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RELATIONSHIP CLOSENESS AND JOINT ACTION COORDINATION

VINCENT TYLER CIALDELLA

64 Pages

Researchers define *joint action coordination* as “two or more actors [coordinating] their actions under real time constraints with or without the explicit intention to do so” (van der Wel, Knoblich, & Sebanz, 2011, p. 1420). While previous research has investigated how the valence (i.e., the attractiveness or aversiveness) of interpersonal relationships affects interpersonal coordination dynamics (Hommel, Colzato, & van den Wildenberg, 2009), the present experiment examines the effects of relationship closeness on joint action coordination. First, dyads collaboratively completed a stimulus-control task on a computer. This task is used to assess general cooperative performance (Schloesser, Bai, Abney, & Jordan, 2015). Each dyad member then individually completed a reaction time task that is used to assess whether they developed associations between the keypress movements they made while controlling the stimulus and the effects produced by these keypress movements (i.e., the intentionally-generated stimulus movements and unintentionally generated auditory effects). Dyads then took part in one of two conditions (i.e., shared-disclosure or private-disclosure) in a self-disclosure task, followed by another three minutes of stimulus control and another reaction time task. While the closeness manipulation appeared to be successful, the data obtained from the performance and reaction time task do not allow one to draw any firm conclusions regarding the effects of relationship closeness on joint action coordination.

KEYWORDS: joint action, cooperative performance, closeness, theory of event coding

RELATIONSHIP CLOSENESS AND JOINT ACTION COORDINATION

VINCENT TYLER CIALDELLA

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Fulfillment of the Requirements
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RELATIONSHIP CLOSENESS AND JOINT ACTION COORDINATION

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CHAPTER I: INTRODUCTION

The Problem and its Background

Perception and *action* comprise two fundamental phenomena within cognitive psychology. Perception may be construed as the process of obtaining information about one's environment. Action, on the other hand, may be construed as the process of engaging one's environment. Thus, perception-action theories concern how a cognitive system's contact with the world constrains the expression of behavior (and vice versa) or, more simply, how perception relates to action. Multiple frameworks have been developed to address this perception-action relation. For example, Prinz (1990) describes what he terms the "standard model" in which perception and action are incommensurable, so cognitive work is required to translate perception into action. However, other frameworks have been devised in which there is a greater degree of continuity or overlap between perception and action. For example, in the Theory of Event Coding (TEC; Hommel et al., 2001), perception and action planning share common representational codes and, therefore, require minimal (or no) translational work to get from perception to action planning. In the ecological approach to perception-action (Gibson, 1979), information obtained through perception directly specifies opportunities for action (i.e., affordances). Like TEC, the ecological perspective assumes minimal (or no) translational work to get from perception to action planning, but unlike TEC, the ecological approach often does not incorporate neural events or representations in its account of the perception-action relationship.

While researchers operating from these various perspectives greatly differ in their fundamental assumptions about the perception-action relationship, what is common across all theories is that they have historically focused on the individual, emphasizing the contextual factors that constrain the expression of individual behavior. Such research has investigated the

role of neural dynamics (e.g., Georgopoulos, Kalaska, Caminiti, & Massey, 1982; Georgopoulos, Schwartz, & Kettner, 1986), bodily factors (e.g., Proffitt, 2006; Warren, 1984), as well as the features of visual or auditory stimuli (e.g., Craft & Simon, 1970; Simon, 1990). More recently, researchers have taken interest in the role of the social context in perception-action and whether our perception-action theories about individuals can be extrapolated to explain group dynamics. One can see traces of this interest in research on behavioral mimicry (see Chartrand & Lakin, 2013, for a review) which extends James' (1890a) approach to action planning to explain the tendency to nonconsciously mimic the behaviors of others. Likewise, researchers operating from the ecological perspective have begun to extend their approach to social contexts by investigating social affordances and perception of affordances for others (Ferri, Campione, Dalla Volta, Gianellia, & Gentilucci, 2011; Wagman, Stoffregen, Bai, & Schloesser, 2017). This trend is also reflected in the use of 'joint' versions of more traditional cognitive-psychological tasks such as the Simon task to assess the similarities and differences between intrapersonal and interpersonal coordination (Craft & Simon, 1970). Whereas the Simon task was originally used to study individuals, recent research has had participants work together on this task to study interpersonal coordination (see Dolk et al., 2014).

One phenomenon that lies within this realm of research is *joint action coordination*. Van der Wel and colleagues (2011, p. 1420) defined joint action coordination as “two or more actors [coordinating] their actions under real time constraints with or without the explicit intention to do so.” Whether the coordination emerges spontaneously, as is the case when one is walking amidst a crowd, or out of an explicit intention, as in cooperative sports, individuals use information about others' action intentions to successfully coordinate their actions. When jointly moving furniture, coactors may communicate an intention to lift the furniture or to move by simply

saying so, but when verbal language is not a feasible form of communicating one's intentions, or when it is inappropriate, people make use of other available information to coordinate their actions. For example, automobile brake lights indicate an intention to decelerate, allowing others to act accordingly to avoid collision. In conversation, the timing of one's speech serves as externalization of an intention to either continue speaking or allow the other to speak (Streeck & Jordan, 2009). With information about the other's intentions, a coactor can effectively coordinate their actions with those of the other.

In addition to necessitating information about each other's actions, coordination may also be influenced by social factors. For example, one might think that coworkers with a hostile relationship would be less effective in coordinating their efforts than coworkers with a supportive, positive relationship. Similarly, one might expect close friends to more successfully coordinate their actions in cooperative video game than strangers. These speculations reflect two key questions. First, does the nature of coactors' relationship affect their performance in a cooperative task? Second, what mechanism might explain how the coactors' relationship influences cooperative performance?

In the present paper, I first review previous experimental work on joint action coordination and present the Theory of Event Coding (Hommel et al., 2001) as a useful framework for understanding the relationship between perception and action planning. I then discuss how joint action may be affected by aspects of the actor-coactor relationship (e.g., closeness). Finally, I propose an experiment that is designed to a) test whether relationship closeness influences dyads' success in a dynamic joint-action task and b) generate a possible explanation for this potential relationship between closeness and joint action coordination.

Joint Action Coordination

Research on joint action collectively suggests that individuals regularly share their intentions by manipulating their external environment in ways that represent their intentions. Galantucci (2005) conducted an experiment in which members of dyads were required to coordinate their actions in a computer task, but they were only able to communicate with novel self-generated symbols (e.g., clusters of dots or horizontal lines). Over the course of the experiment, the members of a dyad had to come to an agreement as to which unique symbols to use and what they stood for without ever being able to see or hear each other.

Despite these constraints, each dyad was able to develop its own unique systems of communication. At the root of this ability to create and detect intentional information in the environment is the ability to associate one's own body movements and/or the body movements of others with the environmental effects they reliably produce, regardless of whether the effects are intentional or unintentional. For example, Richardson, Marsh, Isenhower, Goodman, and Schmidt (2007) demonstrated that two participants' oscillatory rocking movements in rocking chairs become coupled via vision of each other's oscillatory movements, suggesting that vision of another's movement effects (i.e., rocking) is sufficient to afford one the ability to generate synchronous behavior. In van der Wel, Knoblich, and Sebanz's (2011) experiment, participants were tasked with swinging a small pole back and forth by pulling two attached cords on either side of the pole. Participants took part in this task as either individuals or dyads. Individuals had bimanual control of the cords whereas each member of a dyad had control of one cord. The data from this experiment indicate that dyads generate much more overlapping forces in this task than individuals do. The authors propose that these additional haptic forces serve as an "information channel" and allow dyads to coordinate and perform at the level of individuals. In other words,

dyads generated these additional forces (i.e., action effects) and used them as information about each other's action intentions. Individuals, on the other hand, may not have generated as much overlapping forces since they have internal access to their own action intentions and, therefore, can successfully coordinate their hands without as much reliance on information in their external environment.

A study by Knoblich and Jordan (2003) adds to this body of research by demonstrating how unintentionally generated auditory effects can serve as information about others' action intentions. In their experimental paradigm, a solid dot stimulus (the "target") traveled back and forth across the computer screen at a constant velocity. The participants' task was to keep a larger, hollow circle stimulus (the "tracker") on top of the target stimulus. Participants did so using two keys that controlled the tracker's velocity. The left key incremented the tracker's velocity to the left, and the right key incremented the tracker's velocity to the right. To observe differences between intra- and inter-personal action coordination, participants were randomly assigned to participate in this task either individually or in pairs. When participating as an individual, a participant had control over both the left and right keys. When participating as part of a dyad, a participant only had control over one key, and their partner had control over the other key. In the dyad condition, each member of a dyad participated using a separate computer out of the other participant's view. Additionally, for participants in a *tone* condition, each keypress was accompanied by an auditory effect. Pressing the left key produced a low-pitch tone, while pressing the right key produced a high-pitch tone. For the participants in a *no-tone* condition, the keypresses did not produce auditory effects.

The results of their experiment indicated that, in the beginning of the experiment, dyads performed worse than individuals. However, by the end of the experiment, dyads in the tone

condition performed at the same level as individuals whereas the no-tone dyads performed worse than both individuals and tone groups. In addition to these general performance differences, tone dyads developed coordination strategies over time that resembled the coordinative dynamics exhibited by individuals. In response to this pattern of results, one important question is: why might the simple addition of keypress-contingent tones improve dyad performance? A possible answer to this question lies in the Theory of Event Coding (Hommel et al., 2001).

