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Sensitivity to cooperative and noncooperative contingencies: An experimental analysis of persistent rule-governed behavior

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by

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Abstract

Persistent rule governed behavior can be described as behavior that has come under the control of a particular rule, compromising contact with other contingencies in the environment. Researchers have looked at several factors that moderate insensitivity to programmed reinforcement, yet among these researchers, there are discrepancies related to the strength and direction these variables have in moderating rule following. This dissertation study used the modified Implicit Relational Assessment Procedure (MD IRAP) to identify specific groups of individuals who were more likely to persist in rule following. Additionally, an experimental history of coherent rule following was built for each participant to demonstrate the effect coherent trials have on persistent rule following. Participants were identified as "high conformity" or "low conformity" based on D-IRAP scores and subsequently presented with two concurrent schedules of reinforcement in a simulated medical data entry task with a contrived partner. Motivational statements to cooperate with a partner, and neutral statements were both paired with reinforcement and extinction conditions in an alternating treatment design to measure cooperative responses. Results showed that coherent trials may make persistent rule following more likely for all participants. More specifically, higher number of participants in the high conformity group persisted in rule following in the neutral statement extinction condition than participants in the low conformity group. The implications of these findings are discussed as they contribute to the literature on persistent rule following and the predictive validity of the MD IRAP.

Dedication

Dedicated always and with boundless love to Chris, Margaret, and Benjamin.

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Table of Contents

List of Tables

List of Figures

Introduction

Rule-governed behavior (RGB), also known as instructional control, allows humans to behave appropriately in certain contexts without having to come into contact with the direct consequences of a particular behavior. Contingency-shaped behavior, on the other hand, is behavior under the influence of direct interaction with environmental stimuli and consequences (Monestés et al., 2017). Skinner (1966) defined RGB as a stimulus or stimuli that specify reinforcement contingencies. Skinner's 1966 definition was in the context of problem solving: behaving appropriately in a given situation while avoiding direct contact with contingencies. Among others, the consequences that are identified in a rule can be entirely abstract (e.g. "Be a good Christian and you will go to heaven"), allow you to avoid dangerous situations (e.g. "Don't touch a hot stove or you will get burned"), increase self-control behaviors (e.g. "If I save now, I will have the down payment later") or help to identify schedules of reinforcement (e.g. instructions related to a DRL). One of the main advantages of RGB is that the stimuli specified in a rule can generalize to similar contexts (e.g., "Stop at the red light") or a rule can be so generic that it can be applied in the absence of any contextual control (e.g., "Live by the Golden Rule"). Skinner's 1966 definition of rules as discriminative stimuli, however, is a problematic explanation. It does not account for exactly what in the rule is the discriminative stimulus, if the elements of a rule have no history of reinforcement, and instances when RGB generalizes to a context that does not share any topographical properties with the previous context (Monestés et al., 2017; Törneke et al., 2008).

Relational Frame Theory (RFT) provides an explanation of RGB that helps to account for these problems. A basic explanation of RFT is beyond the scope of this paper (see Hayes et al., 2001; Hughes et al., 2016) but highlighting some of the key elements of RFT as it relates to RGB is warranted. Arbitrarily applicable relational responding (AARR, referred to as relating or relational responding for the remainder of the paper) helps to explain the conditions under which rules specify contingencies based on non-physical relations among stimuli and the transformation of those stimuli functions (Monestés et al., 2017; Harte et al., 2018; Harte et al., 2020). O'Hora et al. (2014) demonstrated that derived relational responding can occur in the absence of a direct history of reinforcement, and thus provided a potential model of one of the defining features of rule-governed behavior (i.e., it allows for problem solving in the absence of direct

contingency control). Furthermore, establishing a history of derived relational responding in experimental settings has been a technical model to investigate RGB in the absence of direct contingency control (Harte et al., 2018; O'Hora et al., 2004; O'Hora et al., 2014). Relating incudes three main components: mutual entailment (e.g., if A=B, this entails B=A) combinatorial entailment (e.g., if A=B and B=C, this entails A=C) and transformation of function (e.g., if A is positive, and A=C, then C is positive). In the above example of transformation of function, C acquired the *same* stimulus functions as A, which is referred to as a frame of coordination. Other relational frames include, but are not limited to, opposition, distinction, spatial, comparison, and hierarchical (Hughes et al., 2016; Törneke, et al., 2018). Relating stimuli based on contextual cues (i.e., same as, opposite of, closer than, etc.) is learned though a history of multiple exemplars such that relations can be abstracted and arbitrarily applied to new stimuli in the absence of any direct learning history or formal similarity. Given the arbitrary nature of relational responding, any stimulus can be related to a rule which then sets the occasion for RGB. For example, being told that mail-in voting is wrought with issues places voting generally, and perhaps the United States Postal Service specifically, in a frame of coordination with incompetence. In this case, voting has now acquired stimulus functions that it did not have before hearing the statement, "Mail-in voting is rigged." What results: a rule is derived that voting by mail is fraudulent; and behaviors related to that rule may include avoiding voting altogether, or even denying the results of an election. This may set the occasion for a group of individuals that share this similar relational repertoire to engage in behaviors that have much larger socio-cultural consequences, like participating in an insurrection.

Persistent Rule Following

Aside from the previous example, deriving rules can be advantageous in many situations. However, strict adherence to rules can come at a cost. Rules related to adaptive behavior in a previous environment can be maladaptive in a new context. The probability of an individual following a rule can: increase when the rule is explicitly stated prior to a task; decrease or even be eliminated when steps are taken to minimize their impact on subsequent performance; and set the occasion for people to be insensitive to the subsequent changes in the environment (Hayes et al.,1986; Hayes et al.,1986). In other words, when behavior comes under control of a particular rule, contact with other contingencies in the environment can

often be compromised. Several researchers have looked at persistent rule following in experimental settings and have found that RGB can be associated with an insensitivity to scheduled reinforcement contingencies (Baruch et al., 2007; Harte et al., 2017; Harte et al., 2018; Hart et al., 2020; Kissi et al., 2018; McAuliffe et al., 2014; Monestés et al., 2017, O'Conner et al., 2019, Wulfert et al., 1994). Kissi et al. (2018) refers to strict adherence to rules and insensitivity to programmed reinforcement as the "insensitivity effect (IE)" (p. 431). Insensitivity to contingencies and persistent rule following, however, should not be taken to represent the same phenomenon. It is important to note that instances of persistent rule following can be described in two ways: when a person fails to discriminate changes in contingencies (IE) and when a person continues to follow a rule even when changes to contingencies have been contacted (persistent rule following, PRF).

Most research on persistent rule following deals with the former, instructional control and insensitivity to changing contingencies. Experimental procedures vary across researchers, but what follows is the basic structure: a participant is given instructions to respond to a particular programmed schedule of reinforcement (e.g., DRL) during a task, like match to sample. After a pre-determined number of trials, an un-signaled change to the schedule of reinforcement is employed (e.g., from a DRL to a VR20). Studies consistently find that some participants continue to respond in accordance with the original instructions (e.g., low rates of behavior) rather than adjust their responding to contact reinforcement. Wulfert et al.'s (1994) study on insensitivity to operant contingencies found a correlation between scores on a self-report rule rigidity scale and sensitivity to contingencies in an experimental setting. Those participants who scored high on the rigidity scale were more likely to persist in inaccurate instructions when the contingencies of reinforcement were modified. Those who scored lower on the rigidity scale were more likely to abandon the inaccurate rules and respond appropriately to the programmed contingency. However, when the rules accurately reflected the reinforcement contingencies, rigidity was not a predictor of rule following. Other studies show that when participants modify their behavior and contact programmed contingencies, participants most often maintain responding based on the contingencies rather than switch back to responding that is relevant to the (now inaccurate) rule. These findings would suggest that participants are initially responding based on a history of rule following rather than to the direct contingency. However, it is not simply the introduction of instructions that influences persistent rule following. Researchers have

looked at several factors that moderate insensitivity to programmed reinforcement. Some of these factors include accuracy of rules (Hojo, 2002), authority of rule-giver (Baruch et al., 2007), physical presence or absence of rule-giver (Kroger-Costa et al., 2012), history of rule following (Baruch et al., 2007), source of the rule (i.e., plys vs. tracks, Baruch et al., 2007; Kissi et al., 2018; McAuliffe et al., 2014), programmed reinforcement (Ghezzi et al., 2020; Kissi et al., 2018; McAuliffe et al., 2014), individualized rules (Ghezzi et al., 2020), level of derivation of rule (Harte et al., 2017; Harte et al., 2018), level of sensitivity to social consequences (O'Conner et al., 2019) and presence of psychopathology (Baruch et al., 2007; McAuliffe et al., 2014; Rosenfarb et al.,1993). Yet among these researchers and studies, there are discrepancies related to the strength and direction that some of these variables have in moderating rule following.

McAuliffe and colleagues (2014) found that high dysphoric participants were more likely to persist in rule following rather than low dysphoric participants, whereas Baruch et al. (2007) and Rosenfarb et al. (1993) found that high dysphoric participants were *more* sensitive to changing contingencies compared to their low dysphoric counterparts. Also, when looking at the source of the rule, some researchers (Kissi et al., 2018; McAuliffe et al., 2014) reported that plys (instructions that were made public to the researcher) were more likely to maintain persistent rule following than tracks (instructions that were read silently). However, Baruch et al. (2007) found no difference between plys and tracks. Individual history of participants has also been subject to discussion. College students, a demographic readily available to most academic researchers, has been regarded as non-compliant and therefore less likely to follow rules (Baruch et al., 2007). However, college students have also been discussed as having an extensive history of rule-following and therefore more likely to persist in rule following (Kissi et al., 2018). Discrepancies in the data across researchers have also been discussed in the context of reinforcer selection (i.e., money vs. tokens), authority of rule-giver (i.e., priest vs. graduate assistant) and number of trials before changing contingencies (i.e., 10 trials vs. 100 trials). In all of these studies, it seems clear that persistent rule following very much so depends on context. Basic analog studies, though extremely important to an experimental analysis of persistent rule following, may not account for extremely complex relational repertoires in participants.

Persistent rule following based on a complex history of relational responding may best be analyzed through RFT and more specifically the dimensions of relating. Recently, researchers have refined the conceptual framework of relating by breaking it down to dimensions and levels, referred to as the hyper dimensional, multi-level (HDML) model (Barnes-Holmes et al., 2017; Barnes-Holmes et al., 2020). The four dimensions of relating are coherence, complexity, derivation, and flexibility (Barnes-Holmes et al., 2017). All four dimensions are relevant to a discussion of persistent rule following and/or IE.

Four Dimensions of Relating

Coherence refers to "when all of the elements in a derived relation are related in a manner that is consistent with what was previously learned" (Hughes et al., 2016, p. 163). For example, if A is positive and A=B and B=C, then C should acquire the same functional properties of A (i.e., C is positive). This relationship would be considered coherent if it continues to be reinforced by the verbal community. In the case of rule following, coherence could refer to the relationship between instructions (e.g., DRL) and the programmed contingencies (e.g., reinforced for low rates of behavior). To highlight further, consider that a person has been reinforced in the past for behaving in accordance with the rule, "I like to please people" or more simply "I follow the rules" in certain contexts. As long as this rule and the behaviors associated with it (i.e., doing as people tell you) continue to be reinforced by the verbal community, the rule is coherent. Assuming the person is reinforced for behaving in accordance with the rule across many settings and situations (multiple exemplars), the rule will continue to be abstracted and applied to stimuli, and the person may derive the rule, "I am a people pleaser." Persistent rule following has been shown to be more likely when there has been a longer history of coherence between the rule and the way reinforcement contingencies are arranged (e.g., 10 coherent trials versus 100 coherent trials; Harte et al., 2017). In other words, if an individual has a long history of being reinforced for being a "people pleaser" than it will be harder for that person to modify their behavior even when responding to a rule is either no longer reinforced or perhaps even punished. It is important to note that the derived rule, "I am a people pleaser" and the contexts under which that rule is derived may not have anything to do with direct contingencies of reinforcement for behaving with respect to some rule (i.e., the "rule" could have endless consequences) but rather instances of socially mediated reinforcement of being a "people pleaser" or "rule follower."

Relational responding is considered complex when the relations are more intricate or dense. A simple relation may involve a limited number of stimuli wherein not only the relations are few (mutual entailment) but the functions that are being transformed are also limited. A more complex relationship, for example, involves relating entire relational networks to other networks and stimulus functions being modified as a result (Hughes et al., 2016). Relational complexity may be more relevant to "real life" situations of rigid rule following when relational responding is more complex and involves networks rather than analog relations trained in the lab. Using the previous example of self-generated rules, a person may see a message that reads, "Cooperation is highly valued" and based on their history of deriving the rule, "I am a people pleaser" will behave cooperatively. This is an example of a mutually entailed relation of coordination with a single function being transformed. The relationship would increase in complexity if it involved combinatorially (or mutually) entailing relations among entire networks and as a result modify a range of stimulus functions.

