AN ANALYSIS OF DEPENDENT CONTINGENCIES IN A TRIADIC INTERACTION USING AN EXCHANGE TASK TO UNDERSTAND DYNAMIC CONCURRENT CONTINGENCIES UNDER INDEPENDENT AND RECIPROCAL CONDITIONS

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Although behavioral science, due to its emphasis on the use of single-subject research design, appears to focus solely on individual behaviors, behavioral scientists have a long history of lamenting the trajectory of humans, societies, and the discipline itself. Some scholars, for instance, called for our attention to expand our focus beyond individual behaviors to generate solutions for societal issues that we face. When we attempt to develop solutions for issues that require multi-level analysis, we must be cognizant of how institutional contingencies operate at the individual level. The current study analyzed triadic interactions using an exchange task in six triads. The result of this study showed that one common pattern of interactions among participants across triads was direct reciprocation between two participants. The implications of such findings, how they inform social behavior and metacontingency experiments, and future directions are discussed.

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CHAPTER 1

INTRODUCTION

Behavioral scientists have collected a myriad of data on individual behavior in basic (e.g., *Journal of the Experimental Analysis of Behavior*), applied (e.g., *Journal of Applied Behavior Analysis*), and practice (e.g., *Behavior Analysis and Practice)* settings; these data have helped to establish principles of behavior (e.g., Skinner, 1938, 1953) and technologies of behavior change based on these principles (e.g., Cooper et al., 1987, 2007, 2020). One strength of the discipline of behavior science is that the experimental analysis of behavior, applied behavior analysis, and conceptual analysis (e.g., *Perspectives on Behavior Science*), inform each other through recursive interactions among these arms of the science, working collectively to develop, refine, and improve the science and technologies that it offers (Neef & Peterson, 2003; Wilder et al., 2022). Although behavioral science, due to its emphasis on the use of single-subject research design (cf., Sidman, 1960), appears to focus solely on individual behaviors, behavioral scientists have a long history of lamenting the trajectory of humans, societies, and the discipline itself (e.g., Pritchett et al., 2022; Holland, 1978; Skinner, 1988; Ulman, 1986).

Malagodi (1986) and Malagodi and Jackson (1989), for instance, called for our attention to expand our focus beyond individual behaviors to generate solutions for societal issues that we face. To understand the difference between individual-level and societal-level analysis, Malagodi and Jackson discussed the work of Mills (1959). Mills distinguished between struggles that are experienced as an ‘individual matter’ and struggles that are experienced as a ‘public matter’, labeling the former as *troubles* and the latter as *issues*. Troubles are those challenges experienced by individuals in their immediate environments whereas issues go beyond the individual’s immediate environment and include the organization of social structures (e.g., institutions) and especially those that create threats or barriers to the interest of the public. For example, new students entering graduate schools may initially feel anxiety and stress related to being successful in their new schools and programs. These individual feelings are natural, considering the fact that they are entering new environments. If, however, the students persistently experience these feelings well into their graduate school lives, these struggles may be considered as troubles that individual students experience (e.g., anxiety, depression, etc.). When, on the other hand, these troubles become a common phenomenon among many students across different schools and programs, this becomes an issue (i.e., imposter syndrome; cf. Chrousos & Mentis, 2020). Malagodi and Jackson, therefore, argued that issues are created through the replications of contingencies that produce troubles, and our analysis should focus not only on understanding how a particular set of social contingencies affects individual behaviors but also on understanding why these continencies are replicating and are impacting increasing numbers of individuals.

Differentiating between troubles and issues encourages behavior scientists to expand the scope of their analysis to include not only individual behavior but also to consider multiple individuals' behaviors and the role of social organizations in the analysis (Cihon, 2022). In other words, to address issues, the contingency analysis requires a focus on individual behavior, taking into consideration that these individual behaviors occur in a social environment, which includes the behaviors of other individuals (cf. Cihon, 2022; Skinner, 1953), and the social organizations formed as the products of individual behaviors (Krapfl & Gasparotto, 1982). In the example of imposter syndrome, students, faculties, and administrative staff are the individuals interacting under the shared environment of an educational institution, forming what Skinner (1953) called a *social system*. The educational institution places a set of institutional contingencies under which those individuals interact, and some of those interactions, in conjunction with the institutional contingencies, may be responsible for the development and replication of contingencies that produce imposter syndrome.

When we attempt to develop solutions for *issues* that require multi-level analysis, such as the hypothetical educational institutions and individuals within these institutions, we must be cognizant of how institutional contingencies operate at the individual level. Sandaker (2009), for example, cautioned that "when approaching social systems, we have to deal both with what is guided by deliberate planning of how the system *should* behave and with the *actual* practical working of the system, which may be a function of contingencies over which there is little or no control" (p. 279, emphasis in original). A similar point was made by Kunkel (1975) in terms of the effects of policies: "As the policy literature shows all too clearly, by the time a policy reaches the grass roots level its effects are likely to be quite different, and may indeed be opposite from those intended" (p. 143). These scholars appear to suggest that we must delineate two levels, if you will, of contingencies when we are faced with *issues*; these *levels* of contingencies helpful to the analysis of social interactions may be differentiated as independent and dependent contingencies (Weingarten & Mechner, 1966).

Independent contingencies are programmed (or planned) by experimenters prior to any experiments (Weingarten & Mechner, 1966). In the case of individual behavior experiments, an experimenter may specify the number of pecks on a disk that operates the food dispenser (e.g., FR-10) a pigeon must perform. In the analysis of social interaction between two behaving organisms, the independent contingency may take a form of two behaving organisms responding within a specified time (e.g., responding within 0.04 seconds of each other) followed by food delivery. Thus, the independent contingencies are under the total control of experimenters.

Dependent contingencies, on the other hand, emerge from the interactions of behaving organisms (Weingarten & Mechner, 1966); an organism's behavior functions as an environmental event for (i.e., enters the contingency of) another organism's behavior. For example, two behaving organisms may develop a specific pattern of responding, such as leader-follower relations, during an experiment (Azrin & Lindsley, 1956). Stated differently, in individual behavior experiments, the experimenter controls the environment, and the participant behaves accordingly. Then, the participant's behavior modifies the experimenter's behavior. Thus, there is a reciprocal relationship between the experimenter and the participant (Skinner, 1961). In the analysis of social interaction, the experimenter controls the environment, and multiple participants (two or more) behave accordingly; however, the interactions between participants also modify the environment for each other which is beyond the control of the experimenter. Thus, in addition to the reciprocal relationship between the experimenter and the participants, there is also a reciprocal relationship between the participants. To summarize, independent contingencies are programmed by (under the control of) the experimenters under which organisms behave whereas the dependent contingencies emerge from the interaction of these behaving organisms during experiments. Thus, the notion of independent and dependent contingencies appears to raise a similar point to that brought up by Sandaker (2009): independent contingencies specify how organisms *should* behave and dependent contingencies show how organisms *actually* behave.

Remembering one strength of our discipline is the recursive interactions among the basic, applied, and conceptual analysis, two lines of research in the basic domain are relevant to understand the topic of significance in the applied (*issues*) and the conceptual (*social system*) domains: social behavior and metacontingency. In the next sections, these two lines of research are reviewed and gaps in the literature are noted.

Social Behavior

When the behavior of one individual functions as an environmental event (i.e., an antecedent stimulus or a consequence) for another individual's behavior, this has been described as social behavior (Guerin, 1994; Keller & Schoenfeld, 1950; Schmitt, 1998; Skinner, 1953). Skinner (1953) defined social behavior as "the behavior of two or more people with respect to one another or in concert with respect to a common environment" (p. 297). He discussed three types of social behavior: reciprocal interchange, cooperation, and competition. To analyze patterns of contingencies produced by the interactions of individual behaviors, the focus of the current study is on *reciprocal interchange* and *cooperation* (Baum, 2017; Skinner, 1953).

Reciprocal interchange occurs when a person has something that is valued (i.e., functions as a reinforcer) by another person, and that person has something to offer the other person in return. For instance, Person A needs advice on how to write a paper for publication so Person A asks Person B for advice. Person B gives advice to Person A, and Person A appreciates the advice. If this interchange is mutually reinforcing to both Person A's and Person B's behaviors, this interchange is likely to recur in the future. Skinner (1953) called this set of interlocking contingencies a social episode and emphasized the importance of identifying variables that account for the interaction between these two persons in the analysis. In this scenario, Person A's asking-for-advice behavior functions as a discriminative stimulus (S^D) for Person B's advice-giving behavior. This advice-giving behavior is not only a positive reinforcer for Person A's asking for advice but also an S^D for Person A to express their appreciation. Furthermore, this expression of appreciation by Person A is a positive reinforcer for Person B's advice-giving behavior. This example illustrates the first part of Skinner's (1953) definition of social behavior, "with respect to one another" (p. 297). *Cooperation* also involves a mutually reinforcing consequence for the coordination of behaviors between or among multiple individuals. Persons A and B agree to work on a paper for publication. Both Person A and Person B work on the paper together; if the paper is published, this event may function as a reinforcer for the coordinated behaviors of Persons A and B. The behaviors of both Persons A and B are "in concert with respect to a common environment" (i.e., the manuscript; Skinner, 1953, p. 297).

Reciprocal interchange and cooperation can be distinguished from one another in terms of time span and equitable, mutual reinforcement (Baum, 2017). Reciprocal interchange may occur over a longer time span than cooperation and may result in inequitable reinforcement. Cooperation, on the other hand, is maintained by equitable and mutual reinforcement and occurs within a relatively short time span (Baum, 2017). As an instance of reciprocal interchange, in the advice-giving example, Person B may continue to give Person A advice contingent on Person A's asking for advice behavior, and Person A may continue to express their appreciation contingent on the advice. Although this interchange is mutually reinforcing to both persons' behaviors while it is occurring, over time inequality in reinforcement may develop. For example, if Person A continues to publish while Person B is stuck giving advice to Person A, Person B has no time to focus on their work (let us hope that Person A includes Person B as a co-author on the publications). Although the term reciprocal interchange implies that the reciprocation has already occurred, it may not result in reciprocation and instead may lead to inequality in reinforcement; reciprocal interchange often begins with an individual doing something for the other individual without any knowledge that reciprocation might occur (Emerson, 1969). Thus, for instance, Person B may ask Person A for advice on a different task on a later day, and if Person A is unable to advise Person B on such a task, this sets up an instance of non-reciprocation or inequality in reinforcement.

As an example of cooperation, imagine a situation involving three individuals, a host, a server, and a chef, who work together at a restaurant. The host welcomes guests and directs them to open seats. The server takes orders and relays them to the chef. The chef cooks and the server brings food to the table. If these individuals' behaviors are sufficiently coordinated, then the guests may provide some approval to the employees, which may function as a reinforcer for the coordination of behaviors of the workers. Thus, the restaurant workers' behaviors are maintained by equitable and mutual reinforcement (you may disagree with this analysis in terms of the monetary compensation each worker receives but the approval from the customer seems to be, at least, equitable for all) and occur within a relatively short time span.

A further distinction between reciprocal interchange and cooperation can also be made in terms of the consequences maintaining these social behaviors (Schmitt, 1998). In reciprocal interchange, the consequence that maintains an individual's behavior is mediated by another individual's behavior (cf. Skinner, 1957); the consequence that maintains Person A's asking-for-advice behavior is mediated by Person B's advice-giving behavior (i.e., Person B's behavior is the consequence that maintains Person A's behavior). This type of consequence is called a *dependent consequence* because the behaviors of the individuals involved are dependent on each other. With cooperation, the consequence that maintains individuals' behaviors depends on the coordination of these individuals' behaviors. In the restaurant example, the approval from the guests (i.e., the maintaining consequence) depends on how well the workers coordinate their behaviors. This type of consequence is called *joint-dependent* because the maintaining consequence is produced jointly by the workers' behaviors.

The effects of reinforcement on the rate, or the number of the occurrences over time, of coordinated behaviors (cooperation) and reciprocal interchange between two participants (i.e., dyad) have been investigated in basic (human operant) experimental settings (e.g., Burgess & Nielsen, 1974; Cohen & Lindsley, 1964; Hake & Schmid, 1981; Hake et al., 1975a, 1975b; Lindsley, 1966; Marwell et al., 1971; Marwell & Schmitt, 1972; Matthews, 1977; Matthews & Shimoff, 1979; Matthews et al., 1983; Schmid & Hake, 1983; Schmitt & Marwell, 1971a, 1971b, 1972). One early example is Azrin and Lindsley's (1956) study on cooperative behaviors between two children. They seated two children across from one another at a table with three holes in front of each child. When both children put their styli in the holes opposite of one another within 0.04 s, defined as coordinated behaviors, they received a candy or a penny. The results showed that the rates of the children's coordinated behaviors were controlled by the programmed contingency. Azrin and Lindsley also observed that the pairs of children would form an emergent pattern of coordination in which one child tended to respond first, followed by the second child's response; the social interaction between the two children produced an emergent leader-follower relationship (Lindsley, 1966). Numerous studies exploring social behavior in basic research settings followed, exploring different aspects of cooperation like the leader-follower relationships just described, as well as how risk influences cooperation, and what happens to cooperation under conditions in which the distribution of reinforcers is unequal. Other studies focused on reciprocal interchange, exploring topics such as sharing and giving, trust, and equity. Table 1 provides an overview of previous research on social behavior that is relevant to the current study.

As previously stated, reciprocal interchange and cooperation can be distinguished in terms of the types of maintaining consequences (dependent vs. joint-dependent; Schmitt, 1998).

This distinction, however, can be overlooked if one does not pay careful attention to experimental procedures. For instance, in a study conducted by Hake and colleagues (1975b), participants were asked to solve simple problems to earn money. Participants were grouped into dyads, and the experimental apparatus signaled when a problem was available. The first participant to respond to the signal could: 1) solve the problem for themselves, or 2) give the problem to the other participant. The second response, giving the problem to the other participant, was termed a "cooperative response" in their study. Although this response was labeled as "cooperative", careful attention to their procedure reveals that this response could be more accurately conceptualized in terms of reciprocal interchange (or exchange for short); reciprocal interchange is also one of the major foci in interdisciplinary research (Schmitt, 1984). In other words, the maintaining consequence for the giving response was the other participant's giving response (i.e., dependent consequence), rather than the consequences jointly produced by two participants' responses (i.e., joint-dependent consequence)[1].

In order to remove the subtle confusion created by our natural language, it is possible to depict the difference between dependent and joint-dependent consequences visually using Mechner's (1959, 2011; Weingarten & Mechner, 1966) notation system. The notation system maps out contingencies visually, similar to the symbolic logic used in philosophy. The notation system specifies "if-then" contingency relations. It is outside of the scope of this manuscript to fully describe the notation system (see Mechner, 2011, for more information); however, two diagrams that delineate dependent and joint-dependent consequences will be introduced. The diagram at the top of Figure 1 shows cooperation between two participants. The left side of the arrow specifies the "if" part of the contingency relation. The capital letter A depicts an "act" and

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[1] Hake and Olvera (1978) termed such cooperation as dependent cooperation.

the small letters, “a” and “b”, depict an agent who performs the act. Thus, “aA”, on the left, depicts agent “a” performing act A. Similarly, on the right, “bA” depicts agent “b” performing act A. The nature of these acts can be specified by putting numbers on the lower right quadrant of A and descriptions corresponding to each number in legends; however, for the simplicity of this discussion, the nature of these acts is not specified. On the right side of the arrow, which specifies “then” part of the contingency relation, the capital letter C depicts the consequence of acts. The upper right quadrant of C, a+ and b+, shows the valence of the consequence. In this case, the consequence, C, is positive (e.g., good, beneficial, etc.) for both agents “a” and “b”. Finally, a symbol, $\cap$, between these two acts depicts “and” relations between aA and bA; thus, the diagram at the top can be read as, “*if* agent ‘a’ performs act A <u>and</u> *if* agent ‘b’ performs act A, *then* consequence C would follow, which is positive for both agents ‘a’ and ‘b’.” Thus, this figure depicts a typical instance of cooperation maintained by an joint-dependent consequence.

The diagram at the bottom of Figure 1, on the other hand, shows an example of a reciprocal interchange maintained by dependent consequences. The bracket on the left shows that these two contingencies are in effect simultaneously. The top can be read as, “if agent ‘a’ performs act A, then consequence C would follow that is positive for agent ‘b’”. Similarly, the bottom can be read as, “if agent ‘b’ performs act A, then consequence C would follow that is positive for agent ‘a’”. Therefore, the top diagram shows a contingency similar to that programmed by Azrin and Lindsley (1956), although one more element is necessary to specify the latency between the two responses, whereas the bottom diagram shows contingencies similar to that programmed by Hake et al. (1975b).

Thus, a review of the social behavior literature suggests that experimenters can program two types of independent contingencies to aid in developing an understanding of the coordination of individual behaviors that can also be depicted using Mechner's notation system: joint-dependent consequences or dependent consequences. Reminiscent of our example of imposter syndrome, students, faculties, and administrative staff may work together to mitigate the impact of such issues. Stated differently, if students perform act A, and if faculties perform act A, and if administrative staff perform act A, then consequence C would follow that is positive for students, faculties, and administrative staff (joint-dependent consequence: Figure 2 top diagram). Similarly, the mitigation of such issues may also come from dependent consequences (Figure 2 bottom diagram). If students perform act A, then consequence C would follow that is positive for faculties. If faculties perform act A, then consequence C would follow that is positive for administrative staff. Finally, if administrative staff perform act A, then consequence C would follow that is positive for students.

The critical difference between these two independent contingencies, if delineated, can specify the controlling variables responsible for participants' interaction during experiments. As previously stated, the dependent consequence, or reciprocal interchange, involves participants engaging in an initial giving response that may, or may not, be reciprocated (reinforced) by another participant (Emerson, 1969). Over time, reciprocations between participants may increase as a function of giving and receiving contingent on each other. Stated differently, the giving responses contingent on receiving are under the control of participants (i.e., dependent contingency) and this differentiates the reciprocal interchange (or exchange) from cooperation (Schmitt, 1998).

Historically the social behavior literature focused on dyad relations, rarely employing three or more participants in one experiment (Schmitt, 1998). There is, however, one area in behavioral research that has explored social behavior involving the interactions among three or more participants: the basic laboratory research focused on metacontingency.

Metacontingency

When the environmental condition(s) selects recurring coordinated behaviors of two or more individuals (interlocking behavioral contingencies [IBCs]) that produce aggregate products (APs), this has been described as a metacontingency (Glenn et al., 2016; Glenn & Malagodi, 1991). The concept of the metacontingency extended from Skinner (1981; also see Catania & Harnad, 1988) who postulated the idea of "a third kind of selection" (p. 502) or cultural selection as an extension of biological (natural) and behavioral (operant) selection. Skinner (1981) wrote that human behaviors are jointly produced from the processes of natural selection, operant selection, and "the special contingencies maintained by an evolved social environment" (p. 502). The special contingencies are those responsible for the evolution of cultures and the maintenance of cultural practices among members of a culture. Although Skinner's (1981) third kind of selection was critically reviewed by scholars across several disciplines (again see Catania & Harnad), some behavioral scientists started searching for the mechanism(s) responsible for the selection of cultural practices and the evolution of culture.

Notably, Glenn (1986, 1988, 1989, 1991, 2003, 2004; Glenn & Malagodi, 1991) proposed the metacontingency as the mechanism involved in the selection of cultural practices and the evolution of culture (however, see Zilio, 2019, 2022 for an alternative perspective). The example of the restaurant employees can be conceptualized through the lens of the metacontingency. Remembering that the approval from the customer depends on how well the workers coordinate their behaviors to provide their services, a metacontingency account suggests that the coordinated behaviors of the employees (IBCs) produce the services (APs) that are selected by the customer's approval (selecting environment [SE] or cultural consequence [CC]).

If the approval from the customer functions as a SE or CC for the employees' coordinated behaviors, then this set of coordinated behaviors (IBC + AP) is maintained or recurs.

Numerous basic laboratory studies have been conducted to explore the selective properties of the metacontingency since the first experimental analysis of the metacontingency (Vichi et al., 2009; also see Cihon et al., 2020 and Zilio, 2019 for reviews). Cihon and colleagues (2020) discussed the range of experimental preparations employed in these studies to date. The experiments often involve two to four participants who interact in a tightly controlled experimental setting (e.g., Ortu, et al., 2012; Vasconcelos & Todorov, 2015) which allows for an examination of the coordinated behaviors of multiple individuals (Cihon et al., 2020). Briefly, in typical metacontingency experiments, each participant's response is followed by an individual consequence, such as earning points, while certain combinations of participants' responses (IBC +AP) are followed by cultural consequences, such as bonus points for each participant (e.g., Ortu, et al., 2012) or donations to local communities (e.g., Borba, et al., 2017). Recent experimental studies of the metacontingency have explored a variety of topics such as ethical self-control (e.g., Borba et al., 2017) and variability in the coordinated behaviors of individual participants (e.g., Vasconcelos & Todorov, 2015). Applied research on the metacontingency is less common; however, the concept of the metacontingency has been integrated into behavioral systems analysis (Glenn & Malott, 2004; Krapfl & Gasparotto, 1982; Malott, 2003; Malott & Glenn, 2006) and conceptualizations of how organizations operate. For example, metacontingency has been discussed as a tactic to analyze and improve the functioning of organizations as a whole, as well as the flow of tasks in processes that occur across different departments. Those who have integrated the concept of metacontingency with behavioral systems analysis consider organizations and departments as metacontingencies that operate at different levels of organizational structures (e.g., Malott, 2003 and the behavioral systems engineering model).

The integration of systems science into the concept of metacontingency has been raised by several scholars (e.g., Krispin, 2016, 2017, 2019; Marr, 2006; Mattaini, 2006, 2009, 2020; Sandaker, 2009). These scholars have stressed the importance of understanding the events occurring inside of a system (e.g., culture, institution, community, family, etc.) and how these events could influence the functioning of the system as a whole. This requires a careful analysis of interactions of individual behaviors, presumably forming interlocking behavioral contingencies, within a system of interest. Remembering the example of the students, faculties, and administrative staff within an educational institution, the interaction among these three elements/entities/etc. within such a system may be maintained by joint-dependent (Figure 3, the top diagram), dependent (Figure 3, middle diagram), or some combination(s) of both types of consequences (Figure 3, bottom diagram).

Emerson (1969) suggested that boundaries of groups could be identified by a careful analysis of productive exchange (i.e., joint-dependent consequence); thus, if behaviors of students, faculties, and administrative staff are maintained by a joint-dependent consequence, then the educational institution can be viewed as a whole. This viewpoint supports the integration of metacontingency in behavioral systems analysis given that the individuals behaving in the organizations, such as business companies, are likely under the control of a joint-dependent consequence (e.g., revenues, market share, etc.). Stated differently, individuals are working together (IBC) to produce “something” (AP) that has a demand by the external (selecting) environment, such as customers. Therefore, the joint-dependent consequence assumes a boundary of a system within which behaving individuals have a common goal/mission/etc.

(e.g., Malott, 2003; Krapfl & Gasparotto, 1982). One of the APs of educational institutions may be skilled graduates who are in societal demand (Malott), and this requires coordination of behaviors by the students, faculty staff, and administrative staff. However, when we attempt to analyze *issues*, such as imposter syndrome, a careful analysis of events occurring inside of a system appears to be warranted; societal demand for skilled graduates is clear. Are there societal demands for imposter syndrome? Highly unlikely. In other words, while the goal of the educational institution, as a whole, may be to produce skilled graduates, students, faculties, and administrative staff within the institution may have different goals or operate under different contingencies (e.g., students want good grades, faculties want research opportunities, and administrative staff want student retention). Moreover, these individuals' goals, or consequences, are provided by other individuals' behaviors (dependent consequences). Therefore, this seems to suggest that when we analyze social systems, we must be cognizant of not only the coordination of individual behaviors under joint-dependent consequences which define boundaries of such systems with external demands (e.g., societal demand on skilled graduates) but also how individuals within such a system interact (dependent consequence) that produce not only skilled graduates but also (possibly) imposter syndrome. This suggests some clear limitations in the literature on social behavior and metacontingency.

Limitations of Social Behavior and Metacontingency Experiments

The basic experimental research on social behavior and metacontingency have provided the foundation for behavioral accounts of social and cultural phenomena (Mattaini, 2009; Schmitt, 1998), albeit with two notable limitations. First, many of the social behavior experiments included only two participants—the minimum number of participants needed to study social behavior (see Schmitt, 1998); there are fewer investigations of social behavior that involve more than two persons (e.g., Mithaug, 1969; Mithaug & Burgess, 1967, 1968) despite the need to better understand social interactions/episodes that involve more than two people. Second, metacontingency experiments have tended to focus on the aggregate product (AP: a combination of participants' responses) and delivery of the cultural consequences (CS) contingent on the specific topographies of AP without careful analysis of how interlocking behavioral contingencies (IBCs) produced such APs (Cihon et al., 2020).

Consider, as an example of the first limitation, two people playing rock-paper-scissors. When two people play the game, there are only three ways to tie the game (rock-rock, scissors-scissors, or paper-paper). However, when a third person joins the game, this increases the number of ways the game can be tied: the three ways resulting from rounds in which each of the three players makes the same choice as in the two-person arrangement, and the tie that occurs when all three players make different choices (i.e., rock-scissors-paper). Adding a third person to the game increases the complexity of not only how people play the game (guessing what other *two*, instead of *one*, players will choose; dependent contingencies, Weingarten & Mechner, 1966) but also the game itself (i.e., rules; the independent contingency, Weingarten & Mechner). Social behavior experiments among three participants, specifically in the area of reciprocal interchange/exchange, will, therefore, introduce a similar increase in the complexity in the interactions among the participants.