The Theory of Event Coding

The Theory of Event Coding (TEC) is a framework for understanding the relation between perception and action planning. The central tenet of TEC is that actions are planned in terms of the distal (i.e., environmental) effects they are intended to produce (Hommel, 2009; Hommel et al., 2001). This ability to plan actions via intention of effects is afforded by associations that develop between actions and their effects. To illustrate how such associations develop, one may imagine an infant lying beneath a mobile that is attached to the infant's ankle via a ribbon. Given these conditions, movement of the infant's foot would reliably produce movement of the mobile. Every time the infant kicks, the infant unintentionally generates a visual effect: movement of the mobile. According to TEC, after repeatedly producing these actions (i.e., the kicking) and perceiving their effects (i.e., the mobile movement), these perceived effects become associated with the actions that produced them. Due to this association, later perception—or intention—of those effects facilitate the production of, or *prime*, the action that produces them.

These claims of TEC have been supported in a series of experiments by Hommel (1996). In a learning phase of one experiment, participants engaged in a task involving a series of trials in which they were required to produce left and right keypresses depending on whether the

“target” stimulus (presented in the center of a computer screen) was either an *X* or an *O*. When participants made keypress responses during this first phase, the responses were followed by auditory effects. For half of the participants, left responses were followed by low-pitch tones, and right responses were followed by high-pitch tones. For the other half of participants, the response-tone mapping was reversed. In the second phase of the experiment, participants engaged in a compatibility test. In trials of this compatibility test, a “prime” stimulus—the low- or high-pitch tone from the learning phase—was presented simultaneously with the target stimulus. As in the learning phase, the participants were required to press a left or right key on the basis of the target stimulus. The results from this experiment indicate that participants were quicker to respond on trials in which the prime stimulus was the tone that was previously paired (in the learning phase) with the correct response than when the prime stimulus was the tone that was previously paired with the incorrect response.

To clarify this pattern, one may take, for example, a participant that heard the low-pitch tone following a left response and the high-pitch tone following a right response in the learning phase. In the compatibility test, when this participant was required to make a left response, they were, on average, quicker to respond when they heard the low-pitch tone than when they heard the high-pitch tone. Alternatively, when they were required to make a right response, they were, on average, quicker to respond when they heard the high-pitch tone than when they heard the low-pitch tone. That is, consistent with the prediction of TEC, the presence of this *compatibility effect* indicates that responses were facilitated by the presentation of the tones that the responses previously produced in the learning phase and, therefore, suggests that the participants’ actions (i.e., the keypresses) became associated with the effects (i.e., the tones) they reliably produced.

This theory may be able to provide insight into the results of the experiment conducted by Knoblich and Jordan (2003). In their experiment, dyads whose keypresses produced additional auditory effects (i.e., tones) learned to perform at the level of individuals and developed coordination strategies that resembled those of individuals. Dyads in the no-tone condition produced one notable effect: the intended effect of tracker movement. The actions of dyads in the tone condition produced an unintended effect in addition to the intended effect. That is, their actions had two notable effects: the intended tracker movement and the unintended tones. Given the addition of these unintended effects, the dyads with tones had additional information about each member's action intentions. In the same way that saying "lift" while beginning to lift a couch may offer more information about one's intentions (and, thus, lead to more effective coordination) than solely lifting the couch without any verbalizations, the auditory effects in Knoblich and Jordan's task may have allowed members of dyads to better anticipate the actions of their partners than they would have if they had only perceived and generated the intended effect of tracker movement. Along these lines, dyads' improvement in performance and development of interpersonal coordination's strategies that resembled intrapersonal coordination strategies may be attributable to associations that developed over the course of the experiment between keypresses and their effects (i.e., tracker movements and tones). Nonetheless, one would need to use a task like Hommel's (1996) compatibility test to assess whether such associations developed and to support this possible explanation.

The Actor-coactor Relationship

While some researchers (e.g., Knoblich & Jordan, 2003) have used novel paradigms to study joint action coordination, others have had participants simply work together in more traditional cognitive-psychological tasks such as the Simon task (Simon & Rudell, 1967). The Simon task is

an experimental task similar to Hommel's (1996) compatibility test. The task is composed of trials in which participants are to make spatially definable responses (e.g., press a left or right key) in response to a stimulus that has two features: a spatial feature and a non-spatial feature. The spatial feature may be the stimulus' location on the screen, and the non-spatial feature may be the color of the stimulus. Participants in this task are asked to respond on the basis of the non-spatial feature (e.g., respond left if the stimulus is green). Observations using this task indicate that participants are quicker to respond when the task-irrelevant, spatial feature of the stimulus corresponds to the spatial feature of the required response than when they do not correspond. For example, participants are, on average, quicker to respond with a left keypress when the stimulus is located on the left side of the screen than when it is located on the right side of the screen. This 'Simon effect' coheres with the predictions of TEC: The presentation of 'left effects' will facilitate the production of actions which generate 'left effects' (e.g., a left-keypress), and the presentation of 'right effects' will interfere with the production of actions which generate 'left effects.' Thus, differences in response time on the basis of stimulus-response spatial correspondence in the Simon task is akin to differences in response time on the basis of action-effect compatibility in Hommel's (1996) compatibility test.

The joint-Simon task is a version of the Simon task in which two participants work together; each participant has control over one of the two response keys (e.g., Sebanz, Knoblich, & Prinz, 2003). On each trial, each participant will either press their key or will withhold their response. In this joint version of the Simon task, one may observe a 'joint-Simon effect' that is identical to the single-participant Simon effect. That is, members of a dyad are quicker to respond to the target stimulus when the response primed by the task-irrelevant, spatial feature of the target stimulus is compatible with the correct response (as indicated by the target stimulus).

Interestingly, this effect does not occur if each participant does their part of the joint-Simon task alone. That is, the joint-Simon effect only occurs if there is another person present.

Building on this previous research, Hommel and colleagues (2009) used a joint-Simon task to examine how interpersonal relationships may influence joint action coordination. In their experiment, participants took part in a joint-Simon task alongside a confederate. In a *positive* condition, the confederate was kind to the participant as they completed the task, saying phrases such as, “it is not too difficult, is it?” and “you are doing a good job.” In a *negative* condition, the confederate was somewhat aggressive and intimidating, saying phrases such as, “you have to respond quicker” and “you are too slow.” The results of this experiment indicate that the participants in the positive condition exhibited a Simon effect: They were quicker to respond when the task-irrelevant, spatial feature of the stimulus corresponded to the spatial feature of the required response than when they did not correspond. However, participants in the negative condition did not exhibit a Simon effect: Response times did not differ on the basis of stimulus-response spatial correspondence.

Hommel and colleagues explain this finding by proposing that we represent self- and other-generated action-effects separately, but these representations can be integrated depending on the nature of one’s relationship with the other. They propose that a positive relationship between self and other leads to integration whereas a negative relationship between self and other leads to suppression of integration. Therefore, participants who worked alongside the positive confederate exhibited a joint-Simon effect because, in terms of representations of generated action-effects, self and other are represented more as a unit. In short, this experiment provides preliminary evidence that the valence of the actor-coactor relationship modulates the

size of the observed compatibility effects and, in this way, more generally suggests that the nature of the actor-coactor relationship influences interpersonal coordination.

Relationship Closeness

Hommel and colleagues' (2009) experiment demonstrated that the valence of a dyad's relationship (i.e., whether they have a 'positive' or 'negative' relationship) has coordinative consequences. Another aspect of relationships that may affect interpersonal coordination dynamics is closeness. Closeness is generally construed as a connectedness among individuals. Aron, Aron, and Smollan (1992) follow this conception and defined closeness as overlapping selves or inclusion of the other in the self (Aron & Aron, 1986; Aron, Aron, Tudor, & Nelson, 1991). Aron and colleagues (1992) noted that this identification of closeness as overlapping selves dates back at least as far as James (1890b) and stems from the idea that the self, in a close relationship, may incorporate the resources, perspectives, and characteristics of the other. Accommodating this definition of closeness, Aron and colleagues described a measure that taps into participants' general sense of interpersonal connectedness or closeness. This measure, the Inclusion of Other in the Self (IOS) scale, consists of seven pairs of circles (labeled "You" and "Other") that overlap to various degrees. For this scale, a participant responds by circling one pair of circles that best represents their relationship with the other.

Scores on the IOS scale have been demonstrated to correlate with other measures of closeness (Melinat, 1991), measures of marital quality (McKenna, 1989), as well as marital commitment and satisfaction measures (Griffin, 1990). More recently, Gächter, Starmer, and Tufano (2015) conducted a series of studies that collectively indicate a high positive correlation between the IOS scale and other closeness measures: the We Scale (Cialdini, Brown, Lewis, Luce, & Neuberg, 1997), the Subjective Closeness Index (Berscheid, Snyder, & Omoto, 1989),

the Relationship Closeness Inventory (Berscheid et al., 1989), the Loving and Liking Scale (Rubin, 1970), and the Personal Acquaintance Measure (Starzyk, Holden, Fabrigar, & MacDonald, 2006). Taken together, these studies demonstrate the value of the IOS scale in assessing participants' perceived relationship closeness.

Researchers have experimentally manipulated relationship closeness through the use of closeness-generating tasks. An example of this can be seen in Aron, Melinat, Aron, Vallone, and Bator's (1997) structured self-disclosure task (SSDT). In this task, dyads take turns sharing their answers to 36 questions over the course of 45 min. In a closeness-generating condition of this task, the questions become increasingly intimate as dyads progress through the question lists. In a small-talk condition, the questions remain at a relatively non-intimate level throughout the task. Given that intimacy is often associated with closeness (Helgeson, Shaver, & Dyer, 1987), one might expect that this difference in intimacy between the two conditions might engender differences in relationship closeness. Indeed, in one experiment, dyads who participated in the closeness-generating condition self-reported greater closeness to their interaction partners than dyads who participated in the small-talk condition (Aron et al., 1997).