Derivation refers to a person's history with a set of relations between stimuli. When a person is initially trained or comes into contact with a relation between stimuli (e.g., A=B and B=C, *then* A=C), derivation is considered high as it is the first instance of the person deriving A=C. Accordingly, any transfer of stimulus function associated with the relation between stimuli will also initially be high in derivation. The more opportunities to encounter the relationship between stimuli, the less novel the relationship becomes and therefore continues to decrease in level of derivation. The initial presentation of a message like, "Cooperation is highly valued" followed by a response that is reinforced may be low in derivation if "following rules" or "I am a people pleaser" is already in your repertoire. However, in a basic study, a person may be trained relations among stimuli that includes nonsense words (e.g., rew=tok and tok=zab, *then* rew=zab). In this case derivation would be high. Derivation continues to "drop" after repeated presentations of the relation and correct responses continue to be reinforced (i.e., coherence). Research has shown that relational responses that are high in derivation are less likely to maintain persistent rule following versus relations among stimuli that are low in derivation. Harte and colleagues (2017) showed that direct rules (presumed to be low in derivation) maintained persistent rule following more so than derived rules (presumed to be high in derivation). Or in other words, "we may 'give up' on a

rule more readily…if the rule requires some recent derivation in terms of understanding its meaning" (Harte et al., 2017, p. 758). Therefore, a person who considers themselves to be a rule follower (low derivation) may be less likely to give up on the rule, "Cooperation is highly valued" when the relevant behavior no longer produces some programmed or direct reinforcement than someone who does not consider themselves to be a rule follower (high derivation).

Lastly, relational flexibility refers to the ability to modify relational responding based on current contextual variables. For example, the established relationship between stimuli (A=B, B=C, *then* A=C) and the ability to alter those relationships in a given context (A=B, but now B>C, *then* A> C) and behave accordingly shows the flexibility of relating. The person said to have a long history (low derivation) with the rule "I like to follow the rules and please people" and having been reinforced for behaving accordingly (coherence) may have a hard time modifying their behavior when presented with a neutral rule like, "Your participation is valued" that is associated with new programmed contingencies. If the person continues to behave with respect to the previous rule rather than modify their responding based on the current contextual factors would be regarded as responding inflexibly. This example highlights how the four dimensions of AARR are interactive and modified based on the current context under which they are analyzed such that "complex patterns of AARRing…may produce changes in one or more properties of AARRing" (Barnes-Holmes et al., 2017, p. 438). For a visual depiction of the four dimensions of AARR as they relate to persistent rule following, see Table 1.

The complex nature of relational responding and its sensitivity to contextual factors makes identifying the conditions under which a person engages in persistent rule following difficult. "[Relating relational networks] is presumably a set of functional relations that occur on a relatively regular basis in real life…there might be a way to design research that taps into those complex repertoires, perhaps depending on some or many previously established functions" (Barnes-Homes et al., 2017 p. 440). By using the four dimensions of AARR along with assessment tools like the Implicit Relational Assessment Procedure (IRAP), we can attempt to predict patterns of persistent rule following based on a history of relational responding with certain stimuli. Coherent relational responding depends on reinforcement from the verbal community; therefore, a social context is relevant to a discussion of persistent rule following. By

using cooperative and noncooperative contingencies with a "partner," the current study attempted to create a specific social context that set the occasion for persistent rule following. Given that cooperative contingencies were manipulated to analyze persistent rule following, a discussion related to cooperation is warranted.

Cooperative Contingencies and Rule-Governed Behavior

Cooperation, as a social behavior, is behavior that achieves a shared outcome (between two or more individuals) that is not achievable by one individual behaving alone (Guerin, 1994; Hake & Vukelich, 1972; Keller & Schoenfeld, 1950; Schmitt, 1984; Skinner, 1953; Skinner, 1974). A more recent analysis of cooperative behavior by Cariveau et al. (2020) states that in order for the inter-locked behaviors of two or more individuals to be considered a cooperative contingency there must be goal-directed behavior and rewards for all individuals. These two elements, Cariveau et al. (2020) argues, must be clarified within a cooperative contingency. For example, the rule "If you fix my error, then I will fix your error; and we will both make money." In this case, the goal directed behavior is defined (i.e., fix my error) and reinforcement is distributed among individuals (i.e., we make money). From an RFT perspective behavior is, "under the control of the apparent correspondence between the rule and the way the world is arranged," or the behavior that is specified in the rule produces the consequence that was also specified in the rule (see discussion on tracking, Hayes et al., 2001, p. 109). One procedure used to assess cooperative responding that fits within the definition of cooperation is a "forced response-sharing procedure" (Cariveau, 2020, p. 118). Also referred to as coordinated response arrangements, this experimental procedure usually operates on a single schedule of reinforcement or concurrent schedules of reinforcement wherein all participants must engage in some behavior to produce reinforcement for all participants. For the purposes of this study, we will refer to this type of cooperative contingency as a reciprocal cooperative contingency. Other researchers have arranged procedures where reinforcement was dependent on a partner producing reinforcement for the other partner. Called a dependent cooperative contingency (Cariveau et al., 2020), exchange responding (Schmitt, 1984), and fate control (Kelley & Thibaut, 1978), problems with this arrangement include participants "free riding" by receiving reinforcement and producing none for their partner and "worker" participants who produce reinforcement for their partner but never receive

reinforcement in return. What results is one participant behaving "cooperatively" provides reinforcement for their partner without reciprocation: an inequitable contingency. Therefore, the dependent cooperative contingency would not be considered a true cooperative contingency because it lacks the critical features of a cooperative contingency (Cariveau et al., 2020). This dissertation project utilized both a reciprocal cooperative contingency and dependent cooperative contingency to assess levels of persistent rule following.

Manipulating reinforcement magnitude and rates between participants in reciprocal cooperative contingencies has shown that inequity between partners greatly decreases cooperation (Lindsley, 1966; Schmitt & Marwell, 1972, Shimoff & Matthews, 1975). Schmitt and Marwell (1972) found that when participants were presented with concurrent schedules of reinforcement, the majority of participants allocated more time to individual responding as the size of inequity for cooperating increased. In a similar study, Shimoff and Matthews (1975) showed that inequitable reinforcement decreased cooperative responding for three of four participants. Interestingly, one participant persisted in cooperative responding across all conditions regardless of inequity. Given our discussion on persistent rule following, a participant may continue to respond cooperatively in the presence of an inequitable cooperative contingency based on a history of being a "people pleaser" or "rule follower" (low derivation) and previous trials where cooperative responses were reinforced equally (coherence). We may call their response a "cooperative" response, however the contingency is no longer cooperative. Further, feedback in these studies is a critical feature as it allows participants to discriminate conditions with unequal distribution of reinforcers, so persistent rule following in these instances is not simply an insensitivity to contingencies.

Distinction Between Cooperation and Conformity

Like in a dependent cooperative contingency or an inequitable reciprocal cooperative contingency, when an individual continues to behave "cooperatively" they may persist in following a particular rule based on a general sensitivity to consequences provide by others (perceived or real) and disregard the direct outcome or consequence of behavior. As discussed above, this behavior does not fit the description of cooperation. Ghezzi et al. (2020) referred to behavior that comes under the control of a particular social influence that may be entirely abstract, verbally constructed, and/or socially mediated as conformity.

Cooperation is achieved by some shared outcome not achievable by one individual behaving alone (Guerin, 1994; Hake & Vukelich, 1972; Keller & Schoenfeld, 1950; Schmitt, 1984; Skinner, 1953; Skinner, 1974) whereas instances of conformity lack a clearly shared outcome between two or more individuals behaving and in some cases no outcome for the individual "cooperating." A potential outcome of conformity includes a general sensitivity to consequences provided by others (perceived or real) and insensitivity to the direct outcome or consequences of behavior, or what some behavior analysts have referred to as generalized pliance (O'Conner et al., 2019; Ruiz et al., 2019; Törneke et al., 2008). Cooperative behavior is associated with variation in individual responding to produce a shared outcome. Therefore, cooperative behavior is more susceptible to flexible rule following, sensitivity to changing contingencies, and the factors involved to produce commensurate consequences. Conformity behavior is more susceptible to rigid rule following given an individual's history of responding under the control of socially mediated consequences (i.e., being reinforced for "doing what you're told") that may lead to maladaptive persistent rule following (Ghezzi et al., 2020).

Implicit Relational Assessment Procedure (IRAP) and Rule-Governed Behavior

As mentioned previously, assessment procedures like the IRAP may help researchers predict those participants who may engage in persistent rule following in specific contexts. The IRAP is an empirically validated assessment tool that measures the latency and consistency of participant's responses to a given set of stimuli presented on a computer screen (Barnes-Holmes et al., 2008). Participants who respond more consistently and quickly to sets of stimuli in the IRAP are assumed to be relationally responding based on a history with those same stimuli in the environment over multiple exemplars. Previous work using the IRAP captures the implicit attitudes of participants and the predictive utility of those results in relevant experimental settings (Barnes-Holmes et al., 2010; Candido, 2013; Cullen et al., 2009; Drake et al., 2010; Ghezzi et al., 2020; Jackson et al., 2016; Ju & Hayes, 2008; McKenna et al., 2007; Murphy et al., 2014; Rafacz et al., 2019). Specifically, the IRAP has been helpful in identifying an individual's history with cooperative and conformity stimuli that predicts the likelihood those stimuli will transform the function of ineffective rules in dependent cooperative contingency conditions (i.e., rules associated with inequitable cooperative contingencies, Rafacz et al., 2019; Ghezzi et al., 2020).

Rafacz et al. (2019) looked at cooperative behavior in a concurrent schedule of reinforcement preparation to analyze the impact of motivational statements (rules) on cooperative behavior. Participants were asked to complete medical data entry records to potentially earn money for correct records processed. The participant always had the choice to "work alone" and complete the medical data entry record on their own or choose to "fix partner errors" where the screen had errors that the participant had to fix before submitting. In this case, "fix partner errors" was considered the cooperative response. In all conditions and for each trial within a condition, participants could choose to work cooperatively with a dependent cooperative contingency (extinction, "fix partner errors") or choose to work independently (FR1, "work alone"). Rafacz et al. found that in conditions when participants were presented with motivational statements to cooperate (e.g., "Collaboration is highly valued") they were more likely to select the option to "fix partner errors," at least initially, when the motivational statement included cooperative stimuli. Moreover, participants were even more likely to select "fix partner errors" when the cooperative stimulus in the motivational statement was identified as having a strong history of reinforcement for that participant (e.g., the stimulus "collaborate"), as identified in the IRAP. However, once participants came into contact with the extinction consequence, most participants switched over to the schedule of reinforcement to work alone and make money, even in the presence of the cooperative motivational statement. These findings align with previous work in persistent rule following as participants, once contacting the programmed contingencies, switched to responding that produced reinforcement rather than continue to follow an inaccurate rule. In conditions when motivational statements were neutral (e.g., "Paying attention is highly valued") and the dependent cooperative contingency was operating, the majority of participants exclusively chose to work alone for direct and immediate reinforcement (FR1). This study showed that motivational statements, or rules, augment the reinforcing function to persist in maladaptive rule following, at least temporarily. Moreover, the temporary transformation of function of ineffective rules became more likely when the researchers included stimuli based on a person's history of relational responding (i.e., results from an IRAP). Or put another way, the more "tailored" the rule to the individual, the more likely the rule transformed the reinforcing function of a particular behavior (i.e., verbal motivating operation/motivative augmental).

In a similar study using the same medical data entry task, Ghezzi et al. (2020) identified participants who, in conditions with motivational statements to cooperate or conform, persisted in selecting to "fix partner errors" with the dependent cooperative contingency (EXT) schedule rather than switch over to the independent schedule (FR1) as was the case with Rafacz et al. (2019). The data showed that those participants who maintained responding on the dependent cooperative contingency schedule (EXT) in motivational statement conditions had D-IRAP scores with respect to cooperative and conformity stimuli that were statistically higher than control groups. The researchers calculated response latencies of the IRAP by using the standard D-algorithm, which produced D-IRAP scores for each stimulus that were similar to Cohen's *d* effect size (Barnes-Holmes et al., 2010; Cohen, 1988). Based on Rafacz et al. (2019) and Smith et al. (2013) classification system of the strength of D-IRAP scores, Ghezzi et al. (2020) considered participants as having a moderate to strong *positive* history with a particular stimulus if their D-IRAP score was .5 or higher. Ghezzi et al. speculated that participants who fell within the .5 or higher D-IRAP score with the two cooperative stimuli and two conformity stimuli used in the experimental procedure were not necessarily insensitive or unaware of the programmed contingencies (FR1 v. EXT) but rather persisted in rigid rule following based on a personal history of being a "cooperative" person and the socially mediated contingences related to being cooperative (i.e., conformity). Moreover, when the researchers looked at the average participant D-IRAP score at the list level for the conformity stimuli (average of all four stimuli used in the IRAP) they found differences across groups. Those participants whose average conformity D-IRAP score was above .5 were more likely to persist in cooperative responding than those who had an average conformity score of less than -.2, irrespective of cooperative stimuli. However, those that had a high average conformity D-IRAP score *and* a high average cooperative D-IRAP score were the most likely to respond cooperatively. Based our analysis of RFT, the HDML model, and persistent rule following, higher average participant D-IRAP scores related to a class of stimuli may identify those stimuli as being part of a functional class that is low in derivation and high in coherence, making it more likely that these stimuli, presented in new contexts, will transform the function of ineffective rules.