To illustrate, let us imagine a scenario involving two individuals – a student and a faculty member – who are at the same school. The student would like to get some experience in conducting experiments and asks the faculty member for some opportunities, and the faculty member provides a research assistant position for the student. The student helps the faculty member with research-related activities and the faculty member guides the student during the activities. In this scenario, these two individuals are supporting each other, and it illustrates a case of *direct reciprocation*: the student provides support (assistance) for the faculty member, and the faculty member provides support (guidance) for the student (direct exchange; Emerson, 1981; Molm, 2014).

Now, let us introduce a third individual in this scenario: an administrative staff person. When the third individual is added to this scene, it creates an opportunity for two potential events that were not possible when only the student and the faculty member were involved. First, indirect reciprocation, or what sociologists call *generalized exchange* (Emerson, 1981; Molm, 2014) may occur when, for example, the student helps the faculty member with research-related activities, the faculty member publishes a paper (with the student) and notifies an administrative staff person about the publication, then the administrative staff person notifies the student of some scholarship available based on the publication. This is a situation involving not only *direct reciprocation* between the student and the faculty member as mentioned above but also involving an indirect form of reciprocation among three individuals. Stated differently, the student's help is valuable for the faculty member, the faculty member's publication is valuable for the school (hence, for the administrative staff person), and the scholarship is valuable for the student. Thus, social behavior experiments that include only two participants allow researchers to investigate direct exchange, but it does not allow researchers to investigate generalized exchange. Second, social systems, such as the educational institution, may consist of more than two individuals (or two groups of individuals, such as students and faculty members), and the administrative staff person (or the administration) is an important component in the educational institution. Thus, the addition of the third individual in experiments may mimic the complex interactions occurring within social systems. For instance, two individuals may support each other (direct reciprocation) while leaving the third individual alone (imagine a school where students and faculty members are supportive of each other, but the administration struggles to support them due to the lack of resources!).

As previously noted, behavioral scientists have investigated different social phenomena, such as trust and equity, using reciprocal interchange (exchange) tasks (see Table 1). In general, trust was defined as the temporary deviation from the equitable relationship, and an equitable relationship (or equity) was defined as the correspondence in earned points between two participants during the experiments (e.g., Hake & Schmid, 1981). If a third participant is added to experiments, it may increase the complexity of emergent social phenomena such as trust and equity, similar to the example of the rock-paper-scissors game. For example, if the student and the faculty member "trust" each other, and if the administrative staff person is unable to support the student and/or the faculty member due to a lack of resources, does this mean that the administration is "untrustworthy"? If there is an equitable relationship between the student and the faculty member, is there an inequitable relationship among all these three individuals? These questions may be less frequently investigated in basic research settings, but they certainly have relevance to our day-to-day environments and interactions (imagine you are thinking about applying for a school with inequitable relationships among students, faculty members, and the administration!). An experiment that adds a third participant to the basic experimental research preparations historically involving only two participants would mimic the types of complex relationships that have been described in the previous example, which is also analogous to those we experience in our daily lives.

The second important limitation is related to the experimental tasks employed in the studies focused on metacontingencies. Cihon and colleagues (2020) noted that these studies have tended to focus on the aggregate product (AP: a combination of participants' responses) and delivery of the cultural consequences (CCs) contingent on the specific topographies of AP. However, in doing so, they overlook an analysis of the interlocking behavioral contingencies (IBCs). Borba and colleagues' (2017) investigation of ethical self-control may be one example. Borba et al. (2017) asked three participants to choose rows from a matrix with different colors. The row choice corresponded to one of two individual consequences: choosing the odd row would produce 3 points and choosing the even row would produce 1 point for a participant who chose a row (i.e., points were earned individually and exchanged for money). In addition, if all participants picked different even rows, a donation would be made to the local community later (i.e., cultural consequences).

The task Borba et al. (2017) employed restricts the features of the analysis in two ways. First, participants made their choices sequentially: the first participant made a choice, then the second participant, and finally the last participant made their choice. The choice made by the first participant (odd or even row choice) functioned as a S^D for the second participant's choice (and the second for the third), presumably forming IBCs. Second, and more importantly, each participant was asked to give themselves either 3 points or 1 point. This experimental arrangement restricted participants from producing points for other participants and prevented the development of unique IBCs. Stated differently, programming an experimental task based on dependent consequences will reveal interactions of participants in a more explicit manner because such a task will specify "who gave points to whom".

What would happen in an extension of Borba et al. (2017) if, for instance, participants were allowed to make choices non-sequentially or concurrently? Doing so could set the occasion for the experimenter to observe possible emergent properties from participants' interactions such as the leader-follower relations observed among Azrin and Lindsley's (1956) participants (also see Lindsley, 1966). What would happen if each participant's response produced points for themselves individually *and* participants had a response option that would produce points for other participants? The experimental task could be arranged, for instance, such that this latter option could be maintained by dependent consequences while the former option could be maintained by cultural consequences (i.e., joint-dependent consequences), or vice versa. In summary, the exclusion of concurrent choices and other response options limits the participants' opportunities to develop relationships among each other, formed when they can give points to one another (i.e., IBC).[2]

Purpose of the Current Study

The limitations of the social behavior and metacontingency experiments could be addressed by including experimental tasks that incorporate reciprocal interchange/exchange (dependent consequence) and doing so among three participants. Investigations of this type would create conditions under which participants might develop more dynamic patterns of interactions and create conditions that permit experimenters to identify (hence, to capture/select) certain patterns of interactions through participants' tasks choices (i.e., dependent contingencies; Weingarten & Mechner, 1966). Therefore, the purpose of the current study was to identify and analyze the patterns of interactions that would form among three participants engaged in a reciprocal interchange situation in the basic experimental setting.

The experiment was conducted in the context of a 3-person reciprocal interchange situation (referred to as an exchange task hereafter) and data related to participant interactions

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[2] It should be noted that some metacontingency experiments (e.g., Borba et al., 2017; Marques & Tourinho, 2015) employed participants replacement during studies which is a unique feature of this lineage of experiments.

were collected. During the experiment, three participants engaged in an exchange task presented through a trial-based computer game. The game was organized such that each participant could choose one of three tasks on each trial: an independent task or one of two giving tasks. The independent task produced 5 points for participants who chose the task while the giving tasks produced more points than those corresponding to the independent task; the number of points for the giving tasks varied depending on the experimental condition.

The availability of the independent task was important in two ways. First, it allowed participants to abstain from social interactions (i.e., the giving tasks), more representative of everyday situations in which social interactions are not forced upon participants (Hake & Vukelich, 1972; Molm, 1979). The independent task could be viewed as an activity that a person can do by themselves which might be preferred to working with others. Second, the independent task allowed the experimenters to assess participants' relative preference for the independent task (individual behavior) over the giving tasks (social behavior).

Similarly, the availability of the giving tasks, which represented behaviors that produced a valuable outcome/consequence for the other person in exchange relation (Emerson, 1972; Molm, 1990), was also important in two ways. First, the giving tasks involved a cost for participants because in choosing the giving tasks, participants would forego the points produced by choosing the independent task and assume the risk of points not reciprocated by the other participants. In this sense, the giving tasks might be viewed as an activity that participants might engage in with another person (e.g., talking among each other, helping each other, etc.) which might be preferred over working alone. Second, the availability of two giving tasks allowed the experimenters to assess participants' relative preference for giving points to one participant over the other participant.

This study did not include a task choice for participants to give points to the other participants simultaneously in a trial, which could be a unique option that would not be available in experiments employing dyads; however, this choice was not offered to ascertain that the interactions through participants' task choices were occurring in the context of triads. In the exchange task in dyads, participants were faced with one choice during experiments: to give (points) or to keep. In the exchange task in triads, participants were faced with two (instead of one) choices during experiments: 1) to give or to keep, and 2) to whom to give points. Thus, the availability of the task choice to give points to the other participants simultaneously could potentially eliminate this second choice, which was a unique feature of triad relations, for participants. Thus, such a task choice was not employed in the current study to maximize this feature of triad relations. The current experimental task and the choices, therefore, could be viewed as three individuals having a conversation (or not for the independent task). One participant may say, "how are y'all doing?" to the other two participants. The second participant may respond by saying, "I'm good. How are y'all doing?" Although the second participant's response may appear to be directed to the first and the remaining participant, this response was occasioned by the first participant's response. Stated differently, although the contents of the conversation may appear that all three participants are talking among themselves (i.e., a task choice that gives points to the other two participants simultaneously), we can analyze the episode (social or verbal) to identify the controlling variables that occasion and maintain conversations among three participants (imagine three people talking simultaneously with no continuity in the content of a conversation!).

In summary, the availability of two giving tasks and the independent task created the conditions for dynamic interactions to form among three participants. On one hand, the availability of the independent tasks allowed participants to give points to themselves without interacting with other participants through giving tasks. On the other hand, participants could reciprocate points between or among each other in a trial. In general, choosing the giving tasks had the potential to earn more points than choosing the independent task, if they were reciprocated (i.e., giving tasks produced more points than the independent task). Reciprocation could occur between two participants *or* among three participants. For instance, two participants, Participant 1 (P1) and Participant 2 (P2), could give each other points in a trial (direct reciprocation). Alternatively, all three participants could give points to each other in a coordinated manner in a trial; P1 could give points to P2, P2 could then give points to Participant 3 (P3), and P3 could give points to P1 (indirect reciprocation/generalized exchange). In addition to these types of reciprocation, participants could also develop more elaborated patterns of reciprocation across trials. For instance, in one trial, P1 could choose the independent task while P2 and P3 chose giving tasks that gave points to P1. In the next trial, P2 could choose the independent task while P1 and P3 chose giving tasks that gave points to P2, and so on. The availability of three task choices (the independent task and two giving tasks) provided opportunities for participants to engage in different forms of reciprocation if they chose to do so.

Four additional characteristics of the current study should also be noted. First, participants were able to see what tasks other participants had chosen during a trial. Displaying participants' choices in this manner created conditions in which participants could choose their task based on the other participant(s)'s task choice(s). For instance, if P1 (agent "a") gave points to P2 (agent "b") first, this could function as an S^D for P2 to give points to P1 and an S^D for P3 (agent "c") to choose the independent task (direct reciprocation: see Figure 4 top diagram). Or P1's choice could function as an S^D for P2 to give P3 points, and for P3 to give P1 points (indirect reciprocation: see Figure 4 bottom diagram).

Second, participants were not forced to make choices in a pre-determined sequential order (e.g., P1 always chooses first, then P2, then P3). This aspect of the experimental preparation gave participants the flexibility of when to make their choices in a given trial which allowed the experimenters to observe whether the triad would develop orderly patterns in the sequence(s) in which they made their choices, (e.g., one participant always chose first).

Third, the current study was arranged as a multiple baseline design (Johnston & Pennypacker, 1993). The number of points that the giving tasks produced increased across participants in a staggered manner across experimental conditions, simulating situations in which a certain member has potentially more influence on others than remaining members under a shared social environment. For instance, the administrative staff in the above example may acquire additional resources that may be beneficial for students and/or faculties. These resources are beneficial if used by students/faculties, but not necessarily beneficial for the administrative staff themselves. The use of the multiple baseline design in the current study allowed one or two participants to give more points than the remaining participant(s) in some conditions. Therefore, if some, or all, participants developed specific patterns of reciprocation between or among each other during the previous condition(s), the changes to the experimental conditions would force participants to establish different patterns of reciprocation.

Finally, this study allowed participants to see the points each participant earned during the experiment. As the experiment progressed, participants could observe differences in points earned among themselves. Previous experiments using an exchange task often limited participants' ability to see other participants' points during the experiment to reduce the likelihood of competition or equity effect where participants cooperated to reduce the point differences (Molm et al., 2007); however, this study allowed participants to access such information to observe whether the participants, without communication or prior histories, would coordinate their responses to reduce point differences among them. Moreover, permitting participants to see each other's points, which continuously changed during the experiments, mimicked a shared and evolving environment for all participants.

To summarize, in the current study, participants, in triads, were asked to choose from an array of three task choices that produced points to themselves or give points to one of the other participants during the experiment (i.e., the independent contingency). The experimental task involved dependent consequences in which participants' giving task choices could be reinforced by the reciprocation from the other participant(s) (i.e., the dependent contingencies). The experimental task was organized such that participants' giving task, if reciprocated, had the potential to earn more points than the independent task. This created dynamic concurrent contingencies under independent and reciprocal conditions for each participant in triads. The current study, however, did not employ cultural consequences contingent on some specific forms, or combinations, of participants' choices in a trial used in metacontingency experiments (i.e., joint-dependent consequence).

Research Questions

Having laid out the basic features of the current study and its importance thereof, the current study addressed two primary research questions with a follow-up question:

1) Will participants, without any prior relationship, choose the giving tasks over the independent tasks?
2) If participants choose the giving tasks, what pattern(s) of reciprocations emerges in triads?
    a. When point values for the giving tasks change in a staggered manner across participants, does this affect emerging patterns of reciprocations, and if so, how?

The study also addressed two secondary research questions:

1) Will three participants who can see each other's points try to minimize the point differences between and/or among participants during the experiment?

2) Will three participants develop certain order in which they make choices?

CHAPTER 2

METHOD

Participants

Eighteen participants over the age of 18 were recruited via a flier (Appendix A) posted on social media (i.e., Facebook, Twitter, and Instagram). The flier stated that the experimenter was looking for volunteers for a research study on social behavior and that individuals who were interested in why we work together or compete with one another might be interested in participating in the experiment which consisted of playing a simple game. To participate, individuals needed a desktop or laptop computer with internet access. The flier also included information regarding compensation for participation ($5 for every 30 min and each point earned during the experiment was worth 0.3 cents). The 18 individuals who were recruited were divided into six groups of three (triads) based on their availability to participate in the experiment. The first triad (Triad 1) consisted of Participants 1 (P1) through P3, and the last triad (Triad 5) consisted of P16 through P18.

Individuals who were interested in participating in the current study reached out to the experimenter via email to express their interest. The experimenter replied with an email that stated their appreciation for the individual's interest and asked three screening questions: 1) are you over the age of 18, 2) do you have a desktop/laptop computer, and 3) do you have an internet connection. The experimenter also attached the consent disclosure statement that had been approved by the University of Tennessee Health Science Center (UTHSC) Institutional Review Board (IRB; Appendix B) for their review. Once potential participants confirmed that they met the prescreening criteria, the experimenter sent follow-up emails to determine the times they were available to participate and to schedule the experiment. Participants were asked to select their two most preferred timeslots from the following options: Monday, Wednesday, and Friday: 6 pm to 9 pm; Saturday and Sunday: 10 am to 1 pm and 3 pm to 6 pm.

Once three individuals chose the same timeslot, the experimenter emailed each participant individually to confirm and indicate that they would receive a Zoom link (Zoom.us, 2020) and instructions as to how to access the online game developed for this experiment (see Setting & Material section) 24 hours before the start of the experiment. Participants were told that the experiment would also use Zoom so that the experimenter could provide a general overview of the experiment, instructions as to how to play the game, and technical assistance if anyone experienced any issues during the experiment. Because the online platform posed barriers to verifying the accuracy of participants' demographic information, such as their specific ages, gender, race/ethnicity, etc., this information was not collected for this experiment.

Setting and Materials

Participants accessed Zoom (Zoom.us, 2020) and the online game using their desktop or laptop computers connected to the internet from a location of their choice (e.g., home, classroom, etc.). Because the experiment was conducted on an online platform, participants did not have an opportunity to learn that they would be playing the game with actual people until they joined the Zoom meeting. Zoom created an opportunity for participants to be exposed to each other at the beginning of the experiment while still protecting their identities (see the Experimental Procedure section).

The experimenters contracted a computer programmer to develop an online platform for conducting the current study. This platform provided the experimenters the flexibility to design different types of experiments online. First, it allowed conducting experiments involving up to four participants. Second, it allowed the experimenters to specify response choices and contingencies associated with each choice; thus, the experimenters were able to design independent tasks and exchange tasks for each participant in the current experiment (see Experimental Task section). Third, it allowed the experimenters to specify the number of trials each choice and its associated contingency could be in effect; thus, allowing the experimenters to set up the multiple baseline design for the current study (see Experimental Design section). In addition to these features, it allowed the experimenters to 1) change the game screen's background color for each experimental condition, 2) change the instruction displayed on the game screen for each participant, and 3) other features that were not used for the current study (e.g., texting among participants, setting up different types of basic schedules of reinforcement for each response choice, etc.).[3]

Each participant's game screen displayed the following at the start of each trial and remained on the screen for the duration of the experiment: 1) the participant's assigned ID, 2) the instructions for the game, including the points that corresponded to the independent task, the points that corresponded to the two giving tasks, and which participant would receive the points corresponding to each of the two giving tasks, 3) each participant's cumulative number of points earned during the experiment, 4) each participant's choice on the previous trial, 5) each participant's choice on the current trial, and 6) the available choices (see Figure 5). Following each trial, participants saw an announcement that showed the number of points each participant earned for that trial, including the sources of the points (e.g., "P1 increased X points by P2") on their screens. The announcements remained on the screen until the end of the current trial at which point the announcement was replaced with a new announcement that showed the information from the most recent trial. The background color for the game changed to signal

[3] We are grateful for the computer programmer, Eli Klein, for developing this program.

changes in experimental conditions. The change in the background color was also accompanied by a change in each participant's instructions as the points corresponding to the giving tasks also changed across experimental conditions (see Experimental Design section). The game tracked, time-stamped, and saved each participant's choices and the cumulative points earned throughout the experiment.

Experimental Task

During the experiment, participants moved through a series of trials in which each participant chose one of three shapes: a circle, a square, or a triangle. The circle represented an "independent task" and gave 5 points to the participant who chose it. The square and the triangle represented a "giving task" and gave some points to one of the other two participants (range, 10 points to 20 points). Thus, available task choices and point values corresponding to each task represented the overall independent contingencies that the experimenter placed during the experiments. Table 2 summarizes the choices available to each participant/position and to which participant/position points were given based on the chosen shape/task. A trial ended after all three participants made their choices. Each game consisted of no more than 350 trials spread across up to seven experimental conditions (see the Experimental Design section). The instructions on the game screen showed how many points the independent task would give to participants who chose it and how many points the giving tasks would give to one of the other participants.

Figure 6 summarizes all of the possible combinations of all three participants' choices in a trial. Circles represent participants and letters within circles represent each participant's position in experiments. "A" represents the first participant in a triad whose giving point values were increased (P1, P4, P7, P10, P13, and P16: see the Experimental Design section). "B" represents the second participant in a triad whose giving point values were increased (P2, P5, P8, P11, P14, and P17). "C" represents the last participant in a triad whose giving point values were increased (P3, P6, P9, P12, P15, and P18). Arrows represent giving tasks and the direction of the arrow specifies to whom points were given in a trial. Circles without arrows directing outwards represent participants who chose the independent task in a trial. Numbers on the upper left corner of each box depict the combination patterns. Combination 1 shows all participants choosing the independent task; thus, no interactions among participants in a trial. Combinations 2 through 7 depict one participant choosing a giving task and the remaining participants choosing the independent task in a trial. Combinations 8, 9, and 10 depict choices that could maximize one participant's earned points in a trial. Combinations 11, 12, 14, 15, 17, and 18 depict two participants choosing the giving tasks without direct reciprocation/exchange occurring between these two participants with the remaining participant choosing the independent task in a trial. Combinations 13, 16, 19, and 22 through 27 depict direct reciprocation/exchange between two participants in a trial. These combinations show that two participants could potentially reinforce each other's choice while leaving the third participant alone in a trial. Combinations 20 and 21 depict indirect reciprocation/generalized exchange in a trial.

Participants were not allowed to communicate with each other either vocally or through a chat on Zoom during the experiment. Communication was restricted: 1) to ensure each participant's giving tasks were controlled by reinforcement contingencies created by other participants' giving tasks that produced points for the participant rather than following instructions generated among the participants (e.g., P1 tells P2 to give points), and 2) to remove the possibility of negotiations among participants. The experimenter disabled the chat function on Zoom (participants were only able to chat with the experimenter) and told participants to keep their microphones off during the experiment. To protect participants' identities, the camera was always off during the experiments. Therefore, participants were not able to observe other participants' facial expressions or gestures during the experiment.

Experimental Procedure

The experimenter emailed a Zoom link and instructions for how to access the online game site to participants 24 hours before the scheduled experiment. Participants accessed the Zoom link at the time the experiment had been scheduled. As participants logged into Zoom, the experimenter brought them into the main room one participant at a time. The first participant was welcomed, and the experimenter changed their name on Zoom to protect their identity. Then, the experimenter directed the participant to their designated breakout room with a game code to join the online game and asked them to keep their camera off to protect their identities. Once the first participant was in a breakout room, the experimenter brought the second participant into the main room. The experimenter welcomed the second participant, changed their name on Zoom, and directed them to another breakout room with the game code and the same instructions. Finally, the experimenter brought the last participant into the main room, welcomed them, changed their name on Zoom, and directed them to a third breakout room with the game code and the instructions that were provided to the first two participants. The order in which participants joined Zoom determined the participants' assigned IDs/positions in the game (e.g., the first participant to enter Zoom was assigned as P1 in the game, which is position A in Figure 6). General instructions for the game were displayed on the game screen when participants joined the game while in their respective breakout rooms (see Appendix C).

After all participants joined the online game and were in their respective breakout rooms on Zoom, the experimenter brought all participants back to the main Zoom room to provide a general overview of this study. The experimenter asked participants to look at the instructions on their game screens and read the following script out loud to the participants (see Appendix D). After the experimenter read the script, the experimenter answered any questions the participants asked. Once all questions were answered or there were no questions, the experimenter started the game, and new instructions were displayed on the participants' screens (see Appendix E). Once the game began, participants chose their shapes (i.e., tasks) concurrently by engaging in the following steps:

1. Each participant selected a shape by clicking one of the shapes on their screen.
2. Each participant clicked the "submit choice" located just below the choices.
3. The game produced a pop-up window that asked each participant to confirm their choice by either clicking "ok" or "cancel" on the pop-up window.
4. Each participant clicked "ok" to confirm their choice or "cancel" to change their choice.
5. If a participant opted to change their choice, the participant clicked "cancel" on the pop-up window and returned to Step 1.
6. Once a participant confirmed their choice, the participant was no longer able to change their choice until the next trial.

When a participant confirmed their choice (Step 6), it was displayed on all participants' screens. The first participant to confirm their choice could not see what other participants were choosing; however, the other two participants could see what the first participant had chosen. Similarly, the last participant to confirm their choice could see what the other two participants had chosen. Once all participants confirmed their choices (Step 6), the game announced how many points each participant earned based on all participants' choices in that trial, and each participant's cumulative points at the top of their screens were updated. All participants completing steps 1 through 6 defined one trial. After one trial ended, the next trial immediately began.

No triad engaged in more than 350 trials; however, two triads completed the experiment with fewer than 350 trials due to the participants' work schedules. Triad 3 completed the study after 247 trials, and Triad 4 completed the study after 239 trials. All other triads completed the study after 350 trials. Regardless of after which trial the experiment ended, the experimenter met with participants individually to thank them for their participation and to discuss the total compensation for their participation. The experimenter also asked the following questions: 1) What do you think were the changes occurring in the game? 2) Do you think you were playing the game with actual people? 3) What did you think about the game? Was it boring, fun, confusing, or any other reactions? The first two questions were asked to ensure that the participants were paying attention to the game and responding to other participants' choices; the last question was asked to understand participants' reactions toward the game and the other participants. After the participants answered these questions, the experimenter asked the participants if they had any questions regarding the experiments. The experimenter answered questions the participants asked before completing the experiments.

Practice Trials

Because the experimental setting created a unique context in which participants were asked to give points to other participants they had, we assumed, never met or known, the first three triads followed one experimental procedure and the next three trials followed a slightly different experimental procedure. This change was made based on the patterns of responding observed in the first three triads. Specifically, the first three triads showed differences in terms of when participants began consistently choosing the giving tasks. Participants in Triad 1 and Triad 3 began choosing giving tasks in earlier trials, whereas participants in Triad 2 spent the nearly first half of the experiment choosing the independent tasks. In addition, one of the participants in

Triad 1 stated that the game was confusing, and they simply picked their favorite shape. Thus, to increase the probability that participants would contact the contingencies associated with each choice and reduce confusion regarding the rules of the game, Triads 4 to 6 were instructed through a series of nine practice trials after the experimenter provided the general overview of the experiment. This allowed the experimenter to vocal-verbally guide the participants on how to play the game, to show which task choice would give points to which participant, and to create a history of participants giving points to each other before the game officially started.

Thus, at the onset of the experiment for Triads 4 to 6, the experimenter told participants that they would start with a few practice trials. They were told that the points they earned during the practice trials would be counted toward their total compensation, so they needed to follow the experimenter's instructions carefully. For a total of nine practice trials, participants were instructed to choose specific shapes. Participants were first instructed to look at the instruction on the left of the game screen: "*Choosing the Circle will give you 5 points*". Then, they were instructed to choose the circle for three trials. They were also told not to choose any other shapes because they were deactivated. After participants chose the circle three times, the experimenter told the participants that the instruction on their screens was changed to, "*Choosing the Square will give 10 points to player #*". Participants were then instructed to choose the square in the next three trials. After participants chose the square three times, the experimenter told the participants that the instruction on their screens was changed to, "*Choosing the Triangle will give 10 points to player #*". Participants were instructed to choose the triangle in the next three trials. At the onset of trial 10, the experimenter told the participants that new instructions were on their screen that showed the full set of instructions associated with each of the three shapes, and the game was officially starting. The experimenter told the participants that they would no longer be told what to choose and were now free to choose any of the three shapes for the remaining duration of the experiment.

Due to an experimenter error, the sequence of practice trials for Triad 6 varied such that participants chose triangles in practice Trials 4 to 6 and squares in practice trials 7 to 9. Participants followed the experimenter's instructions by choosing these tasks during these trials; however, points were not produced during these trials.

