'DO' the Items in Bold

'SAY' all other typeface items

Introduce yourself and ask participants' names.

Give participants Consent Forms: We are researchers in Industrial/Organizational Psychology and we're interested in learning how people are able to establish effective working relationships and we're doing research on team communication. Most of this information is in the online description; however, there is one thing I would like to point out under the "What are the study procedures, what will I be asked to do?" letter (a), 'Speech Activity Monitoring'. There are microphones in the other room I'm going to ask you to wear but we can't hear anything that you say and we're not recording anything that you say. We are simply capturing your speech activity, or whether or not you're talking. The rest of this was explained in the online description, the experiment takes about 90 minutes and we sometimes end a few minutes early but it all depends.

Do you have any questions?

If you still want to participate please sign on the last page.

Give participants Telemetry Diagram and Sensors: There are a lot of things to put on today and first we're going to put on the sensors that will send your heart rate signals to the computer in the other room. In a minute, I will walk you to the bathroom so you can put these on yourselves, but I want to explain what you will to do with them first. Each of you has three sensors connected to three wires and you're going to place these sensors on yourselves corresponding to the stars on the diagram. The first star is going to be one of the black wires and you are going to place the sensor on the left side of your chest, directly below the collarbone. The second star is the grey wire and it goes on the right side of your body, front of the abdomen, directly below your rib cage. The third star is the other black wire (doesn't matter which one), and that goes on the left side of your body, front of the abdomen, directly below the rib cage. Just remember, the light is on the right, the black wires go on the left. The sensors are self-adhesive

and stick to the skin just like a Band-Aid. There is a saline solution in each sensor, so if you feel any moisture it is just salt water and nothing that will harm you.

Do you have any questions?

Escort participants to the bathroom

Collect other physiological measurement devices:

- **4 Breathing Bands (best size guess)**
- **2 Oscillator Sashes**
- **2 Black Packs**
- **2 Telemetry Units**

Sign Consent Forms. File consent forms in Data Box.

Did everything go OK with the sensors?

Give participants the first breathing band: Next, we have to put on the breathing bands that will send your breathing signals to the computer in the other room. This first band is going to go around your chest, as high under your arms as possible, and Velcro in the front.

Give participants the second breathing band: The second band is going around the smallest part of your waist and Velcro in the front.

Give participants the oscillator sash. This grey sash is going to go over your head and one arm so that it is comfortable to wear; it doesn't matter which side you wear it on. The black box attached to the gray sash has wires attached to it. Those wires are going to connect to the bands you are wearing around your chest and abdomen. The black connections go to the BOTTOM band and the white connections go to the TOP.

Help participants locate connections.

Give participants telemetry packs. These packs are also going to go over your head and one arm so that they're comfortable to wear. The packs are going to hold onto the units that will send your heart rate signal to the computer in the other room. _____ you are going to be person 'A' today. Could you hand me the wires that we put on first? **Connect telemetry unit to participant, place in the pack.** _____ you are going to be person 'B' today. Could you hand me the wires that we put on second? **Connect telemetry unit to participant, place in the pack.**

Is everything comfortable so far?

Before we move into the experiment room over hear **(Point to the door)** I have the first survey for you to complete. In a minute I'm going to have _____ go over here to take the survey in the envelope marked 'A' and _____ you are going to stay here and take the survey in the envelope marked 'B'. Please be sure to fill out both sides of the survey. When you're done, leave the surveys in the envelopes on the desks. Then come meet me in the experiment room. Please leave your things here because there isn't much space in the other room. The door stays locked and it will be safe.

Escort students to the desks

When students come to the room have Person A sit on the right and Person B sit on the left.

Connect the participants to the scope. Begin AIStream program.

Explain the iso-volume breathing maneuver.

Before we can begin the experiment we need to calibrate the machine to be sure our signals are coming in correctly. The way we do this is with something called the iso-volume breathing maneuver. Right now, we are looking at _____'s breathing. The signal on the top is coming from the band you're wearing on top and the signal on the bottom is coming from

the band you're wearing on the bottom. See how the lines are moving together? That's how people breathe normally. In a minute, I'm going to have you do something to make these lines move opposite each other. The way we do this is something called the iso-volume breathing maneuver; to do this you'll have to move air back and forth from your lungs to your stomach as quickly as you can for as long as you can. Most people need a few tries before they get it right. When they get it right, most people say they focus on their stomach more than their lungs. It is like taking a deep breath in, holding your nose, then moving your stomach in and out without actually breathing. Try to do this as quickly as you can and as long as you can, but if you need to stop and breath, please stop and breath.