This study extended Ghezzi et al. (2020) by including conditions with a reciprocal cooperative contingency (FR1) to replace the dependent cooperative contingency (EXT) when selecting the option to

"fix partner errors." The addition of a reciprocal cooperative contingency assessed whether instances of coherence between a rule (e.g., "Cooperation is highly valued') and the way reinforcement contingencies were arranged (FR1) increased the likelihood participants would persist in maladaptive rule following in subsequent conditions with dependent cooperative contingencies (EXT). In other words, when participants initially came into contact with trials that included a direct motivational statement (rule) to cooperate, responded cooperatively (i.e., selecting the option to "fix partner errors"), and were reinforced, be more likely to persist in cooperative responding in later conditions when the contingency was not equitable. In addition, based on Ghezzi et al. (2020) findings, the current study selected only those participants who had a moderate to strong positive history of reinforcement with the class of conformity stimuli presented in the IRAP (an average ≥.3 D-IRAP score for all 4 stimuli) or a moderate to strong negative history of reinforcement with conformity stimuli (an average ≤-.2 D-IRAP score for all 4 stimuli) to move on to the phase two experimental portion of the study. This was done to analyze potential group differentiations related to cooperative responding in both dependent and reciprocal cooperative contingencies. It was predicted that participants who have a positive history with conformity stimuli may have a stronger history of socially mediated rule following. Therefore, they would engage in persistent rule following (i.e., selecting "fix partner errors") in dependent cooperative conditions (EXT) more so than those that have a strong negative history with conformity stimuli. In other words, participants that fell within the "high conformity group" may have a history of being reinforced by the verbal community for "doing what they are told." Participant D-IRAP scores for all four conformity stimuli (see Table 2 for list of stimuli) were averaged and analyzed to see if a participant's average D-IRAP score fell above ≥.3 or below ≤-.2. In doing this, an analysis of the patterns of choice behavior in the phase two EKG medical data entry task data based on individual MD IRAP data was possible. This included an analysis of the conformity stimuli and grouping participants based on MD IRAP assessment data that were 1) "high" conformity (≥.3 average D-IRAP score) and 2) or "low" conformity (≤-.2 average D-IRAP score) irrespective of their cooperative stimuli. Based on previous research (see Ghezzi et al. 2020) it was predicted that those participants who have a strong positive history with conformity stimuli would be the most likely to engage in persistent rule following. By dissecting the data in these ways, it allowed for the potential to identify what, if any, of the

MD IRAP data (based on individual D-IRAP scores) predicted the likelihood that a participant would engage in persistent rule following in reciprocal and dependent contingencies. See Table 3 for a breakdown of the primary inclusion criteria based on D-IRAP scores.

The existing literature on persistent rule following and the conditions under which it occurs highlights the importance of context. In this study we attempted to analyze the complex phenomenon of persistent rule following in a cooperative and social context. This was done by not only by analyzing individual MD IRAP data in an attempt to identify a specific history of complex relational responding to certain stimuli, but also creating the social context that may evoke persistent rule following based on that history (i.e., manipulating cooperative contingencies with a "partner"). Additionally, this research expands the current persistent rule following literature by having used an assessment procedure (IRAP) that has been successful in predicting patterns of behavior, specifically sensitivity to rule following in dependent cooperative contingencies (Ghezzi et al., 2020; Rafacz et al., 2019). With the objective to add to the existing research on persistent rule following, this study also attempted to advance Monestés (2017) suggestion that studies would benefit by including an "initial screening for rule following inclination and schedule learning sensitivity to test for potential effects on transfer of functions and individual modes of adjustment to contingency change in the case of RGB" (p. 59). This study also aimed to identify specific groups of individuals who were more likely to persist in rule following in maladaptive contexts. This potential finding may have socio-cultural implications related to the power of socially mediated rules, their self-generation, and the associated behavior that is maintained. Hence, the purpose of the study was two-fold:

1. to measure the strength of specific conformity and cooperative relational responses by using the MD IRAP to determine if a participant's history with these stimuli predicted increased persistent rule following in experimental settings (as shown in Ghezzi et al., 2020).
2. to demonstrate the effect of coherent conditions on subsequent incoherent conditions (coherent conditions present rules that are accurate to the operating programmed contingency, incoherent conditions present rules that are inaccurate to the operating programmed contingency). Accordingly, a reciprocal cooperative contingency condition with accurate rules

was introduced to build a history of coherence between a rule (i.e., "Cooperation is highly valued") and the relevant behavior (i.e., cooperation is reciprocated and reinforced).

Method

Pilot Studies

Two pilot studies were conducted using modified versions of the current methodology (for a detailed description of the experimental procedure, see sections below). Pilot 1 and 2 used the same experimental design as seen in Table 4, however pilot 1 had the following modifications. In the first A and B conditions, participants were not provided with instructions related to the programmed contingencies. Participants were also not paid and did not receive demographic information on the post-experiment questionnaire related to religion. Pilot 1 participants were shown a cumulative error tally window for "partner" and "you" instead of a cumulative submission window. For example, when a participant made an error, either work alone or fix partner errors, a tally would appear in their error window. If a participant selected to fix partner errors and submitted a correct screen, the partner error tally would subtract. In B conditions (reciprocal cooperative contingency) if a participant selected to fix partner errors and submitted a correct record, an error would be removed from both the participant and partner and both would make $.05 (i.e., the partner reciprocated and fixed an error on the participant's behalf). This contingency is the same as the current methodology however the display of total errors, rather than total submissions, reflected a negative reinforcement contingency. The inclusion criteria were also different. Participants were identified as being high conformity or low conformity using the same criteria as proposed, however high conformity scores were expanded to those greater than .4 and inclusion criteria was also dependent on cooperative stimuli scores. Participants could only move on to phase two if both of their top two cooperative stimuli were greater or equal to >.5 or less than or equal to <-.2. Additionally, those participants that fell within the low cooperative score group (regardless of conformity scores) received their lowest two cooperative stimuli in phase two and those that fell within the high cooperative score group (regardless of conformity scores) received their highest cooperative stimuli in phase two. The neutral statement also differed. Pilot 1 participants were presented with the neutral statement (in conditions B^0 and

A^0), “Working hard is highly valued.” Lastly, a participant’s partner did not have a unique UNR_#### name. The partner syncing screen simply read, “Synchronizing with partner.”

Modifications based on Pilot 1

Pilot 1 informed the updates to pilot 2 and the experimental procedure in the following ways. Participants were reporting on the post-experiment questionnaire that the neutral statement, “Working hard is highly valued” was promotive of a work alone selection. The statement was not functioning as a neutral statement as participants were deriving a rule based on the statement. It was predicted that the stimuli “working hard” and “work alone” may share some functional and topographical properties that would make deriving a rule related to that specific choice more likely. Therefore, the neutral statement, “Your participation is highly valued” was substituted to help increase the neutrality of the statement. The first three conditions (ABA) were meant to ensure participants came under stimulus control of the cooperative and financial contingencies. Based on our visual analysis of these conditions at the individual and group level and self-report data from the post-experiment questionnaire, it was clear that participants were not discriminating the contingencies within each condition. To make the contingencies explicit, instructions related to the cooperative contingencies for conditions A and B were included. Participant D-IRAP score inclusion criteria were also modified based on pilot 1 data. An initial between group post-hoc analysis using just the high and low cooperative D-IRAP scores showed no significance between groups. However, when the data was analyzed using conformity D-IRAP scores at the list level, differential responding was apparent. Lastly, the feedback provided to participants was also changed to reflect issues made evident in post-experiment reports. Some participants were reporting a punishing effect of seeing their errors posted and their partner’s errors increase; and would select the option fix partner errors in order for errors to stay near zero levels. In other words, accuracy of the partner and participant was negatively reinforcing for some participants. This issue, compounded with not paying pilot 1 participants, led to the change in the feedback screen to reflect cumulative record submissions, rather than errors, and paying participants what they earn in phase two. Based on these changes, another pilot study was warranted.

Pilot 2 informed the experimental procedure and methodology in the following two ways. To assess the strength of persistent rule following in the absence of a direct rule (motivational statement

conditions, B^1 and A^2) in subsequent conditions with neutral rules (B^0 and A^0), the order of conditions was updated. In pilot 1 and pilot 2, neutral statement conditions preceded motivational statement conditions. The experimental design for this dissertation study incorporated the motivational statement conditions before the neutral statement conditions with the same cooperative contingency. This allowed for a discussion of derived relational responding based on a history of conditions with direct rules (motivational statements, considered low in derivation) and their carry over effects to conditions that require a higher level of derivation (neutral statements, considered high in derivation). Based on pilot 2 results in condition A^0 it was predicted that those with high conformity D-IRAP scores would derive rules related to being "cooperative" in the neutral conditions (B^0 and A^0) and select the option to fix partner errors more so than the low conformity group. Secondly, the current procedure included to the post-experiment questionnaire the Generalized Pliance Questionnaire (GPQ), an 18-question self-report measure of generalized pliance. The GPQ has been shown to predict contingency insensitivity in The Wisconsin Sorting Test (WCST) and The Contingency-shifting variant Iowa Gambling Task (csIGT) (O'Conner et al., 2019). Including the GPQ provided the opportunity to assess for any correlations between D-IRAP scores, responding in the experimental procedure, and self-report measures.

Participants and Setting

Participants were 30 undergraduate students at the University of Nevada. Participants were compensated with 3 SONA credits and the dollar amount they earned during phase two in the form of an Amazon gift card (if the participant qualified to move on to phase two based on our inclusion criteria). All sessions were conducted online using online software; requiring participants to have a desktop or laptop computer with Internet access. Participants were explicitly asked to not use handheld devices (i.e., smart phone) to participate in sessions.

Phase One: MD IRAP

Apparatus

The modified Implicit Relational Assessment Procedure (MD IRAP) was administered as a computer-based online assessment through a third-party hosting website, Azure Websites. The MD IRAP had two specific purposes: 1) select those participants who fell within our experimental inclusion criteria

based on their MD IRAP scores to move on to phase two and, once selected, 2) identified participant's stimuli from the MD IRAP to be embedded into the motivational statements for phase two. The MD IRAP is the product of an ongoing translational research program that builds on Smith (2013), and subsequent collaborations between the Performance System Technologies Laboratory at the University of Nevada Reno, and the University of Nevada, Reno Medical School. The MD IRAP incorporates variations of the standard IRAP (Barnes-Holmes et al., 2008) and the mixed-trial IRAP (Levin et al., 2010) in an attempt to remediate some of the methodological issues both the standard IRAP and mixed-trial IRAP present. The MD IRAP still relies on the block-by-block hypothesis introduced by the traditional IRAP but addresses the limitations of the block design by isolating stimulus relations in a randomly presented order. Such a design has permitted investigative flexibility when it comes to designing stimuli. Specific trials are presented more than once within a given block; however, the practice phase blocks of the modified version use a different set of practice target stimuli, along with the same two categorical/evaluative stimuli, such that the repeated practice exposures to test stimuli from the traditional version are eliminated within the current version. Besides this, what distinguishes the MD IRAP from the standard and mixed-trial IRAP, is the way by which the MD IRAP accounts for responses that do not meet either accuracy (incorrect) or latency criteria. Rather than simply recording responses that are either incorrect or too slow and including them in the final data set of latencies for analysis, the program recognizes a response that does not meet one or both criteria and then quasi-randomly re-presents that specific trial later in the same block. The process is repeated as necessary during each block, such that the final data set for analysis includes only responses that are specific to the relation that is being targeted (i.e., correct responses) and are emitted under sufficient time pressure to drive the implicit responding effect. Like list-level analyses, raw response latencies are transformed into D-IRAP scores, however, the transformation follows a slightly different procedure. The D-IRAP scores for each target stimulus are calculated using the response latencies for that specific target stimulus and each of the evaluative/categorical stimuli (i.e., "Comfortable" and "Uncomfortable"), across all test blocks of trials. For example, each relation is presented three times: "Comfortable and Team Player" -Yes/Agree; "Comfortable and Team Player"-No/Disagree. The mean latency is calculated for Yes and No responses, respectively. Then, the standard deviation is calculated from those trials combined (agree and

disagree responses), and the difference between the two means is divided by that standard deviation. Thus, the same equation is applied, but instead of taking block means, stimulus means are used for each response type.

Procedure

The MD IRAP provided the assessment of participant's individual responding when presented with the four cooperative target stimuli and four conformity target stimuli (see Table 2 for the MD IRAP stimuli used). Presented on the computer screen with the target stimuli was one evaluative word ("comfortable" or "uncomfortable") and two accuracy words ("yes" and "no") wherein participants responded using a keyboard key press to make their accuracy response, see Appendix A for an example. Instructions were provided for the participants at the beginning of each trial block that indicated the relationship to which they were to respond (e.g., comfortable, or uncomfortable) to a particular set of stimuli (e.g., cooperative/conformity stimuli or independent stimuli). For example, the target stimulus "team player" and the attribution stimulus "comfortable" were presented in a trial block with instructions to respond comfortably to cooperative and conformity stimuli. If a participant emitted the response "yes" quickly, it suggested a stronger relationship with that target stimulus. A response of "no" was considered an inaccurate response. The MD IRAP began with two practice blocks to familiarize the participants followed by six testing blocks, alternating between three consistent and three inconsistent blocks. This resulted in four different IRAP trial types and provided the researcher with information relevant to responding for each. Participants needed to pass the two practice blocks and test blocks by responding under 3s and with at least 70% accuracy. An IRAP effect in the testing blocks was determined by subtracting the mean response latency for the hypothesized consistent blocks from the mean response latency for the inconsistent blocks. This difference is said to reflect the "differences in the probabilities of the two patterns of responding, as established in the pre-experimental history of the individual" (Barnes-Holmes et al., 2017, p. 437).