Since Aron and colleagues' (1997) creation of their SSDT, researchers have used similar tasks to answer various research questions. For example, studies using SSDTs have highlighted the effects of mobile phone and social network accessibility on the quality of social interactions (Przybylski & Weinstein, 2012; Sprecher, Hampton, Heinzl, & Felmlee, 2016), the mediating role of behavioral synchrony in the relationship between self-disclosure and embodied rapport (Vacharkulksemsuk & Fredrickson, 2012), the importance of self-disclosure reciprocity for the development of closeness and liking (Sprecher, Treger, Wondra, Hilaire, & Wallpe, 2013), and the factors that mediate the relationship between self-disclosure reciprocity and attraction

(Sprecher & Treger, 2015). Through these studies and many others, one can see that SSDTs, such as the one described by Aron and colleagues (1997), are valuable tools for researchers investigating social dynamics.

The Present Experiment and Predictions

While Hommel and colleagues (2009) provided preliminary evidence that the nature of the actor-coactor relationship modulates the basic coordinative processes that underlie joint action, what remains to be seen is whether such differences in interpersonal coordination can be observed in a more dynamic, ecologically valid task. The present experiment is designed to fill this gap and add to the relationship closeness literature by potentially identifying coordinative outcomes of generating closeness. Along these lines, I pose the following research questions:

- *RQ1*: Does relationship closeness influence cooperative performance in dynamic cooperative tasks?
- *RQ2*: Can potential improvements in cooperative performance be explained by appealing to developed associations between actions and action-contingent effects?

To address these research questions, dyads participated in a three-phase experiment. In the *pre-disclosure phase*, dyads first took part in a continuous 3-min trial of a dot-control task (a dynamic cooperative task originally used by Schloesser et al., 2015). Following this dot-control task, dyads completed a compatibility test (e.g., Hommel, 1996) to test for the presence of associations between actions and action-contingent effects from the dot-control task. After the compatibility test, participants completed a questionnaire on which they reported, among other things, how close they feel to the other member of the dyad. In the *disclosure phase* of the experiment, dyads were assigned to either a closeness-generating (“shared-disclosure”) or control (“private-disclosure”) condition in a structured self-disclosure task (Aron et al., 1997).

Dyads subsequently completed another 3-min trial of the dot-control task, another compatibility test, and another self-report questionnaire in the *post-disclosure* phase of the experiment.

If dyads with greater relationship closeness exhibit greater cooperative performance than dyads who are less close, then dyads in the shared-response condition will exhibit greater pre- to post-disclosure increases in dot-control performance than dyads in the private-response condition. If dyads' improvements in performance can be explained by associations that developed between actions and action-contingent effects, then pre- to post-disclosure increases in dot-control performance will be associated with pre- to post-disclosure increases in the size of compatibility effects in the compatibility test. Thus, in context of the present experiment, the research hypotheses can be stated as follows:

- *H1*: Dyads who are closer will perform better in a dynamic cooperative task than dyads who are less close.
- *H2*: Dyads who perform better in the dynamic cooperative task will exhibit greater compatibility effects in a compatibility test than dyads who perform worse.

CHAPTER II: METHOD

Participants

The sample was obtained through an online participant recruiting system (SONA) at Illinois State University. Seventy-four (74) participants (37 dyads) took part in this experiment. However, three dyads were excluded from the sample: two dyads in which there were computer malfunctions during the experiment and one dyad in which the participants reported being friends with one another prior to the experiment. The remaining 68 participants (mean age = 20.03 years [$SD = 1.91$]) comprised the 34 dyads that are included in the analyses. Of these dyads, 23 were woman-woman, 9 were woman-man, and 2 were woman-nonbinary.

Procedure

Each dyad was guided through this experiment by one experimenter. When both participants of a dyad arrived for a session, they gave their informed consent to participate in the study. The experimenter then brought each participant into separate rooms equipped with computers and headphones. From here, the experiment progressed through three main phases: *pre-disclosure*, *disclosure*, and *post-disclosure*.

In the *pre-disclosure* phase, an experimenter first oriented each participant, one at a time in their respective rooms, to the dot-control task (Schloesser et al., 2015) by providing verbal instructions (see Appendix C). Participants were each given control over one keyboard key—A or L—and were instructed, one at a time, on how to control the dot object. While each participant was being instructed, the other participant was asked to wait patiently in his or her individual room until the experimenter returned with instructions. When both participants were ready, they put on pairs of headphones so that they could hear keypress-contingent auditory effects, and the dot-control trial was initiated. At the beginning of the dot-control trial, the dot descended at a

constant velocity ($v_{vel} = -300$ pps) until the participants took control. Dyads worked to keep the dot in the middle of a rectangle appearing on the computer screen, uninterrupted, for 3 min. After the dot-control trial, the experimenter described the compatibility test (Elsner & Hommel, 2004; Hommel, 1996) to each participant, individually (see Appendix C). On every trial, participants pressed the keyboard key that corresponds to the *target* stimulus—the letter “A” or “L”—displayed during each trial, as quickly and as accurately as possible, while ignoring all other stimuli. As with the dot-control task, participants were wearing headphones throughout the compatibility test so that they could hear the computer-generated auditory effects. After the compatibility test, participants completed a paper version of the pre-disclosure questionnaire, which included various items regarding their feelings about the other participant (e.g., closeness, similarity, and liking).

The *disclosure* phase began after participants completed the pre-disclosure questionnaire. Both participants of each dyad were brought out into a larger room where they took part in a face-to-face, structured self-disclosure task adapted from Aron and colleagues’ (1997) closeness-generating procedure. Dyads were randomly assigned to one of two conditions in the task: shared-response or private-response. For this task, dyads were provided with sheets of paper that included instructions for the task and the list of questions (see Appendix A). In the shared-response condition, pairs were asked to share their answers aloud to each question with their interaction partners. In the private-response condition, pairs were asked to privately handwrite their answers on paper (see, e.g., Gaertner & Schopler, 1998), and they were told that these responses would remain private. After the experimenter left the room, dyads spent a maximum of

18 min progressing through the questions.¹ To ensure privacy, the dyad's engagement in this task was not monitored. The participants took turns reading the questions aloud, and both participants shared or wrote down an answer for every question, depending on the condition to which they are assigned.

The *post-disclosure* phase followed the structured self-disclosure task. This phase has the same structure as the pre-disclosure phase. The participants were taken back into their separate rooms where they completed another 3-min dot-control trial and, subsequently, another 80 trials of the compatibility test. After the compatibility test, each participant was given a paper copy of the post-disclosure questionnaire, which incorporates all the items from the pre-disclosure questionnaire but has additional demographic questions and questions regarding the participants' experiences in the self-disclosure task. Once participants completed this questionnaire, they were brought out into the larger room, thanked, and debriefed. Each experimental session took 35-40 min.

¹ Inspection of means for amount of time (in seconds) spent in the SSDT suggests that, on average, dyads in the shared-disclosure condition ($M = 728.12$, $SD = 264.43$) spent more time in the task than dyads in the private-disclosure condition ($M = 587.59$, $SD = 147.15$). However, an independent sample t-test revealed that this difference was not statistically significant, $t(32) = 1.92$, $p = .065$, Cohen's $d = 0.66$.

Apparatus and Materials

Structured Self-disclosure Task

The structured self-disclosure task was adapted from the closeness-generating procedure used by Aron and colleagues (1997) and was used to experimentally manipulate closeness. The task was comprised of 15 questions (see Appendix A). For this task, dyads sat in a room together, face-to-face, reading over these questions and providing responses to each question, either stated aloud to the other or privately written on paper.

The questions in this task become increasingly intimate as participants work through the question list. To create an abbreviated version of Aron and colleagues' (1997) question list, I randomly selected multiple questions from each of their question sets. Following Vacharkulksemsuk and Fredrickson (2012), the first 4 questions were taken from 'Set I,' the next 4 questions were taken from 'Set II,' and the last 7 questions were taken from 'Set III.' Thus, the earlier questions initially elicit disclosure of information that is likely shared among good friends (e.g., "What would constitute a 'perfect' day for you?"), but as dyads progress through the questions, they begin to disclose information that is likely only shared with one's closest friends or family (e.g., "When did you last cry in front of another person?"). The value and reliability of structured self-disclosure tasks such as the one used in the present experiment have been demonstrated in studies showing that individuals in the closeness-generating condition report a greater degree of closeness to their interaction partners than individuals in a small-talk—or control—condition (Aron et al., 1997; Sedikides et al., 1999).

Dot-control Task

The dot-control task is a dynamical joint-action task initially developed and used by Schloesser and colleagues (2015) to study intrapersonal and interpersonal action coordination.

The dot-control program was developed using Microsoft's XNA Framework and runs at 60 hz refresh rate. This task was used both before and after the disclosure manipulation, and it had two purposes in the present study. First, it served as a 'learning phase' in that participants may have learned associations between certain actions and their effects while engaging in this task. Second, it afforded assessment of dyads' performance in a continuous, cooperative task. For this task, participants viewed a computer monitor from about 60 cm (23.62 in) away. The task domain was comprised of a hollow, black, rectangular box in the center of the screen (600 x 100 pixels; 10 pixels thick) with a gray background. A black circle (10 x 10 pixels) superimposed on a white circle (50 x 50 pixels) was used as the controllable dot object (see Figure 1).