Have each participant perform the calibration while fixing the signals. (You may have to instruct participants multiple times until they get it right).

Show participants the microphones. Finally, we have to put on the microphones I mentioned earlier. These go behind your head and over your ears and you can adjust the microphone so it is in front of your mouth. Remember, we cannot hear anything that you say and we're not recording anything you say, this is simply capturing your speech activity.

Do you have any questions?

Read Task Instructions Below:

I am going to read the instructions for the task you are going to do:

In the Hollywood Team Task, you will each play the role of either the Vice President of Marketing and Research or the Vice President of Talent and Scripts. Your team's task is to decide which movies to produce across one simulated business year.

Tell participants who is who: Person A is the VP of Marketing and Research; Person B is the VP of Talent and Scripts

Each of you will have a binder containing a general memo from the CEO that provides information about how to determine the movies with the best profit potential and summaries of 11 screenplays that you can choose to purchase and turn into a movie. In addition, you each will receive some information specific to your individual role. Your team should use this information to make decisions about what movies to produce and how much to spend marketing each one. You may use personal experience and intuition to fill in the gaps. However, when this conflicts with the information provided by the simulation, you should defer to the simulation.

When I leave the room, you will hear a beep. When you hear the beep you may open your binders. You will have a period of 15 minutes to silently and individually review the information at your disposal. No discussion or interaction is permitted during this time. You may take notes on the scratch paper provided, but do not share this information with the other participants.

Point out the binders on the long table.

I ask that while reading the binders, you please sit at either side of that longer table. There is scratch paper on the inside cover of the binders if you want to write anything down or take notes, and there are pens and calcultaors here for you to use.

After the 15-minute individual review period, you will hear another beep. This is the signal to move back to the larger table. You will have 25 minutes from the sound of the second beep to discuss the task and reach agreement concerning which movies to produce and how much money to spend on marketing them. You will have the entire 25 minutes to fill out a Final Recommendation sheet, so please take your time and try to maximize your profit using your $150 million budget.

Show participants Final Recommendation Sheet.

You may select as many movies as you can afford, but please remember to only choose ONE marketing strategy PER MOVIE, and do not exceed a budget of $150 million.

A 5-minute warning will sound when you have five minutes left to fill out the Final Recommendation sheet.

After you complete the simulation you will fill out a short survey. Before leaving you will be provided with a feedback report comparing your team's profit to the highest possible profit for the year. You will also be asked to fill out a final brief survey.

Do you have any questions?

Good Luck!

Leave room, close door.

Press switch to begin experiment.

AFTER FINAL TASK BEEP

Are you all set? You can take off your microphones. I have two surveys for you to complete. Please feel these out on your own.

Collect and score Final Recommendation Sheet. Fill out feedback report and replace post-experiment survey envelopes.

END CALIBRATION

Bring spirometer hose into the room, affix first mouthpiece.

We have one more calibration to do today and it is much easier than the first one. This hose is connected to a spirometer that's in the other room and the spirometer is going to measure the size of a couple of each of your breaths. You will each take three turns breathing into the tube. In a minute I'm going to have _____ breathe into the tube first. We will give you a clear signal each time you should breath. When you breathe into the tube it is

important to remember three things: (1) do not breathe from the tube, only breathe into the tube; (2) try to let as little air escape out of your nose and around the mouth piece as possible (this requires you to hold your nose and place your mouth over the mouthpiece; the mouthpiece is sterile and we will throw it away when you're done); (3) when you breathe into the tube, don't make it a long drawn out breath, it is a quick deep breath. Once you breathe into the tube, you may immediately let it go.

Do you have any questions?

Have Person A breathe 3 times, giving them a signal and recording the mL in the lab notebook each time.

Repeat with Person B.

Please wait one moment and I will help you remove all the physiological equipment.

Remove hose from room.

Disconnect the scope wire and telemetry unit from both participants. While doing this explain to them how to take off the rest of the equipment.