Participants who responded with shorter latencies in MD IRAP test blocks that presented a consistent relation (e.g., cooperation/comfortable) as compared to an inconsistent relation (e.g., cooperation/uncomfortable) were assumed to have a stronger history of reinforcement with that stimulus-stimulus relation. In other words, it was expected that words with shorter latencies and more consistent

patterns of responding would have an additive effect when presented in other contexts (Hughes & Barnes-Holmes, 2013). The successful completion of both practice and test blocks of the MD IRAP and falling within the D-IRAP score inclusion criteria was required to move on to phase two. Participants who had D-IRAP scores for all four conformity stimuli that averaged ≥.3 *or* participants who had all four conformity stimuli that averaged ≤-.2 were invited to participate in phase two. Participants were excluded from phase two of the study if 1) their average conformity D-IRAP score fell between .25 and -.15 or 2) failed the MD IRAP. See Table 3 for a breakdown of the inclusion criteria that was used.

Once a participant signed up for the study, they were emailed by the researcher or research assistant with a personal username and password to access the MD IRAP and a link to first complete a Qualtrics online survey that screened for eligibility to participate in the study (see Appendices B and C for sample email and survey). Eligibility required participants be over 18 years old, able to read and speak fluent English, and have no repetitive stress injuries in the hands (the MD IRAP requires rapid responding on a keyboard). Once confirmed that a participant met these criteria, they were directly linked to the MD IRAP participant homepage where they entered the unique username and password that was sent via email. Participants were given at least 24 hours to complete the MD IRAP. Participants were prompted through a series of instructions prior to beginning the MD IRAP explaining the assessment and how to respond (see Appendix D). Once finished, an end slide appeared thanking the participants for completing the MD IRAP and that the researcher would be contacting them shortly with next steps. Participants were contacted within 12 hours after the deadline to complete the phase one MD IRAP to communicate next steps. Participants received an email based on a possible three outcomes of participating in phase one: 1) they had failed the MD IRAP and therefore would not be moving on to phase two; 2) they were not "randomly" selected to move on to phase two (i.e., they didn't meet our inclusion criteria); or 3) they were sent a link and username to participate in phase two. In all three scenarios, participants received 1 SONA credit for participating in phase one, regardless of the outcome. See Appendix E for post-phase one sample emails.

Phase Two: Data Entry Task and Post-Experiment Questionnaire

Apparatus

The EKG medical data entry task was administered online through a secure third-party hosting site, Digital Ocean. A link with a unique username was emailed to participants prior to phase two (see Appendix E). Once a participant had completed the data entry task, they were automatically directed to an online post-experiment questionnaire administered through Qualtrics.

Procedure

Phase two was an alternating treatment design that included 7, 3m conditions ($ABAB^1B^0A^2A^0$), see Table 5 for a breakdown of each condition. All participants were exposed to the same experimental design and conditions; however, participants were exposed to individualized statements in the B^1 and A^2 conditions based on their two highest MD IRAP cooperation stimuli scores. For example, a participant's highest D-IRAP score for cooperative stimuli (e.g., the stimulus "cooperation") was embedded into the motivational statement in condition B^1 (e.g., "*Cooperation* is highly valued") and their second highest cooperative stimulus (e.g., "team player") was embedded into the motivational statement in condition A^2 (e.g., "Being a *team player* is highly valued"). For all the possible motivational statements based on a participant's MD IRAP scores that were presented during conditions B^1 and A^2 see Table 6.

The A and B conditions indicated the financial contingencies operating on the concurrent schedules of reinforcement. Participants had the option in any condition to choose between these two schedules of reinforcement labelled "work alone" or "fix partner errors." Based on Ghezzi et al. (2020) and Rafacz et al. (2019) definitions of cooperation, the option to "fix partner errors" is what was considered the cooperative response. The buttons "work alone" and "fix partner errors" were presented at the beginning of each trial and reappeared after each record was submitted (each record submitted = one trial) for the entirety of each 3m condition; it was a free operant preparation. On the screen at all times was a cumulative submission window that showed how many medical records a participant had submitted correctly and how many medical records their partner had submitted correctly across all conditions. When the window updated with a new submission for either the participant or partner, the total submission tally briefly flashed green. Since the partner was a simulation, submissions for the partner were programed on a FT30 schedule. Also, on the screen was a cumulative money earned window that showed how much a participant had earned and a timer that counted down from 3m. When a participant earned money for a particular trial

in any condition, the money earned window immediately flashed bold as it updated. At the beginning of each 3m condition, a window appeared on the screen for 3-5 seconds that said, "Syncing with UNR_####" (see Appendix F for example). Each participant was assigned a random 4-digit partner code (i.e., UNR_1213). This was be done to increase the believability of the partner, which has been documented as a limitation in similar experimental procedures (Candido & Houmanfar, 2013; Rafacz et al., 2019; Ghezzi et al., 2020). At the end of each 3m condition, a feedback screen popped up that provided productivity feedback related to the previous condition (see Appendix G for example).

In the A conditions, a button selection and correct submission of a "fix partner errors" record resulted in no financial gain (EXT) and a correct submission of a "work alone" record resulted in a fixed ratio one (FR1) consequence. Additionally, when in condition A, a correct participant submission of "fix partner errors" resulted in an automatic partner submission, but no submission for the participant. In other words, the participant received feedback that they did not receive any positive financial consequence, the submission did not count towards their submission tally, and instead tallied for the partner in their submission window (see Appendix H for a screenshot of the EKG data entry task). Therefore, condition A reflected a dependent cooperative contingency, reinforcement for the participant was dependent on the partner, however the partner in these instances was "free riding" or not cooperating in return (i.e., fixing an error on the participant's behalf). If a participant submitted a correct "work alone" record in condition A, the participant received an automatic financial consequence of $.05 and a tally on their submission count. In the B conditions, a button selection and correct submission of a "fix partner errors" record was reciprocated by the partner and resulted in the same financial gain as "work alone" (i.e., $.05). Therefore, the concurrent schedules operating were on an FR1 and FR1. Additionally, in Condition B, a "fix partner error" selection resulted in a submission tally for the participant and the partner. Condition B "fix partner error" submissions were considered reciprocal cooperative contingencies; when a participant submitted a correct medical record on the behalf of their partner (i.e., selecting to fix partner errors) the partner immediately reciprocated and submitted a "corrected partner" medical record on the behalf of the participant. Both the participant and partner received feedback in the form of an immediate tally in their submission window and earned $.05. If a participant selected to "work alone" in condition B, like condition

A, they received an automatic financial consequence of $.05 and a tally on their submission count. When a participant selected either choice, but errored, a window immediately appeared that said “Invalid submission” and neither the money earned, or submission tally changed.

In the first three conditions, ABA, participants were exposed to the EKG medical data entry task in the absence of neutral or motivational statements. In the first A condition, however, instructions indicating the dependent cooperative contingency were presented. The instructions, “When the background is YELLOW, your partner will NOT reciprocate if you select to fix one of their errors” was presented as scrolling text throughout the 3m condition (See Appendix I for example screenshot). Likewise, in the first B condition, instructions indicating the reciprocal cooperative contingency were presented. The instructions, “When the screen is GREEN you and your partner can earn money by fixing each other's errors” was presented as scrolling text for the entirety of the 3m condition (See Appendix J for example screenshot). Instructions related to the cooperative contingencies were included as initial pilot data indicated participants were not becoming sensitive to the programmed contingencies. As the current study is concerned with persistent rule following and not insensitivity to programmed reinforcement, the instructions were warranted. As such, the purpose of the first three conditions (ABA) were to ensure participants came under control of the programmed contingencies and assessed choice behavior in the absence of neutral or motivational statements.

In the latter 4 conditions ($B^1B^0A^2A^0$), condition B^1 presented a motivational statement that included a participant’s highest cooperative D-IRAP stimulus, like “Being a *team player* with your partner is highly valued” (see Appendix K for screenshot example) and preceded the neutral statement condition with the same reciprocal cooperative contingency. Condition B^1 assessed for any change in condition effects from the initial three ABA conditions with the introduction of a motivational statement with a reciprocal cooperative contingency. Condition B^0, as compared to condition B^1, analyzed the potential additive effects of the motivational statement presented in condition B^1 as compared to the neutral statement when the same cooperative contingency was operating (i.e., B conditions, reciprocal cooperative contingencies). Following a motivational statement condition (B^1) with a neutral statement condition (B^0) also allowed for an analysis of any carry over effects from a condition with a direct rule to a condition with

neutral rule that required a higher level of derivation. Said another way, did a participant's learning history (and reinforcement history) set the occasion to derive a rule related to fixing partner errors in neutral statement conditions. Conditions B^1 and B^0 were considered the "coherent" conditions. The current study's use of the term coherent fits the definition outlined by Barnes-Holmes et al. (2017). A pattern of derived relational responding (i.e., seeing statement and selecting FPE) was reinforced. Thus, when a participant selected the button, "fix partner errors" within any trial in the B conditions they were consistently reinforced for doing so, building a coherent pattern of responding.

Condition A^2 re-introduced the dependent cooperative contingency with a motivational statement that included a participant's second highest cooperative D-IRAP stimulus (see Appendix L for screenshot example). Condition A^2 followed the neutral statement reciprocal cooperative contingency condition and preceded the neutral statement dependent cooperative contingency (A^0) using the same neutral statement as condition B^0 (i.e., "Your participation is valued"). Condition A^2 assessed for any changes in choice behavior as a function of the introduction of a motivational statement (i.e., direct rule to "cooperate") from a neutral statement (i.e., derived rule) and changing contingencies from the previous condition (i.e., B^0). Condition A^0, as compared to condition A^2, analyzed the potential additive effects of the motivational statement presented in condition A^2 as compared to the neutral statement when the same cooperative contingency was operating (i.e., A conditions, dependent cooperative contingencies). As in the B^1 and B^0 conditions, following a motivational statement condition (A^2) with a neutral statement condition (A^0) allowed for an analysis of any carry over effects from a condition with a direct rule to a condition with a neutral rule that required a higher level of derivation. Given the non-cooperative dependent contingency operating in the A condition (EXT for cooperative response), the last two A conditions set the occasion for a discussion on persistent rule following. These two conditions were considered incoherent as any response on the fix partner error button was not reciprocated or reinforced. Therefore, those participants who continued to select the option "fix partner error" throughout these conditions were responding to either a direct (A^2) or derived rule (A^0) rather than the programmed contingencies. Moreover, condition A^0 was the condition that best demonstrated those that persisted in maladaptive rule following as the rule presented in this condition required a higher level of derivation than a direct rule.

The motivational statements presented in conditions B^1 and A^2 were considered direct rules as they stated how a participant should respond. Direct rules like, “Cooperating with your partner is highly valued” were regarded as low in derivation, or well-practiced. It was assumed that most, if not all, participants had a history outside of the current study of emitting similar patterns of derived relational responses (i.e., cooperating when asked to do so) when presented with rules related to cooperation. The neutral statement presented in conditions B^0 and A^0 were highly derived rules. Unlike the motivational statements, the neutral statement, “Participation is highly valued” did not direct a participant to respond to a specific schedule of reinforcement. Therefore, any rule that was derived by a participant in these conditions was considered to be highly derived, or not well practiced. This delineation of the terms “direct” and “derived” rules is consistent with previous work related to the level of derivation of relational responding and persistent rule following (Harte et al, 2017). It is important to note from an RFT perspective, however, that both motivational and neutral statement conditions require some degree of derivation. Flexibility, as defined by Barnes-Holmes et al. (2017) refers to the extent to which an individual will modify a pattern of established relational responding given a change in some contextual variable. Participants who continued to select the option fix partner error within the A^0 condition were considered to be persisting in a rigid rule following and being inflexible to the current contextual variables operating. Whereas those that modified their behavior and selected the work alone option were considered to be responding flexibly. In short, the experimental procedure was conducted to determine the effects of varying cooperative contingencies and individualized motivational statements and neutral statements (rules) on the maintenance of cooperative choice behavior (selecting option “fix partner errors”).

The independent variables included the manipulation of the cooperative contingencies (i.e., FR1/FR1 and FR1/EXT) and the statements presented (i.e., neutral, and motivational) across conditions. Dependent variables included the percent response allocation on the fix partner error button and the work alone button within and across each condition. Given persistent rule following is concerned with maintaining a specific choice within and across conditions, the pattern of responding within each 3m condition was analyzed.

As outlined above, researchers took participants' top two cooperative stimuli identified in the MD IRAP and embedded them into statements that were presented in specific conditions (B^1 and A^2) in phase two. Therefore, it was necessary that there was time between phase one and phase two for researchers to analyze the MD IRAP data. Upon completing phase one, participants who meet the criteria to move on to phase two received an email within 24 hours with a link to the data entry task (see Appendix E) and had at least 24 hours to complete the task. Once participants clicked on the phase two link, they were taken to a landing page with consent information and instructions (see Appendix M). Once the participant selected the button, "I agree to these terms and conditions" they were directed to a tutorial. The tutorial took the participant through a series of animated screens that showed the participant how to complete the EKG medical data entry task (see Appendix N). Upon completion of the tutorial, a 90s practice trial with no cooperative contingencies or statements was required to ensure participants understood how to complete the task.