Independent and Dependent Variables

The independent variable for the current study was the systematic increase in the number of points participants could give to one of the other participants in a trial. At the beginning of the experiment, all participants were able to give 10 points to one of the other participants in a trial. After the first 50 trials, the number of points that two giving tasks produced were increased by 5 points for one participant (Position A in Figure 6); thus, this participant could give 15 points to one of the other participants in a trial while the remaining two participants could only give 10 points to one of the other participants in a trial. The changes in the number of points for the giving tasks occurred across participants every 50 trials in a staggering manner (see the Experimental Design section).

There were four dependent variables: 1) the number of times each participant chose the independent task and the two giving tasks, 2) the number of occurrences of each form of the combinations of participants' choices (Figure 6), 3) the equality/inequality in earned point differences among participants, and 4) the order in which participants made choices in trials.

The number of each participant's independent task choices was defined as the number of times each participant chose the circle. The number of each participant's giving task choices was defined as the number of times each participant chose the square and the number of times each participant chose the triangle. The number of occurrences of each form of the combinations of participants' choices was defined as the number of times each combination occurred during the experiments.

The equality/inequality in earned point differences among participants was defined based on the deviation scores of each participant from each triad's mean points across trials. The deviation scores for each participant were calculated by subtracting the triad's mean points from each participant's points in that trial across trials. A deviation score of zero indicated that a participant's cumulative points at a particular trial were the same as the triad's mean. As deviation scores moved away from zero, this indicated that a participant had less than (negative deviation score) or more than (positive deviation score) the triad's mean points. The deviation scores were used as a measure of equality/inequality in earned point differences among participants as grouping the participants in triads posed a barrier to measuring the degree of equality/inequality as an absolute value (i.e., differences in points among all three participants). This occurred if, for instance, P1 had 10 points, P2 had 15 points, and P3 had 20 points in a trial. This meant that, in terms of the absolute value, there were three degrees of inequality among participants: 1) inequality between P1 and P2, 2) inequality between P2 and P3, and 3) inequality between P1 and P3. In this situation, if P3 chose to give points to P1, it was not clear whether this choice was influenced by the degree of inequality between P1 and P2 or the degree of inequality between P1 and P3. Therefore, to minimize this confusion and to capture the potential relation between equality/inequality in earned point differences and each participant's choice, the deviation scores from the triad's mean points, rather than the absolute values, were used. In addition, deviation scores were able to depict small changes in point differences across trials compared to absolute values during the analysis.

The order in which participants made choices in trials was defined as the temporal sequence in which participants made their choices in each trial. The online game timestamped each participant's choice and the experimenter used the RANK.EQ function on Microsoft Excel to rank the timestamps in ascending order in each trial for each participant. The smallest time frame that the online game was able to capture was 1 s; thus, participants' choices occurring in less than 1 s were indistinguishable. When this occurred, the choices were noted as occurring simultaneously. Therefore, if two participants made the first choice within 1 s of each other, they were both coded as 1 and the remaining participant's choice was coded as 3. Conversely, if a participant made the first choice, this was coded as 1 and if the remaining two participants made choices within 1 s of each other, their choices were coded as 2.

Experimental Design

The experimental conditions were arranged following a multiple baseline across participants design (Johnston & Pennypacker, 1993). The experiment began with a baseline condition and point values for the giving tasks were increased by 5 points for one participant at a time after every 50 trials. The criterion to change experimental conditions (i.e., every 50 trials) was arbitrarily determined for this experiment. Figure 7 is a schematic representation of the experimental design used in this study and a summary of the experimental conditions is provided in Table 3. Triads 1 through 3 began the game, starting in Condition A, immediately after the experimenter provided the general overview of the experiment. Triads 4 through 6 were exposed to a series of nine practice trials before the beginning of Condition A.

Across all experimental conditions, all participants' choices for the independent tasks produced 5 points for the participant who chose this task in a trial. During Condition A, all participants' choices for giving tasks gave 10 points to one of the other two participants in a trial.

Thus, all participant's independent tasks and giving tasks produced the same number of points in Condition A (5 points for the independent tasks and 10 points for the giving tasks). Condition A is denoted as (5:10); the first number specifies the number of points that the independent task produced, and the second number specifies the number of points that the giving tasks produced (Burgess & Nielsen, 1974; Shimoff & Matthews, 1975). Because there were three participants in each experiment, Condition A is denoted as (5:10)(5:10)(5:10); the first parenthesis indicates the point values for position A's tasks (Independent: Giving), the second indicates the point values for position B's tasks, and the third indicates the point values for position C's tasks. Condition A lasted for 50 trials.

After Condition A (first 50 trials), the number of points for the giving task for Position A (Figure 6: P1, P4, P7, P10, P13, P16) was increased from 10 to 15 (5:15) at the onset of the 51st trial; this condition is designated as Condition B and is denoted as (5:15)(5:10)(5:10). This change in the condition was accompanied by the change in the game screen's background color (i.e., from white to green) for all participants. In addition, the instructions for the giving tasks for position A's screen were changed from 10 points to 15 points ("*Choosing the Square gives 15 points to P2. Choosing the Triangle gives 15 points to P3*"). Instructions for the giving tasks for positions B and C remained the same as in Condition A. After 50 trials in Condition B (trial 51 to 100), the number of points for the giving tasks for position B (Figure #6: P2, P5, P8, P11, P14, P17) increased from 10 to 15 at the onset of the 101st trial: Condition C (5:15)(5:15)(5:10). Like the change from Condition A to Condition B, the background for color for all participants changed at the onset of Condition C (e.g., from green to pink), and the instruction for the giving tasks for position B also changed. After the next 50 trials (trials 101 to 150), the number of points for position C (Figure 6: P3, P6, P9, P12, P15, P18) giving task increased to 15 at the onset of the 151st trial; therefore, Condition D is denoted as (5:15)(5:15)(5:15). The background color for all positions and the instructions for giving tasks for position C changed at the onset of Condition D. Condition D was like Condition A in that all positions' independent tasks and giving tasks produced an equal number of points; the only difference between Condition A and Condition D was that the number of points for the giving tasks for all positions increased from 10 to 15. After 50 trials (trials 151 to 200) in Condition D, an additional 5-point increase for the giving tasks across positions began. In Condition E (trials 201 to 250), the number of points for the giving tasks for position A increased from 15 to 20: (5:20)(5:15)(5:15). In Condition F (trials 251 to 300), the number of points for the giving tasks for position B increased from 15 to 20: (5:20)(5:20)(5:15). Finally, in Condition G, the number of points for the giving tasks for position C increased from 15 to 20: (5:20)(5:20)(5:20). The background color and instructions for the giving tasks changed in the same manner as previously stated.

CHAPTER 3

RESULTS

The results for Triads 1 through 6 are shown in Figures 8 through 21 and Tables 4 through 14. Table 4 summarizes the total number of task choices by each participant with the percentage of task allocation in parentheses; the data are visually represented in Figure 8.

The results for Triads 1 and 2 (no practice trials) indicate that P2 and P3 and P4 and P5 allocated more of their choices to the giving task than the independent task. In Triad 3 (no practice trials), however, all participants allocated more of their choices to the giving task than the independent task. Triads 4 through 6 completed practice trials but these data were not included in the analysis. In Triads 4 and 5, P10 and P12 and P14 and P15 allocated more of their choices to the giving task than the independent task. In Triad 6, all participants allocated more of their choices to the giving task than the independent task. Table 5 summarizes the total number of points each participant earned and the total number of points each triad earned during the experiments. Triad 6 earned the most points, followed by Triad 5. Triads 3 and 4 did not go through all 350 trials (247 and 239 trials, respectively); therefore, the triad that earned the least number of points by going through all trials was Triad 1. Figure 9 depicts all participants' deviations from the triads' mean points across trials. Triad 5 shows the largest differences in points and Triads 3 and 6 show the smallest differences in points among participants during the experiments.

The detailed results for each triad are shown in Figures 10 through 21 and Tables 6 through 14. Figures 10, 12, 14, 16, 18, and 20 are scatter plots that depict each occurrence of different combinations of participant's choices across trials for each triad. Figures 11, 13, 15, 17, 19, and 21 depict participants' deviation from the triad's mean points across trials for each triad.

Tables 7, 10, 11, 12, 13, and 14 summarize the total number of occurrences of each combination per condition for each triad. Table 6 summarizes the total number of occurrences of each combination of participants' choices with the percentage of occurrence depicted in parentheses, Table 8 summarizes the points each participant earned per condition, and Table 9 shows the total number of times each participant made their choice first, second, or third per condition for all triads.

The results for Triad 1 are shown in Figures 10 and 11, and Tables 6 through 9. In Triad 1, the most frequent pattern of reciprocation (Table 6) was Combination 19 which involved P2 and P3 who reciprocated points with P1 who was choosing the independent task. Combination 19 occurred 155 times (44.29% of trials). The second most frequent pattern of reciprocation was Combination 16 which involved P1 and P3 who reciprocated points with P2 who was choosing the independent task. Combination 16 occurred 8 times (2.29%). The third most frequent pattern of reciprocation was Combination 23 which involved P2 and P3 who reciprocated points with P1 who was choosing the giving task to P3. Combination 23 occurred four times (1.14%). Table 5 shows that P1 earned 2450 points, P2 earned 3840 points, and P3 earned 3425 points during the experiment.

Participants in Triad 1 initially allocated their choices to independent tasks in Condition A (see black and yellow circles in Figure 10). Direct reciprocations (filled and empty blue circles) between two participants began occurring toward the end of the condition, and there was one instance of indirect reciprocation among participants in Condition A (see Table 7). Participants’ deviation lines (Figure 11) show that the participants’ points hovered around the triad’s mean (see Table 8). P1 made the first choice in 27 trials, P2 made the second choice in 23 trials, and P3 made the third choice in 31 trials (Table 9).

In Condition B, P1 could give more points than the other participants, and P2 and P3 began reciprocating points (Combinations 19, 22, and 23) consistently (Figure 10 and Table 7). Participants' deviation lines show that P1's and P2's points began departing from each other while P3's points hovered near the triad's mean (Figure 11 and Table 8). P1 and P3 made the first choice 23 and 28 times, respectively, and P2 made the third choice 30 times (Table 9).

In Condition C, P1 and P2 could give more points than P3, and P2 and P3 continued to reciprocate points. However, the reciprocation paused during the middle of this condition (Figure 10 and Table 7). P2's and P3's points hovered around each other's and above the triad's mean while P1's points hovered below the mean (Figure 11 and Table 8). P1 made the first choice 33 times, P2 made the second choice 20 times, and P3 made the third choice 26 times (Table 9).

In Condition D, all participants could give an equal number of points. P2 and P3 continued to reciprocate points; however, the reciprocation paused toward the end of this condition (Figure 10 and Table 7). P2's and P3's points increased away from the triad's mean but hovered near each other, and P1's points decreased away from the mean (Figure 11 and Table 8). P1 made the first choice 35 times, P2 made the second choice 34 times, and P3 made the third choice 39 times (Table 9).

In Condition E, P1 could give more points than the other participants. P2 and P3 initially reciprocated points but paused briefly before resuming the reciprocation (Figure 10 and Table 7). P2's and P3's points increased away from the triad's mean but hovered near each other's points and P1's points decreased away from the mean (Figure 11 and Table 8). P1 and P2 made the first choice 32 times and 26 times, respectively, and P3 made the third choice 39 times (Table 9).

In Condition F, P1 and P2 could give more points than P3. The reciprocation between P2 and P3 paused initially but later resumed (Figure 10 and Table 7). P2's and P3's points increased away from the triad's mean but hovered near each other's points and P1's points decreased away from the mean (Figure 11 and Table 8). P1 made the first choice 34 times, P2 made the second choice 31 times, and P3 made the third choice 35 times (Table 9).

In Condition G, all participants could give an equal number of points. P2 and P3 continued to reciprocate points and reciprocations between P1 and P2 occurred during the middle of the condition (Figure 10 and Table 7). P2's and P3's points diverged from each other's while P1's points increased toward the triad's mean (Figure 11 and Table 8). P1 made the first choice 36 times and P2 and P3 made the third choice 21 times and 22 times, respectively (Table 9).

The results for Triad 2 are shown in Figures 12 and 13, and Tables 6, 8, 9, and 10. In Triad 2, the most frequent pattern of reciprocation (Table 6) was Combination 19 which involved P4 and P6 who reciprocated points with P5 who was choosing the independent task. Combination 19 occurred 169 times (48.29% of trials). The second most frequent pattern of reciprocation was Combination 27 which involved P4 and P6 reciprocated points with P5 who was choosing the giving tasks to P6. Combination 27 occurred once. No other combination involving reciprocations occurred in this triad. Table 5 shows that P4 earned 4125 points, P5 earned 1800 points, and P6 earned 4120 points during the experiment.

Participants in Triad 2 primarily allocated their choices to the independent tasks in Condition A as shown by the filled black circles in Figure 12 (also see Table 10). Participants' deviation lines (Figure 13) show that the participants' points hovered on the triad's mean (see Table 8). P6 made the first choice 25 times, P4 made the second choice 23 times, and P5 made the third choice 34 times (Table 9).

In Condition B, P4 could give more points than the other participants, and the participants continued to allocate their choices to the independent task except for P3 who allocated their choices to the giving tasks for some trials (Combination 6; Figure 12 and Table 10). This resulted in P4's points increasing away from the triad's mean while P6's points decreased away from the mean (Figure 13 and Table 8). P5's points hovered around the mean. P6 made the first choice 36 times, P4 made the second choice 28 times, and P5 made the third choice 32 times (Table 9).

In Condition C, P4 and P5 could give more points than P6, and the participants continued to allocate their choices to the independent task (Figure 12 and Table 10). P4's points hovered above the triad's mean, P6's points hovered below the mean and P5's points hovered around the mean (Figure 13 and Table 8). P6 made the first choice 20 times, P4 made the second choice 22 times, and P5 made the third choice 28 times (Table 9).

In Condition D, all participants could give an equal number of points, and P4 and P6 began reciprocating points consistently (Figure 12 and Table 10). This resulted in P4's and P6's points increasing away from the triad's mean while P5's points decreased away from the mean (Figure 13 and Table 8). P5 and P6 made the first choice 20 times and 26 times, respectively, while P4 made the second choice 21 times (Table 9).

In Condition E, P4 could give more points than the other participants, and P4 and P6 continued to reciprocate points throughout the condition (Figure 12 and Table 10). This resulted in P6's points increasing away from the triad's mean more so than P4's and P5's points which continued to decrease away from the mean (Figure 13 and Table 8). P5 and P6 made the first choice 25 times and 19 times, respectively, and P4 made the second choice 22 times in this condition (Table 9).

In Condition F, P4 and P5 could give more points than P6, and P4 and P6 continued to reciprocate points. However, near the end of this condition, P4 chose the independent task and

P6 continued to give points to P4 (Combination 6; Figure 12 and Table 10). This resulted in P4's and P6's points equalizing while P5's points continued to decrease away from the triad's mean (Figure 13 and Table 8). P5 and P6 made the first choice 27 times and 23 times, respectively, and P4 made the third choice 20 times in this condition (Table 9).

In Condition G, all participants could give an equal number of points, and P4 and P6 continued to reciprocate points (Figure 12 and Table 10). P4's and P6's points increased away from the triad's mean while hovering near each other's points and P5's points continued to decrease away from the mean (Figure 13 and Table 8). P6 made the first choice 25 times, P4 made the second choice 31 times, and P5 made the third choice 21 times in this condition (Table 9).

The results for Triad 3 are shown in Figures 14 and 15, and Tables 6, 8, 9, and 11. In Triad 3, the most frequent pattern of reciprocation (Table 6) was Combination 16 which involved P7 and P9 who reciprocated points with P8 who was choosing the independent task. Combination 16 occurred 36 times (14.57% of trials). The second most frequent pattern of reciprocation was Combination 27 which involved P7 and P9 who reciprocated points with P8 who was choosing the giving tasks to P9. Combination 27 occurred 29 times (11.74%). The third most frequent pattern of reciprocation was Combination 26 which involved P7 and P9 who reciprocated points with P8 who was choosing the giving task to P7. Combination 26 occurred 18 times (7.29%). Table 5 shows P7 earned 2595 points, P8 earned 2465 points, and P9 earned 2885 points during the experiment.

Participants in Triad 3 initially allocated their choices to the independent tasks, but P7 began reciprocating points with other participants (Combinations 13, 25, 24, 16, 26, and 27) in Condition A (Figure 14 and Table 11). There were also two instances of indirect reciprocation in this condition. Participants' points hovered around the triad's mean (Figure 15 and Table 8). P8 made the first choice 31 times, P7 made the first and second choice 18 times, and P9 made the third choice 24 times in this condition (Table 9).

In Condition B, P7 could give more points than the other participants, and P7 continued to reciprocate points with other participants (Figure 14 and Table 11). Participants' points continued to hover around the triad's mean (Figure 15 and Table 8). P8 and P9 made the first choice 22 times and 18 times, respectively, and P7 made the second choice 21 times in this condition (Table 9).

In Condition C, P7 and P8 could give more points than P9, and P7 continued to reciprocate points with other participants (Figure 14 and Table 11). There were also two instances of indirect reciprocation. Although the range of participants' points hovering around the triad's mean increased from the previous conditions, their points continued to hover around the mean (Figure 15 and Table 8). P8 made the first choice 19 times, P9 made the first and second choice 18 times, and P7 made the third choice 21 times in this condition (Table 9).

In Condition D, all participants could give an equal number of points, and P7 primarily reciprocated points with P9 (Figure 14 and Table 11). There was one instance of indirect reciprocation. The participants' points initially converged around the triad's mean. However, P9's points began increasing away from the mean while P8's points decreased below the mean and P7's points hovered below the mean (Figure 15 and Table 8). P7 and P8 made the first choice 24 times and 19 times, respectively, and P9 made the third choice 23 times (Table 9).

In Condition E, P7 could give more points than the other participants, and P7 primarily reciprocated points with P9 with some occurrences of reciprocations between P7 and P8 and between P8 and P9 (Figure 14 and Table 11). This resulted in P9's points increasing away from the triad's mean while P8's points decreased away from the mean and P7's points hovered below the mean (Figure 15 and Table 8). P7 and P8 made the first choice 19 times and 24 times, respectively, and P9 made the third choice 25 times in this condition (Table 9). This triad completed the experiment at trial 247.

The results for Triad 4 are shown in Figures 16 and 17, and Tables 6, 8, 9, and 12. In Triad 4, the most frequent pattern of reciprocation (Table 6) was Combination 16 which involved P10 and P12 who reciprocated points with P11 who was choosing the independent task. Combination 16 occurred 114 times (47.7% of trials). The second most frequent pattern of reciprocation was Combination 19 which involved P11 and P12 who reciprocated points with P10 who was choosing the independent task. Combination 19 occurred 56 times (23.43%). The third most frequent pattern of reciprocation was Combination 27 which involved P10 and P12 who reciprocated points with P11 who was choosing the giving task to P12. Combination 27 occurred 14 times (5.86%). Table 5 shows P10 earned 2850 points, P11 earned 1455 points, and P12 earned 3375 points during the experiment.

Participants in Triad 4 initially allocated their choices to independent tasks, but participants began reciprocating points in Condition A (Combinations 16, 26, 27, and 19; Figure 16 and Table 12). Participants' deviation lines show that participants' points departed from the triad's mean; P10's and P12's points slightly increased away from the triad's mean while P11's points decreased away from the mean (Figure 17 and Table 8). P11 and P12 made the first choice 20 times and 22 times, respectively, and P10 made the third choice 23 times in this condition (Table 9).

In Condition B, P10 could give more points than the other participants, and P10 and P13 initially continued to reciprocate points. However, during the middle of the condition, P11 and

P12 began reciprocating points and continued for the remainder of this condition (Figure 16 and Table 12). Participants' deviation lines show that P10's and P12's points converged and hovered near each other during the middle of the condition (Figure 17 and Table 8). P11's points hovered below the triad's mean. P11 made the first choice 26 times, P12 made the first and second choice 20 times, and P10 made the third choice 30 times in this condition (Table 9).

In Condition C, P10 and P11 could give more points than P12, and P11 and P12 continued reciprocating points with some occurrences of reciprocation between P10 and P11 and between P10 and P11 (Figure 16 and Table 12). P12's points began increasing away from the triad's mean while P10's points decreased toward the triad's mean (Figure 17 and Table 8). P11's points hovered below the mean. P11 and P12 made the first choice 25 times and 27 times, respectively, and P10 made the third choice 49 times in this condition (Table 9).

In Condition D, all participants could give an equal number of points, and P10 and P12 began reciprocating points (Figure 16 and Table 12). P10's and P12's points increased away from the triad's mean while P11's points decreased away from the mean (Figure 17 and Table 8). P12 made the first choice 37 times, P11 made the second choice 25 times, and P10 made the third choice 36 times in this condition (Table 9).

In Condition E, P10 could give more points than the other participants, and P10 and P12 continued to reciprocate points (Figure 16 and Table 12). P10's and P12's points continued to increase away from the triad's mean while P11's points decreased away from the mean (Figure 17 and Table 8). P12 made the first choice 32 times, P11 made the second choice 21 times, and P10 made the third choice 35 times in this condition (Table 9). This triad completed the experiment at trial 239.

The results for Triad 5 are shown in Figures 18 and 19, and Tables 6, 8, 9, and 13. In

Triad 5, the most frequent pattern of reciprocation (Table 6) was Combination 19 which involved P14 and P15 who reciprocated points with P13 who was choosing the independent task. Combination 19 occurred 177 times (50.57% of trials). The second most frequent pattern of reciprocation was Combination 22 which involved P14 and P15 who reciprocated points with P13 who was choosing the giving task to P14. Combination 22 occurred 42 times (12%). The third most frequent pattern of reciprocation was Combination 23 which involved P14 and P15 who reciprocated points with P13 who was choosing the giving task to P15. Combination 23 occurred 37 times (10.57%). Table 5 shows that P13 earned 1960 points, P14 earned 5375 points, and P15 earned 5980 points during the experiment.

Participants in Triad 5 initially allocated their choices to independent tasks, but P14 and P15 began reciprocating points early in Condition A (Figure 18 and Table 13). Participants' deviation lines show that P13's points began decreasing away from the triad's mean while P14's and P15's points hovered just above the mean near the end of the condition (Figure 19 and Table 8). P13 made the first choice 26 times, P15 made the second choice 25 times, and P14 made the third choice 22 times in this condition (Table 9).

In Condition B, P13 could give more points than the other participants, and P14 and P15 continued to reciprocate points. P13 and P15 also reciprocated points near the end of the condition (Figure 18 and Table 13). Participants' deviation lines show that P13's points decreased away from the triad's mean while P15's points increased away from the mean. P14's points hovered just above the mean (Figure 19 and Table 8). P13 and P14 made the first choice 19 times and 22 times, respectively, and P15 made the second choice 19 times in this condition (Table 9).

In Condition C, P13 and P14 could give more points than P15, and P13 and P15 initially reciprocated points. However, this reciprocation was replaced by reciprocations between P14 and P15 (Figure 18 and Table 13). There were also three indirect reciprocations. Participants' deviation lines show that P14's and P15's points increased away from the triad's mean while P13's points decreased away from the mean (Figure 19 and Table 8). P13 made the first choice 32 times, P14 made the first and the third choice 19 times, and P15 made the third choice 24 times in this condition (Table 9).

In Condition D, all participants could give an equal number of points, and P14 and P15 continued to reciprocate points (Figure 18 and Table 13). There were also two instances of indirect reciprocation. P14's and P15's points continued to increase away from the triad's mean while P13's points continued to decrease away from the mean (Figure 19 and Table 8). P13 and P14 made the first choice 22 times and 32 times, respectively, and P15 made the third choice 32 times in this condition (Table 9).

In Condition E, P13 could give more points than the other participants, and P14 and P15 continued to reciprocate points (Figure 18 and Table 13). There was one instance of indirect reciprocation at the end of this condition. P14's and P15's points continued to increase away from the triad's mean while P13's points decreased away from the mean (Figure 19 and Table 8). P13 and P14 made the first choice 22 times, and P15 made the second choice 21 times (Table 9).

In Condition F, P13 and P14 could give more points than P15, and indirect reciprocations occurred 24 times. However, toward the end of this condition, P14 and P15 began reciprocating points again which stopped the indirect reciprocations (Figure 18 and Table 13). P15's points continued to increase away from the triad's mean while P14's points hovered above the mean. P13's points initially hovered below the mean but began decreasing away from the mean toward the end of the condition (Figure 19 and Table 8). P14 made the first choice 35 times, P15 made the second choice 22 times, and P13 made the third choice 28 times in this condition (Table 9).

In Condition G, all participants could give an equal number of points, and P14 and p15 continued to reciprocate points (Figure 18 and Table 13). There was an instance of indirect reciprocation at the beginning of this condition. P14's and P15's points continued to increase away from the triad's mean while P13's points continued to decrease away from the mean (Figure 19 and Table 8). P14 made the first choice 38 times, P15 made the second choice 19 times, and P13 made the third choice 25 times in this condition (Table 9).

The results for Triad 6 are shown in Figures 20 and 21, and Tables 6, 8, 9, and 14. In Triad 6, the most frequent pattern of reciprocation (Table 6) was Combination 21 which involved all participants indirectly reciprocating points. Combination 21 occurred 39 times (11.14% of trials). The second most frequent pattern of reciprocation was Combination 27 which involved P16 and P18 who reciprocated points with P17 who was choosing the giving task to P18. Combination 27 occurred 35 times (10%). The third most frequent pattern of reciprocation was Combination 20 which involved another pattern of indirect reciprocation. Combination 20 occurred 30 times (8.57%). Table 5 shows that P16 earned 4540 points, P17 earned 4385 points, and P18 earned 4675 points during the experiment.

In Condition A, participants in Triad 6 initially sampled different tasks but began reciprocating points with different partners (Figure 20 and Table 14). There were also three occurrences of indirect reciprocation. Participants' deviation lines show that the participants' points hovered around the triad's mean (Figure 21 and Table 8). P17 made the first choice 34 times, P16 made the second choice 22 times, and P18 made the third choice 21 times in this condition (Table 9).