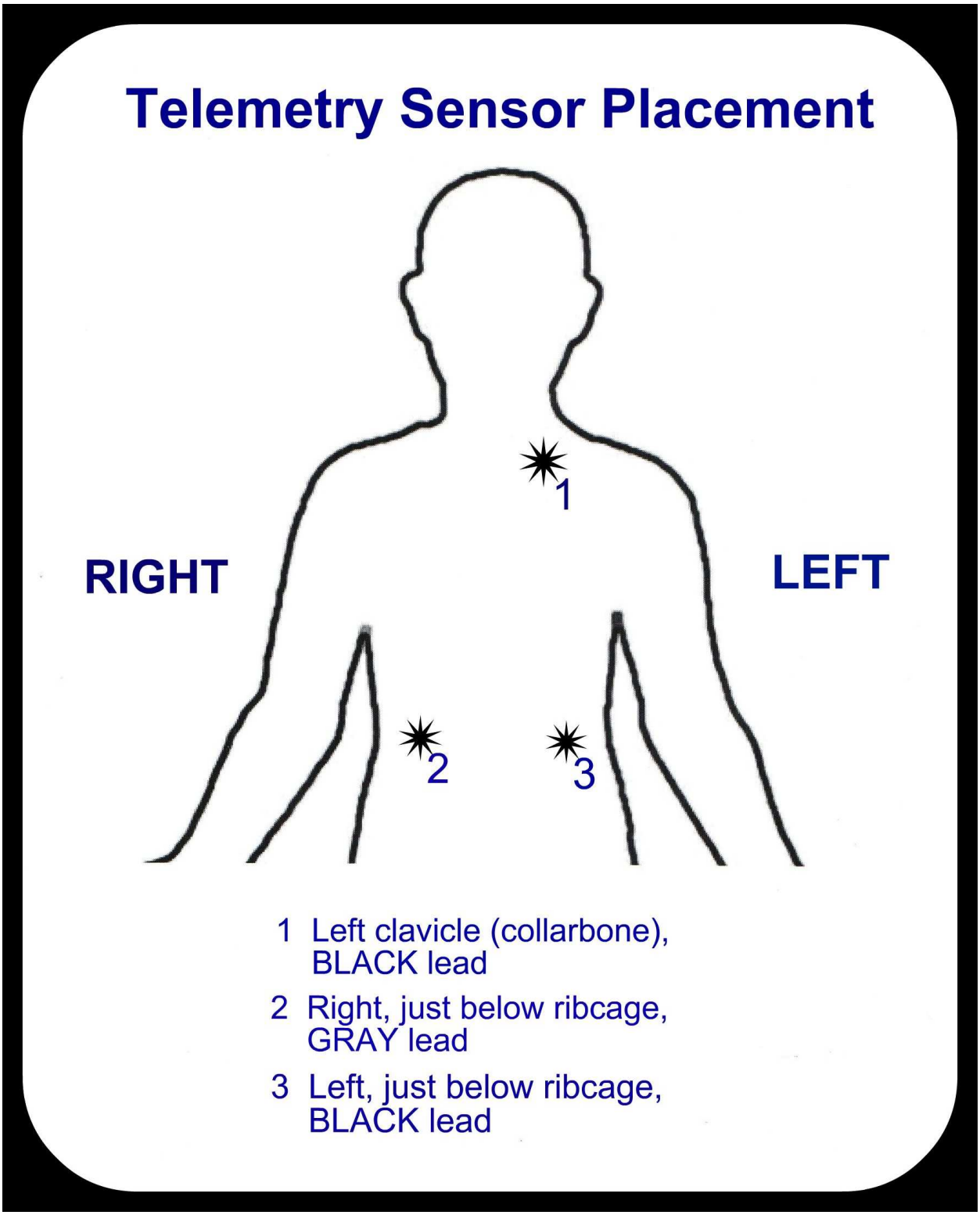
Once I have these disconnected, you may start taking things off the way we put them on. Please be careful with the connections because they are very fragile. You can leave everything on the table in front of you. When you remove the sensors, please unsnap the white circles from the wires and throw them in the garbage.

There is one more thing to do before you go. On the desks where you took the original surveys are the feedback reports I mentioned earlier. The report compares your team's profit to the highest possible profit for the simulation. Please take a look at the report and complete the final survey; it is very short, only five questions. When you're done please leave the surveys in the envelope and you're free to go.

Lab Clean Up

- Put away physiological equipment
- Make sure microphones are set to off
- Turn off lights
- Shut down computer
- Turn off filters individually, turn off racks with main switch
- Put consent forms in binder with others
- Collect all surveys, final recommendation sheet, and feedback report and place them in the back of the data binder.

Appendix C: Telemetry Diagram



Appendix D: Pre-Experiment Survey Instrument

	Never Talked Before				Talk all the time
	1	2	3	4	5
Before coming here today, how well did you know the other person in this experiment?					

Based on my first impression of the other person in the experiment:	Strongly Disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly Agree
	1	2	3	4	5	6	7
I am looking forward to talking with this person.							
I could see myself being friends with this person.							
I like this person.							