The phase two EKG medical data entry task was an analog data entry task designed to simulate a medical record-processing task. The task involved the participant choosing radio button options that categorized a patient's heart rate and QT interval (heart rhythm). New, fictitious patient information including the patient's name, date of birth, age, gender, patient ID number, heart rate measurement, and QT interval appeared for each medical record that was processed. Based on this information, participants had to identify the patient's heart rate and QT interval as being above, below or within a specified range by selecting two buttons, one for heart rate and one for QT interval. For example, patient heart rate and age information were listed and had to be compared to a normal heart rate for a specified age range. Participants had to select the correct option as being above, within, or below the specified range. Participants made two responses (heart rate and QT interval) for each record and then clicked a "submit" button to complete one trial/medical record (see Appendix H for screenshot of data entry task).

At the beginning of each condition, participants had to select "next" in order to move on to the next 3m condition. Following a selection of "next" a screen appeared that said, "syncing with UNR_####" and counted down on a VT4s. Once the timer expired, the participant was taken to the data entry screen with that particular condition color background, programmed contingencies, and programmed statement; if

applicable. If the participant was moving into a condition with a statement, either motivational or neutral (i.e., B^1 B^0 A^2A^0), a text box appeared before the first trial with that condition's programmed statement presented in the text box. The participant had to click out of the text box to start that 3m condition. This was done to ensure the participants came into contact with the programmed statement (see Appendix O for example of text box). Beginning the first trial, and every trial thereafter, the choice buttons, "work alone" and "fix partner errors" appeared while the same motivational or neutral statement scrolled continuously at the top of the screen for that 3m condition. After an option was selected, fictitious patient information appeared, and participants had to fill out the necessary medical entry information and select "submit." If "work alone" was selected, participants completed the medical task "from scratch" (i.e., the response options were blank). If "fix partner errors" was selected, a medical entry screen appeared with patient information completed but had errors to be corrected (i.e., both response options were filled in and either one or both were incorrect). After all fields were completed or corrected, the participant clicked the submit button and the "work alone" and "fix partner errors" buttons re-appeared. On the screen at all times was the timer counting down from 3m so that participants were aware of how much time was left within that condition. Additionally, a cumulative money earned text box was always present on the screen that immediately updated upon a correct submission (or did not update, i.e., A conditions selection of fix partner errors), indicating the amount earned for a particular choice. And lastly, a "you" and "partner" submission window that immediately updated upon a correct submission (or did not update, i.e., A conditions selection of fix partner errors would only add a submission to partner submissions). In all conditions, participants received feedback after each incorrect submission that said "invalid submission" in red. Submitting a record correctly in the dependent cooperative contingency conditions (condition A) resulted in the participant receiving $.05 and a tally to the participant submissions but only if they chose the "work alone" button. Medical records that were submitted correctly when selecting "fixing partner errors" in condition A did not result in any financial consequence but updated the partner submission tally. Therefore, the only way to earn money in A conditions was to select the "work alone" button. When in the reciprocal cooperative contingency conditions (condition B) and a "work alone" screen was processed correctly, this resulted in the participant receiving $.05 and a tally to the participant submissions. Medical

records that were submitted correctly when selecting "fixing partner errors" in condition B also resulted in the participant receiving $.05 and a tally to *both* the participant and partner submission windows (as it is the partner that had "reciprocated" a medical record on the participant's behalf). Therefore, participants earned the same amount of money in B conditions regardless of the choice. After each condition, a feedback screen replaced the medical data entry screens. The feedback screen informed participants how many total screens were submitted correctly, how much money they earned in that condition, how many screens were processed "working alone" and how many screens were processed "fixing partner errors." See Appendix G for an example of the post condition feedback window.

After completing all seven conditions, participants were taken to a screen that gave them instructions to access the post-experiment questionnaire. The post-experiment questionnaire was required for participants to receive their remaining 2 SONA credits and receive an Amazon gift card for the amount they earned during phase two. See Appendix P for a screenshot of the text presented at the end of phase two. The main purpose of the post-experiment questionnaire was to confirm participants were sensitive to the financial/cooperative contingencies, and if those contingencies, along with the motivational statements, had any impact on their choice behavior. Participants were also asked if they believed their partner to be a real person and if that impacted their choice behavior. Additionally, a series of demographic questions were asked (see Appendix Q for the complete post-experiment questionnaire). The Generalized Pliance Questionnaire (GPQ), included in the post-experiment questionnaire, allowed for any correlations to be made between levels of generalized pliance, D-IRAP scores, and choice data related to the experimental procedure. Generalized pliance, like the conceptualization provided for conformity, is behavior that becomes insensitive to direct-acting contingencies wherein "social approval becomes the main source of reinforcement for the individual" (Ruiz et al., 2019, p.190). In a recent study on generalized pliance, O'Conner et al. (2019) found that scores on the GPQ strongly correlated with results on two measures of insensitivity to contingencies: The Wisconsin Sorting Test (WCST) and The Contingency-shifting variant Iowa Gambling Task (csIGT). Participants who reported higher levels of "pliant rule-following" (p. 837) on the GPQ were less likely to be sensitive to the changing contingencies in the WCST and csIGT. Measures like the GPQ allow behavior scientists to contribute substantially to the experimental analysis of

rigid and persistent socially mediated rule-following (i.e., generalized pliance) commonly referred to as conformity. Lastly, within 24 hours of completing phase two and the post-experiment questionnaire, an Amazon e-gift card for the amount the participant earned in the EKG medical data entry task was sent via email.

Results

Phase one: MD IRAP

A slight modification of the Ghezzi et al. (2020) classification system of D-IRAP scores was justified given the difficulty of participants moving on to phase two using the previous inclusion criteria of an average D-IRAP score of .4 or -.2 in pilot study 2. Therefore, the current study considered a participant to have a moderate to strong positive relationship with the class of conformity stimuli if their average D-IRAP score at the list level was greater than .3. Conversely, a participant was considered as having a moderate negative relationship with the conformity stimuli if their average D-IRAP score at the list level was less than -.2 In doing this, a .5 relative difference of IRAP valence between groups was maintained.

A total of 67 participants completed phase one of the study. The "high conformity group" consisted of participants who had an average D-IRAP score greater than or equal to .3 for all four conformity stimuli. The "low conformity group" consisted of participants who had an average D-IRAP score of less than or equal to -.2. Of the 67 participants who completed the phase one MD-IRAP, 15 participants satisfied the criteria to be in the high conformity group and 15 participants satisfied the criteria to be in the low conformity group for a total of 30 participants. Twenty-three participants were female (77%), six were male (22%), and one participant preferred not to answer. Twenty-four (80%) participants were between 18-25 years old. Looking specifically between groups, the high conformity group had 12 female participants (80%), two male participants (13%) and one participant that did not answer (13%). The low conformity group had 10 female participants (67%), and five male participants (33%). Of the six participants who were over 25 years old, only one fell into the high conformity group. For a breakdown of demographic information, see Table 7.

The high conformity group's average conformity list D-IRAP score was .51, which is considered a moderate to strong positive relationship with stimuli, if we regard those stimuli as a part of a functional

class. The low conformity group's average conformity list D-IRAP score was -.34 which is considered a small to moderate negative relationship with stimuli (Ghezzi et al. 2020; Rafacz et al. 2019; Smith et al. 2013). A post hoc t-test using a Bonferroni adjustment (a=.025) showed statistical significance in IRAP conformity list stimuli between the two groups (t= 12.667, p <.00001). Identifying participants based on their D-IRAP scores as being part of a particular group (high conformity and low conformity) allowed for a between group analysis and a discussion related to the differential responding between each group and persistent rule following in phase two. See Table 8 for raw D-IRAP scores for each participant and Table 9 for the average D-IRAP score for each group. Regardless of group, each participant's highest two D-IRAP scores from the cooperative list were embedded into the motivational statements presented in conditions B^1 and A^2 in phase two. Individual D-IRAP scores for the cooperative stimuli can be referenced on Table 8. When comparing groups, the high conformity group on average had higher D-IRAP scores for their first and second highest cooperative stimuli, .81 and .44, respectively. The low conformity group averaged .53 for their highest cooperative stimulus and .17 for their second highest cooperative stimulus. A post hoc t-test using a Bonferroni adjustment (a=.025) showed no statistical significance between groups with respect to the two IRAP cooperative stimuli (t= 1.575, p = .1183).

Phase two: EKG data entry task

This study had two primary aims. The first was to analyze the effects of different cooperative contingencies and varying statements (neutral and motivational) on persistent rule following (i.e., selecting option "fix partner errors"). The second was to assess for potential differential responding in phase two between two groups (high and low conformity) based on individual D-IRAP scores. This was accomplished by using visual and statistical analyses of the data with the group as a whole and broken out by the high conformity and low conformity group. Given the categorical measurement of the EKG data entry task (i.e., selecting WA or FPE), non-parametric statistical tests were run to test for significance. Specifically, Kruskal-Wallis Rank Sum tests were used for testing significance of fix partner error responses between and within groups based on specific conditions, discussed below. Mann-Whitney U tests were used for comparing responding at the beginning and end of each condition between groups, also discussed in detail below. A secondary aim was to measure the relationship between D-IRAP scores, GPQ scores, and

responding in the data entry task through correlational analyses. Categorical and continuous data were tested for correlations, therefore both Pearson Correlation Coefficient and Spearman's Rho Correlation tests were used.

All Participant Data Analyses

Cooperative Contingencies and Fix Partner Error Choice. A Kruskal-Wallis test was conducted to analyze the difference between reciprocal and dependent cooperative contingencies regardless of neutral or motivational statements on fix partner error choice for all 30 participants. Participants selected the fix partner error button in reciprocal cooperative conditions significantly higher than dependent cooperative conditions (H-value = 5.005, p =.025, df = 1). These findings demonstrated participants' ability to discriminate the contingencies operating in each condition and respond in a predictable manner. Or said another way, it was assumed participants would increase responding on the fix partner errors button in conditions when there was a direct positive financial consequence for that choice (i.e., B conditions) rather than extinction conditions (i.e., A conditions). For a visual depiction of the data for the average of all participants allocation of fix partner error choice, see Figure 1. See Table 11 for each participant's fix partner error choice across all conditions.

Statements, Contingencies, and Fix Partner Error Choice. The reciprocal cooperative contingency conditions (B) had concurrent schedules of reinforcement with equal rates of reinforcement (FR1/FR1). Therefore, based simply on the matching law, condition B absent of other independent variables (i.e., statements), would predict participants would split their responding equally between the two options and then increase their choice of the work alone option in A condition (Herrnstein, 1961). Figure 1 shows that in baseline condition B, participants on average selected the option fix partner errors 29% compared to 22% and 16% in the first two baseline A conditions. At the overall group level, the data shows that the motivational statement paired with a reciprocal cooperative contingency had the largest impact on selecting the option fix partner errors (condition B^1, see Figure 1). The participant data displayed in Figure 1 shows that the motivational statement reciprocal cooperative contingency condition (B^1) had an impact on fix partner error choice for 97% of participants (n=29) as compared to the baseline reciprocal cooperative contingency condition (B). Moreover, only one participant (7826) increased their fix partner

error choice when moving from B^1 to the neutral statement reciprocal cooperative contingency (B^0). A Kruskal-Wallis test was conducted to examine the differences of fix partner error choice according to motivational and neutral statements in the reciprocal contingency conditions (B^1 and B^0). Significant differences (H-value = 34.2767, p <.00001, df = 1) were found between the two conditions. This shows that at the individual level, regardless of D-IRAP group and/or scores, the motivational statement in condition B^1 increased cooperative choice behavior in the reciprocal cooperative contingency for most participants as compared to a neutral statement. Most participant's (87%, *n*=26) fix partner error choice also increased in the motivational statement dependent cooperative condition (A^2) as compared to both baseline dependent cooperative conditions (A). When looking at the impact of a motivational statement on responding compared to a neutral statement in dependent contingency conditions (A^2 and A^0), a Kruskal-Wallis test showed significant differences on fix partner error choice (H-value = 22.8042, p <.00001, df = 1). Taken together, these findings show that when the same cooperative contingency is operating, motivational statements increased fix partner error choice compared to neutral statements at a statistically significant level. However, when looking at fix partner error choice differences between the motivational statement reciprocal condition (B^1) and the motivational statement dependent condition (A^2), a Kruskal-Wallis test determined no significant differences between the two conditions (H-value = 3.2002, p=.074, df = 1). For a visual analysis of these data see Figure 1 and for a detailed analysis of each participant's fix partner error choice across all conditions see Table 11. Further statistical analyses of fix partner error choice can be found in Table 12.

Group Analyses

Our classification of groups based on D-IRAP scores yielded a high conformity group of 15 participants and a low conformity group of 15 participants, thus all statistical analyses between groups were of equal sample size.