In Condition B, P16 could give more points than the other participants, and the participants continued to reciprocate points with different partners (Figure 20 and Table 14). There were also 13 occurrences of indirect reciprocation. Participants' deviation scores show P16's and P18's points began diverging away from the triad's mean while P17's points hovered around the mean (Figure 21 and Table 8). P17 made the first choice 35 times, P16 made the second choice 24 times, and P18 made the third choice 27 times in this condition (Table 9).

In Condition C, P16 and P17 could give more points than P18, and the participants continued to reciprocate points with different partners (Figure 20 and Table 14). There were also 17 occurrences of indirect reciprocation. P16's and P18's points initially converged toward the triad's mean while P17's points hovered around the mean during the first half of this condition and maintained a certain range from the mean in the latter half of the condition (Figure 21 and Table 8). P16 and P18 made the first choice 28 times and 26 times, respectively, and P17 made the first and the second choice 21 times in this condition (Table 9).

In Condition D, all participants could give an equal number of points, and reciprocations between different partners occurred initially but paused until the middle of this condition (Figure 20 and Table 14). There were also nine occurrences of indirect reciprocation. P18's points hovered above the triad's mean while P16's points increased toward the mean, passing P17's points during the middle of the condition. P17's points initially hovered just below the mean but began decreasing away from the mean (Figure 21 and Table 8). P17 and P18 made the first choice 21 times and 29 times, respectively, and P16 made the third choice 30 times (Table 9).

In Condition E, P16 could give more points than the other participants, and reciprocations occurred between different participants (Figure 20 and Table 14). There were also five occurrences of indirect reciprocation. P18's points increased away from the triad's mean while P17's points decreased away from the mean. P16's points hovered just below the mean (Figure

21 and Table 8). P17 and P18 made the first choice 26 times and 28 times, respectively, and P16 made the third choice 40 times (Table 9).

In Condition F, P16 and P17 could give more points than P18, and reciprocations occurred primarily between P16 and P18 and between P17 and P18 (Figure 20 and Table 14). There was one instance of indirect reciprocation. P16's points decreased away from the triad's mean and toward P17's points while P17's points hovered below the mean during the first half of the condition (Figure 21 and Table 8). However, in the latter half of the condition, P16's points increased toward the mean while P17's points decreased away from the mean. P18's points increased away from the mean. P17 and P18 made the first choice 28 times and 23 times, respectively, and P16 made the third choice 37 times in this condition (Table 9).

In Condition G, all participants could give an equal number of points, and reciprocations between different partners occurred sporadically (Figure 20 and Table 14). There were 21 occurrences of indirect reciprocation. P18's points and P17's points converged toward the triad's mean while P16's points hovered around the mean (Figure 21 and Table 8). P16 made the first choice 27 times, P17 made the second choice 25 times, and P18 made the third choice 35 times in this condition (Table 9).

At the end of each experiment, the experimenter asked each participant three questions individually. One participant left the experiment after the game was done due to family business and did not answer the questions. Participants' responses to the questions are summarized in Table 15. Fifteen out of the 17 participants who responded to the questions reported that they were aware of the points or background color change during the experiment. In addition, 12 out of 17 participants reported that they believed that they were playing the game with actual people.

CHAPTER 4

DISCUSSION

The results of this study showed that 14 of 18 participants (Figure 8 and Table 4), including all participants in Triads 3 and 6, allocated more of their choices to the giving tasks over the independent task. Triad 6 earned the most points (Table 5) as a group. Triads 1, 2, and 5 showed a preference for direct reciprocation between two specific participants (Table 6), which resulted in point differences as large as 4020 points (Triad 5; Table 5) among participants at the end of the experiment (see also Figure 9). No clear pattern of the order of responding (Table 9) emerged in any of the six triads.

The experimental task was organized such that participants' giving tasks, if reciprocated, had the potential to generate more points than the independent task. The 14 participants who allocated more of their choices to the giving tasks also began reciprocating points with each other. Three triads (1, 2, and 5) demonstrated a pattern of a preference for a direct exchange (Emerson, 1981; Molm, 2014) between two specific participants (Table 6; Combinations 16, 19, 22, and 23). Although the participants included benefited from the direct exchange relations, the remaining participants did not; therefore, this pattern created an inequality in points among them. Previous studies investigating equity/inequity and trust in dyad relations (Table 1) showed that participants tended to minimize the point differences during the experiments. However, these studies programmed additional contingencies to increase point differences between the two participants. For instance, Matthews (1977) and Matthews and Shimoff (1979) programmed a penalty (i.e., subtracting points) when participants switched who could give or get points during trials. Similarly, Hake and Schmid (1981) increased the response effort (i.e., the number of lever pulls required to distribute problems) during the experiment to increase point differences between the two participants. These additional programmed contingencies allowed the researchers to investigate trust (the temporary deviation from the equitable relationship) and equitable relationships (the correspondence in earned points between two participants; e.g., Hake & Schmid, 1981). The current study involving triadic relations demonstrated inequalities in points across triads without any additional independent contingencies.

One explanation for the inequalities may be that, in the current study, participants were able to give and get points in the same trial. This is a major procedural difference between the current study and the previous studies that allowed only one participant to get points in a trial (e.g., Hake & Schmid, 1981; Matthews, 1977; Matthews & Schimoff, 1979). This procedural difference (give and get points in the same trial) may have increased inequalities in points among participants based on the unequal number of points participants could give during the experiments. The current study allowed participants to give and get points in a trial to avoid the possibility that only two participants would give points to each other and effectively remove the third participant during the experiment. Despite the major procedural difference between the current study and the previous studies investigating trust, the procedure used in the current study still seems to capture some elements of trusting relationships as indicated by P14's answer to the post-experimental question: "*Kind of fun. (It was) built on trust*" (Table 15). Another explanation for this difference may be that the addition of the third participant created complexities in how participants coordinated choices to minimize point differences. In dyadic exchange relations, there are only four possible combinations of choices in a trial whereas, in triadic exchange relations, there are 27 possible combinations of choices in a trial (Figure 6). This suggests interesting empirical questions that could be investigated in future research.

Although inequalities in points were observed in triads, some participants seemed to develop different forms of equitable relationships during the experiments. For instance, the deviation scores of P2 and P3 in Triad 1 (Figure 11), and P4 and P6 in Triad 2 (Figure 13) showed their points trailing each other during the experiments. In addition, P4 and P6 coordinated their task choices near the end of Condition F, which minimized their point difference. Triad 3 (Figure 15) and Triad 6 (Figure 21) appeared to show a more complex pattern of responding that minimized the inequality in points during the experiment. Although there were point differences among the participants in Triads 3 and 6, their points continued to hover around the triads' means. Furthermore, in Triad 6, the participants' points merged toward the triad's mean toward the end of Condition G. Triads 3 (Figure 14) and 6 (Figure 20) also showed variability in direct exchange partners during the experiment as well as in the participants' choice combinations. Triad 6, for example, demonstrated frequent occurrences of indirect reciprocation (i.e., generalized exchange; Emerson, 1981; Molm, 2014).

The current study allowed participants to see others' earned points during the experiment which is often limited in experiments using an exchange task. Thus, these data suggest that one possible controlling variable could have been that the participants in Triad 1, 2, 3, and 6 observed the point differences between or among participants during the experiments (equity effect; Molm et al., 2007). Inequalities in points between the direct exchange partners were larger in Triads 4 (P10 and P12) and 5 (P14 and P15) than in Triads 1 and 2. This may indicate that participants in these triads chose tasks based on the availability of immediate reciprocal partners. For instance, participants in these triads continued to reciprocate points even when participants were giving an unequal number of points to each other. This likely explains why the inequalities in points between the exchange partners were larger in these triads.

Another possible explanation for their continued reciprocations in unequal conditions, however, might be the way the game was organized. Specifically, the game was organized such that the giving response had a potential for larger returns as compared to the independent task; and as previously stated, participants could give and get points in the same trial. Therefore, the participants who were receiving fewer points than the exchange partners were “better off” receiving fewer points in reciprocation than the points produced by the independent task. Given Triads 4 and 5 received practice trials before the experiments, the larger inequalities in points in these triads (compared to Triads 1 and 2) also could have influenced the forced history of giving points to other participants.

The triads did not develop a clear pattern in the order of responding (e.g., leader-follower relationships) during the experiments like those observed by Azrin and Lindsley (1956), which Lindsley (1966) later systematically investigated. The lack of a clear pattern of sequential responding among participants in the current study may be related to the type of independent contingencies employed. The current study used an exchange task that involved dependent consequences in which participants’ choices potentially reinforced other participants’ task choices. Lindsley’s (1966) study, on the other hand, used an experimental task that involved joint-dependent consequences (i.e., participants were required to respond within a specified time frame which was followed by reinforcers); Lindsley programmed contingencies that specified the orders of participants’ responding, a contingency that was not programmed in the current experimental arrangement. In addition, five of 17 participants who responded to the post-experimental questions reported that they were not sure if they were engaging in the experimental task with actual people. Given that the current experimental setting did not provide the opportunity for participants to see or talk to each other during the experiment, it is possible that doing so in future research may provide additional stimuli that facilitate the development of a specific order of responding like in previous experiments (Azrin & Lindsley, 1956; Lindsley, 1966).

Although the triads did not develop a clear pattern of the order of responding, the temporal data (i.e., timestamps) collected provided some insight as to the patterns of reciprocations between and among participants. For instance, in Triad 1, Combination 19 occurred frequently in Conditions D through F and the temporal data showed that P1 who was not involved in reciprocations made their choices first 35 times (Condition D), 32 times (Condition E), and 36 times (Condition F). Thus, in several trials during these conditions, P1 chose the independent task first which allowed P2 and P3 to observe P1's response which may have facilitated the reciprocation between P2 and P3 (i.e., P1 withdrew from the social situation). Therefore, P1's allocation of choices to the independent task may have served as a potential controlling variable for the reciprocation between P2 and P3 during these conditions. A similar pattern was also observed in Triad 2 in which P5 chose the independent task first. Combination 19, in which P14 and P15 reciprocated points, also frequently occurred in Triad 5. However, Combinations 22 and 23 frequently occurred in this triad as well, which differed in comparison to the pattern that occurred in Triads 1 and 2. This difference suggests that P13 was choosing the giving tasks to the other participants when the direct reciprocation between P14 and P15 was occurring. Therefore, the concurrent/non-sequential choice-making among participants might have created competition among the participants (e.g., P13 gives points to P14 faster than P15 in the hope of reciprocation of points by P14).

Despite the interesting findings obtained from the current study's investigation of triadic interactions embedded in an exchange task, there were several limitations that should be noted. First, the only demographic information collected was that participants were over the age of 18.

Schmitt (1998) suggested that demographic information could be valuable if researchers were interested in conducting between-subject comparisons and exploring how participants' backgrounds may influence their patterns of reciprocation. Therefore, collecting additional demographic information about participants in further experiments could offer distinct advantages. For instance, demographic information may help experimenters in understanding the variability observed in triads' patterns of reciprocation. In the area of cross-cultural research, Hayward and Kemmelmeier (2007) reported that individual beliefs and attitudes toward competition varied based on several interconnected factors, such as cultural background, socioeconomic status, and individuals' societal positions. All or some of these variables may have influenced participants' allocation of choices in the current study; however, without additional demographic information, no analyses could be conducted. In addition, given this study was conducted on an online platform, it is possible that participants were located in different countries, and the compensation for participants (paid in US dollars) may have also differed in value for some participants relative to others. Future studies should include a pre-screening session in which participants' demographic information is collected to further rule out these potential influences on responding.

There are several additional advantages to the inclusion of a pre-screening session. For example, it could be used for participants to practice playing the online game which could help participants to become familiar with the game and reduce the total duration of the experiment. In addition, experimenters could ask participants about any prior experience(s) with games. It is possible that how participants were recruited for the current study (i.e., involving "a simple game") may have strengthened different patterns of responding common to those involved in gaming communities, such as histories of playing poker with others. P9 in Triad 3 stated, "*It was* *interesting. It was kind of like gambling*" during the post-experiment questions (Table 15). Thus, this participant's allocation of choices could be influenced by the probability of reciprocation by other participants (i.e., the matching law; Herrnstein, 1974) rather than the influence of the equity effect (Molm et al., 2017). In addition, some participants reported that they were unsure whether they had played the game with actual people (Table 15); these participants might have also chosen tasks based on strategies that they had developed from previous game experiences rather than the more immediate contingencies in effect based on other participants' choices.

Second, each triad completed the current study in a single session. Previous experiments in social behavior were often conducted across multiple days. Schmitt (1998) describes some advantages and disadvantages of organizing social behavior experiments in one or more sessions. One advantage of conducting social behavior experiments across multiple days is that it allows participants to develop a longer relationship with each other; this shared history could help participants to identify different ways to reciprocate, such as the patterns observed in Triads 3 and 6. Another advantage of conducting social behavior experiments across multiple days is that it allows researchers to shorten the duration of the experiment each day which in turn reduces the likelihood of participants getting bored or fatigued in each experimental session as P4 and P7 indicated (Table 15). Triads 4 (P10 and P12) and 5 (P14 and P15) continued to reciprocate points during unequal point conditions and this may have been due to the length of the experiment causing these participants to become tired or bored.

Conducting experiments across multiple days with shorter durations could reduce fatigue and/or boredom and further isolate the variables influencing participants' choices. Conducting experimenters across multiple days might also enhance the potency of points as conditioned reinforcers to be exchanged for money at the end of the experiment. When the experiment is restricted to only one day, participants do not come in contact with the contingency of exchanging points for money until the experiment ends. Organizing experiments across multiple days brings the advantage of allowing participants to come in contact with this contingency during the experiment, as the points participants earned during the first day of participation can be exchanged for money at the beginning of the second day of the experiment. Hake et al. (1975b), for example, noted that their participants were less likely to decrease the point difference when many experimental sessions were conducted in one day. Therefore, it is possible that the patterns observed in which triads did not reduce the point differences were related to the fact that the current experimenter was conducted in only one day. At the same time, conducting social behavior experiments across multiple days may necessitate additional funding and increases the risk of attrition if participants do not return for subsequent sessions (Schmitt, 1998).

A third limitation of the current study was that it was conducted in an online environment. Although this environment provided flexibility in terms of participants being able to join the experiment from anywhere as long as they had a computer and an internet connection, it also imposed some restrictions. Notably, the researcher was not able to observe the participants' behaviors during the experiments. Thus, there was no way for the researcher to confirm if participants were looking at their screens and attending to the experimental task or not. Although the patterns of reciprocations observed seem to suggest that participants were engaged throughout the experiment, it is possible that this was not the case. The use of the online game also increased the probability of participants experiencing technical difficulties. Even though it was not a frequent occurrence, some participants did experience their computer screens freezing. For example, when the experimenter noticed that a participant was taking a long time to respond, the experimenter contacted the participant via Zoom chat, and they stated that their screens were freezing. This likely influenced some of the timestamps on the data obtained Conducting future experiments in person and improving the accessibility of the program could minimize these concerns.

A fourth limitation of the current study was that the program did not allow the experimenter to set up automatic experimental condition changes based on the pattern of participants' choices. Instead, the condition changes were programmed to occur following a set number of trials (i.e., 50 trials) in each condition. If future studies could allow for the determination of condition changes based on the pattern of participants' choices in previous trials, then this could support the identification of stable patterns of reciprocations before the experimental contingencies shift. With the possibility to observe stable patterns, the experimenter could more readily investigate the effects of condition changes, such as the increase in the number of points for the giving tasks for one participant. Borba et al. (2017) is one example of previous research that employed systematic criteria for condition changes. Doing so allowed them to demonstrate the effect of the metacontingency on the number of occurrences of a specific form of participants' choices (i.e., IBC and AP). A similar preparation could prove useful in extensions of the current study.

Fifth, as previously noted, the program timestamped each participant's response; however, if participants' responses occurred within 1 s, these responses were coded as simultaneous occurrences. Adjusting the program such that an inter-response pause and/or observing response is built in between participants' responses could allow for more differentiated data to be collected regarding the order in which participants' choices were made, allowing for the identification of leader-follower relations or other emergent patterns of responding among participants.

Lastly, the current study was arranged as a multiple baseline design in which the number of giving points was systematically increased across participants. However, data from many triads did not show clear effects of condition change on the patterns of reciprocations. The combination of the lack of stable patterns of responding and the development of dependent contingencies may have overridden the effects of condition changes. Using a different experimental design for future studies may provide a clearer picture of how changes in the number of points correlated with the giving tasks influence participants' task choices. A reversal design (Sidman, 1960) could be one possibility. A reversal design could be organized such that following Condition A, P1's giving task might be increased to 15 points, followed by a return to Condition A. Inclusion of a reversal could help to isolate shifts in preference of task choices, minimizing the effects of the increase in the points for the giving task for another participant.

Social systems, such as educational institutions, involve many individual behaviors interacting with each other under a set of institutional contingencies. The social behavior literature (Table 1) has traditionally focused on dyadic relations; however, the current study added a third participant, welcoming the additional complexities often involved in social interactions. In the current experiment, the experimenter programmed a set of institutional contingencies (independent contingencies; Weingarten & Mechner, 1966), which took a form of an exchange task with increasing numbers of points produced by the giving tasks staggered across participants. Moreover, participants' giving task choices could be reinforced by the reciprocation from the other participant(s) (dependent consequences; Schmitt, 1998). This experimental arrangement created dynamic concurrent contingencies under independent and reciprocal conditions for each participant in triads (dependent contingencies; Weingarten & Mechner). Although the independent contingencies were programmed such that if all participants allocated their choices to the same giving task in a trial (squares or triangles; Combinations 20 and 21, indirect reciprocation) participants could earn more points as a group than if participants' allocated their choices to the independent task (How the system *should* behave; Sandaker, 2009), different patterns of reciprocations were observed across triads (How the system *actually* behaves; Sandaker, 2009). This extended the literature on social behavior, providing the opportunity to observe patterns of participants' task allocations governed by dependent contingencies that were not under the control of the experimenter.

The institutional contingencies (i.e., independent contingencies) programmed in the current study may also be conceptualized through the lens of the cultural/cultural organizational milieu (Houmanfar, et al., 2010; Houmanfar, et al., 2020). Houmanfar and colleagues elaborated the concept of metacontingency to include contextual factors, such as policies, values, instructions, etc., that could influence the development and maintenance of IBCs (or socio-interlocked behaviors; see Houmanfar et al., 2010; Houmanfar et al., 2020). The cultural/cultural organizational milieu, as well as metacontingencies, require further empirical studies to investigate the validity of such concepts. The current study may be able to provide an additional strategy to do so. For instance, although experimental manipulations relating to the above concepts, such as instructions or cultural consequences, were not employed in the current study, P16's report to the post-experimental questions indicated that participants in Triad 6 might have developed certain "values" during the experiment ("*Fun, I felt like we got the idea later*"; Table 15). Future investigations may involve programming cultural consequences contingent on different patterns of dependent contingencies to explore how these cultural consequences influence participants' verbal reports across sessions.

The most frequent pattern of reciprocations (i.e., dependent contingencies) observed was the direct reciprocation/exchange between two participants. This pattern created a large inequality in points between participants in the exchange relation and the remaining participant in the triad, therefore, creating a *trouble* (Malagodi & Jackson, 1989) for the remaining participant. This pattern, however, was replicated in four of the six triads. Thus, this could also be viewed as an *issue* (Malagodi & Jackson) in which participants' interactions (dependent contingencies) under the institutional contingencies (independent contingencies) replicated, producing large inequalities among participants and across four triads. As previously stated, participants could earn more points by simply giving each other points during the experiment (independent contingencies); however, this seemingly harmless and simple rule created an *issue* (dependent contingencies). Previous studies (e.g., Hake & Schmid, 1981; Matthews, 1977; Matthews & Shimoff, 1979) observed patterns among participants minimizing the point differences in dyadic relations. Although the patterns of minimizing point differences between two participants were observed in the current study, these patterns appear to be problematic in the context of triadic relations (i.e., replicating *issues*). Stated differently, as we expanded our scope, from dyadic to triadic relations, we identified an unintended consequence (Willems, 1977)—namely the direct exchange between two participants, which was also replicated across triads. Thus, this reminds us that when we approach *issues*, the contingency analysis requires a focus on individual behavior, taking into consideration that these individual behaviors occur in a social environment, which includes the behaviors of other individuals (cf. Cihon, 2022; Skinner 1953), and the social organizations formed as the products of individual behaviors (Krapfl & Gasparotto, 1982).

Participants in Triads 3 and 6, on the other hand, allocated their choices in ways that minimized the point differences among participants during the experiments. One possible controlling variable for the pattern of minimizing point differences observed in Triads 3 and 6 (and to some extent, P2 and P3 in Triad 1 and P4 and P6 in Triad 2) could be the visibility of other participants' points during the experiments (equity effect; Molm et al., 2007) rather than the availability of an immediate reciprocal partner (Triads 4 and 5). While addressing the aforementioned limitations, one future study could include a systematic evaluation of the effects of the visibility of other participants' points on participants' allocation of task choices (e.g., an audit response; Hake & Vukelich, 1973; Vukelich & Hake, 1974). Previous experiments using an exchange task often limited participants' ability to see other participants' points during the experiment to reduce the likelihood of competition or equity effect where participants cooperated to reduce the point differences (Molm et al., 2007). Therefore, a systematic evaluation of an audit response may provide additional insight onto variables that influence how participants reciprocate in triadic relations.

It is important to note that the current study did not use metacontingency arrangements (i.e., providing a cultural consequence contingent on a specific form IBCs and APs); rather, the current study focused on the analysis of the dependent contingencies emerging from the participants' interactions through the exchange task. The exchange task provided a condition under which the participants could potentially reinforce other participants' choices through the reciprocation of points. Although the current study did not analyze the participants' choices in a moment-to-moment fashion within trials (see Figure 4), future research might include this analysis (see, however, the fifth limitation above). Specifically, the use of the current experimental task with the concurrent choice-making in metacontingency experiments could: 1) allow a detailed analysis of the IBCs between and among participants, 2) provide more variations in APs that can be targeted for selection by cultural consequences (CCs), and 3) allow for observations as to how CCs influence IBCs that produced different APs. Once triads develop their unique patterns of interactions/reciprocations through dependent contingencies as seen in the current study, the target for the cultural consequence (i.e., APs) can be identified. Moreover, depending on the target AP identified, experimenters could observe, in greater detail, how CCs impact on IBCs.

The exchange task with the concurrent task choice-making allows for a greater variety of APs than are usually examined in the experimental analyses of metacontingencies. For instance, the specific temporal pattern of choice-making (i.e., the leader-follower relations) could be a potential target to increase by way of CCs. Another potential target may be equality/inequality among participants, and CCs could be provided contingent on reducing or increasing point differences among participants. This type of APs (equality/inequality) can be achieved by different combinations of participants' choices. For instance, participants could maximize one participant's points in a trial (Combinations 8, 9, and 10) or two participants could reciprocate points with each other while the remaining participant chooses the independent task (Combinations 13, 16, and 19), as we have seen in the current study. In any case, it should be emphasized that equality/inequality as an AP is not a specific form of the combination of the participants' choices; rather, this AP is the result of participants' choices and can be produced in different ways.

Zilio (2019) has provided a critical review of metacontingency literature and suggested that the metacontingency experiments could be viewed as cooperation experiments. When CCs are applied to the specific combinations of participants' responses, this is consistent with the joint-dependent consequence typically employed in cooperation experiments (top diagram in Figure 1; see also Weingarten & Mechner, 1966). Moreover, even if the CCs are applied to the combination of participants' choices in the exchange task, this could also be, retrospectively, viewed as a joint-dependent consequence. A close examination of the exchange procedure, however, reveals that the interactions between participants involve dependent consequences (bottom diagram in Figure 1). Thus, metacontingency experiments employing an exchange task may be able to delineate two levels, if you will, of selection processes: 1) dependent consequences governing the operant selection (i.e., dependent contingencies), and 2) joint-dependent consequences governing the cultural selection (cf. Couto & Sandaker, 2016). This approach may alleviate Zilio's critical review of metacontingency experiments as cooperation experiments.[4] Weingarten and Mechner (1966) suggested that "One task of experimental research on social interactions is to determine what, if any, dependent contingencies of various types of independent contingencies produce" (p. 449). Cultural practices certainly involve interactions between and among individuals participating in such practices and the point made by Weingarten and Mechner should also apply to the area of metacontingency.[5]

We live in a complex environment where we interact with each other under sets of contingencies that are products of human behavior. As we expand the scope of our analysis from dyads to triads (and beyond) and welcome complexities in the basic experimental setting, we may find sources of *issues* that have been replicating our societal problems, such as the inequality observed in the current study that was produced by dyad reciprocations. The current experiment extends the literature in several ways that support our understanding of the contingencies in complex social environments. Additional research in this area may identify

[4] Some may argue that the reciprocations observed in the current study are a form of cooperation as Hake and Olvera (1978) called such reciprocations dependent cooperation; however, the critical point to understand here is the type of consequence that maintains such cooperation (joint-dependent vs dependent consequence; Schmitt, 1998).
[5] It must be re-emphasized that the unique aspect of metacontingency experiment is the replacement of participants during experiments. The exchange task and the resulting dependent contingencies may provide insight as to how cultural practices can be transmitted across generations of participants.

additional sources of inequality, unintended consequences of policy implementations (i.e., independent contingencies) at the individual level (i.e., dependent contingencies), and variables that facilitate or inhibit group formations among multiple individuals. For example, Emerson (1969) suggested that the boundaries of groups could be identified by a careful analysis of productive exchange (i.e., joint-dependent consequence). The current study did not program joint-dependent consequences or cultural consequences; thus, the boundary of a group was not defined procedurally. However, retrospectively speaking, as we observed reciprocal relations between two participants, the participants engaged in what appears to be "cooperation" (or dependent cooperation; Hake & Olvera, 1978) and defined, so to speak, their boundaries. When this occurred, one option for the participant who was left out was an attempt to engage in exchange with the participants within the boundary (Triad 5, P13, Figure 18) perhaps in the hopes of being included.