Figure 1. A sample image of the task domain with the controllable dot in the center.

To control the dot, one member of a dyad used the A key and the other used the L key. Holding down the A key propelled the dot to the right at a constant velocity ($x_{vel} = +300$ pixels per second [pps]). Holding down the L key propelled the dot to the left at a constant velocity ($x_{vel} = -300$

pps). When both keys were held down simultaneously, the dot travelled upward ($y_{vel} = +300$ pps) and in the direction it was previously moving with respect to the x axis ($x_{vel} = +/-300$ pps). When no key was pressed, the dot travelled downward ($y_{vel} = -300$ pps) and in the direction it was previously moving with respect to the x axis ($x_{vel} = +/-300$ pps). See Figure 2 for a graphical depiction of the key-mapped controls of the dot.

Figure 2. A graphic depicting the key-mapped controls of the dot.

In addition to altering the dot's movement, the A and L keypresses generated auditory effects. While the A key was held, the program produced a continuous sinusoidal tone at 523.25 Hz. While the L key was held, the program produced a continuous sinusoidal tone at 349.23 Hz. While the two keys were held down together, both tones were produced, and while no key as held down, no tone was produced. Throughout a dot-control trial, the state of the keyboard and the dot's position were recorded at a sampling rate of 60 Hz. With these values, the program calculated the total time that the dot was inside the rectangular box during the trial. The

percentage of the total trial time that the dot was inside of the rectangular box served as an indication of cooperative performance for a dyad in this task.

Compatibility Test

Compatibility tests are typically used to assess whether participants have developed action-effect associations after engaging in a task with robust action-effect contingencies (e.g., Elsner & Hommel, 2004; Hommel, 1996). The compatibility test in the present study was used before and after the disclosure manipulation to test for the presence of learned associations between A and L keypresses and the effects—visual and auditory—that those actions produced in the dot-control task. As with the dot-control task, the present compatibility test was programmed using Microsoft’s XNA Framework and runs at 60 Hz refresh rate.

For this task, participants viewed a computer monitor from a distance of about 60 cm (23.62 in). Each trial in the compatibility test contained two stimuli: a *target* and a *prime*. The target stimulus was the letter “A” or “L” and appeared in the center of the screen. The prime stimulus was one of the visual or auditory action-contingent effects from the dot-control task. There were four prime stimuli: (a) a dot that starts at an x,y pixel position of -30,0 and moves at 300 pps to the right, (b) a dot that starts at 30,0 and moves at 300 pps to the left, (c) a 523.25 Hz tone, and (d) a 349.23 Hz tone. In accordance with the Theory of Event Coding (Hommel et al., 2001), a prime stimulus is referred to as such because it is assumed that its presentation will facilitate the activation of, or prime, the movement with which it has been associated (e.g., a 523.25 Hz tone would prime an A keypress). Along these lines, each trial of the compatibility test can be categorized as a *compatible* or an *incompatible* trial. Compatible trials are those in which the response required by the target corresponds to the response that is assumed to be activated by the prime (e.g., an A target and a 523.25 Hz tone). In incompatible trials, the

response required by the target conflicts with the response that is assumed to be activated by the prime (e.g., an A target and a 349.23 Hz tone). All visual stimuli presented during the compatibility test were superimposed on the same gray background used in the dot-control task.

Each trial of the compatibility test was preceded by a 1400 ms inter-trial interval during which a blank gray screen was displayed. After the inter-trial interval, trials began with the presentation of a centrally located fixation cross for 500 ms. Following a 100 ms gap, the target and prime were concurrently presented for 200 ms. After the target and prime stimuli disappeared, a blank screen was presented for 1000ms to allow the participants extra time to respond. When a trial is completed, the test automatically proceeded to the subsequent trial. Each trial lasted 2800 ms. Participants responded to the target stimulus by pressing the A or L key with their left or right index fingers, respectively. Participants' response times (as well as other information about the presented stimuli) were recorded for each trial. These response times served as the primary dependent measure in this task and were used in later calculations to assess the size of compatibility effects

The compatibility test contained eight (i.e., 2 [target: A or L] x 2 [prime mode: visual or auditory] x 2 [compatibility: compatible or incompatible]) unique trials, and each unique trial was presented 10 times. Given the 8 unique trials and 10 repetitions of each trial, the compatibility test was comprised of 80 total trials. The order of the trials was randomized at runtime.

Pre-disclosure Self-report Measures

The *pre-disclosure* questionnaire included 9 total items (see Appendix B). The first item was the Inclusion of Other in the Self (IOS) scale (Aron et al., 1992). The IOS scale is commonly used to measure the degree of closeness that participants feel to their interaction

partners (Aron et al., 1997; Brown et al., 2009; Page-Gould, Mendoza-Denton, & Tropp, 2008; Przybylski & Weinstein, 2012; Sprecher, 2014; Sprecher, Treger, & Wondra, 2012; Sprecher et al., 2013; Vacharkulksemsuk & Fredrickson, 2012). For this scale, participants responded by circling one of seven pairs of overlapping circles (labeled “You” and “Other”) that best described their relationship with their interaction partners.

The pre-disclosure questionnaire also included eight other questions. The first five were used to assess participants’ feelings and thoughts about their interaction partners. Among these were: “How much do you think you have in common with the other participant?” (1 = *nothing*, 7 = *a lot*), “How similar do you think you and the other participant are likely to be?” (1 = *not at all*, 7 = *a great deal*), “How much do you like the other participant?”, “How close do you feel toward the other participant?” (1 = *not at all*, 7 = *a great deal*), and “How compatible do you think you and the other participant are?” (1 = *not at all*, 7 = *a great deal*). Two other items were used to assess their experiences in the dot-control task. One item was “How cooperative was the other participant in the dot-control task?” (1 = *not at all*, 7 = *a great deal*) and the other was “How much did you enjoy the dot control task?” (1 = *not at all*, 7 = *a great deal*). The last item was adapted from Byrne’s (1971) Interpersonal Judgement Scale: “How much would you like/dislike working with the other participant again in an experiment?” (1 = *very much dislike*, 7 = *very much like*).

Post-disclosure Self-report Measures

The *post-disclosure* questionnaire included all the same items as the pre-disclosure questionnaire and additionally contained 13 other items (see Appendix B). Four of these items were adapted from Reis, Maniaci, Caprariello, Eastwick, and Finkel’s (2011) responsiveness scale: “The other participant seemed to really listen to me during the conversational task,” “The

other participant seemed interested in what I was thinking and feeling,” “The other participant was on ‘the same wavelength’ with me,” and “The other participant was responsive to my answers in the conversational task” (1 = *strongly disagree*, 7 = *strongly agree*).

Three other items concern participants’ experiences during the experimental tasks: “How much did you enjoy the interaction during the conversational task?” “How much did you and the other participant laugh during the conversational task?” and “How much did you enjoy the conversational task?” (1 = *not at all*, 7 = *a great deal*). The remaining items consisted of a question to assess previous familiarity with the other participant, demographic items (i.e., age, racial/ethnic background, and handedness), and an open-ended question regarding any use of a strategy during the dot-control task.

Closeness Measures

The two closeness items in these questionnaires (i.e., the IOS scale and the explicit closeness question) served two purposes. First, they collectively served as a manipulation check, affording the assessment of differences in pre- to post-disclosure changes in closeness based on disclosure type (shared-response vs. private-response). Second, they were used as dependent measures in analyses testing for a relationship between closeness and performance. For these analyses, dyad closeness scores were computed for each phase of the experiment by averaging responses to both closeness items for both members of each dyads (e.g., pre-disclosure dyad closeness score = $[\text{IOS}_{pre}^A + \text{Closeness}_{pre}^A + \text{IOS}_{pre}^L + \text{Closeness}_{pre}^L]/4$). Cronbach’s α for these closeness items (i.e., the IOS scale and the explicit closeness item) were .54 and .72 for the pre- and post-disclosure phases, respectively.

CHAPTER III: RESULTS

Self-report Measures

Repeated Items

For the self-report measures, I treated the dyad as the unit of analysis. To accomplish this, I computed the average of the dyad members' responses for each item. Table D-1 presents means and standard deviations for difference scores (post-disclosure – pre-disclosure) for the repeated questionnaire items. I submitted the dyad-level scores to a 2 (disclosure type: shared-response vs. private-response) x 2 (time: pre-disclosure vs. post-disclosure) repeated measures multivariate analysis of variance (RMMANOVA). This RMMANOVA revealed a significant main effect of time, Wilks' $\Lambda = .128$, $F(9, 22) = 16.64$, $p < .001$, $\eta_p^2 = .87$. In general, scores for these repeated questionnaire items were higher in the post-disclosure questionnaire than they were in the pre-disclosure questionnaire. This analysis did not yield a significant main effect of disclosure type, Wilks' $\Lambda = .715$, $F(9, 22) = 0.98$, $p = .486$, $\eta_p^2 = .29$. However, there was a significant time by disclosure type interaction, Wilks' $\Lambda = .418$, $F(9, 22) = 3.41$, $p = .009$, $\eta_p^2 = .58$. Inspection of the associated effect sizes (see Table D-1) suggests that the pattern of responses to the commonality, similarity, liking, closeness, and compatibility items likely drove this interaction. Specifically, dyads in the shared-response condition exhibited greater pre- to post-disclosure increases for these items than dyads in the private-response condition. Figures 3 and 4 present graphical depictions of the patterns for the IOS and closeness scores, respectively.

Figure 3. Mean IOS scores by disclosure type for both pre- and post-disclosure phases. Error bars represent 1 standard error above the mean.