Total Screens Processed During Phase Two. The first analysis at the group level was simply to determine if one group responded significantly higher than the other, or in other words submitted more records overall. Figure 2 shows the total screens processed in each condition broken out by group. The low conformity group submitted more records than the high conformity group in every condition. A total 1,637

records were submitted by the low conformity group and 1,487 records were submitted. The difference, however, was not significant. A Mann-Whitney U test showed no significant statistical difference between groups with respect to total screens submitted (U = 14.5, p = .113, z = -1.214).

Statements, Contingencies, and Fix Partner Error Choice. A visual depiction of the data broken out by the two groups across experimental conditions showed there was a differentiation between groups with respect to presence or absence of statements, cooperative contingencies, and fix partner error choice (last four conditions, see Figure 3). To better examine the impact varying the contingencies paired with motivational and neutral statements had on choice, Figure 4 isolates the last four experimental conditions. In condition B^1 both groups responded identically, fixing partner errors a percent average of 79%. It is in the subsequent three conditions that the group data began to increasingly diverge. In condition B^0 the high conformity group fixed partner errors on average 22% and the low conformity group fixed partner errors on average 15% of the time. A Kruskal-Wallis test determined no significant differences between the two groups in the B^0 condition (H-value = .8327, p=.3615, df = 1). When moving to the dependent contingency with a cooperative statement (A^2), the low conformity group selected the option fix partner errors more than the high conformity group, 74% and 51% respectively. A Kruskal-Wallis test showed significant differences on fix partner error choice (H-value = 3.5617, p =.05913, df = 1) between groups in the A^2 condition. Lastly, we see the largest differentiation in responding on the fix partner error button in the A^0 condition, statistically speaking. The high conformity group selected the option to fix partner errors a percent average of 24% compared to 9% for the low conformity group. A Kruskal-Wallis test determined significant differences between the two groups in the A^0 condition (H-value = 4.1308, p=.04211, df = 1). For a full summary of participant responding and group averages within each condition and the corresponding statistical analyses, see tables 11 and 12.

Maintenance of Fix Partner Error Choice. ***Within Group Analysis.*** Persistent rule following can be described as the maintenance over time of a particular behavior based on a history of deriving a rule or being provided a rule related to that behavior, regardless of programmed reinforcement. Within condition choice patterns at the group and individual level is integral to a discussion on rule following. To see if responding was maintained within each condition, an analysis of fix partner error choice for the first

three and last three choices for each participant was warranted. For example, if a participant selected the option fix partner errors for two of their first three choices, a 2 was added to the FPE count and a 1 was added to the WA count. The same was done for their last three choices. This ensured that the data was normalized and denominators for each condition were the same (i.e., 3 choices x 15 participants = 45 choices). These data were collected for each participant and then summed by group, see Table 13 for participant and group totals. Figure 5 shows these data broken out by group. When comparing a group's first three choice counts to their last three choice counts, neither group's responding from the first three responses to the last three responses changed drastically enough to be at a statistically significant level for any condition. Meaning both groups were consistent with responding throughout each condition. For example, in Figure 5, the high conformity group fixed partner errors 39 of 45 opportunities for the first three choices and 32 of 45 opportunities for their last three choices. This difference is not statistically significant. Mann-Whitney tests were used for both groups to assess for increases or decreases in responding within each condition (i.e., the example above) and none were found to be statistically significant or nearing statistical significance. For the specific statistical values, see Table 14.

It is important to note, however, that the within group analysis identified just three instances of a particular group *increasing* fix partner error choice from the first three choices to the last three choices within any condition. The high conformity group selected the option fix partner error choice more at the end of both neutral conditions (B^0 and A^0) than at the beginning of those conditions. The low conformity group increased their responding on the fix partner error button in the reciprocal motivational statement condition B^2. See Figure 5 and Table 13 for reference.

Maintenance of Fix Partner Error Choice. ***Between Group Analysis***. A between group analysis of choice behavior at the beginning and end of each condition provided the discussion of group differences related to persistent rule following. Figure 5 captured group choice totals specific to the fix partner error button, for the first and last three choices in each condition. The high conformity group chose the fix partner error option more than the low conformity group at the beginning of condition B^1; however, the low conformity group chose the fix partner error option more at the end of condition B^1. This shows that the low conformity group maintained their responding in the B^1 condition more than the high conformity

group. The high conformity group selected to fix partner errors more than the low conformity group at the beginning and end of condition B^0. During condition A^2, the low conformity group selected the option fix partner errors more than the high conformity group both at the beginning and end of the condition. Lastly, the A^0 analysis showed that the high conformity group selected the option fix partner errors more than the low conformity group both at the beginning and end of the condition. Mann-Whitney U tests were run to see if there were statistical differences between the groups. Tests were administered comparing the fix partner error sum differences between first three responses for the groups in all four experimental conditions. Tests were also run comparing the fix partner error sum differences between the groups for the last three responses in each condition. All the conditions that were run for significance can be found in Table 14. Two analyses were statistically significant and three were nearing statistical significance. Fix partner error choice was greater for the first three choices in Condition B^1 for the high conformity group than for low high conformity group ($U = 83.5$, $p = .12$, $z = -1.182$), nearing statistical significance. Also nearing statistical significance, fix partner error choice was greater for the last three choices in Condition B^0 for the high conformity group than for the low conformity group ($U = 82.5$, $p = .11$, $z = 1.223$). Fix partner error choice was significantly higher for the first three choices in condition A^2 for the low conformity group than for the high conformity group ($U = 67$, $p = .03$, $z = -1.867$). The last three choices in condition A^2 were nearing significance with the low conformity group fixing partner errors more than the high conformity group ($U = 82.5$, $p = .11$, $z = -1.223$). Lastly, fix partner error choice was significantly higher for the last three choices in Condition A^0 for the high conformity group than for the low conformity group ($U = 74$, $p = .05$, $z = 1.576$).

Individual Analysis

However significant group data results appear to be, an analysis at the participant level of an intervention is necessary to reveal any individual patterns lost in aggregating participant data. Cumulative graphs (Figures 6-35) were created for all participants that show medical records submitted for both response options (fix partner errors and work alone) across conditions. Table 11 also highlights each participant's percent of fix partner error percent choice within each condition. Participants from both

groups are highlighted below as their responding fits the descriptions of persistent rule following behavior and/or flexible responding that is sensitive to programmed contingencies.

Participants 1004 and 2877 were part of the high conformity group. Both participants are examples of steady responding on the fix partner error button across all four experimental conditions. Figure 6 is a cumulative graph of participant 1004. Isolating the first three baseline conditions for this participant shows that selecting the work alone option was accelerating and responding on the fix partner error button had flatlined. Responding on the fix partner error button steadily increased after the introduction of the first rule to cooperate (i.e., condition B^1). The fix partner error data series revealed that there was a greater acceleration of the fix partner error choice than the work alone button in the last four conditions. Participant 2877 follows a somewhat similar pattern, shown in Figure 7. This participant selected fix partner errors across all seven conditions more than any other participant (66%). Trendlines for responding on the work alone button and the fix partner error button are relatively similar for the first three conditions (ABA). However, once the participant came into contact with a motivational statement to cooperate (B^1), a clear delineation of the data is apparent. With both participant 1004 and 2877, responding on the fix partner error button did not decrease in either neutral statement condition (B^0 and A^0).

Participants 9456 and 8019 were part of the low conformity group. Both participants are examples of responding that was relevant to the programmed contingencies and, in particular, the motivational statements. Participant 9456 (Figure 31) responded almost exclusively on the work alone button for the first three conditions (ABA). When presented with a motivational statement, regardless of financial contingency (B^1 and A^2), participant 9456 switched over immediately to the fix partner error button and stayed there for the remainder of the condition. When presented with a neutral statement, regardless of financial contingency (B^0 and A^0), they switched over to the work alone button and responded exclusively on that button. Participant 8019, shown in Figure 33, displays a very similar pattern of responding. Responding in the first ABA conditions showed that they were sensitive to the programmed contingencies, fixing partner errors less in the A conditions and more in the B conditions. Once presented with a motivational statement to cooperate, regardless of contingency (B^1 and A^2), like participant 9456, participant 8019 responded exclusively on the fix partner error button. When in a condition with a neutral statement (B^0 and A^0), they

immediately switched over to exclusive responding on the work alone button in B^0 and chose to fix partner errors just one time in condition A^0.

Post-Experiment Questionnaire

Only the post-experiment questionnaire results most relevant to the experimental task and persistent rule following will be analyzed here. The post-experiment questionnaire can be found in Appendix X and the entirety of the results can be found in Table 15. Twenty participants (70%) reported that they were unsure if their partner was a UNR student, eight participants (30%) reported that their partner was a UNR student and two participants (<1%) said that their partner was not a UNR student. Of the 22 participants who either were unsure or answered no, when asked who they thought their partner was, if not a UNR student, nine participants said it was likely another person (i.e., researcher, student, etc.), eight reported it was likely a computer, and five were still unsure. This means that 17 of the 30 participants (57%) believed their partner to be a real person. Of the thirteen participants who reported they thought their partner was computer generated, seven came from the high conformity group and six from the low conformity group. Fix partner error choice for these participants did not deviate from group overall averages. For example, the seven participants from the high conformity group that did not think their partner was real selected the fix partner error button 22% in condition A^0. Likewise, those six participants from the low conformity group who reported not believing their partner was real selected the fix partner error button 10% in condition A^0. When asked which task was harder, 15 participants (50%) said fixing partner errors, 5 participants (17%) said working alone, and 10 participants (33%) said they were equally difficult. Only five participants (17%) reported that they discriminated the reciprocal contingency (i.e., all B conditions). However, when the reciprocal contingency was in place, nine participants (30%) reported it increased their cooperative responding and when the reciprocal contingency was not operating (i.e., all A conditions), nine participants (30%) reported it decreased their cooperative responding. All 30 participants noticed that there were financial contingencies operating and 21 participants (70%) reported being motivated to some degree by the money they were earning. Twenty-four participants (80%) reported that they increased their responding on the fix partner error button in the presence of a cooperative statement.

Twelve participants (40%) reported that the neutral statements increased their responding on the fix partner error button and twelve participants reported that it decreased responding on the fix partner error button.

Correlational Analyses of GPQ, MD IRAP, and EKG responding

Results from the GPQ, MD IRAP and responding in the EKG task were tested for any significant relationships. Table 16 highlights each participant's GPQ and conformity list D IRAP score. The Spearman rank-order correlation coefficient was used to test the relationships between the GPQ or MD IRAP results (continuous variables) to the EKG task (categorical variable). The Pearson correlation coefficient was used to test the relationship between the GPQ and MD IRAP. Table 17 outlines the results of all the variables tested for significant relationships. Generalized Pliance Questionnaire scores were not strongly correlated with fix partner error responding in any of the conditions in the EKG data entry task. Scores on the MD IRAP, however, were positively correlated to fix partner error responding in the A^0 condition, $r(26) = .49$, $p = .008$. Spearman's rank correlation was also computed to assess the relationship between MD IRAP scores and fix partner error responding in the A^1 condition. There was a moderately negative correlation between the two variables, $r(26) = -.35$, $p = .065$. Lastly, Pearson's correlation coefficient was used to assess the relationship between the MD IRAP and the GPQ. There was a moderately positive correlation between the two variables, $r(26) = .35$, $p = .065$.

Discussion

This study examined persistent rule following in a new preparation (social/cooperative context) to determine the effects that coherent trials of cooperative responding had on incoherent trials of cooperative responding. This research also sought to identify those that were more likely to derive rules related to a particular behavior (i.e., following instructions, selecting FPE, or responding cooperatively) and persist in maladaptive rule following. Previous research studies have shown that the MD IRAP is a predictor of specific patterns of behavior in experimental tasks, specifically maintenance of responding under extinction conditions (Ghezzi et al., 2020). Modifying the MD IRAP inclusion criteria and cooperative contingencies used in Ghezzi et al. allowed the current research to have a more robust discussion related to the conditions under which persistent rule following may occur. The current research took liberties with Smith et al.'s (2013) classification system and instead of regarding a stimulus as being moderate to strong above .5 or

below -.5, used the list level average D-IRAP scores of .3 and -.2 for each group as the inclusion criteria. In this way, the .5 significance minimum was between the two groups. And in fact, at the group level, the difference between the high conformity group's D-IRAP conformity list average (.51) and the low conformity groups D-IRAP average (-.34) was .85. Results from the MD IRAP data showed that at the list level, D-IRAP conformity scores between groups was significant ($p < .0001$). Modifying the inclusion criteria and seeing group differentiations in responding in the EKG task generated the potential for categorization using a .5 difference between group rather than individual or list level D-IRAP scores being above .5 or below -.5. MD IRAP scores were also tested to see the relationship they have with specific conditions in the EKG task in order to strengthen the argument that the MD IRAP is a predictor of persistent rule following. The MD IRAP was found to be strongly correlated with persistent rule following in the A^0 condition ($p=.008$). This condition is the most relevant to a discussion on persistent rule following. Condition A^0 follows both coherent conditions (B^1 and B^0) and motivational statement conditions (B^1 and A^2). This was done to build a participant's history of coherence and derived relational responding relevant to cooperating (i.e., selecting the option, fix partner errors) to see what happens in extinction conditions.