Our behaviors occur in space through time, and we share our limited time on this planet. As behavioral scientists, we hope that this line of research will shed a light on identifying variables we can change so that the participants who were "left out" can be included in the boundary defined by the interactions of human behaviors. If the sources of social issues lie in the behaviors of the human species (Cihon & Kazaoka, 2021), we can change our behaviors to achieve "Equity for All". As we stand on the shoulders of giants, we are reminded of the words of one such wise person who frequently reminded us, "*We are all in this together*."

Table 1

Sampling of Previous Social Behavior Research Conducted in Basic Experimental Settings that is Relevant to the Current Study

Researcher(s) & Year	Procedure/Type of Consequence Maintaining Social Behavior	Topic
Cohen & Lindsley (1964)	Cooperation/Joint-Dependent Consequence	Leadership
Lindsley (1966)	Cooperation/Joint-Dependent Consequence	Cooperation, Competition, Leadership
Marwell et al. (1971)	Cooperation/Joint-Dependent Consequence	Cooperation in the Presence of Risk
Marwell & Schmitt (1972)	Cooperation/Joint-Dependent Consequence	Cooperation in the Presence of Risk
Schmitt & Marwell (1971a)	Cooperation/Joint-Dependent Consequence	Cooperation in the Presence of Risk
Schmitt & Marwell (1971b)	Cooperation/Joint-Dependent Consequence	Cooperation in the Presence of Risk
Schmitt & Marwell (1972)	Cooperation/Joint-Dependent Consequence	Inequity
Shimoff & Matthews (1975)	Cooperation/Joint-Dependent Consequence	Inequity
Burgess & Nielsen (1974)	Exchange/Dependent Consequence	Inequity
Hake et. al. (1975a)	Exchange/Dependent Consequence	Cooperation, Sharing, Equity
Hake et. al. (1975b)	Exchange/Dependent Consequence	Cooperation, Sharing, Equity
Matthews (1977)	Exchange/Dependent Consequence	Trust
Mathews & Shimoff (1979)	Exchange/Dependent Consequence	Trust
Matthews et al. (1983)	Exchange/Dependent Consequence	Trust
Hake & Schmid (1981)	Exchange/Dependent Consequence	Trust
Schmid & Hake (1983)	Exchange/Dependent Consequence	Trust

Note. Joint-dependent consequences require coordination of two participants' responses for the production of reinforcement. One participant's response produces reinforcement for the other participant in a dependent consequence.

Table 2

Choices and Recipients of Points based on the Choices

Choice Made by	Points Received by		
	A	B	C
A	Circle (I)	Square (G)	Triangle (G)
B	Triangle (G)	Circle (I)	Square (G)
C	Square (G)	Triangle (G)	Circle (I)

Note. Independent task = I, giving task = G. A, B, C = Positions in the triad.

Table 3

Summary of the Experimental Manipulation

Conditions/Trials/Background Color	Positions		
	A	B	C
A / trial 1 – 50 / white	5:10	5:10	5:10
B / trial 51 – 100 / green	5:15	5:10	5:10
C / trial 101 – 150 / pink	5:15	5:15	5:10
D / trial 151 – 200 / blue	5:15	5:15	5:15
E / trial 201 – 250 / orange	5:20	5:15	5:15
F / trial 251 – 300 / purple	5:20	5:20	5:15
G / trial 301 – 350 / yellow	5:20	5:20	5:20

Note. The number on the left specifies the point value for the independent task while the number on the right specifies the point value for the giving task.

Table 4

Each Participant's Total Number of Task Choices

Triad	Participant	Task	
		Independent	Give
1	P1	310 (88.57%)	40 (11.43%)
	P2	171 (47.37%)	190 (52.63%)
	P3	110 (31.43%)	240 (68.57%)

(table continues)

Triad	Participant	Task	
		Independent	Give
2	P4	167 (47.71%)	183 (52.29%)
	P5	347 (99.14%)	3 (0.86%)
	P6	137 (39.14%)	213 (60.86%)
3*	P7	59 (23.89%)	188 (76.11%)
	P8	119 (48.18%)	128 (51.82%)
	P9	55 (22.27%)	192 (77.73%)
4**	P10	92 (38.49%)	147 (61.51%)
	P11	134 (56.07%)	105 (43.93%)
	P12	19 (7.95%)	220 (92.05%)
5	P13	204 (58.29%)	146 (41.71%)
	P14	32 (9.14%)	318 (90.86%)
	P15	35 (10%)	315 (90%)
6	P16	86 (24.57%)	264 (75.43%)
	P17	75 (21.43%)	275 (78.57%)
	P18	38 (10.86%)	312 (89.14%)

Note. *Triad 3 completed the experiment at the end of trial 247. **Triad 4 completed the experiment at the end of trial 239.

Table 5

Total Number of Points Participants Earned

Triad	Participant	Total Points Earned	Total Points as Triads
1	P1	2450	9715
	P2	3840	
	P3	3425	
2	P4	4125	10045
	P5	1800	
	P6	4120	
3*	P7	2595	7945
	P8	2465	
	P9	2885	

(table continues)

Triad	Participant	Total Points Earned	Total Points as Triads
4**	P10	2850	7680
	P11	1455	
	P12	3375	
5	P13	1960	13315
	P14	5375	
	P15	5980	
6	P16	4540	13600
	P17	4385	
	P18	4675	

Note. *Triad 3 completed the experiment at the end of trial 247. **Triad 4 completed the experiment at the end of trial 239.

Table 6

A Summary of the Number of the Occurrences of each Combination of Participants' Choices

Combination	Triads					
	Triad 1	**Triad 2**	**Triad 3***	**Triad 4****	**Triad 5**	**Triad 6**
21 (G2, G3, G1)	1 (0.29%)	0	3 (1.21%)	0	4 (1.14%)	39 (11.14%)
20 (G3, G1, G2)	0	0	2 (0.81%)	0	27 (7.71%)	30 (8.57%)
13 (G2, G1, I)	1 (0.29%)	0	13 (5.26%)	1 (0.42%)	0	12 (3.43%)
25 (G2, G1, G1)	3 (0.86%)	0	16 (6.48%)	2 (0.84%)	2 (0.57%)	16 (4.57%)
24 (G2, G1, G2)	1 (0.29%)	0	6 (2.43%)	1 (0.42%)	1 (0.29%)	18 (5.14%)
16 (G3, I, G1)	8 (2.29%)	169 (48.29%)	36 (14.57%)	114 (47.7%)	5 (1.43%)	19 (5.43%)
26 (G3, G1, G1)	1 (0.29%)	0	18 (7.29%)	13 (5.44%)	3 (0.86%)	15 (4.29%)
27 (G3, G3, G1)	0	1 (0.29%)	29 (11.74%)	14 (5.86%)	1 (0.29%)	35 (10%)
19 (I, G3, G2)	155 (44.29%)	0	12 (4.86%)	56 (23.43%)	177 (50.57%)	24 (6.86%)
22 (G2, G3, G2)	0	0	4 (1.62%)	0	42 (12%)	14 (4%)
23 (G3, G3, G2)	4 (1.14%)	0	5 (2.02%)	0	37 (10.57%)	13 (3.71%)
8 (I, G1, G1)	5 (1.43%)	0	3 (1.21%)	4 (1.67%)	0	14 (4%)
9 (G2, I, G2)	7 (2%)	0	11 (4.45%)	0	5 (1.43%)	11 (3.14%)
10 (G3, G3, I)	0	0	2 (0.81%)	0	2 (0.57%)	6 (1.71%)
11 (G3, G1, I)	0	0	2 (0.81%)	0	0	5 (1.43%)
12 (G2, G3, I)	0	0	3 (1.21%)	0	3 (0.86%)	6 (1.71%)
14 (G3, I, G2)	1 (0.29%)	2 (0.57%)	10 (4.05%)	0	6 (1.71%)	11 (3.14%)
15 (G2, I, G1)	4 (1.14%)	1 (0.29%)	12 (4.86%)	0	1 (0.29%)	12 (3.43%)

(table continues)

Combination	Triads					
	Triad 1	Triad 2	Triad 3*	Triad 4**	Triad 5	Triad 6
17 (I, G1, G2)	0	0	1 (0.4%)	0	1 (0.29%)	6 (1.71%)
18 (I, G3, G1)	1 (0.29%)	0	4 (1.62%)	2 (0.84%)	1 (0.29%)	18 (5.14%)
2 (G2, I, I)	2 (0.57%)	1 (0.29%)	7 (2.83%)	0	1 (0.29%)	1 (0.29%)
3 (G3, I, I)	7 (2%)	9 (2.57%)	9 (3.64%)	2 (0.84%)	6 (1.71%)	1 (0.29%)
4 (I, G1, I)	1 (0.29%)	0	0	5 (2.09%)	1 (0.29%)	4 (1.14%)
5 (I, G3, I)	6 (1.71%)	2 (0.57%)	5 (2.02%)	7 (2.93%)	16 (4.57%)	0
6 (I, I, G1)	29 (8.29%)	40 (11.43%)	6 (2.43%)	6 (2.51%)	1 (0.29%)	3 (0.86%)
7 (I, I, G2)	20 (5.71%)	0	14 (5.67%)	8 (3.35%)	1 (0.29%)	14 (4%)
1 (I, I, I)	93 (26.57%)	125 (35.17%)	14 (5.67%)	4 (1.67%)	6 (1.71%)	3 (0.86%)

Note. From the top, Combinations 21, 20, 13, 25, 24, 16, 26, 27, 19, 22, and 22 involve reciprocations between or among participants. The three most frequent pattern of reciprocation are highlighted in yellow.

Table 7

Total Number of the Occurrences of each Combination per Condition for Triad 1

Combination	Conditions						
	A	B	C	D	E	F	G
21 (G2, G3, G1)	1	0	0	0	0	0	0
20 (G3, G1, G2)	0	0	0	0	0	0	0
13 (G2, G1, I)	0	0	0	0	0	0	1
25 (G2, G1, G1)	0	0	0	0	0	0	3
24 (G2, G1, G2)	0	0	0	0	0	0	1
16 (G3, I, G1)	5	3	0	0	0	0	0
26 (G3, G1, G1)	0	1	0	0	0	0	0
27 (G3, G3, G1)	0	0	0	0	0	0	0
19 (I, G3, G2)	3	21	20	23	37	28	23
22 (G2, G3, G2)	0	0	0	0	0	0	0
23 (G3, G3, G2)	2	2	0	0	0	0	0
8 (I, G1, G1)	1	0	1	2	0	1	0
9 (G2, I, G2)	3	1	0	0	0	0	3
10 (G3, G3, I)	0	0	0	0	0	0	0
11 (G3, G1, I)	0	0	0	0	0	0	0
12 (G2, G3, I)	0	0	0	0	0	0	0
14 (G3, I G2)	1	0	0	0	0	0	0
15 (G2, I, G1)	1	1	0	0	0	0	2
17 (I, G1, G2)	0	0	0	0	0	0	0
18 (I, G3, G1)	0	0	0	0	0	1	0
2 (G2, I, I)	0	0	0	0	0	0	2
3 (G3, I, I)	6	1	0	0	0	0	0
4 (I, G1, I)	1	0	0	0	0	0	0
5 (I, G3, I)	0	0	0	3	1	0	2
6 (I, I, G2)	6	6	3	3	1	1	9
7 (I, I, G2)	1	3	4	1	0	8	3
1 (I, I, I)	19	11	22	18	11	11	1

Table 8

A Summary of Each Participant's Points Earned per Condition

Triad	Part.	Condition						
		A	B	C	D	E	F	G
1	P1	315	640 (325)	945 (305)	1300 (355)	1565 (265)	1880 (315)	2450 (570)
	P2	360	790 (430)	1175 (385)	1645 (470)	2260 (615)	2900 (640)	3840 (940)
	P3	330	725 (395)	1135 (410)	1630 (495)	2260 (630)	2895 (635)	3425 (530)
2	P4	275	725 (450)	975 (250)	1610 (635)	2365 (755)	3160 (795)	4125 (965)
	P5	255	505 (250)	750 (245)	1015 (265)	1260 (245)	1510 (250)	1800 (290)
	P6	245	395 (150)	660 (265)	1380 (720)	2375 (995)	3140 (765)	4120 (980)
3	P7	390	865 (475)	1420 (555)	1985 (565)	2595 (610)		
	P8	405	940 (535)	1510 (570)	1980 (470)	2465 (485)		
	P9	415	905 (490)	1380 (475)	2145 (765)	2885 (740)		
4	P10	560	965 (405)	1320 (355)	2160 (840)	2775 (615)		
	P11	185	535 (350)	985 (450)	1205 (220)	1380 (175)		
	P12	480	1025 (545)	1690 (665)	2490 (800)	3300 (810)		
5	P13	250	425 (175)	590 (165)	820 (230)	1025 (205)	1700 (675)	1885 (185)
	P14	460	960 (500)	1630 (670)	2455 (825)	3350 (895)	4160 (810)	5300 (1140)
	P15	455	1115 (660)	1965 (850)	2790 (825)	3625 (835)	4725 (1100)	5905 (1180)
6	P16	445	880 (435)	1545 (665)	2275 (730)	2945 (670)	3630 (685)	4525 (895)
	P17	405	1000 (595)	1615 (615)	2195 (580)	2795 (600)	3415 (620)	4370 (955)
	P18	455	1100 (645)	1725 (625)	2325 (600)	3150 (825)	3900 (750)	4660 (760)

Note. Participants' cumulative points earned at the end of conditions and points earned within each condition (in parentheses).

Table 9

Total Number of Times each Participant Made their Choices First, Second, or Third per Condition

Triad	Part	Order	Condition						
			A	B	C	D	E	F	G
1	P1	First	27	23	33	35	32	34	36
	P1	Second	16	15	12	5	7	11	7
	P1	Third	7	12	5	10	11	5	7
	P2	First	10	4	16	15	26	10	10
	P2	Second	3	16	20	34	24	31	19
	P2	Third	31	30	14	1	0	9	21
	P3	First	17	28	13	3	0	8	9
	P3	Second	23	15	11	8	11	7	19
	P3	Third	10	7	26	39	39	35	22
2	P4	First	21	12	21	10	11	11	9
	P4	Second	23	28	22	21	22	19	31
	P4	Third	6	10	7	19	17	20	10
	P5	First	9	4	13	20	25	27	19
	P5	Second	7	14	9	14	12	13	10
	P5	Third	34	32	28	16	13	10	21
	P6	First	25	36	20	26	19	23	25
	P6	Second	19	10	18	13	12	9	11
	P6	Third	6	4	12	11	19	18	14
3	P7	First	18	12	18	24	19		
	P7	Second	18	21	11	14	15		
	P7	Third	14	17	21	12	13		
	P8	First	31	22	19	19	24		
	P8	Second	10	14	17	18	14		
	P8	Third	9	14	14	13	9		
	P9	First	6	18	18	10	10		
	P9	Second	20	15	18	17	12		
	P9	Third	24	17	14	23	25		

(table continues)

Triad	Part	Order	Condition						
			A	B	C	D	E	F	G
4	P10	First	10	8	0	4	0		
	P10	Second	17	12	1	10	4		
	P10	Third	23	30	49	36	35		
	P11	First	20	26	25	16	15		
	P11	Second	11	15	24	25	21		
	P11	Third	19	9	1	9	3		
	P12	First	22	20	27	37	32		
	P12	Second	21	20	23	9	6		
	P12	Third	7	10	0	4	1		
5	P13	First	26	19	32	22	22	12	13
	P13	Second	15	18	12	17	14	10	12
	P13	Third	9	13	6	11	14	28	25
	P14	First	13	22	19	32	22	35	38
	P14	Second	15	9	12	11	12	7	9
	P14	Third	22	14	19	7	16	8	3
	P15	First	12	15	5	3	12	20	15
	P15	Second	25	19	21	15	21	22	19
	P15	Third	13	16	24	32	17	8	16
6	P16	First	10	19	28	13	2	7	27
	P16	Second	22	24	13	7	8	6	10
	P16	Third	18	7	9	30	40	37	13
	P17	First	34	35	11	21	22	28	23
	P17	Second	11	9	20	21	26	19	25
	P17	Third	5	6	19	8	2	3	2
	P18	First	17	3	26	29	28	23	3
	P18	Second	13	20	19	10	17	20	12
	P18	Third	21	27	5	11	5	7	35

Table 10

Total Number of the Occurrences of Each Combination per Condition for Triad 2

Combination	Conditions						
	A	B	C	D	E	F	G
21 (G2, G3, G1)	0	0	0	0	0	0	0
20 (G3, G1, G2)	0	0	0	0	0	0	0
13 (G2, G1, I)	0	0	0	0	0	0	0
25 (G2, G1, G1)	0	0	0	0	0	0	0
24 (G2, G1, G2)	0	0	0	0	0	0	0
16 (G3, I, G1)	0	0	0	37	48	37	47
26 (G3, G1, G1)	0	0	0	0	0	0	0
27 (G3, G3, G1)	0	0	0	0	1	0	0
19 (I, G3, G2)	0	0	0	0	0	0	0
22 (G2, G3, G2)	0	0	0	0	0	0	0
23 (G3, G3, G2)	0	0	0	0	0	0	0
8 (I, G1, G1)	0	0	0	0	0	0	0
9 (G2, I, G2)	0	0	0	0	0	0	0
10 (G3, G3, I)	0	0	0	0	0	0	0
11 (G3, G1, I)	0	0	0	0	0	0	0
12 (G2, G3, I)	0	0	0	0	0	0	0
14 (G3, I G2)	0	0	0	0	0	0	2
15 (G2, I, G1)	1	0	0	0	0	0	0
17 (I, G1, G2)	0	0	0	0	0	0	0
18 (I, G3, G1)	0	0	0	0	0	0	0
2 (G2, I, I)	0	0	0	1	0	0	0
3 (G3, I, I)	0	0	0	8	0	1	0
4 (I, G1, I)	0	0	0	0	0	0	0
5 (I, G3, I)	1	0	1	0	0	0	0
6 (I, I, G2)	2	20	0	4	1	12	1
7 (I, I, G2)	0	0	0	0	0	0	0
1 (I, I, I)	46	30	49	0	0	0	0

Table 11

Total Number of the Occurrences of Each Combination per Condition for Triad 3

Combination	Conditions						
	A	B	C	D	E	F	G
21 (G2, G3, G1)	2	0	1	0	0		
20 (G3, G1, G2)	0	0	1	1	0		
13 (G2, G1, I)	4	3	5	0	1		
25 (G2, G1, G1)	3	5	4	1	3		
24 (G2, G1, G2)	0	1	3	1	1		
16 (G3, I, G1)	9	6	4	7	10		
26 (G3, G1, G1)	4	3	2	5	4		
27 (G3, G3, G1)	2	7	5	8	7		
19 (I, G3, G2)	0	2	3	4	3		
22 (G2, G3, G2)	1	2	0	1	0		
23 (G3, G3, G2)	1	1	0	2	1		
8 (I, G1, G1)	0	2	0	0	1		
9 (G2, I, G2)	2	5	2	1	1		
10 (G3, G3, I)	2	0	0	0	0		
11 (G3, G1, I)	0	1	1	0	0		
12 (G2, G3, I)	0	0	2	0	1		
14 (G3, I G2)	2	2	0	3	3		
15 (G2, I, G1)	2	1	6	3	0		
17 (I, G1, G2)	0	0	0	1	0		
18 (I, G3, G1)	0	2	2	0	0		
2 (G2, I, I)	4	1	1	0	1		
3 (G3, I, I)	2	1	0	6	0		
4 (I, G1, I)	0	0	0	0	0		
5 (I, G3, I)	2	0	1	1	1		
6 (I, I, G2)	1	1	1	1	2		
7 (I, I, G2)	2	3	2	2	5		
1 (I, I, I)	5	1	4	2	2		

Table 12

Total Number of the Occurrences of Each Combination per Condition for Triad 4

Combination	Conditions						
	A	B	C	D	E	F	G
21 (G2, G3, G1)	0	0	0	0	0		
20 (G3, G1, G2)	0	0	0	0	0		
13 (G2, G1, I)	0	0	0	1	0		
25 (G2, G1, G1)	0	0	1	1	0		
24 (G2, G1, G2)	0	0	1	0	0		
16 (G3, I, G1)	22	19	0	38	35		
26 (G3, G1, G1)	5	0	1	5	2		
27 (G3, G3, G1)	5	0	2	5	2		
19 (I, G3, G2)	3	19	34	0	0		
22 (G2, G3, G2)	0	0	0	0	0		
23 (G3, G3, G2)	0	0	0	0	0		
8 (I, G1, G1)	2	1	1	0	0		
9 (G2, I, G2)	0	0	0	0	0		
10 (G3, G3, I)	0	0	0	0	0		
11 (G3, G1, I)	0	0	0	0	0		
12 (G2, G3, I)	0	0	0	0	0		
14 (G3, I G2)	0	0	0	0	0		
15 (G2, I, G1)	0	0	0	0	0		
17 (I, G1, G2)	0	0	0	0	0		
18 (I, G3, G1)	1	1	0	0	0		
2 (G2, I, I)	0	0	0	0	0		
3 (G3, I, I)	0	2	0	0	0		
4 (I, G1, I)	5	0	0	0	0		
5 (I, G3, I)	2	1	4	0	0		
6 (I, I, G2)	0	4	2	0	0		
7 (I, I, G2)	2	2	4	0	0		
1 (I, I, I)	3	1	0	0	0		

Table 13

Total Number of the Occurrences of each Combination per Condition for Triad 5

Combination	Conditions						
	A	B	C	D	E	F	G
21 (G2, G3, G1)	0	0	3	0	0	0	1
20 (G3, G1, G2)	0	0	0	2	1	24	0
13 (G2, G1, I)	0	0	0	0	0	0	0
25 (G2, G1, G1)	0	0	0	0	0	2	0
24 (G2, G1, G2)	0	0	0	1	0	0	0
16 (G3, I, G1)	0	1	4	0	0	0	0
26 (G3, G1, G1)	1	0	0	0	0	2	0
27 (G3, G3, G1)	0	0	1	0	0	0	0
19 (I, G3, G2)	23	24	17	37	32	11	33
22 (G2, G3, G2)	3	6	11	4	7	4	7
23 (G3, G3, G2)	1	4	5	6	5	7	9
8 (I, G1, G1)	0	0	0	0	0	0	0
9 (G2, I, G2)	2	0	1	0	2	0	0
10 (G3, G3, I)	0	1	1	0	0	0	0
11 (G3, G1, I)	0	0	0	0	0	0	0
12 (G2, G3, I)	1	2	0	0	0	0	0
14 (G3, I G2)	1	2	3	0	0	0	0
15 (G2, I, G1)	1	0	0	0	0	0	0
17 (I, G1, G2)	1	0	0	0	0	0	0
18 (I, G3, G1)	0	0	0	0	1	0	0
2 (G2, I, I)	0	0	1	0	0	0	0
3 (G3, I, I)	2	1	3	0	0	0	0
4 (I, G1, I)	1	0	0	0	0	0	0
5 (I, G3, I)	5	9	0	0	2	0	0
6 (I, I, G2)	1	0	0	0	0	0	0
7 (I, I, G2)	1	0	0	0	0	0	0
1 (I, I, I)	6	0	0	0	0	0	0

Table 14

Total Number of the Occurrences of each Combination per Condition for Triad 6

Combination	Conditions						
	A	B	C	D	E	F	G
21 (G2, G3, G1)	3	9	9	3	3	1	11
20 (G3, G1, G2)	0	4	8	6	2	0	10
13 (G2, G1, I)	3	5	1	0	0	0	3
25 (G2, G1, G1)	2	2	7	4	0	0	1
24 (G2, G1, G2)	3	2	5	0	6	2	0
16 (G3, I, G1)	1	2	1	4	1	8	2
26 (G3, G1, G1)	3	4	4	0	1	0	3
27 (G3, G3, G1)	4	6	0	3	13	8	1
19 (I, G3, G2)	4	1	0	4	10	4	1
22 (G2, G3, G2)	2	7	1	0	0	1	3
23 (G3, G3, G2)	1	4	4	3	1	0	0
8 (I, G1, G1)	2	0	0	4	1	5	2
9 (G2, I, G2)	2	0	1	2	0	4	2
10 (G3, G3, I)	4	0	2	0	0	0	0
11 (G3, G1, I)	1	0	2	1	0	1	0
12 (G2, G3, I)	2	0	0	1	0	0	3
14 (G3, I G2)	1	2	1	4	0	2	1
15 (G2, I, G1)	3	0	2	2	0	2	3
17 (I, G1, G2)	1	0	0	2	3	0	0
18 (I, G3, G1)	2	2	2	4	4	4	0
2 (G2, I, I)	1	0	0	0	0	0	0
3 (G3, I, I)	1	0	0	0	0	0	0
4 (I, G1, I)	2	0	0	1	0	0	1
5 (I, G3, I)	0	0	0	0	0	0	0
6 (I, I, G2)	1	0	0	1	1	0	0
7 (I, I, G2)	0	0	0	1	4	7	2
1 (I, I, I)	1	0	0	0	0	1	1