Figure 4. Mean closeness score (on the explicit closeness item) by disclosure type for both pre- and post-disclosure phases. Error bars represent 1 standard error above the mean.

Additional Post-disclosure Items

As with the repeated questionnaire items, I computed the average of the dyad members' responses for the additional, post-disclosure questionnaire items. Table D-2 displays means and standard deviations for these items by disclosure type. These dyad-level scores were submitted to a multivariate analysis of variance (MANOVA) with disclosure type (shared-response vs. private response) as an independent variable. This analysis revealed a significant effect of disclosure type, Wilks' $\Lambda = .424$, $F(7, 26) = 5.05$, $p = .001$, $\eta_p^2 = .58$. On average, scores on these questionnaire items were greater for dyads in the shared-response condition than dyads in the private-response condition.

Performance Measures

Two quantities were computed to assess dyads' performance in the dot-control task. The first, *in-box time*, is computed by dividing the time the dot object is within the 600 x 100-pixel box by the total time of the dot-control trial. It is the most direct measure of a dyad's success in the dot-control task given that the goal is to keep the dot object in the box. Mean *coast time* is the average duration (in ms) of key events. For this purpose, I define a key event as pressure of a single key (i.e., the A key *or* the L key), pressure of both keys (i.e., the A key *and* the L key), or release of both keys. With this definition, each keypress or release constitutes a key event and serves as the offset time for the previous coast time calculation and the onset time of the subsequent coast time calculation. Mean coast time reveals stability in coordinative behavior or, in other words, the degree to which members of a dyad interfere with each other's actions. A series of rapid key events would contribute to a lesser mean coast time and indicates that the members of a dyad are interfering with each other's generation of intended effects (e.g., direct leftward movement of the dot). On the other hand, a greater mean coast time suggests that key

events are, on average, allowed to persist for longer and indicates that members of a dyad are not interfering with each other's generation of intended effects. In other words, greater coast time values may imply the emergence of a stable coordination strategy.

Table D-3 displays means and standard deviations for the dot-control measures by disclosure type. Percentage of in-box time and coast time were submitted to a 2 (time: pre-disclosure vs. post-disclosure) x 2 (disclosure type: shared-disclosure vs. private-disclosure) RMMANOVA. This analysis revealed a significant main effect of time, Wilks' $\Lambda = .432$, $F(2, 31) = 20.407$, $p < .001$, $\eta_p^2 = .57$. In general, dyads performed better and exhibited greater coast times in the post-disclosure phase than in the pre-disclosure phase. In this analysis, the main effect of disclosure type was not statistically significant, Wilks' $\Lambda = .998$, $F(2, 31) = 0.02$, $p = .974$, $\eta_p^2 < .01$. The time by disclosure type interaction was also non-significant, Wilks' $\Lambda = .962$, $F(2, 31) = 0.61$, $p = .547$, $\eta_p^2 = .04$. Figures 5 and 6 present graphical depictions of these patterns for percentage of in-box time and mean coast time, respectively.

Figure 5. Mean percentage of in-box time by disclosure type for both pre- and post-disclosure phases. Error bars represent 1 standard error above the mean.

Figure 6. Mean coast time by disclosure type for both pre- and post-disclosure phases. Error bars represent 1 standard error above the mean.

Compatibility Test Measures

Trials of the compatibility test were recoded to be relative to each member of a dyad. For example, trials on which “A” is the target stimulus were coded as “self-target” for the participant that had control of the A key in the dot-control task and “other-target” for the participant who had control of the L key in the dot-control task. To further reduce the complexity of the response time analysis, compatibility difference (CD) scores were computed by subtracting the average response time (RT) on compatible trials from the average RT on incompatible trials (i.e., incompatible trial RT – compatible trial RT). This computation yields a measure that indicates the size of the compatibility effect. Separate CD scores were computed for each combination of target (self-target vs. other-target), prime mode (visual vs. auditory), and time (pre-disclosure vs. post-disclosure). Participants successfully responded on 99.04% of total trials of the compatibility tests. Response times for trials on which participants responded incorrectly (6.83% of trials) were not used in the calculation of CD scores.

CD Scores

Table D-4 displays means and standard deviations for CD scores by disclosure type. Visual inspection of these means suggests that participants, on average, did not develop the expected associations between the keypresses and the effects used as prime stimuli. Nonetheless, the CD scores were submitted to a 2 (disclosure type: shared-response vs. private-response) x 2 (time: pre-disclosure vs. post-disclosure) x 2 (prime mode: visual vs. auditory) x 2 (target: self-target vs. other-target) repeated measures analysis of variance (RMANOVA). Table D-5 displays the results of this analysis. Notably, the main effect of time and the time by disclosure type interaction were non-significant. There was a main effect of prime mode, $F(1, 32) = 5.05, p =$

.032, $\eta_p^2 = .14$. On average, CD scores for auditory primes were greater than CD scores for visual primes.

Frequency of Errors

Frequency of compatibility test errors for each dyad were submitted to a 2 (time: pre-disclosure vs. post-disclosure) x 2 (compatibility: compatible vs. incompatible) x 2 (disclosure type: shared-disclosure vs. private-disclosure) RMANOVA. This analysis revealed a significant main effect of compatibility, $F(1, 32) = 5.28, p = .028, \eta_p^2 = .14$. On average, dyads made more errors on compatible trials ($M = 0.75, SD = 0.55$) than incompatible trials ($M = 0.60, SD = 0.40$).

Regression Analyses

Closeness and Performance

For the first analysis, a closeness difference score was calculated by subtracting the pre-disclosure dyad closeness scores from post-disclosure dyad closeness scores (i.e., post-disclosure closeness – pre-disclosure closeness). Additionally, performance difference scores were calculated by subtracting pre-disclosure in-box time in the dot-control task from post-disclosure in-box time (i.e., post-disclosure in-box time – pre-disclosure in-box time). Then, performance difference scores were regressed on closeness difference scores. The results of the regression indicated that closeness difference scores did not significantly predict performance difference scores, $\beta = .22, t(30) = 1.23, p = .228$.

Compatibility Effects and Performance

In the second analysis, performance difference scores were regressed on CD difference scores. These CD difference scores were obtained by separately averaging all pre- and post-disclosure CD scores for each dyad. Then, the pre-disclosure CD score average was subtracted from the post-disclosure CD score average (i.e., post-disclosure average CD score – pre-

disclosure average CD score) to obtain a measure that indicates the change in size of CD scores over the course of the experiment: CD difference scores. The results of the regression indicated that CD difference scores did not significantly predict performance difference scores, $\beta = .31$, $t(32) = 1.86, p = .072$.

CHAPTER IV: DISCUSSION

The present study was designed to test two central hypotheses regarding relationship closeness and joint action coordination. The first hypothesis was that dyads who are closer will perform better in a dynamic cooperative task than dyads who are less close. To test this hypothesis, dyads engaged in the dot-control task before and after taking part in one of two conditions of a structured self-disclosure task (SSDT). The results suggest that while the SSDT appeared to produce the intended difference in closeness between dyads, the pre- to post-disclosure changes in closeness were not associated with pre- to post-disclosure changes in dot-control performance. The second hypothesis was that dyads who perform better in the dynamic cooperative task will exhibit greater compatibility effects in a compatibility test than dyads who perform worse. To test this hypothesis, dyads took part in a compatibility test after each dot-control task. No support was found for the hypothesis that pre- to post-disclosure changes in compatibility difference (CD) scores would be associated with pre- to post-disclosure changes in performance. As will be discussed below, this result may merely reflect the presence of more fundamental problems surrounding the compatibility test.

Relationship Closeness

In the study of joint action, the present study focused on the role of relationship closeness. To generate differences in relationship closeness between dyads, I employed an adapted version of Vacharkulksemsuk and Fredrickson's (2012) SSDT. Whereas the conditions of their experiment differed on the basis of the task that dyads engaged in (i.e., the SSDT or an unrelated collaborative task), the conditions in the present study differed on the basis of the relative privacy of the disclosure process (i.e., shared aloud with partner or written down on paper). Given that intimacy is often associated with closeness (Helgeson, Shaver, & Dyer, 1987),

one might reasonably expect those dyads who share their answers to intimate questions to generate more closeness than dyads who simply write their answers down on paper. As expected, this adapted SSDT appeared to generate the intended differences in closeness between dyads assigned to these conditions. While dyads in both conditions generally reported greater feelings of closeness in the post-disclosure phase than in the pre-disclosure phase, the increase in closeness was greater for those dyads in the shared-disclosure condition. This pattern was most evident in the responses to the explicit closeness item (i.e., “How close do you feel toward the other participant?”). While the responses on the Inclusion of Other in the Self (IOS) scale generally followed this pattern, the size of the effect was comparatively small.

This seeming disparity between responses for the IOS scale and responses to the explicit closeness item was unexpected given that previous studies have indicated that the IOS scale is a highly reliable means of assessing perceived relationship closeness (e.g., Gächter, Starmer, & Tufano, 2015). One possible explanation for this is that participants in the present study may have found the meaning of the IOS scale to be elusive—in accordance with one participant’s request for clarification on its meaning during the experiment. Although, if this were the case, one might have expected more frequent questions from participants or a more random pattern of responding for this item. Another possible explanation for this relatively small effect for the IOS scale compared to the explicit closeness item is that the explicit closeness item may be more susceptible to participant reactivity. That is, an item that is more explicitly probing participants’ feelings of closeness toward their interaction partner might see a more pronounced effect than the more subtle IOS scale due to a more obvious relation of the former to their experiences in the SSDT. Regardless of the reason for this discrepancy, it might be that a larger sample size would see the disparity of responses between these two items diminished.