D-IRAP scores were held up against GPQ scores to identify which assessment was a better predictor of persistent rule following. Research has shown that higher GPQ scores can predict less sensitivity in changing contingency preparations like the Iowa Gambling Test (csIGT) and Wisconsin Card Sorting Test (WCST) (O'Conner et al., 2018). Our current research found no strong relationship between the GPQ and increased persistent rule following in the EKG data entry task, in any condition. The current experimental preparation used an alternating treatment design with two concurrent schedules of reinforcement using cooperative contingencies. It is likely that the experimental differences between the EKG medical data entry task and tasks like the csIGT and WCST made it difficult to draw direct conclusions related to the predictive validity of the GPQ. Generalized Pliance Questionnaire scores and D IRAP scores showed a moderately positive correlation. This finding is interesting and worthy of future research looking at the relationship between D IRAP conformity scores and performance on tasks like the csIGT and WCST.

The EKG data entry task results showed that at the individual and group level, responding on the fix error button in the dependent and reciprocal conditions were statistically different. This means that participants were able to discriminate the current contingency operating. This point is important as previous research has identified participant's failure to discriminate contingencies as a limitation (Ghezzi et al., 2020). Having ABA conditions prior to experimental conditions allowed for a discrimination period and created a baseline for responding on both schedules of reinforcement in order to analyze the impact the statements had in subsequent conditions. Future research may consider a forced choice response at the beginning of the A and B conditions to further increase the likelihood participants discriminate the contingencies operating on the concurrent schedules of reinforcement.

Prior to a detailed discussion of the group differences within specific conditions in the EKG data entry task, one general difference between the groups should be examined. Results showed that the low conformity group submitted more records (i.e., work alone *and* fix partner error records) than the high conformity group in every condition. Errors between groups, however, was nonsignificant with the high conformity group erroring 101 instances and the low conformity group erroring 99 instances across the seven conditions. The instructions prior to starting the EKG data entry task stated that "accuracy of reporting for this job is extremely important" (see Appendix N for complete instructions). While the difference was not statistically significant, the high conformity group, given a potential rule following repertoire as predicted by the MD IRAP, may have been more likely to take their time submitting each record to ensure accuracy. This finding may strengthen the argument that the high conformity group is more susceptible to a perceived socially mediated consequence. Or said simply, they were given a rule related to accuracy and were more likely to follow it.

Condition B^1 was the most coherent condition as the motivational statement to cooperate was reinforced with a cooperative response. Because of this, it was predicted that participants from both groups would respond similarly. And indeed, the percent average of fixing partner errors across both groups was identical (see Table 11). Condition B^1 was meant to set the occasion for participants to easily derive a rule related to cooperation and then be reinforced for behaving with respect to the cooperative rule (i.e., selecting option, fix partner errors). Previous research has shown that coherent trials prior to incoherent

trials increases the likelihood of persistent rule following (Harte et al., 2017). Condition A^2 was considered an incoherent trial as the motivational statement and direct acting contingency were not aligned. At the group level (*n*=30), there was no significant decrease in responding on the fix error button between condition B^1 and A^2. This shows that a history of coherent trials (B^1) may influence choice behavior in subsequent incoherent conditions (A^2) regardless of group; a finding that is directly related to the purpose of this research. This finding also strengthens the argument that motivational statements impact choice behavior more than whatever direct acting contingency is operating. To investigate this finding further, future research may benefit from increasing the number of coherent conditions or the length of coherent conditions to see the impact it has on persistent rule following.

As mentioned, condition A^2 was considered an incoherent condition. The cooperative motivational statement was not consistent with the programmed contingency. Condition A^2 was also considered a condition with a direct rule (e.g., "Being a team player is highly valued") rather than a neutral rule. It is assumed direct rules are lower in derivation than neutral rules. Previous research (Harte et al., 2017) has found that lower levels of derivation with respect to rules are more likely to produce persistent rule following than higher levels of derivation. While not statistically significant, the low conformity group fixed partner errors more than the high conformity group in condition A^2. The cooperative rules presented in motivational statement conditions are predicted to be low in derivation for both groups. It is assumed that all participants have a history with rules related to cooperation under many different contexts. The motivational statements in condition B^1 and A^2 were therefore expected to serve as verbal establishing operations to cooperate regardless of the programmed contingency. The low conformity group may have been more sensitive to the presentation of the statements or "overreacting." This is shown in the more significant differences between neutral and motivational statement conditions and fixing partner errors for the low conformity group (see Figures 3 and 4) than the high conformity group.

The neutral statement conditions (B^0 and A^0) were presented after motivational statement conditions to see if direct cooperative statements (B^1 and A^2) impact statements that require a higher level of derivation (B^0 and A^0). It was predicted that the high conformity group would be more likely to derive rules related to cooperation in these conditions based on an experimental history of following cooperative

rules, and more importantly, an individual history of following rules in general. When in the B^0 condition, the high conformity group did select the fix partner error button more than the low conformity group, however it was not statistically significant. This condition is still coherent, albeit less coherent than condition B^1 since the reciprocal cooperative contingency was still operating. Therefore, any rule related to cooperation that was derived by a participant in either group was reinforced, making it a coherent condition. As previously mentioned, continuing to select the fix partner error button in condition A^0 was regarded as persistent rule following. Not only was there no direct statement to cooperate, responding on the fix partner error button was under extinction conditions. Thus, any participant who continued to select that option was regarded as engaging in persistent rule following, and specifically maladaptive rule following as they were not making money when selecting the option to fix partner errors. The high conformity group selected the fix partner error button, or cooperated, significantly more than the low conformity group in this condition ($p = .04$). Based on our discussion of coherence, derivation, and flexibility, the high conformity group, based on their conformity D-IRAP scores, can be said to have a stronger history of reinforcement with socially mediated rule following, making it more likely these stimuli (and the functional relationships associated) were abstracted and applied in new contexts. Participants identified as high conformity were more likely to derive a rule related to cooperation in the A^0 condition and less flexible in their relational responding. This may have made it less likely that these participants would modify their responding based on the current consequential manipulations. In other words, if a participant has a history of deriving rules like “I do what I’m told” based on being reinforced in the past for following rules, then it was more likely the presentation of cooperative statements in the previous conditions set the occasion for a particular rule to be easily abstracted (low derivation) in the neutral statement conditions. Consequently, the behavior relevant to the derived ruled was emitted and that behavior was maintained (low flexibility) in the absence of programmed reinforcement given these participants history with socially mediated rule following (high coherence). The low conformity group, on the other hand, was less likely to derive a rule related to cooperation in neutral statement conditions and instead were more likely to respond with respect to the programmed contingencies within each condition. Based on our discussion of relational responding as it pertains to persistent rule following, these

participants displayed more flexibility and were able to modify their responding based on the current variables.

Within condition data was collected for every participant to discuss changes in choice within each 3m condition. Since participant rate of responding was variable across time, choice data was collected for each participant's first three and last three choices. These data were then summed for the group. Doing this allowed for an analysis of any meaningful changes in responding within condition at the group level. Figure 5 shows the differences in responding between the groups at the beginning and the end of each condition. The low conformity group increased their selection of the work alone choice from the first three choices to the last three choices in every condition except for condition B^1. This finding aligns with previous work in persistent rule following as participants in the low conformity group, once contacting the programmed contingencies, switched to responding that produced reinforcement rather than continue to follow an inaccurate rule. Whereas the high conformity group increased their selection of the work alone choice from the first three choices to the last three choices in every condition except conditions B^0 and A^0. Additionally, the difference between the two groups during the last three choices in condition A^0 was significant. The high conformity group was more likely to engage in a specific behavior (fix partner errors) and maintain that behavior after discriminating reinforcement contingencies. Based on our discussion of persistent rule following, an individual who has a history of reinforcement of responding based on socially mediated consequences (as predicted by the MD IRAP) came under the control of a particular social influence that may have been entirely abstract and verbally constructed, and behaved accordingly (i.e., "Do what your told"). This also aligns with coherence, derivation, and flexibility of relational responding. The high conformity group was more likely to derive a rule related to cooperation in neutral rule conditions given their history of rule following, and persisted in following that rule throughout the condition (even in the absence of reinforcement). Extensions of the current study may consider implementing a limited time component to button selection to increase the immediacy of choice. This change would potentially draw a clearer parallel to MD IRAP scores and provide another approach to discuss coherence, derivation, and flexibility of cooperative responses but in a time sensitive context.

Demographic differences were also found between groups, specifically gender and age. While participants were overwhelmingly female (73%), there were more men in the low conformity group (*n*=5) than the high conformity group (*n*=2). In Western culture, anecdotally, men have historically been reinforced for being independent, assertive, and to challenge authority. On the other hand, women have historically been reinforced for being subservient and compliant. While these differences are stereotypical, future research could examine gender differences in D-IRAP conformity scores and how those impact responding in the EKG data entry task. The majority (80%) of participants were between the ages of 18-25. However, of the six participants that fell out of this age range, five were from the low conformity group. Again, while this is speculative, older individuals may be more likely (or less likely) to challenge a perceived authority figure. In addition to gender, future research could look at age differences in D-IRAP conformity scores and how age impacts, if at all, responding in the EKG data entry task.

The current research attempted to create a social/cooperative context for engaging in persistent rule following. This became increasingly difficult as COVID-19 required studies to be moved all online. Moreover, partner believability has been cited as a limitation in cooperative experimental preparations. As such, partner believability was vital. The experimental procedure section above outlined the steps taken to increase partner believability and the post-experimental questionnaire attempted to confirm that attempt. Over half of the participants (*n*=17, 57%) reported that they thought their partner was a real person. Similar research (Ghezzi et al. 2020) reported less than 25% of participants reporting their partner was real. This finding shows that the changes the current preparation had made to increase believability were successful. The inevitability of future research having to be conducted online would benefit from increasing partner believability, particularly in contrived social interaction preparations.

The EKG data entry task feedback provided to participants had the potential to be a source of positive or negative reinforcement. This may have an impact on persistent rule following. The pilot one experimental procedure reflected a negative reinforcement contingency. When a participant selected to fix partner errors (in a B condition), an error was subtracted from both the partner and participant cumulative error count. Pilot two and the current study arranged a positive reinforcement contingency. When a participant selected to fix partner errors (in a B condition), a record was added to both the partner and

participant cumulative record count. Research has suggested that stress level and persistent rule following are correlated (Barnes-Holmes et al., 2017; Harte et al., 2017). Future research could look at the impact the feedback display (negative versus positive reinforcement contingencies) has on persistent rule following and levels of perceived stress on participant responding.

This dissertation used a reciprocal cooperative contingency and a dependent cooperative contingency to measure persistent rule following. As mentioned previously, a dependent cooperative contingency in fact does not satisfy the definition of cooperation. In our preparation (A conditions), the participant depended on their partner to produce the response that would provide reinforcement, which never happened. Therefore, any participant who continued to persist in following a particular rule by responding "cooperatively" in dependent conditions was doing so based on a general sensitivity to consequences provided by others (perceived or real) and disregarded the direct outcome of selecting the fix partner error button. As discussed, this behavior does not fit the description of cooperation, but rather a description of conformity. Ghezzi et al. (2020) referred to behavior that comes under the control of a particular social influence that may be entirely abstract, verbally constructed, and/or socially mediated as conformity. Based on the distinction between cooperation and conformity, we can say that the maintenance of selecting the option fix partner errors in the dependent contingency conditions was a conformity response. Both the high conformity group and low conformity group selected the fix partner error button at high rates in the A^2 condition. However, the high conformity group continued to select the fix partner error button in the A^0 condition significantly more than the low conformity group. The high conformity group displayed a greater general sensitivity to consequences provided by others (perceived or real) and insensitivity to the direct outcome or consequences of behavior. Said another way, the high conformity group was more susceptible to rigid rule following given an individual history of responding under the control of socially mediated consequences.

Limitations

This study presented limitations that are important to address and discuss in terms of future research. Participant's highest two cooperative stimuli were used in the EKG data entry task motivational statements, regardless of group. This was done to increase the likelihood that the statements would function

as verbal establishing operations for all participants. However, using individual D-IRAP scores to identify the cooperative stimuli embedded in the EKG task presented a potential confound. Differences in cooperative stimuli D-IRAP scores were found between groups. Specifically, the high conformity group on average had higher cooperative stimuli D-IRAP scores. This had the potential to be an independent variable in and of itself. To confirm the difference between groups was negligible, an independent t-test was used to test for significance. Results showed the difference between groups was not significant. Future research should consider using the same cooperative stimuli for all participants to reduce the potential for bias.

Previous research has found that number of coherent trials increases the probability of persistent rule following in subsequent incoherent trials (Hart et al, 2017). The current research only had one completely coherent 3m condition (condition B^1). Given that one of the primary goals of the study was to determine the impact coherent trials have on incoherent trials, more coherent trials would have been beneficial. This could have been accomplished by increasing the duration of each condition to provide more trials within the coherent condition. Another opportunity to increase the number of coherent trials *and* experimental control could have been to include two more B^1/B^0 and A^2/A^0 conditions to function as a reversal. Future research could modify the current experimental design to either increase the time of each condition or change the design to $ABAB^1B^0$ A^2A^0 $B^1B^0A^2A^0$ to see if there is an increase in persistent rule following in the last A^2 and A^0 conditions.