Table 15

Participants' Responses to the Three Questions after the Experiment

Triad	Part	Q1: "what were the changes?"	Q2: "Actual People?"	Q3: "Reaction to the game?"
1	P1	Points and rules were changing	Bots	I tried to play team, but they didn't. Other people were giving each other points, so I kept my points.
	P2	Game didn't make obvious change	Yes	Stress. I had to think. It was confusing. I picked my favorite shape because it gave me more luck.
	P3	Amount of points were changing	Yes	It was fun
2	P4	The color and points were changing	Yes	Boring and long
	P5	How other people played	Yes	Sad and frustrated because I didn't get points
	P6	(P6 had to leave immediately after the game ended)		
3	P7	Color and game were changing	not sure	Boring. I didn't get why other players didn't coordinate to get more points.
	P8	background color	Hard to tell. 70% sure they were real	It was confusing
	P9	Color and points were changing	Real	It was interesting. It was kind of like gambling
4	P10	Points	Yes	It was confusing how to get more points
	P11	Color and points	Real	it was fun, the game is about being selfless
	P12	Point	Real	It was confusing first but understood later
5	P13	Points. Also, P2 and P3 partnered up	Yes	Not boring but I didn't get point. I tried but other players partnered up
	P14	Points	No	Kind of fun. Built on trust
	P15	Points	Yes	It was confusing but understood later

Triad	Part	Q1: “what were the changes?”	Q2: “Actual People?”	Q3: “Reaction to the game?”
6	P16	Points	Yes	Fun, I felt like we got the idea later
	P17	Points	Yes	It was boring first but became fun
	P18	Points	I don’t think so, others were slow first	Interesting. Rules (how others played) were changing

Figure 1

Mechner Notation System Depicting Joint-Dependent and Dependent Consequences

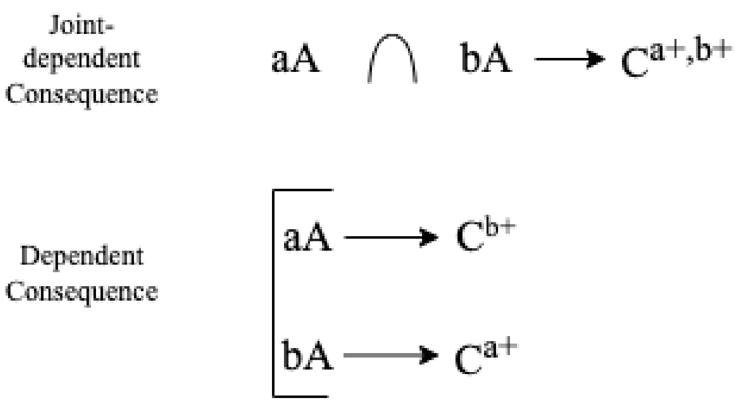


Figure 2

Mechner Notation System Depicting Joint-Dependent and Dependent Consequences among Three Individuals

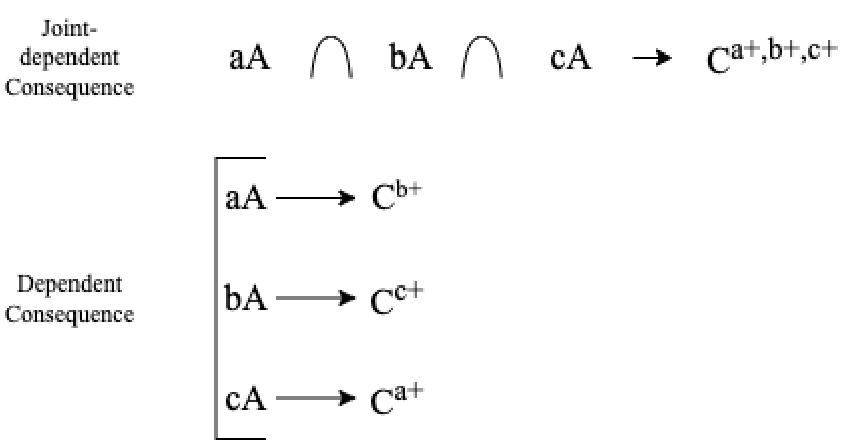


Figure 3

Mechner Notation System Depicting Joint-Dependent, Dependent, and the Combination of Both Consequences among Three Individuals

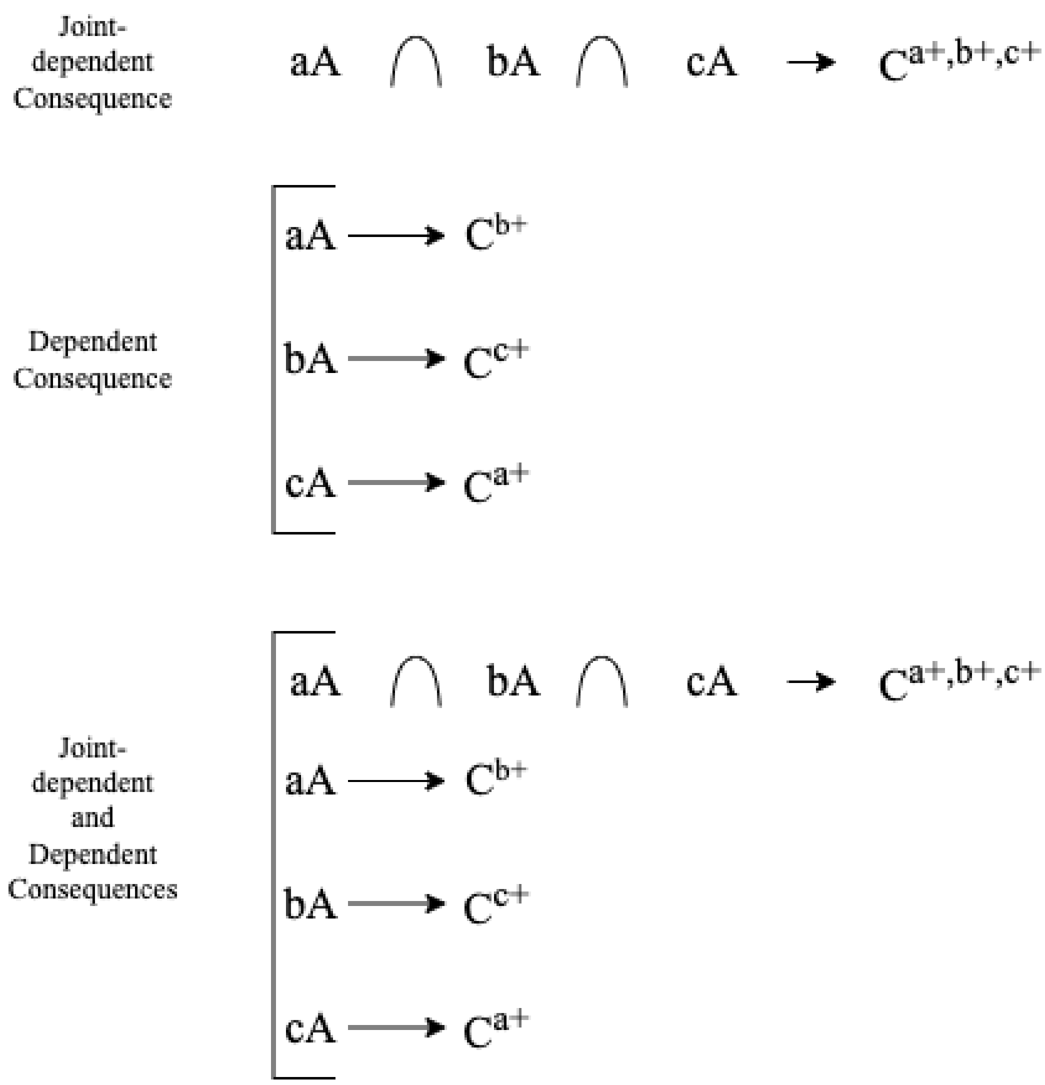


Figure 4

Mechner Notation System Depicting Direct Reciprocation between Two Participants and Indirect Reciprocation among Three Participants

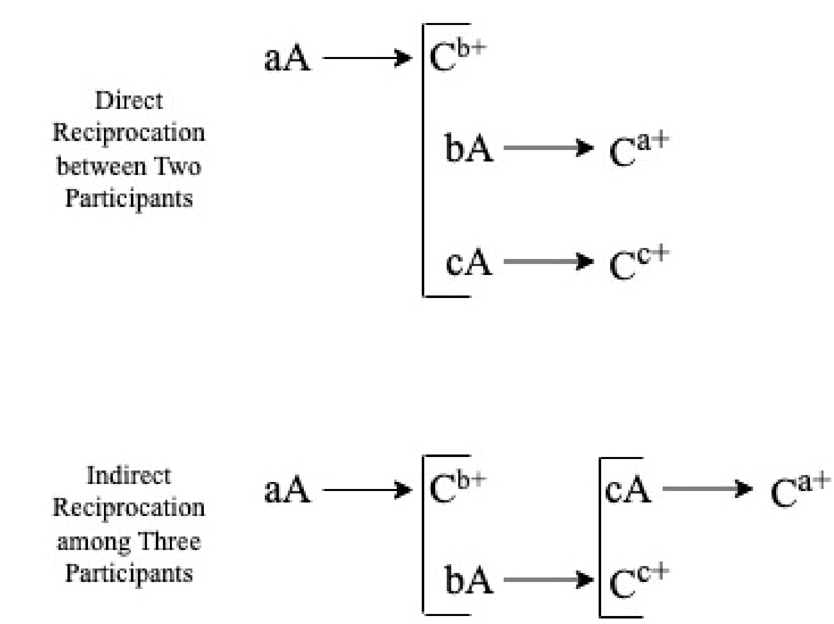
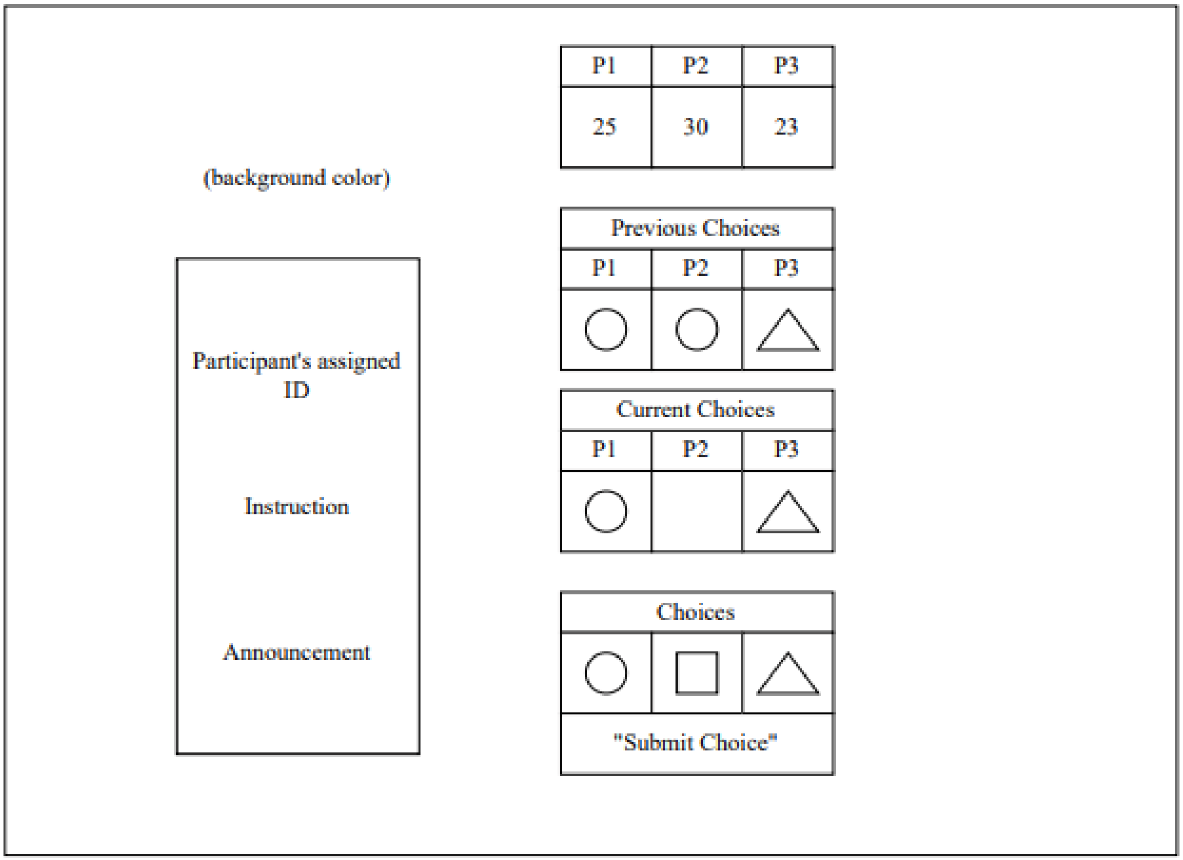


Figure 5

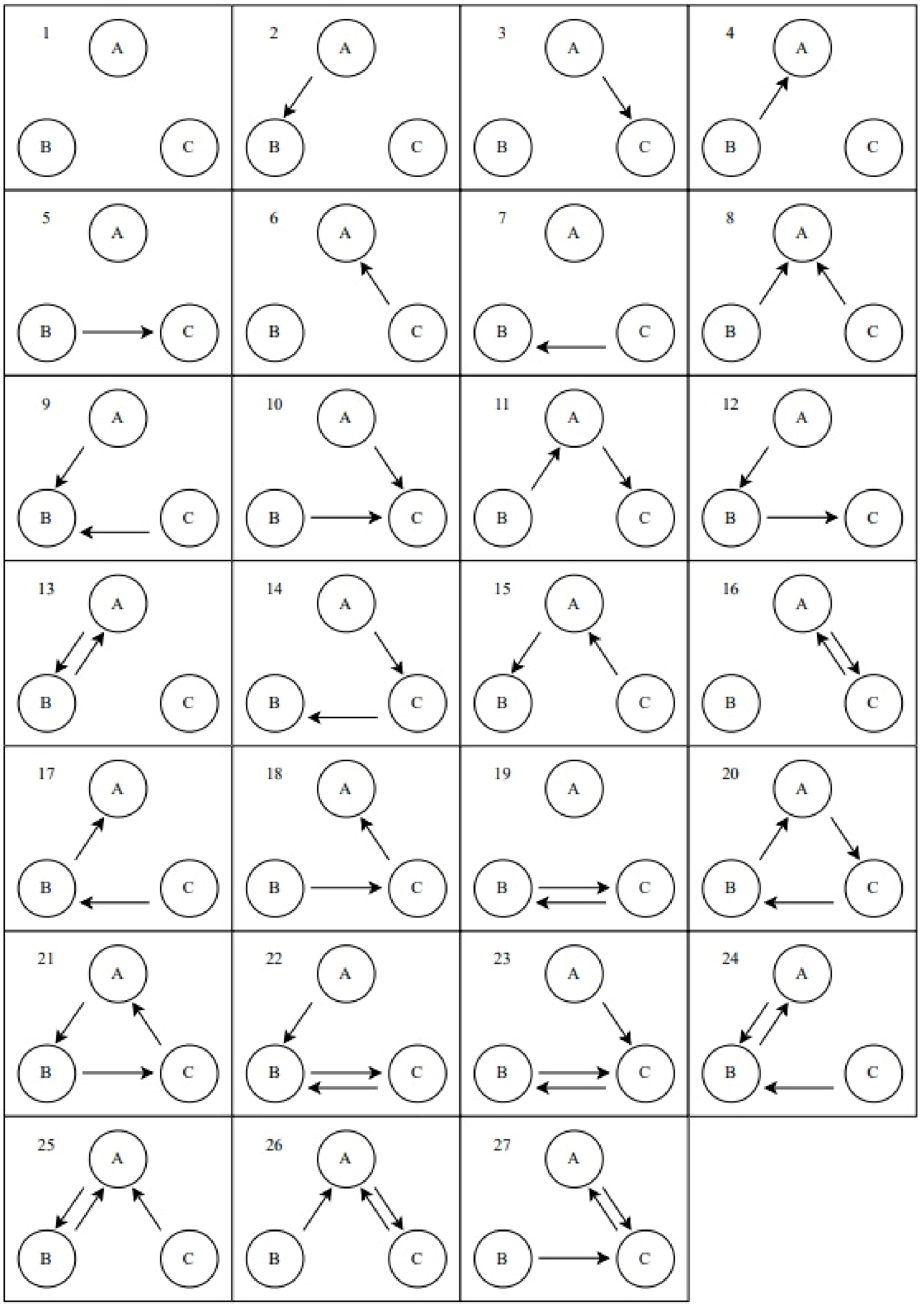
The Game Screen Displayed to Participants



Note. The constant information: A participant's assigned ID (left), the instruction for the game (left), participants' cumulative points (top), participants' previous choices and current choices (middle), and available choices (bottom). Announcements that detail the number of points participants earn (left) and each participant's choice during the previous trial (center) will remain until the end of a trial and will be replaced by new announcements after the trial.

Figure 6

Visual Depictions of Possible Combinations of Participants' Choices in one Trial



Note. Circles represent participants and alphabets within circles represent each participant's position in experiments. A represents the first participant in a triad whose giving point values is increased (P1, P4, P7, P10, P13, and P16). B represents the second participant in a triad whose giving point values is increased (P2, P5, P8, P11, P14, and P17). C represents the last participant in a triad whose giving point values is increased (P3, P6, P9, P12, P15, and P18). Arrows represent giving tasks and the direction of the arrows specify to whom points were given in a given trial. Circles without arrows directing outwards represent participant who chose the independent task in a given trial. Numbers on the upper left corner of each box depict the combination patterns (a total of 27 combinations).

Figure 7

A Schematic Representation of the Experimental Design used in this Study

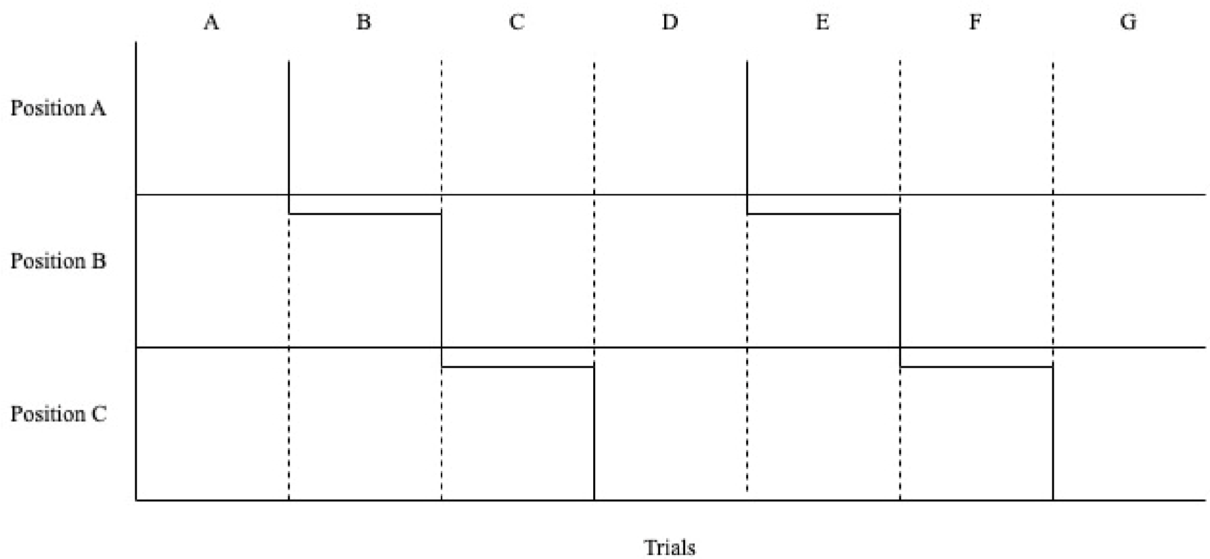
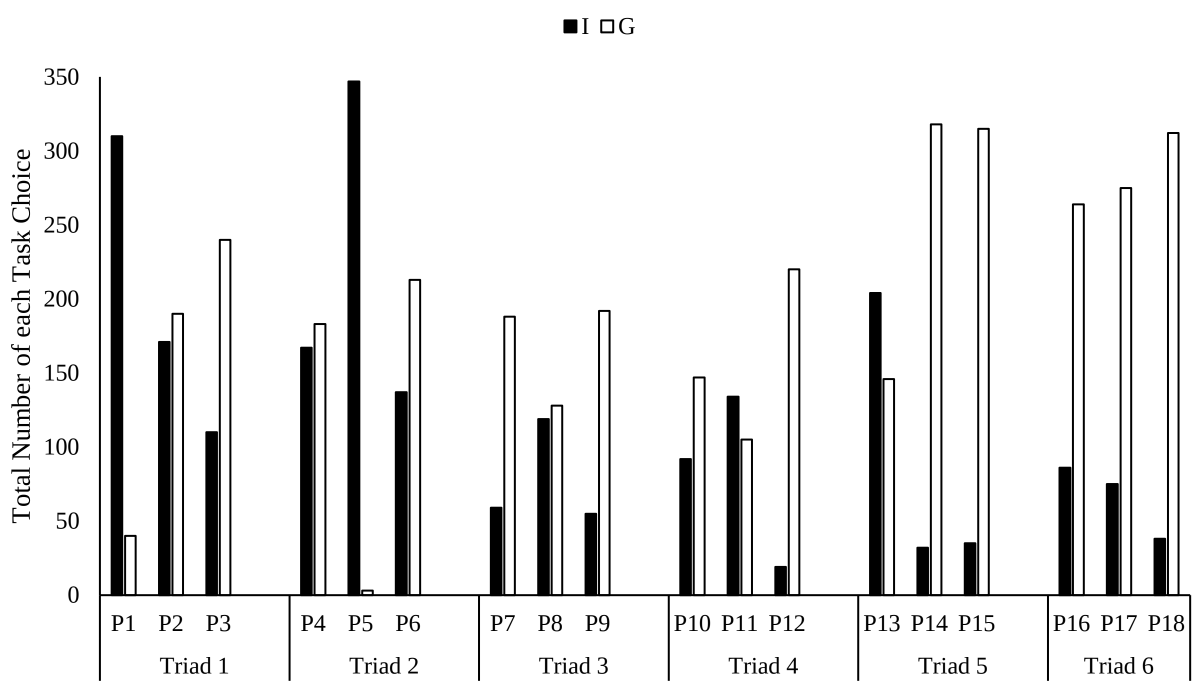


Figure 8

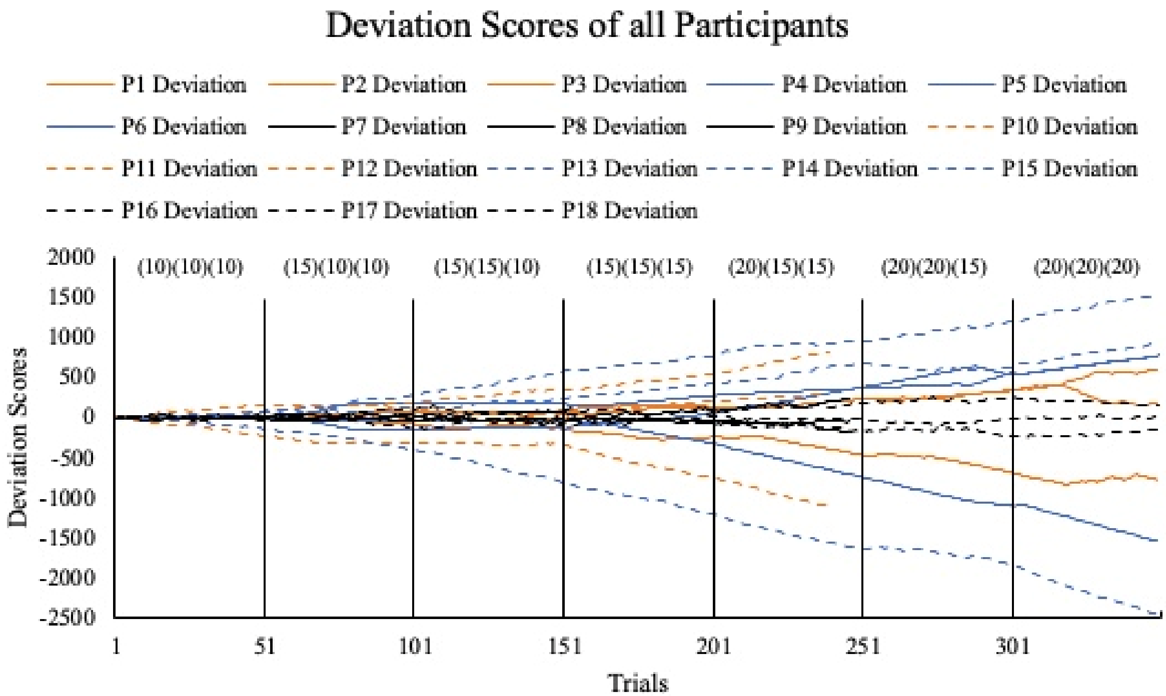
The Total Number of Task Choices by each Participant



Note. The vertical axis depicts the total number of task choices, and the horizontal axis depicts each participant in their respective triad. The black bars represent the independent task, and the white bars represent the giving tasks.