Before coming to the experiment today I was feeling:	Strongly Disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly Agree
	1	2	3	4	5	6	7
Anxious							
At ease							
Bored							
Calm							
Content							
Ecstatic							

Before coming to the experiment today I was feeling:	Strongly Disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly Agree
	1	2	3	4	5	6	7
Energetic							
Enthusiastic							
Excited							
Fatigued							
Inspired							
Relaxed							
Satisfied							
Stressed							
Irritated							
Pressured							
Hectic							
More stressed than I'd like							
Hassled							
Many things were stressful							

Appendix E: Teamwork Assessment Survey Instrument

	Strongly Disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly Agree
	1	2	3	4	5	6	7
When I was working on this task, I thought about nothing else.							
My work on the task gave me a good feeling.							
I would enjoy working on a task like this in my free time.							
I would want to participate in this task, even if I did not receive any credits.							
I work hard because I enjoy it.							
I got carried away while working on the task.							
I enjoyed doing this task.							
When I am working on something, I'm doing it for myself.							
When I was working on the task, I forgot everything else around me.							
I felt happy during this task.							
I get my motivation from the work itself, and not from the course credit reward for it.							
I was totally immersed in the task.							
I felt cheerful while I was working on the task.							
I would still be in experiments like this, even if I did not receive credits for it.							

During the experimental task, we:	Strongly Disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly Agree
	1	2	3	4	5	6	7
Took the time we needed to share all task-related information.							
Discussed our vision of a successful outcome.							
Actively listened to one another.							
Discussed what we could do, step-by-step, to make our vision a reality.							
Effectively communicated with each other throughout the task.							
Created an environment of openness.							
Really trusted each other.							
Discussed our main objectives.							
Thought in terms of what was best for the team.							

After working on the task, I'm feeling:	Strongly Disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly Agree
	1	2	3	4	5	6	7
Anxious							
At ease							
Bored							

Calm							
Content							
Ecstatic							
Energetic							

After working on the task, I'm feeling:	**Strongly Disagree**	**Disagree**	**Slightly Disagree**	**Neutral**	**Slightly Agree**	**Agree**	**Strongly Agree**
	1	**2**	**3**	**4**	**5**	**6**	**7**
Enthusiastic							
Excited							
Fatigued							
Inspired							
Relaxed							
Satisfied							
Stressed							
Irritated							
Pressured							
Hectic							
More stressed than I'd like							
Hassled							
Many things were stressful							

After working with my partner to complete the experimental task:	**Strongly Disagree**	**Disagree**	**Slightly Disagree**	**Neutral**	**Slightly Agree**	**Agree**	**Strongly Agree**
	1	**2**	**3**	**4**	**5**	**6**	**7**

I would be willing to work with this person on a class project.							
I am not satisfied with the quality of our final recommendation.							
I would avoid being on a team project with this person again.							
I think we produced a good budget plan.							
I would welcome a chance to do another project with this person.							

After working with my partner to complete the experimental task:	**Strongly Disagree**	**Disagree**	**Slightly Disagree**	**Neutral**	**Slightly Agree**	**Agree**	**Strongly Agree**
	1	**2**	**3**	**4**	**5**	**6**	**7**
I think we performed well on this task.							
When we were working on this task, we thought about nothing else.							
We would be very willing to work together in our spare time.							
Working together on the task gave us a good feeling.							
We got carried away while working on the task.							
We would work together again because we enjoy it.							
We enjoyed doing this task.							
When we were working on the task, we forgot everything else around us.							
When we were working on the task, it felt like we were doing it for ourselves.							

We felt happy during this task.							
We got our motivation from working together on the task, not the course credit reward for being in an experiment.							
We were totally immersed in the task.							
We felt cheerful while we were working on the task.							
We would want to work together again, even if we did not receive course credit for it.							

Appendix F: Feedback Report

Date: _____

Projected Team Profit:

Highest Possible Profit: **$ 426.17 Million**

Appendix G: Post-Experiment Survey Instrument

After spending this time with the other person in this experiment:	**Strongly Disagree**	**Disagree**	**Slightly Disagree**	**Neutral**	**Slightly Agree**	**Agree**	**Strongly Agree**
	1	**2**	**3**	**4**	**5**	**6**	**7**
I would want to talk with this person again.							
I could see myself being friends with this person.							
I like this person.							

Please rate the amount of effort **you** and the amount of effort **your partner** put into this task.

Be sure the total effort between you and your partner is equal to 100%.

100%= ☐ **+** ☐

Your Effort **Partner Effort**

Please rate the amount of effort that you and your partner, **working together as a team**, put into completing this task.

100% would indicate a maximum team effort.
Please circle your answer below:

0 10 20 30 40 50 60 70 80 90 100