Despite the observed discrepancy between scores on the IOS scale and the explicit closeness measure, the present experiment expands the literature on relationship closeness by incorporating a novel control condition and further demonstrating the efficacy of SSDTs. Compared to dyads assigned to the control condition, dyads in the closeness-generating condition reported greater closeness and liking along with greater perceptions of similarity, commonality, and compatibility. In addition to replicating effects like those observed in previous research (e.g., Aron et al., 1997; Vacharkulksemsuk & Fredrickson, 2012), these patterns suggest that the closeness manipulation in the present experiment was successful.

Cooperative Performance

To examine the relationship between closeness and cooperative performance, dyads engaged in a dynamic cooperative task (i.e., the dot-control task) before and after the SSDT. Regarding this hypothesized relation between closeness and cooperative performance, the present study does not allow one to draw firm conclusions. Neither dyads' performance in the dot-control task (in terms of percentage of in-box time) nor their coordination strategy (in terms of mean coast time) differed on the basis of SSDT condition, and further, pre- to post-disclosure changes in performance were not predicted by pre- to post-disclosure changes in closeness. However obvious, it might be worth noting that relationships among these variables could be difficult to find—particularly in experiments with smaller sample sizes—owing to substantial variance in performance within groups. As the standard deviation of mean coast time indicates, dyads across conditions varied greatly with respect to how they coordinated in the dot-control task. In the post-disclosure phase, dyads ranged from producing key events every 63.23 ms on average to only every 819.26 ms on average. One can abduce from such a range that some dyads just “got it” while others had yet to stumble upon a more efficient and effective coordination

strategy. Without awareness and/or control of the factor(s) to which this large amount of variance owes its allegiance, it may be difficult to discern the effect of relationship closeness alone.

Setting aside the problem of substantial variance within groups, other possible explanations can be entertained. First, it is possible that the *amount* of closeness dyads generated over the course of the experiment was insufficient to observe a clear relation to their performance. Spending less than 18 min in a SSDT appears sufficient to produce differences in self-reported closeness between dyads, but it could still be insufficiently powerful to produce an observable effect on dyads' performance. It may even be necessary to generate greater closeness through a more elaborate process—possibly spanning days—in order to observe its effect on performance. Although it would be more similar to the generation of closeness in natural contexts, future experiments will likely not employ such an elaborate process due to the practical constraints involved.

Another explanation for these findings regards the possibility that cooperative performance is largely unconstrained by the degree of closeness that individuals feel toward one another. While this may be, it still leaves open the possibility that cooperative performance is constrained by a different—but related—factor: familiarity with the other's behavioral tendencies. Given that individuals who have developed closeness more naturally often have spent much time observing and acting alongside each other in various contexts, one might imagine that each individual has effectively embodied, or internalized, the behavioral dynamics of the other. In other words, one's neural dynamics will come to be about the events the other generates as they attempt to coordinate with one another. In the same way that the dance student's embodiment of her instructor's movement dynamics affords later anticipation or

planning of those movements (Hahn & Jordan, 2014), close individuals may embody the movement dynamics of their partners, allowing them to anticipate each other's movements and plan complementary movements. Consequently, individuals that are close to each other may coordinate more efficiently and effectively through this embodied form of knowledge about each other's behavior. To be sure, dyads who engaged in the present experiment had little opportunity to embody each other's movement dynamics, so this factor would not be at play in the present experiment which is designed to examine the effect of closeness generated via a SSDT.

The absence of a clear relationship between cooperative performance and closeness in the present experiment is somewhat surprising given other research demonstrating the effects of other interpersonal factors on dyadic coordination (this will be discussed in more detail in the following section). Needless to say, it seems clear that a considerable amount of research is still needed to determine the various factors that contribute to dyads' performance and coordination strategies in dynamic cooperative tasks.

Action-effect Associations

Developing Associations in a Dynamic Task

In addition to examining the relationship between closeness and cooperative performance, the present study investigated the relationship between cooperative performance and action-effect associations. These associations were assumed to have developed as dyads engaged in the dot-control task and were tested for using a compatibility test similar to that employed by Hommel (1996). Dyads engaged in this compatibility test after each 3-minute trial of the dot-control task. While the present experiment did not yield evidence of a relationship between cooperative performance and the size of compatibility effects, the results spark a few points of discussion.

First, to explain the absence of a relationship between performance and the size of compatibility effects, I will introduce the problem of developing action-effect associations in dynamic tasks. To contextualize this problem, one must recognize that most (if not all) research involving compatibility tests have examined action-effect associations that were developed in highly controlled tasks. For example, recall the previously discussed experiment by Hommel (1996) in which participants learned associations by engaging in numerous, structured trials. In each trial, the participant either pressed a left key or a right key. If they pressed the left key they heard a low pitch tone, and if they pressed the right key they heard a high pitch tone. Moreover, each tone was always heard for the same duration, and the low and high pitch tones were never heard in the same trial. This highly structured learning phase allowed Hommel to maintain a certain one-to-one movement-effect mapping. That is, each movement was always followed by the same effect. Then, when testing for the presence of these associations in a compatibility test, participants were presented with precisely the same auditory effects they heard in the learning phase.

In contrast, the present experiment did not employ such a highly controlled learning phase. Instead, participants engaged in a dynamic, continuous task in which there was a one-to-many movement-effect mapping. That is, each keypress could produce many possible effects depending on the circumstances in the dot-control task. To illustrate this problem, let us consider the L keypress and its contingent visual effects. The visual effects of an L keypress will vary on a few dimensions: direction, duration, and position. Regarding direction, when the L key is held down in isolation, the dot travels to the left. However, when the L key is held down in addition to the A key, there are two additional possible directions depending on the order in which the keys were pressed. If the L key is pressed *after* the A key, the dot will travel upward and to the left,

but if the L key is pressed *before* the A key, the dot will travel upward and to the right. Thus, in total there are three possible movement directions of the dot when pressing the L key. Only two of these directions share some semblance as they are both, to some extent, leftward movement whereas the third direction is rightward movement.

Not only does the L key's effects vary in terms of the dot's direction of movement, they also vary in terms of the duration of the effect and the position where it occurs depending on how long the participant holds down the L key and where the dot is when the key is pressed. As mentioned earlier, dyads varied greatly in their mean coast times. One dyad, for example, generated a key event every 63.23 ms on average. This means that the observed visual and auditory effects are changed, on average, every 63.23 ms.

The purpose of discussing this at length is to illustrate why it might not be all that surprising that participants in the present study did not exhibit clear compatibility effects (see Table D-4). This may be because the present experiment tested for the presence of an association between, for example, an L keypress and a dot that starts at pixel position 30,0 and moves at 300 pps straight to the left for exactly 200 ms, but it is entirely possible that dyads never generated such an effect while engaging in the dot-control task or maybe only generated a similar effect a handful of times. Therefore, without first establishing robust compatibility effects by using prime stimuli that resemble the effects that dyads generated in the dot-control task, it would be incoherent to draw any conclusions about how these "compatibility effects" may change over time and how they may be related to performance or closeness.

With that said, the goal of the present study was to employ a dynamic cooperative task to examine the relationships among these variables in a more ecologically valid task, so this lack of experimental control, to some degree, inheres in the research goal. That is not to say, however,

that the method cannot be improved upon. I can imagine two ways in which one might overcome this problem in future research. First, one would benefit from constraining the possible number of outcomes of each action. In context of the dot-control task, this might be done by restricting the overlap key events (i.e., when both the A and L keys are held down or when no key is held down) so as to only produce straight vertical movement. In this way, each keypress will have two (rather than three) possible outcomes and will never produce an effect that is similar to those produced by the other keypress. The other way one might improve on the method of the present experiment would be to have dyads engage in the dot-control task for longer. This would likely help participants establish action-effect associations because a greater time spent in the task will simply afford them more time to produce keypresses and observe their effects. I would imagine that combining these two improvements would make it more likely that participants develop action-effect associations in the dot-control task and, consequently, exhibit compatibility effects in a later compatibility test. Once this is achieved, then one can examine the relationship between performance and compatibility effects.

Closeness and Self-other Integration

With the compatibility effect data from the present experiment, I cannot draw any firm conclusions regarding how dyads' representations of self- and other-generated action-effects may be affected by their perceived closeness. It is interesting to note, however, that there are a few studies that have investigated the effect of interpersonal factors on compatibility effects as observed in joint Simon tasks. As previously mentioned, Hommel and colleagues (2009) found that participants who had a positive relationship with their partner exhibited greater joint Simon effects than participants who had a more negative relationship with their partner. Similarly, Colzato, de Bruijn, and Hommel (2012) demonstrated that the size of the joint Simon effect is

modulated by self-construal: dyads who were primed with interdependent words (e.g., “we” and “ours”) exhibited greater joint Simon effects than dyads who were primed with independent words (e.g., “I” and “mine”). Finally, Ruissen and de Bruijn (2016) showed that dyads who had previously engaged in a cooperative task exhibited greater joint Simon effects than dyads who had previously engaged in a competitive task.

Taken together, this body of research highlights how various interpersonal factors modulate the extent to which one’s representation of self- and other-generated action-effects are integrated. While these studies have demonstrated that a positive relationship, cooperative attitude, and interdependent self-construal promote this self-other integration, it remains to be seen whether perceived closeness will have a similar effect. One way this can be tested is by manipulating dyads’ perceived closeness via a SSDT before they engage in a joint Simon task. I would anticipate that, consistent with these previously mentioned studies, dyads in the closeness-generating condition of the SSDT will exhibit greater joint Simon effects than dyads in a control condition. This would add to the body of literature by revealing yet another interpersonal factor that affects this self-other integration and provide empirical support for the conception of closeness as overlapping selves (Aron & Aron, 1986; Aron et al., 1991).