Figure 9

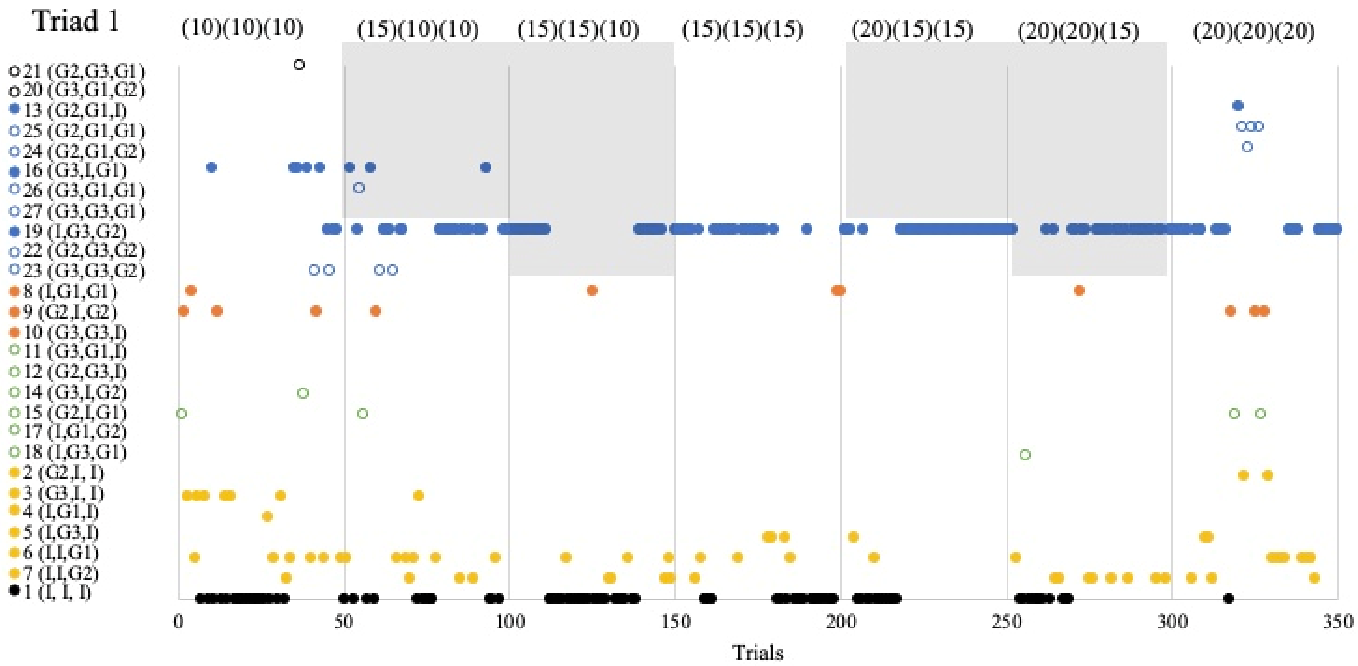
Deviation Scores from Triads' Mean Points for all Participants



Note. Trials are depicted on the x-axis, and the deviation scores are depicted on the y-axis. Deviation scores for each triad are differentiated by color. Triad 1 = solid orange lines. Triad 2 = solid blue lines. Triad 3 = solid black lines. Triad 4 = dashed orange lines. Triad 5 = dashed blue lines. Triad 6 = dashed black lines.

Figure 10

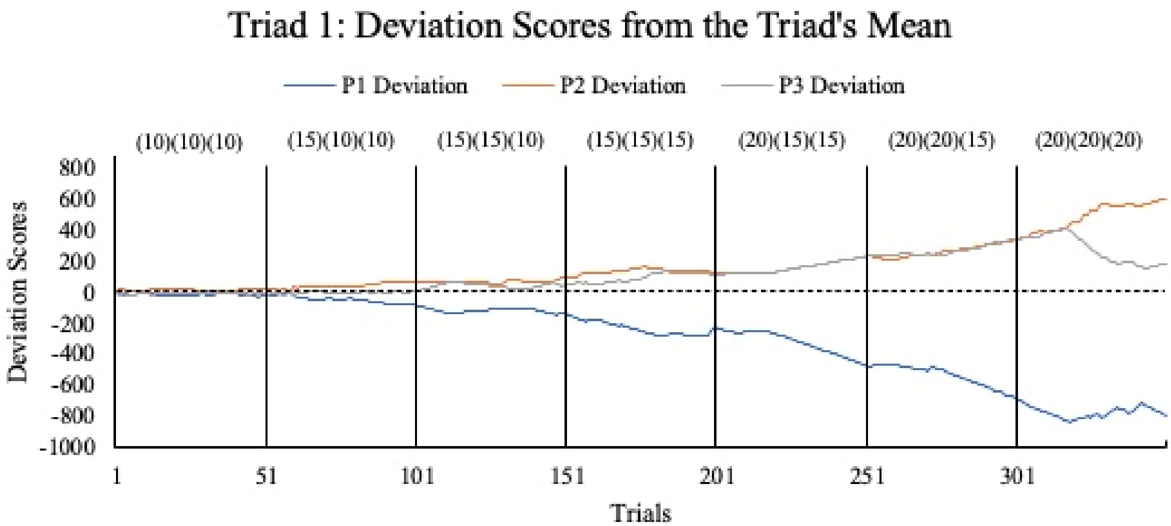
Scatter Plot Depicting the Occurrences of each Combination of Participants' Choices across Trials for Triad 1



Note. The vertical axis depicts the different combinations of participants' choices, and the horizontal axis shows trials. Each participant's choice in each combination is described in the parentheses next to the combination number. For instance, Combination 21 (G2, G3, G1) shows: 1) G2, or give 2, was chosen by P1 (or Position A), 2) G3, or give 3, was chosen by P2 (or Position B), and 3) G1, or give 1, was chosen by P3 (or Position C). The empty black circles represent indirect reciprocations among participants (Combinations 20 and 21). The filled blue circles represent direct reciprocations between two participants while the remaining participants chose the independent task (Combinations 13, 16, and 19). The empty blue circles represent direct reciprocations between two participants while the remaining participant chose the giving tasks (Combinations 22 through 27). The filled orange circles represent choices that maximized one participant's earned points in a trial (Combinations 8 to 10). The empty green circles represent two participants choosing the giving tasks without direct reciprocation occurring between these two participants with the remaining participant choosing the independent task (Combinations 11, 12, 14, 15, 17, and 18). The filled yellow circles represent one participant choosing a giving task and the remaining participants choosing the independent tasks (Combinations 2 through 7). The filled black circle represents all participants choosing the independent task (Combination 1). Experimental conditions are separated by vertical lines and labeled at the top of each condition. Because the point values for the independent tasks were consistent across all conditions (5 points), the condition labels on the figures show only the point values for the giving tasks (e.g., Condition A is labeled as (10)(10)(10)). The shaded areas in each figure show direct reciprocations between two participants and indirect reciprocations among three participants which involved giving an unequal number of points between/among participants.

Figure 11

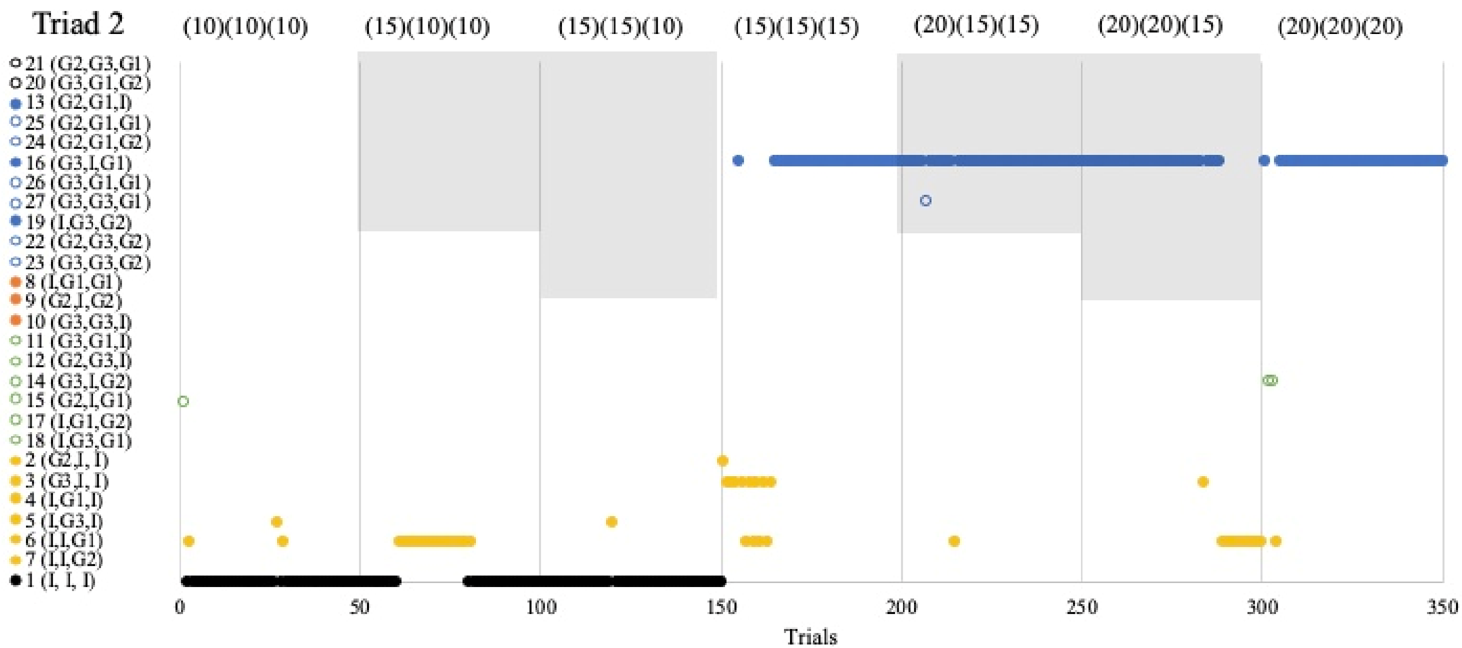
Participant’s Deviation Scores from Triad 1’s Mean Points across Trials



Note. Trials are depicted on the x-axis, and the deviation scores are depicted on the y-axis. The dashed black horizontal line depicts the triad’s mean points and participants’ deviation scores are differentiated by color. Deviation lines above the dashed line indicate that a participant earned points above the triad’s mean and deviation lines below the dashed line indicates that a participant earned points below the triad’s mean.

Figure 12

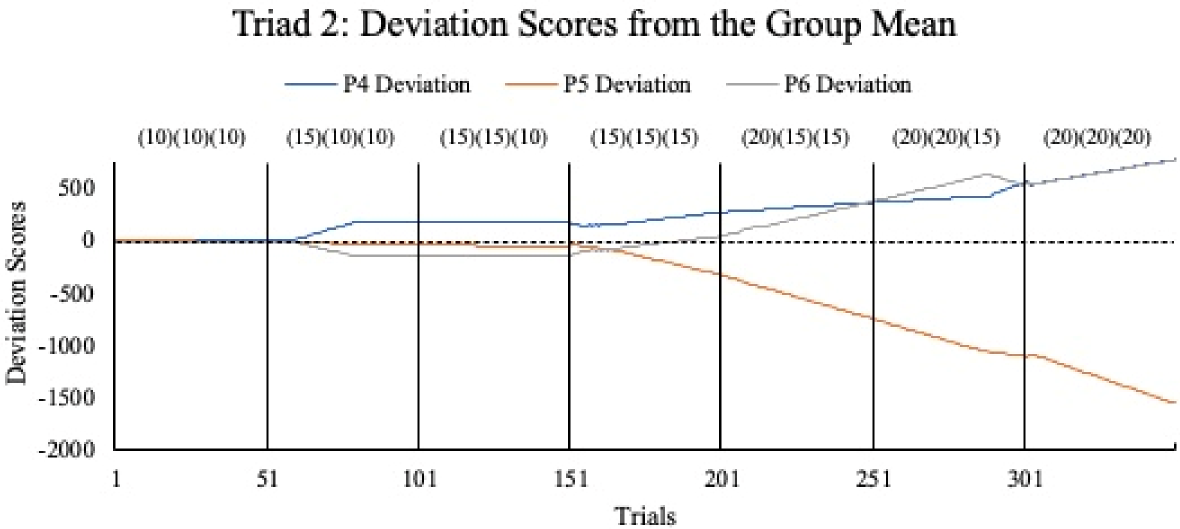
Scatter Plot Depicting the Occurrences of each Combination of Participants' Choices across Trials for Triad 2



Note. The vertical axis depicts the different combinations of participants' choices, and the horizontal axis shows trials. Each participant's choice in each combination is described in the parentheses next to the combination number. For instance, Combination 21 (G2, G3, G1) shows: 1) G2, or give 2, was chosen by P4 (or Position A), 2) G3, or give 3, was chosen by P5 (or Position B), and 3) G1, or give 1, was chosen by P6 (or Position C). The empty black circles represent indirect reciprocations among participants (Combinations 20 and 21). The filled blue circles represent direct reciprocations between two participants while the remaining participants chose the independent task (Combinations 13, 16, and 19). The empty blue circles represent direct reciprocations between two participants while the remaining participant chose the giving tasks (Combinations 22 through 27). The filled orange circles represent choices that maximized one participant's earned points in a trial (Combinations 8 to 10). The empty green circles represent two participants choosing the giving tasks without direct reciprocation occurring between these two participants with the remaining participant choosing the independent task (Combinations 11, 12, 14, 15, 17, and 18). The filled yellow circles represent one participant choosing a giving task and the remaining participants choosing the independent tasks (Combinations 2 through 7). The filled black circle represents all participants choosing the independent task (Combination 1). Experimental conditions are separated by vertical lines and labeled at the top of each condition. Because the point values for the independent tasks were consistent across all conditions (5 points), the condition labels on the figures show only the point values for the giving tasks (e.g., Condition A is labeled as (10)(10)(10)). The shaded areas in each figure show direct reciprocations between two participants and indirect reciprocations among three participants which involved giving an unequal number of points between/among participants.

Figure 13

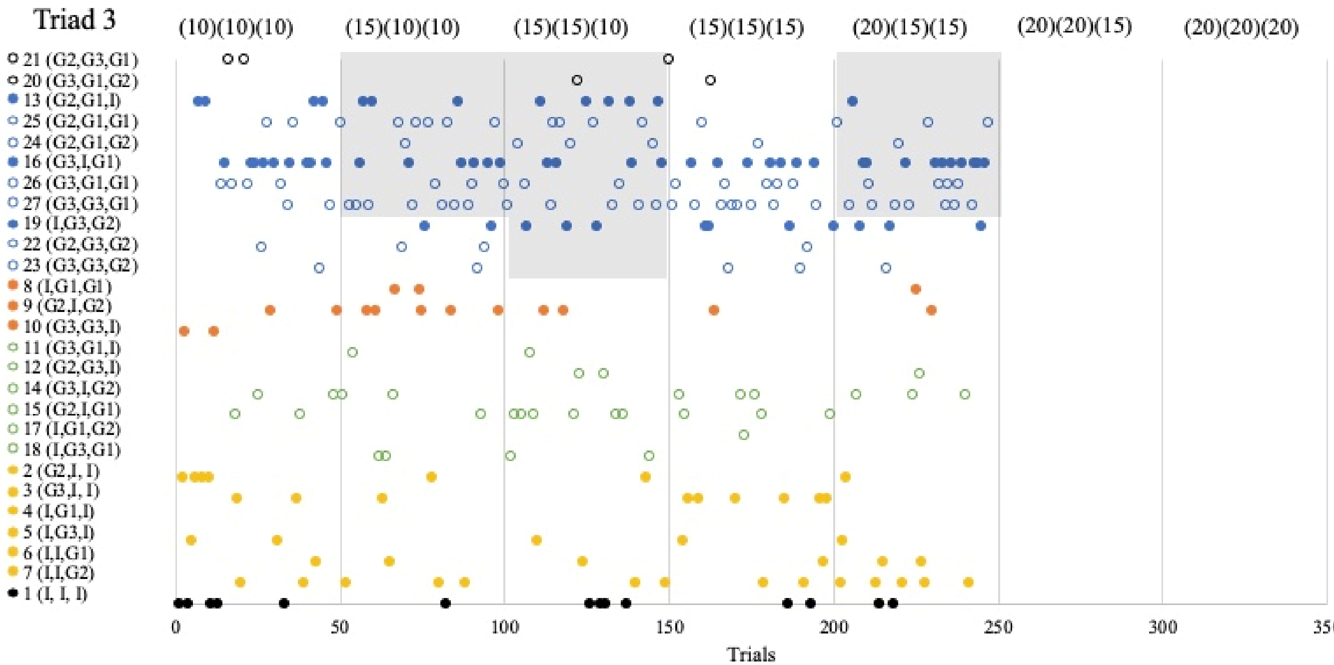
Participant's Deviation Scores from Triad 2's Mean Points across Trials



Note. Trials are depicted on the x-axis, and the deviation scores are depicted on the y-axis. The dashed black horizontal line depicts the triad's mean points and participants' deviation scores are differentiated by color. Deviation lines above the dashed line indicate that a participant earned points above the triad's mean and deviation lines below the dashed line indicates that a participant earned points below the triad's mean.

Figure 14

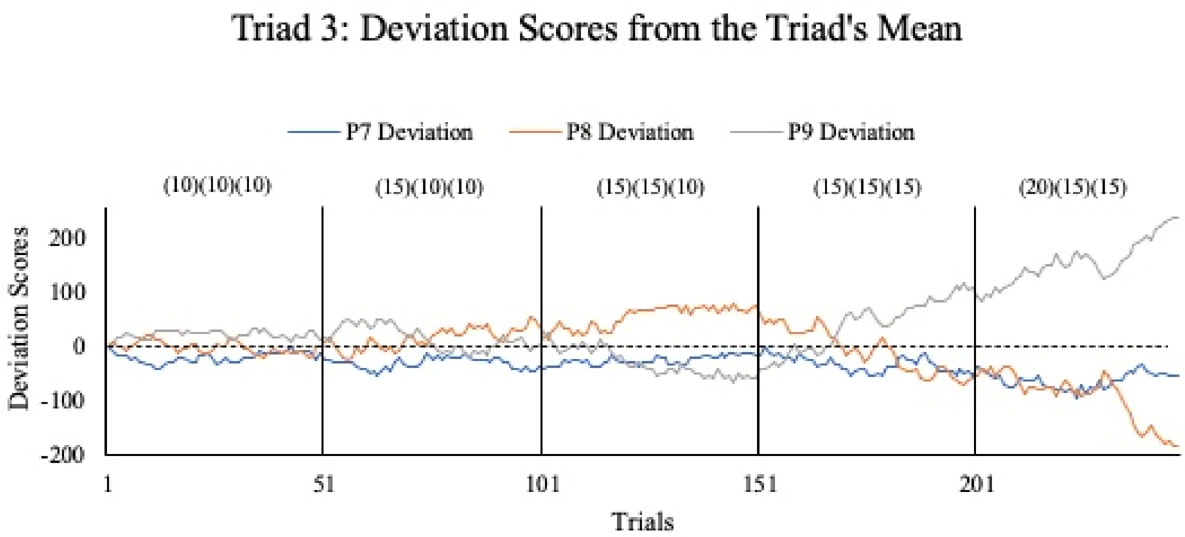
Scatter Plot Depicting the Occurrences of each Combination of Participants' Choices across Trials for Triad 3



Note. The vertical axis depicts the different combinations of participants' choices, and the horizontal axis shows trials. Each participant's choice in each combination is described in the parentheses next to the combination number. For instance, Combination 21 (G2, G3, G1) shows: 1) G2, or give 2, was chosen by P7 (or Position A), 2) G3, or give 3, was chosen by P8 (or Position B), and 3) G1, or give 1, was chosen by P9 (or Position C). The empty black circles represent indirect reciprocations among participants (Combinations 20 and 21). The filled blue circles represent direct reciprocations between two participants while the remaining participants chose the independent task (Combinations 13, 16, and 19). The empty blue circles represent direct reciprocations between two participants while the remaining participant chose the giving tasks (Combinations 22 through 27). The filled orange circles represent choices that maximized one participant's earned points in a trial (Combinations 8 to 10). The empty green circles represent two participants choosing the giving tasks without direct reciprocation occurring between these two participants with the remaining participant choosing the independent task (Combinations 11, 12, 14, 15, 17, and 18). The filled yellow circles represent one participant choosing a giving task and the remaining participants choosing the independent tasks (Combinations 2 through 7). The filled black circle represents all participants choosing the independent task (Combination 1). Experimental conditions are separated by vertical lines and labeled at the top of each condition. Because the point values for the independent tasks were consistent across all conditions (5 points), the condition labels on the figures show only the point values for the giving tasks (e.g., Condition A is labeled as (10)(10)(10)). The shaded areas in each figure show direct reciprocations between two participants and indirect reciprocations among three participants which involved giving an unequal number of points between/among participants.

Figure 15

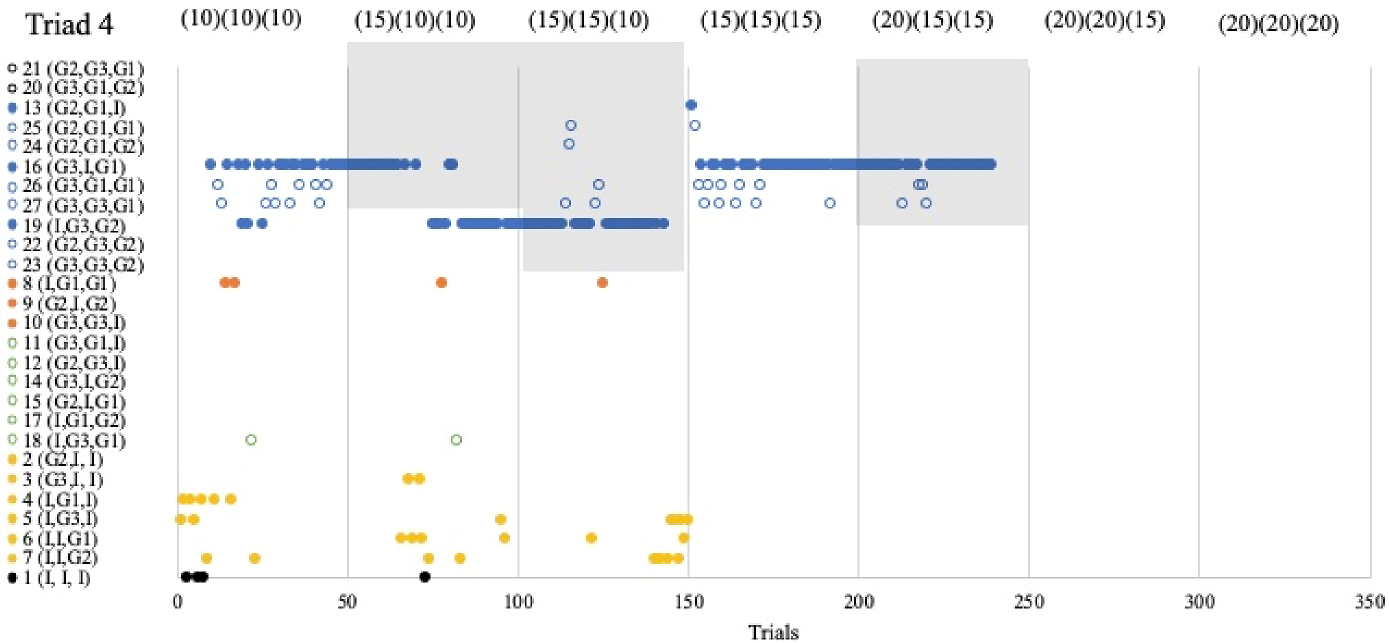
Participant's Deviation Scores from Triad 3's Mean Points across Trials



Note. Trials are depicted on the x-axis, and the deviation scores are depicted on the y-axis. The dashed black horizontal line depicts the triad's mean points and participants' deviation scores are differentiated by color. Deviation lines above the dashed line indicate that a participant earned points above the triad's mean and deviation lines below the dashed line indicates that a participant earned points below the triad's mean.

Figure 16

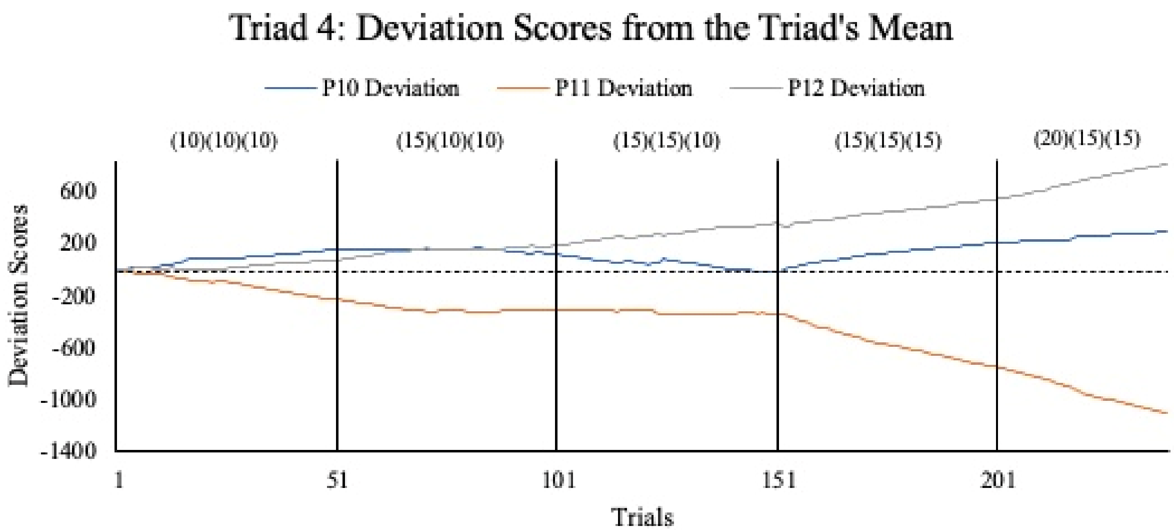
Scatter Plot Depicting the Occurrences of each Combination of Participants' Choices across Trials for Triad 4



Note. The vertical axis depicts the different combinations of participants' choices, and the horizontal axis shows trials. Each participant's choice in each combination is described in the parentheses next to the combination number. For instance, Combination 21 (G2, G3, G1) shows: 1) G2, or give 2, was chosen by P10 (or Position A), 2) G3, or give 3, was chosen by P11 (or Position B), and 3) G1, or give 1, was chosen by P12 (or Position C). The empty black circles represent indirect reciprocations among participants (Combinations 20 and 21). The filled blue circles represent direct reciprocations between two participants while the remaining participants chose the independent task (Combinations 13, 16, and 19). The empty blue circles represent direct reciprocations between two participants while the remaining participant chose the giving tasks (Combinations 22 through 27). The filled orange circles represent choices that maximized one participant's earned points in a trial (Combinations 8 to 10). The empty green circles represent two participants choosing the giving tasks without direct reciprocation occurring between these two participants with the remaining participant choosing the independent task (Combinations 11, 12, 14, 15, 17, and 18). The filled yellow circles represent one participant choosing a giving task and the remaining participants choosing the independent tasks (Combinations 2 through 7). The filled black circle represents all participants choosing the independent task (Combination 1). Experimental conditions are separated by vertical lines and labeled at the top of each condition. Because the point values for the independent tasks were consistent across all conditions (5 points), the condition labels on the figures show only the point values for the giving tasks (e.g., Condition A is labeled as (10)(10)(10)). The shaded areas in each figure show direct reciprocations between two participants and indirect reciprocations among three participants which involved giving an unequal number of points between/among participants.