Proactive Interference in Action-effect Association

While the results of the compatibility test were generally inconclusive, one pattern that emerged was an effect of prime mode (i.e., whether the prime stimulus was a visual or auditory effect). Specifically, the observed compatibility effects were smaller when the prime stimulus was a visual effect compared to when it was an auditory effect. In fact, almost all the mean CD scores (as shown in Table D-4) for visual primes were numerically negative, suggesting that participants were, on average, quicker to respond on incompatible trials than on compatible

trials. To clarify with an example, if the target key was “L,” participants would be quicker to respond if they were primed with a rightward-moving dot than if they were primed with a leftward-moving dot. However, in the dot-control task, the L keypress generated leftward movement, so it was expected that participants would associate the L keypress with leftward movement and, therefore, be quicker to respond with an L keypress when they were primed with a leftward-moving dot.

At first glance, this pattern may be puzzling, but I suspect that it is due to proactive interference. In other words, it seems likely to be due to the fact that an L keypress naturally consists of generating ‘right’ effects: participants used their right hand to press the L key and this movement generates visual effects on the right side in one’s visual field. From this, one can imagine that participants have a lifetime of experience associating actions made with their right hand—such as an L keypress—with ‘right’ effects. However, the L keypress was made to generate a ‘left’ effect (i.e., leftward movement of the dot) in the dot-control task. Consequently, I referred to compatibility test trials in which the correct response was an L keypress and the prime stimulus was a leftward-moving dot as a “compatible trial.” As the results seem to suggest, the amount of time learning the unnatural action-effect contingencies of the dot-control task was not sufficient to compete with a lifetime learning the natural contingency between movements of one’s right hand and ‘right’ effects.

In addition to making sense of what is otherwise an unanticipated pattern of results, this explanation also highlights a consistency between my compatibility test data and previous research on the Simon effect. In short, participants were quicker to respond when the task-irrelevant, spatial feature of the stimulus corresponded to the spatial feature of the required response than when they did not correspond. This is demonstrated in previous studies using the

Simon task (Simon & Rudell, 1967), and the presence of numerically negative CD scores suggests that participants in the present experiment exhibited a similar effect.

Limitations and Future Directions

Future studies could improve upon the present experiment in a few ways. First, to test the effect of closeness on integration of self- and other-generated action-effects, researchers may benefit from simply examining the difference in joint Simon effects between dyads assigned to either a closeness-generating condition of a SSDT or a control condition. As in previous research (Colzato et al., 2012; Hommel et al., 2007; Ruissen & de Bruijn, 2016), greater joint Simon effects would imply greater self-other integration. Second, to examine the relationship of cooperative performance and compatibility effects, one could use a more controlled version of the dot-control task as previously discussed or, alternatively, use a task more like Knoblich and Jordan's (2003) stimulus-control task. Using this task as an assessment of performance and a domain in which dyads may develop action-effect associations would allow one to test for the presence of these associations in a following compatibility test. Finally, to investigate the relationship between relationship closeness and cooperative performance, it might be worthwhile to first employ a quasi-experimental design, comparing the cooperative performance of familiar individuals who are close (e.g., friends or spouses) to familiar individuals who are less close (e.g., school or work acquaintances). Once it has been established that these individuals do, indeed, vary in how well they perform in a cooperative task, then more rigorous experiments can be conducted to test this hypothesis using closeness manipulations like the SSDT.

Conclusion

Previous research has shown that interpersonal coordination is constrained by various interpersonal factors (Colzato et al., 2012; Hommel et al., 2007; Ruissen & de Bruijn, 2016).

Following from this evidence, the present experiment tested the hypothesis that dyads that are close will perform better on a cooperative task than dyads who are less close. Results from this experiment do not support this hypothesis owing to substantial variance in cooperative performance and coordination strategies within groups. Following from Knoblich and Jordan's (2003) demonstration that unintentionally-generated auditory effects improve dyads' performance in a cooperative task, the present experiment was designed to determine whether this can be explained by the development of action-effect associations (see, e.g., Hommel, 1996). However, great variance in dyads' coordination strategies revealed a fundamental problem with the present compatibility test and impeded the ability to obtain meaningful results in relation to this hypothesis. Future research may overcome these problems by using a more controlled cooperative task such as the one employed by Knoblich and Jordan (2003).

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APPENDIX A: STRUCTURED SELF-DISCLOSURE QUESTIONS

Shared-response Condition

In this part of the experiment, you will be engaging in a conversational interaction with your partner. I have provided 15 questions. During this time, you and your partner will be sharing your answers to these questions.

To proceed through these questions, one of you will first read aloud the question, and then you will *both* share your answer to the question/do what it asks. The person who reads the question aloud will share their answer to the question first. Then, the other person will share their answer to the same question. After you have both shared your answers, you will proceed to the next question. You and your partner should alternate reading the questions/answering first.

Proceed through the questions one at a time and in order. On any question, if you would prefer to not share your answer, you may simply say “pass.” Please take your time with each question, doing what it asks thoroughly and thoughtfully.

You will be given 18 minutes to complete this task. If you and your partner have completed all of the questions before then, let the experimenter know. After you and your partner have both finished reading these instructions, you may begin.

1. Before making a telephone call, do you ever rehearse what you are going to say? Why?
2. What would constitute a “perfect” day for you?
3. If you could change anything about the way you were raised, what would it be?
4. If you could wake up tomorrow having gained any one quality or ability, what would it be?
5. Is there something that you’ve dreamed of doing for a long time? Why haven’t you done it?
6. What is your most treasured memory?
7. If you knew that in one year you would die suddenly, would you change anything about the way you are now living? Why?
8. How do you feel about your relationship with your mother?
9. Complete this sentence: “I wish I had someone with whom I could share...”
10. If you were going to become a close friend with your partner, please share what would be important for him or her to know.
11. Share with your partner an embarrassing moment in your life.
12. When did you last cry in front of another person? By yourself?
13. What, if anything, is too serious to be joked about?
14. If you were to die this evening with no opportunity to communicate with anyone, what would you most regret not having told someone? Why haven’t you told them yet?
15. Your house, containing everything you own, catches fire. After saving your loved ones and pets, you have time to safely make a final dash to save any one item. What would it be? Why?

Private-response condition

In this part of the experiment, you and your partner will be engaging in a reflective exercise. I have provided 15 questions. During this time, you and your partner will both privately write down your answers to these questions.

To proceed through these questions, one of you will first read aloud the question, and then you will *both* privately write down your response to the question at the same time. You do not need to write in full sentences; feel free to just write down keywords and phrases. After you have both completed writing down your answers, you will proceed to the next question. You and your partner should alternate reading the questions.

Proceed through the questions one at a time and in order. On any question, if you would prefer to not share your answer, you may simply write down “pass.” Please take your time with each question, doing what it asks thoroughly and thoughtfully. Your written responses to these questions will be private (i.e., they will not be shared with anyone).

You will be given 18 minutes to complete this task. If you and your partner have completed all of the questions before then, let the experimenter know. After you and your partner have both finished reading these instructions, you may begin.

1. Before making a telephone call, do you ever rehearse what you are going to say? Why?
2. What would constitute a “perfect” day for you?
3. If you could change anything about the way you were raised, what would it be?
4. If you could wake up tomorrow having gained any one quality or ability, what would it be?
5. Is there something that you’ve dreamed of doing for a long time? Why haven’t you done it?
6. What is your most treasured memory?
7. If you knew that in one year you would die suddenly, would you change anything about the way you are now living? Why?
8. How do you feel about your relationship with your mother?
9. Complete this sentence: “I wish I had someone with whom I could share...”
10. If you were going to become a close friend with your partner, please share what would be important for him or her to know.
11. Share an embarrassing moment in your life.
12. When did you last cry in front of another person? By yourself?
13. What, if anything, is too serious to be joked about?
14. If you were to die this evening with no opportunity to communicate with anyone, what would you most regret not having told someone? Why haven’t you told them yet?
15. Your house, containing everything you own, catches fire. After saving your loved ones and pets, you have time to safely make a final dash to save any one item. What would it be? Why?

APPENDIX B: PRE- AND POST-DISCLOSURE QUESTIONNAIRES

Pre-disclosure Questionnaire

1. Please circle the picture below which best describes your relationship with the other participant.

For this next set of questions, please read each question and circle the number that best represents your answer.

2. How much do you think you have in common with the other participant?

1	2	3	4	5	6	7
nothing						a lot

3. How similar do you think you and the other participant are likely to be?

1	2	3	4	5	6	7
not at all						a great deal

4. How much do you like the other participant?

1	2	3	4	5	6	7
not at all						a great deal

5. How close do you feel toward the other participant?

1	2	3	4	5	6	7
not at all						a great deal

6. How compatible do you think you and the other participant are?

1	2	3	4	5	6	7
not at all						a great deal

7. How cooperative was the other participant in the dot-control task?

1	2	3	4	5	6	7
not at all						a great deal

8. How much did you enjoy the dot-control task?

1	2	3	4	5	6	7
not at all						a great deal

9. How much would you like/dislike working with the other participant again in an experiment?

1	2	3	4	5	6	7
very much dislike						very much like

Post-disclosure Questionnaire

1. Please circle the picture below which best describes your relationship with the other participant.

For this next set of questions, please read each question and circle the number that best represents your answer.