Figure 17

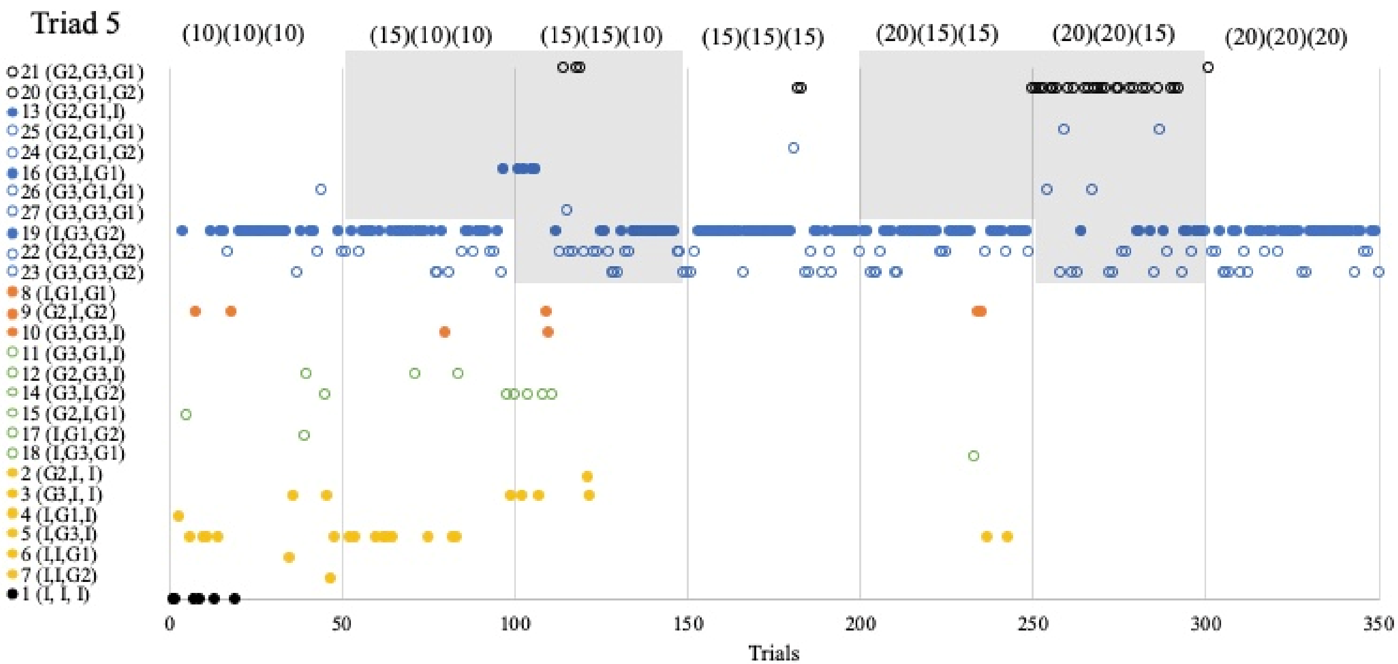
Participant's Deviation Scores from Triad 4's Mean Points across Trials



Note. Trials are depicted on the x-axis, and the deviation scores are depicted on the y-axis. The dashed black horizontal line depicts the triad's mean points and participants' deviation scores are differentiated by color. Deviation lines above the dashed line indicate that a participant earned points above the triad's mean and deviation lines below the dashed line indicates that a participant earned points below the triad's mean.

Figure 18

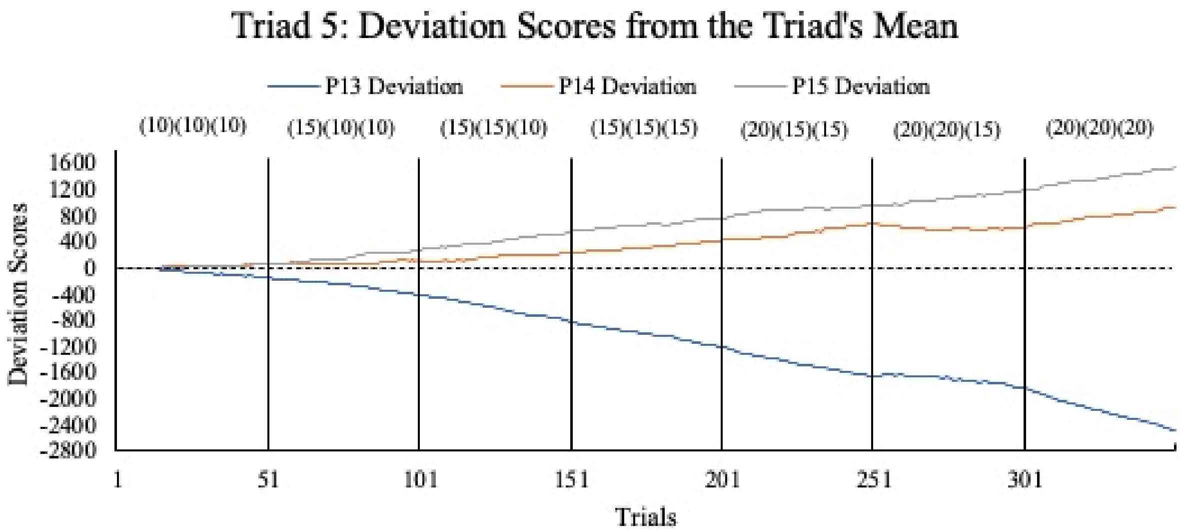
Scatter Plot Depicting the Occurrences of each Combination of Participants' Choices across Trials for Triad 5



Note. The vertical axis depicts the different combinations of participants' choices, and the horizontal axis shows trials. Each participant's choice in each combination is described in the parentheses next to the combination number. For instance, Combination 21 (G2, G3, G1) shows: 1) G2, or give 2, was chosen by P13 (or Position A), 2) G3, or give 3, was chosen by P14 (or Position B), and 3) G1, or give 1, was chosen by P15 (or Position C). The empty black circles represent indirect reciprocations among participants (Combinations 20 and 21). The filled blue circles represent direct reciprocations between two participants while the remaining participants chose the independent task (Combinations 13, 16, and 19). The empty blue circles represent direct reciprocations between two participants while the remaining participant chose the giving tasks (Combinations 22 through 27). The filled orange circles represent choices that maximized one participant's earned points in a trial (Combinations 8 to 10). The empty green circles represent two participants choosing the giving tasks without direct reciprocation occurring between these two participants with the remaining participant choosing the independent task (Combinations 11, 12, 14, 15, 17, and 18). The filled yellow circles represent one participant choosing a giving task and the remaining participants choosing the independent tasks (Combinations 2 through 7). The filled black circle represents all participants choosing the independent task (Combination 1). Experimental conditions are separated by vertical lines and labeled at the top of each condition. Because the point values for the independent tasks were consistent across all conditions (5 points), the condition labels on the figures show only the point values for the giving tasks (e.g., Condition A is labeled as (10)(10)(10)). The shaded areas in each figure show direct reciprocations between two participants and indirect reciprocations among three participants which involved giving an unequal number of points between/among participants.

Figure 19

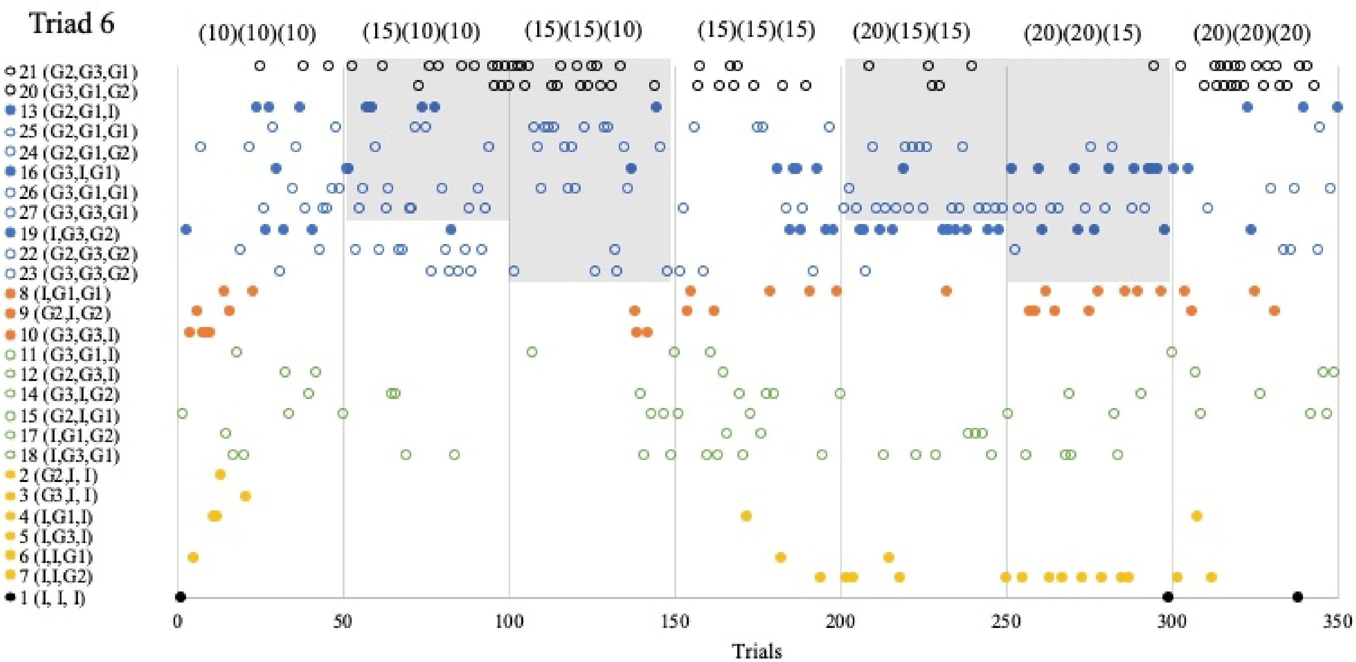
Participant's Deviation Scores from Triad 5's Mean Points across Trials



Note. Trials are depicted on the x-axis, and the deviation scores are depicted on the y-axis. The dashed black horizontal line depicts the triad's mean points and participants' deviation scores are differentiated by color. Deviation lines above the dashed line indicate that a participant earned points above the triad's mean and deviation lines below the dashed line indicates that a participant earned points below the triad's mean.

Figure 20

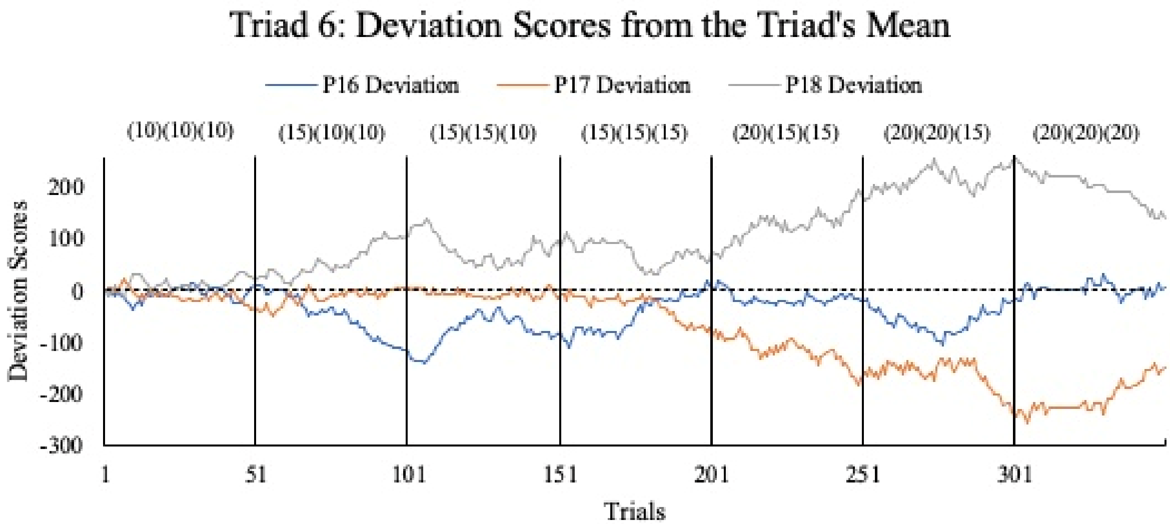
Scatter Plot Depicting the Occurrences of each Combination of Participants' Choices across Trials for Triad 6



Note. The vertical axis depicts the different combinations of participants' choices, and the horizontal axis shows trials. Each participant's choice in each combination is described in the parentheses next to the combination number. For instance, Combination 21 (G2, G3, G1) shows: 1) G2, or give 2, was chosen by P16 (or Position A), 2) G3, or give 3, was chosen by P17 (or Position B), and 3) G1, or give 1, was chosen by P18 (or Position C). The empty black circles represent indirect reciprocations among participants (Combinations 20 and 21). The filled blue circles represent direct reciprocations between two participants while the remaining participants chose the independent task (Combinations 13, 16, and 19). The empty blue circles represent direct reciprocations between two participants while the remaining participant chose the giving tasks (Combinations 22 through 27). The filled orange circles represent choices that maximized one participant's earned points in a trial (Combinations 8 to 10). The empty green circles represent two participants choosing the giving tasks without direct reciprocation occurring between these two participants with the remaining participant choosing the independent task (Combinations 11, 12, 14, 15, 17, and 18). The filled yellow circles represent one participant choosing a giving task and the remaining participants choosing the independent tasks (Combinations 2 through 7). The filled black circle represents all participants choosing the independent task (Combination 1). Experimental conditions are separated by vertical lines and labeled at the top of each condition. Because the point values for the independent tasks were consistent across all conditions (5 points), the condition labels on the figures show only the point values for the giving tasks (e.g., Condition A is labeled as (10)(10)(10)). The shaded areas in each figure show direct reciprocations between two participants and indirect reciprocations among three participants which involved giving an unequal number of points between/among participants.

Figure 21

Participant's Deviation Scores from Triad 6's Mean Points across Trials



Note. Trials are depicted on the x-axis, and the deviation scores are depicted on the y-axis. The dashed black horizontal line depicts the triad's mean points and participants' deviation scores are differentiated by color. Deviation lines above the dashed line indicate that a participant earned points above the triad's mean and deviation lines below the dashed line indicates that a participant earned points below the triad's mean.

APPENDIX A

PARTICIPANT RECRUITMENT FLIER

Volunteers Needed for Research Study on Social Behavior

Have you ever wondered;

How people begin to work together or go separate ways?

How we overcome tough situations as a group?

Why we compete?

If so,

You may be interested in participating in this study!

Purpose:

The purpose of this experiment is to understand how people begin to coordinate their behaviors under different conditions using a simple game.

How long?

The study will take 2 to 3 hours to complete.

Where?

The study will take place online.

Can I participate?

You must be 18 or older

You must have a desktop/laptop computer with internet connection (for a simple online game and Zoom during the experiment)

What's in for me?

You will be compensated for the duration of the study ($5 for every 30 min) and points you earn in the study will be exchanged for money (0.3 cent for 1 point). You will receive an electronic gift card after the end of the experiment.

How can I sign up or ask for more information?

Please contact

Neale Chumbler, Ph.D.

nchumbl1@uthsc.edu

Office: (901)448-3574

or

Kio Kazaoka, MA

kiokazaoka@my.unt.edu

APPENDIX B

CONSENT DISCLOSURE STATEMENT

THE UNIVERSITY OF TENNESSEE HEALTH SCIENCE CENTER.

CONSENT DISCLOSURE STATEMENT

This is a research study entitled: To Form or To Disrupt: The Effects of Varying Magnitudes of Reinforcers in Three-Person Exchange Setting

This research is being conducted by Dr. Neale Chumbler (phone: 901.448.3574, email: Nchumbl1@uthsc.edu) and Dr. Traci Cihon (940.565.3318, email: traci.cihon@unt.edu) and Mr. Kyosuke Kazaoka (email: kiokazaoka@my.unt.edu). If you have questions about this research study, please contact Mr. Kyosuke Kazaoka.

Purpose: The purpose of this study is to understand how and why individuals decide to work alone or work with others when in a small group. The overarching goal of this study is to understand the conditions that facilitate or disrupt collaborative relationships among individuals. To better understand these conditions, you and two other individuals will be asked to play an online game we developed for this study. While playing the game, you will be asked to make a series of choices that will either give yourself points or will give points to the other players. The main goal of the game is for you and the other players to earn as many points as possible. Each point you earn is equivalent to 0.3 cents and points will be exchanged for money at the end of the study. You will also receive $5 for every 30 minutes you participate in this study. You may be able to earn between the range of $20 to $50 for your participation.

This is a pilot study, which means that we are trying out the online game we developed for this study for the first time. Although similar studies have been done in the past, they have used different games and arrangements to investigate how and why individuals decide to work alone or work with others when in a small group.

Procedures: In this study, we will be collecting data on the choices you and the other participants make while playing the game. You will be provided with instructions that describe the rules of the game and it will be up to you and the other participants to decide how you play the game and how you earn points. The game is a trial-based game, meaning that you and the other participants will choose one of three shapes on each trial: a circle, a square, or a triangle. Choosing a circle will produce a certain number of points for yourself. Choosing a square or a triangle will produce a certain number of points for one of the other two participants. After each of you confirm your choices, the game will announce the result of the trial (i.e., how many points each of you earned on that particular trial) and then the next trial will begin. The entire game will last for approximately 2 to 3 hours. After you finish the game, we will explain more about the study, how much money you earned for playing the game, and arrange the details for your payment. This is a one-time study; there will be no follow-up study or discussion.

You will be playing an online game for approximately 2 to 3 hours.

Foreseeable Risks: As a result of your participation in this study, you are at risk for the following:

Minor stressors associated with playing an online game during the study

- You may encounter potential technical issues while playing the online game.

Prepared 08/02/2022

  - Experimenters will work to minimize these issues by providing you with instructions as to how to play the game, monitoring the game throughout the experiment, and compensating you for your time in the event that minor technical issues need to be resolved during the game.

- You may experience frustration or fatigue related to playing an online game with others.
  - Experimenters will try to minimize these stressors and fatigue by offering a short break (5 to 10 minutes) every hour that you are playing the game. You and the other players will also be allowed to ask the experimenter for a break at any time during the game as we will be monitoring the game throughout the time you are playing. If you feel that the minor stressors and fatigue are bothersome, you may withdraw from the study at any time.

The loss of confidentiality

- The loss of confidentiality, even though it would be a rarity, is similar to the risk associated with your everyday use of the internet.
  - Experimenters will minimize the risk of the loss of confidentiality by providing you with an assigned ID for the game and a password to log in to the online game, and your cameras will be turned off to help to protect your identity.
- There is a risk that your private identifiable information may be seen by people not involved in the research (such as if a researcher's computer is stolen or an electronic database is hacked).
  - However, we will use very careful security measures (such as locks on file cabinets, computer passwords, etc.) to minimize the chance that any unauthorized persons might see your confidential information.

Your participation is voluntary and if you choose to not participate or to stop participating at any time, your decision will not result in a penalty or affect your rights or loss of compensation for the time spent in the experiment.

If you are a student of UTHSC, participating or not participating in this study will in no way influence your grade in any course. If you are a resident or fellow of UTHSC, participating or not participating in this study will in no way influence your academic standing. If you are an employee of UTHSC, participating or not participating in this study will not affect your employment status.

Benefits to Society and Research Participants: Although you may enjoy playing the online game with others, it is unclear if you will receive any direct benefits from participating in this study. However, by participating in this novel study, you may learn a little more about yourself, especially regarding when you might choose to work alone or with others. However, your participation in this study will also help us to determine if the online game we developed will help us design future studies in which we can learn more about the conditions that facilitate or disrupt collaborative relationships among individuals; how people solve problems when individuals in a group have different resources and/or different levels of power to influence others' behaviors.

Prepared 08/02/2022

Confidentiality: The online program will track, time stamp, and save you and other participants' choices and cumulative points you and others earned throughout the experiment. These data will be stored in an online server, Heroku, during the study. Heroku is a recognized and reputable server that is widely used for the storage of data. Once the study is over, experimenters will download the data to a password-encrypted external hard drive which will be stored in a locked filing cabinet in Dr. Chumbler's the Principal Investigator) locked office at UTHSC (office 610 in the 930 Madison Ave. building) for a period of 3 years at which point the data will be destroyed. The data will be accessible only to research personnel. The data will not contain any identifiable information.

While generic descriptions of participants might be provided in publications or presentations about this study, such as the age and gender of a participant, participants will not be discussed in a way that would allow you to be individually identified as such.

There are no limits to confidentiality for this study. Meaning that there is no identifiable information collected in the study and the data this study collects are simply the choices you and others make and the points you earned during the game.

Payment for Participation: You will receive $5 for every 30 minutes of your participation. We expect that the study will last approximately 2 to 3 hours. You will also have opportunities to earn points (0.3 cents each point) that will be exchanged for additional compensation at the end of the experiment. The total amount of compensation will vary depending on the number of points that are earned by you during the experiment. At the end of the experiment, experimenters will calculate the total amount of monetary compensation and you will receive a gift card with the value of the total compensation amount.

If you are a backup participant, and end up not participating in the experiment, you will be compensated $1 in addition to their compensation for the time you waited to learn if you would join the experimental session and/or in addition to the compensation earned for your actual participation.

Questions: You may contact Cameron Barclay, MSA, UTHSC IRB Director, at 901-448-4824, or visit the IRB website at http://www.uthsc.edu/research/compliance/irb/ if you have any questions about your rights as a research subject, or if you have questions, concerns, or complaints about the research.

Prepared 08/02/2022

Thank you for your interest in the research study entitled: To Form or To Disrupt: The Effects of Varying Magnitudes of Reinforcers in Three-Person Exchange Setting.

Before you can sign up for the experiment, please confirm that you:

1. Are over the age of 18,
2. You have a desktop/laptop computer,
3. You have an internet connection

Once you have confirmed the above details, we will reach out to you to identify dates and time that you are available to participate in the study.

We have also attached a 'Consent Disclosure Statement' for you review.

Kind regards,

Kyosuke

APPENDIX C

GENERAL INSTRUCTIONS FOR THE GAME DISPLAYED ON SCREENS

This is a trial-based game with three players. Here is how to play this online game. Everybody will choose one of the three shapes shown at the bottom of the game screen. Each of you will click a shape, then click the "submit" button located just below. A pop-up window will ask to confirm the choice. Clicking "ok" on the pop-up window will finalize your choice and you will not be able to change your choices until the next trial. Clicking "cancel" on the pop-up window will let you change your choice. Each shape is programmed for a certain person to receive points. Meaning you can give points to yourself or one of the other players. Once everybody decides on their choices, the game will let you know the result of the trial, and the next trial will immediately begin. Each point you earn during the game is worth 0.3 cents. At the end of the game, each player's total points earned during the game will be exchanged for money.

Your seat number is on the left side of your game screen and your total points are at the top of the game screen. If your seat number is 1, your points are under P1. If your seat number is 2, your points are under P2. If your seat number is 3, your points are under P3. If you experience any technical issues during the game, like your screen freezing and not being able to click anything on your screen during the game, please let me know by chatting on Zoom. Please DO NOT refresh the game screen when you have any issues with the game. Once the game starts, new instructions will replace this instruction.

APPENDIX D

A SCRIPT FOR GENERAL INSTRUCTION

Thank you for participating in this study. The purpose of this experiment is to understand how people coordinate their behaviors under different conditions using a simple game. This study consists of playing a trial-based game with three players and takes about 3 hours to complete.

This is not psychological testing. This is just a game that involves you giving points to yourself or others.

Here is how to play this online game. Everybody will choose one of the three shapes shown at the bottom of the game screen. Each of you will click a shape, then click the "submit" button located just below. A pop-up window will ask to confirm the choice. Clicking "ok" on the pop-up window will finalize your choice and you will not be able to change your choices until the next trial. Clicking "cancel" on the pop-up window will let you change your choice.
Each shape is programmed for a certain person to receive points. Meaning you can give points to yourself or one of the other players.

Once everybody decides on their choices, the game will let you know the result of the trial, and the next trial will immediately begin.

Each point you earn during the game is worth 0.3 cents. At the end of the game, each player's total points earned during the game will be exchanged for money.

Your seat number is on the left side of your game screen and your total points are at the top of the game screen. If your seat number is 1, your points are under P1. If your seat number is 2, your points are under P2. If your seat number is 3, your points are under P3.

After the game is done, I will talk to you individually about the experiment and ask a few questions, and we will talk about how much money you earned for your participation.

If you experience any technical issues during the game, like your screen freezing and not being able to click anything on your screen during the game, please let me know by chatting on Zoom. Please DO NOT refresh the game screen when you have any issues with the game.

If there are any questions about how to play the game or about this study, please ask now as I will not be able to answer any questions about the game or the study during the game. If there are no questions, I will start the game. Once the game starts, you will see a new instruction on the left of your screen. Good luck!

APPENDIX E

INSTRUCTIONS DISPLAYED ON SCREEN DURING THE GAME

Choosing the circle gives you 5 points.

Choosing the square gives 10 points to Player 2.

Choosing the triangle gives 10 points to Player 3.

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