2. How much do you think you have in common with the other participant?

1	2	3	4	5	6	7
nothing						a lot

3. How similar do you think you and the other participant are likely to be?

1	2	3	4	5	6	7
not at all						a great deal

4. How much do you like the other participant?

1	2	3	4	5	6	7
not at all						a great deal

5. How close do you feel toward the other participant?

1	2	3	4	5	6	7
not at all						a great deal

6. How compatible do you think you and the other participant are?

1	2	3	4	5	6	7
not at all						a great deal

7. How cooperative was the other participant in the dot-control task?

1	2	3	4	5	6	7
not at all						a great deal

8. How much did you enjoy the dot-control task?

1	2	3	4	5	6	7
not at all						a great deal

9. How much would you like/dislike working with the other participant again in an experiment?

1	2	3	4	5	6	7
very much dislike						very much like

10. How much did you enjoy the interaction during the conversational task?

1	2	3	4	5	6	7
not at all						a great deal

11. How much did you and the other participant laugh during the conversational task?

1	2	3	4	5	6	7
not at all						a great deal

12. How much did you enjoy the conversational task?

1	2	3	4	5	6	7
not at all						a great deal

For these next four statements, please read each statement and circle the number that corresponds to your level of agreement with the statement.

13. The other participant seemed to really listen to me during the conversational task.

1	2	3	4	5	6	7
strongly disagree						strongly agree

14. The other participant seemed interested in what I was thinking and feeling.

1	2	3	4	5	6	7
strongly disagree						strongly agree

15. The other participant was on 'the same wavelength' with me.

1 2 3 4 5 6 7
strongly disagree strongly agree

16. The other participant was responsive to my answers in the conversational task.

1 2 3 4 5 6 7
strongly disagree strongly agree

Please complete the following information about yourself.

17. Gender:

- Woman
- Man
- Trans
- Non-binary

18. Age: _____

19. Racial/Ethnic Background (may select multiple):

- White/Caucasian
- Black/African-American
- Latino(a)
- Asian/Asian-American
- Native-American
- Other:

20. Are you right-handed or left-handed?

- Right-handed
- Left-handed
- Both

21. Did you have any familiarity with the other participant prior to this study?

- Yes, she/he is an acquaintance or friend.
- Yes, I have interacted with him/her once or twice before today.
- Yes, I have seen him/her around campus but have never interacted with him/her.
- No, I have had no contact with him/her prior to today.

22. Did you have a strategy during the dot-control task? Please explain below:

APPENDIX C: VERBAL INSTRUCTIONS

Dot-Control Task: A key

“In this task, you will be working to control this dot. Your goal is to keep it inside this rectangular box. You and your partner will each have control over one key. Using your left index finger, you will have control over the “A” key for this task. The “A” key moves the dot to the right. For as long as you hold down “A,” the dot will move at a constant velocity to the right. Your partner has control over another key which moves the dot to the left. For as long as they hold down their key, the dot will move at a constant velocity to the left. However, when you and your partner’s buttons are both held, the dot will move upward and in the direction it was previously moving. Alternatively, when no button is held (i.e., both you and your partner’s keys are released) the dot will move downward and in the direction it was previously moving. Again, your goal is to keep the dot inside the box. The screen will change when you are completed with the task. When the task is finished, please wait for me to come to you to give you further instruction.”

Dot-Control Task: L key

“In this task, you will be working to control this dot. Your goal is to keep it inside this rectangular box. You and your partner will each have control over one key. Using your right index finger, you will have control over the “L” key for this task. The “L” key moves the dot to the left. For as long as you hold down “L,” the dot will move at a constant velocity to the left. Your partner has control over another key which moves the dot to the right. For as long as they hold down their key, the dot will move at a constant velocity to the right. However, when you and your partner’s buttons are both held, the dot will move upward and in the direction it was previously moving. Alternatively, when no button is held (i.e., both you and your partner’s keys are released) the dot will move downward and in the direction it was previously moving. Again, your goal is to keep the dot inside the box. The screen will change when you are completed with the task. When the task is finished, please wait for me to come to you to give you further instruction.”

Compatibility test

“In this task, you will be presented a series of trials. At the beginning of each trial, a crosshair will be displayed. Please focus on this crosshair whenever it is displayed. After a short amount of time, the crosshair will disappear. You will then see a letter—either “A” or “L”—presented in the middle of the screen. You may also hear a tone or see a moving dot at the same time. Your job during this task is to press the key that corresponds to the letter that is displayed (i.e., press “A” or “L”) in each trial. Please respond as quickly and as accurately as possible. When the trials are finished, please wait for me to come to you to give you further instruction.”

APPENDIX D: TABLES

Table D-1

Means and standard deviations for post – pre differences of repeated questionnaire items by disclosure type.

Item	Shared-disclosure		Private-disclosure		η_p^2
	$M_{(\text{post} - \text{pre})}$	$(SD_{(\text{post} - \text{pre})})$	$M_{(\text{post} - \text{pre})}$	$(SD_{(\text{post} - \text{pre})})$	
IOS Scale	1.53	(0.99)	1.30	(0.82)	.02
How much do you think you have in common with the other participant?	1.50	(0.71)	0.56	(0.53)	.36
How similar do you think you and the other participant are likely to be?	1.21	(0.56)	0.65	(0.49)	.21
How much do you like the other participant?	1.09	(0.78)	0.53	(0.62)	.10
How close do you feel toward the other participant?	2.09	(0.91)	1.24	(1.00)	.17
How compatible do you think you and the other participant are?	1.38	(0.65)	0.74	(0.62)	.19
How cooperative was the other participant in the dot-control task?	0.59	(0.92)	0.85	(0.72)	.04
How much did you enjoy the dot-control task?	0.21	(0.66)	0.38	(0.67)	.01
How much would you like/dislike working with the other participant again in an experiment?	0.79	(0.71)	0.65	(0.66)	.01

Note. The effect sizes in the final column represent the size of the time by disclosure type interaction for each item.

Table D-2

Means and standard deviations for additional, post-disclosure items by disclosure type.

Item	Shared-disclosure	Private-disclosure	η_p^2
	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	
How much did you enjoy the interaction during the conversational task?	5.88 (0.99)	4.85 (1.11)	.20
How much did you and the other participant laugh during the conversational task?	5.29 (1.10)	3.26 (1.82)	.33
How much did you enjoy the conversational task?	5.71 (1.03)	4.71 (1.07)	.19
The other participant seemed to really listen to me during the conversational task.	6.09 (0.83)	5.00 (1.00)	.27
The other participant seemed interested in what I was thinking and feeling.	5.97 (0.80)	3.94 (1.16)	.53
The other participant was on 'the same wavelength' with me.	5.59 (1.15)	4.56 (1.17)	.17
The other participant was responsive to my answers in the conversational task.	6.26 (0.64)	4.09 (1.46)	.49

Note. The effect sizes in the final column represent the size of the disclosure type effect for each item.

Table D-3

Means and standard deviations for dot-control measures by disclosure type.

	Shared-disclosure		Private-disclosure	
Measure	<i>M</i> (<i>SD</i>)		<i>M</i> (<i>SD</i>)	
Pre-disclosure				
In-box Time (%)	50.22	(17.65)	47.23	(19.57)
Mean Coast Time (ms)	228.32	(127.80)	227.97	(122.96)
Post-disclosure				
In-box Time (%)	64.35	(20.04)	66.71	(15.49)
Mean Coast Time (ms)	267.08	(224.79)	294.45	(226.38)

Table D-4

Means and standard deviations for pre- and post-disclosure CD Scores by disclosure type.

Measure	Shared-disclosure	Private-disclosure
	<i>M (SD)</i>	<i>M (SD)</i>
Pre-disclosure		
Self Target, Visual Prime	-3.44 (21.57)	-1.96 (19.19)
Self Target, Auditory Prime	0.19 (36.32)	-9.91 (19.61)
Other Target, Visual Prime	-14.57 (29.12)	3.43 (21.89)
Other Target, Auditory Prime	-6.10 (17.80)	-1.53 (19.00)
Post-disclosure		
Self Target, Visual Prime	-0.70 (23.01)	-12.85 (31.29)
Self Target, Auditory Prime	7.97 (24.50)	-2.44 (30.69)
Other Target, Visual Prime	-6.89 (15.31)	-2.67 (23.81)
Other Target, Auditory Prime	9.86 (20.65)	6.06 (20.19)

Table D-5

Results of the CD Score RMANOVA.

Variable(s)	<i>F</i>	<i>df</i>	η_p^2	<i>p</i>
Disclosure Type	0.17	(1, 32)	< .01	.685
Time	2.46	(1, 32)	.07	.127
Time x Disclosure Type	3.09	(1, 32)	.09	.089
Target	0.15	(1, 32)	.01	.697
Target x Disclosure Type	3.92	(1, 32)	.11	.056
Prime Mode	5.05	(1, 32)	.14	.032
Prime Mode x Disclosure Type	2.58	(1, 32)	.08	.118
Time x Target	0.47	(1, 32)	.02	.497
Time x Target x Disclosure Type	0.10	(1, 32)	< .01	.756
Time x Prime Mode	3.12	(1, 32)	.09	.087
Time x Prime Mode x Disclosure Type	0.53	(1, 32)	.02	.471
Target x Prime Mode	0.54	(1, 32)	.02	.469
Target x Prime Mode x Disclosure Type	0.36	(1, 32)	.01	.554
Time x Target x Prime Mode	< 0.01	(1, 32)	< .01	.956
Time x Target x Prime Mode x Disclosure Type	0.09	(1, 32)	< .01	.762