As previously mentioned, both parts of this research were conducted online. This presents difficulties in ensuring participants were coming under stimulus control of the task, rather than the stimuli no doubt orbiting their physical environment. This is particularly problematic when completing the MD IRAP. The MD IRAP is a fast-paced assessment that requires complete focus and no interference. Distracted participants can influence their MD IRAP scores. Additionally, the issues of partner believability in the EKG data entry task were compounded as participants were able to complete the task online at any time of day. One participant reported not believing their partner was real given they completed the task "in the middle of the night." Extensions of this research would be better served by requiring participants to complete both tasks online at specific times to reduce outside stimulation and increasing partner believability. Another option is to conduct both phases in person. This change, however, may impact

persistent rule following altogether since the physical presence of a researcher or research assistant may increase the probability of persistent rule following.

Implications

The primary result of this study pertained to the utility of the MD IRAP in predicting participants' persistent rule following in conditions that required a higher level of derivation (i.e., B^0 and A^0). This finding extends previous research that has looked at levels of derivation and persistent rule following and found that lower levels of derivation produce more consistent patterns of persistent rule following. Indeed, we noted the same pattern in this study, however the high conformity group continued to derive rules related to cooperation in high derivation conditions. These findings demonstrate the power of socially mediated rules, their derivation, and maintenance. We also analyzed persistent rule following from a new experimental preparation that included a social element. The results showed that including a perceived partner may increase the likelihood that a participant will persist in rule following; a finding that contributes to the current research related to persistent rule following. Previous persistent rule following research has looked at how direct and derived rules and number of coherent trials impact persistent rule following (Harte et al., 2017). Our research showed that in a social setting, it is not just direct rules and coherent trials that will set the occasion for persistent rule following. Moreover, it is argued here that other factors, like a history of relational responding with respect to rule following in general, presence of a partner, coherent trials, and level of derivation help to predict the conditions under which a person will engage in persistent rule following.

Another important result from these data is related to the MD IRAP inclusion criteria that was used to move on to phase two. The inclusion criteria used in the current study to group participants in a high conformity group and low conformity group was a variation of previous research and was shown to be successful in predicting patterns of responding. Using simply a .5 difference between D-IRAP scores for participant inclusion criterion and using list level D-IRAP averages for participants were shown to predict differential responding between groups. This finding may impact how future research chooses to identify participants falling within a specific group. It is important to note, however, that the modifications to the inclusion criteria used were intended for a between group design.

This study, though exploratory, contributes to the existing literature on the HDML model as it relates to persistent rule following. The MD IRAP and our preparation informs how individual histories of relational responding in the context of coherence, derivation, and flexibility impacts rule governed behavior. In particular, the results from the high conformity group being more rigid in their responding in condition A^0 are fascinating and worthy of further investigation. Rigid rule following limits an individual's contact with other contingencies in their environment which is detrimental to critical decision making. This may have implications related to psychological suffering at the individual level and socio-cultural and organizational issues at the group level. When an individual is rigid and becomes insensitive to changing contingencies, the reinforcing or punishing properties of current contingencies are altered (Törneke et al., 2008). This is likely to increase the probability that a person will engage in experiential avoidance; actively avoiding certain thoughts, circumstances, contingencies, etc. that the person regards as aversive (Törneke et al., 2008). The result inevitably being increased psychological suffering. It is also reasonable to assume that an individual's rigid repertoire will impact group relationships. Our behavior scientific understanding of persistent rule governed behavior with respect to cooperation and conformity informs the basic and applied literature as it relates to cooperative work environments that are requiring of adaptability and agility of teams (e.g., cyber security, high risk industries, medical environments). The survival and success of team interactions relies on flexibility and adaptability of individuals working inside that team; or working cooperatively. Culturally, we see the negative impacts of rigid rule following when people act against their best interests and the culture writ large (e.g., storming the U.S. Capitol, strictly voting party line, denying vaccine efficacy, ideological echo chambers, etc.). Moving towards a better understanding of the conditions under which an individual persists in maladaptive rule following allows behavior scientists to create interventions that promote flexibility at the individual and group levels leading to improved mental, organizational, and cultural health.

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Tables

Table 1
Outline of the four dimensions of arbitrarily applicable relational responding

Term	Definition	Influence	Example	Study Example	PRF
Coherence	Elements of derived relation are related in a consistent manner	Verbal environment reinforces coherence, punishes incoherence	SR+ for: A=B, B=C; A=C	"I am a people pleaser" (and behaving accordingly)	High
Derivation	History with relations between stimuli. Considered high upon first instance of deriving relation.	Longer history with rule and deriving in new contexts (How well practiced is the relationship)	A=B, B=C; A=C	History of behaving with respect to rule, "I am a people pleaser" in relevant settings	Low
Flexibility	Ability to modify responding based on current contextual variables and consequential manipulation	Current contextual variables and consequential manipulations, level of derivation and coherence	Now A≠B, B=C, A≠C	People pleaser doesn't change behavior (continues to follow rule) after following rules no longer is reinforced	Low
Complexity	When relations are more intricate or dense and number of functions transformed increases	Number of relations, frames, contextual cues	A=B, B=C; A=C vs. A>B, B>C; A>C	Being a people pleaser is complex as it involves more than a simple relation among stimuli	High

Table 2

Cooperative and independent stimuli used in MD IRAP

Cooperative stimuli
Collaboration
Cooperation
Group effort
Team player
Conformity stimuli
Conform
Compliance
Fitting in
Go along with
Independent stimuli
Independence
On my own
Flying solo
Self sufficient

Table 3

Inclusion criteria to move to phase two based on participant D-IRAP scores

Inclusion Criteria		
	Conformity stimuli (4) average ≥.3	**Conformity stimuli (4) average ≤-.2**
Cooperation stimuli (4) average N/A	HIGH Conformity	LOW Conformity

Table 4

Phase two experimental procedure used in pilot 1 and pilot 2 (work alone, WA; fix partner errors, FPE)

Condition	**A (dependent)**	**B (reciprocal)**	**A**	**B^0**	**B^1**	**A^0**	**A^2**
Time	3m	3m	3m	3m	3m	3m	3m
Statement/ Rule	Instructions	Instructions	None	Neutral	1st Coop	Neutral	2nd Coop
Background color	Yellow	Green	Yellow	Green	Green	Yellow	Yellow
Feedback	Money & entries	Money & entries	Money & entries	Money & entries	Money & entries	Money & entries	Money & entries
Financial Contingency	WA → 1 FPE → 0	WA → 1 FPE → 1	WA → 1 FPE → 0	WA → 1 FPE → 1	WA → 1 FPE → 1	WA → 1 FPE → 0	WA → 1 FPE → 0

Table 5
Phase two study experimental procedure (work alone, WA; fix partner errors, FPE)

Condition	**A (dependent)**	**B (reciprocal)**	**A**	**B^1**	**B^0**	**A^2**	**A^0**
Time	3m	3m	3m	3m	3m	3m	3m
Statement/ Rule	Instructions	Instructions	None	1st Coop Direct	Neutral Derived	2nd Coop Direct	Neutral Derived
Background color	Yellow	Green	Yellow	Green	Green	Yellow	Yellow
Feedback	Money & entries	Money & entries	Money & entries	Money & entries	Money &entries	Money & entries	Money & entries
Financial Contingency	WA → 1 FPE → 0	WA → 1 FPE → 1	WA → 1 FPE → 0	WA → 1 FPE → 1	WA → 1 FPE → 1	WA → 1 FPE → 0	WA → 1 FPE → 0
Coherence	--	--	--	High	High	Low	Low
Derivation	--	--	--	Low	High	Low	High

Table 6

Potential motivational statements and the neutral statement presented during data entry task

Cooperative statements	Neutral statement
Collaboration is highly valued.	Your participation is valued.
Cooperation is highly valued.	
Group effort is highly valued.	
Being a team player is highly valued.	

Table 7
Participant demographic information

		High Conformity	Low Conformity
Gender			
	Female	12	10
	Male	2	5
	N/A	1	0
Age			
	18-25	14	10
	26-35	1	2
	36-45	0	1
	46+	0	2
Religion			
	Christianity	5	6
	Islam	0	1
	Buddhism	1	0
	Other	1	0
	None	8	8

Table 8

Individual D-IRAP scores and grouping

		Cooperation Stimuli				Conformity Stimuli				
Group	Participant no.	Compliance	Cooperation	Group Effort	Team Player	Conform	Compliance	Fitting In	Go Along With	*Average*
High	6039	0.94	1.57	0.12	1.67	-0.18	1.04	1	0.21	*0.52*
	2919	-0.09	-0.06	0.30	0.45	-0.1	0.21	0.69	1.01	*0.45*
	0997	0.98	0.62	0.85	1.32	0.48	1.08	0.70	1.59	*0.96*
	7826	-0.29	-0.28	-1.04	0.10	0.47	0.81	-0.02	0.61	*0.47*
	3202	-0.18	0.39	-0.45	-0.49	0.70	0.37	0.12	-0.04	*0.29*
	6176	0.02	0.71	-0.38	0.27	-0.67	0.50	0.23	1.11	*0.29*
	1004	0.94	-0.13	0.37	0.26	1.38	0.13	1.56	-0.35	*0.68*
	4092	-0.22	0.26	-0.22	-0.33	-0.15	0.66	0.72	0.85	*0.52*
	6469	-0.16	0.88	0.67	0.79	0.70	0.40	0.07	0.81	*0.50*
	1919	0.48	-0.82	-0.04	0.84	0.20	-0.06	0.49	0.61	*0.31*
	9059	-0.45	0.52	-0.77	0.96	1.03	0.15	1.15	0.32	*0.66*
	3875	0.03	0.08	-0.13	0.77	0.96	0.81	0.81	-0.05	*0.63*
	2985	0.17	-0.11	0.1	0.27	-0.32	-0.06	0.83	1.03	*0.37*
	7118	0.51	-0.14	0.24	-0.75	0.76	0.77	0.51	-0.2	*0.46*
	2877	2.08	0.58	1.53	1.26	0.41	0.52	0.28	1.06	*0.57*
Low	6745	-0.26	-0.42	-0.69	-0.55	-0.47	-0.09	0.27	-0.4	*-0.17*
	7064	-0.21	0.26	-0.10	-0.81	0.05	0.34	-0.59	-0.56	*-0.20*
	9456	-0.93	-0.30	0.51	-0.17	-0.75	-0.04	-0.13	-1.42	*-0.58*
	8079	-1.25	-0.17	-0.17	-0.19	-0.68	-1.85	0.15	-1.12	*-0.87*
	3538	0.05	-0.25	-0.09	-0.09	-0.9	-0.59	0.49	-0.92	*-0.48*
	7321	0.23	0.29	0.56	0.33	-0.42	0	-0.11	-0.3	*-0.21*
	8532	0.48	-0.10	0.13	0.21	-0.40	-0.70	-0.57	-0.25	*-0.48*
	2967	-0.61	0.7	0.8	-0.41	-0.06	-0.19	-0.48	-0.19	*-0.23*
	3765	0.03	0.03	0.26	-0.13	-0.21	-0.3	0.03	-0.38	*-0.21*
	7427	-0.32	-0.31	-0.4	0.2	-0.51	-0.47	-0.3	-0.16	*-0.36*
	2340	-0.59	0.93	0.28	0.24	0.13	-0.52	0.06	-0.6	*-0.23*
	9470	1.28	0.80	0.07	1.69	-0.21	0.32	-0.08	-1.01	*-0.24*
	8019	-0.04	-0.08	-0.16	0.96	-0.68	0.05	-0.50	-0.47	*-0.40*
	6342	0.27	-0.06	-0.13	0.80	0.11	0.08	-0.52	-0.63	*-0.24*
	2936	-0.34	0.84	0.26	0.43	0.19	0.36	-1.30	-0.24	*-0.25*

Table 9
Average D-IRAP scores by group

	Cooperative Stimulus #1 (B^1)		**Cooperative Stimulus #2 (A^2)**		**Conformity List Average**	
	M	*SD*	*M*	*SD*	***M***	***SD***
High Conformity Group	0.81	.55	0.44	.57	**0.51**	**.18**
Low Conformity Group	0.53	.50	0.15	.44	**-0.34**	**.19**

Table 10

Total participant screen submissions across conditions broken out by group

High Conformity Group								
Participant no.	**NoM D (A)**	**NoM R (B)**	**NoM D (A)**	**Coop #1 (B^1)**	**NS (B^0)**	**Coop #2 (A^2)**	**NS (A^0)**	**Total**
2919	10	12	12	12	15	15	15	*91*
6039	11	14	13	10	13	11	15	*87*
3202	13	18	20	20	20	20	22	*133*
7826	10	14	17	17	19	18	20	*115*
6176	10	17	15	12	13	17	16	*100*
0997	8	10	4	7	9	8	17	*63*
1004	15	14	16	13	14	11	13	*96*
4092	8	9	11	8	12	16	14	*78*
6469	15	17	18	16	19	17	20	*122*
1919	12	14	17	14	17	15	19	*108*
3875	12	9	16	17	20	19	18	*111*
9059	11	11	12	11	12	13	13	*83*
2985	8	11	12	14	15	12	13	*85*
7118	16	18	20	23	24	24	25	*150*
2877	8	8	10	9	13	8	9	*65*
Total	**167**	**196**	**213**	**203**	**235**	**224**	**249**	***1487***

Low Conformity Group								
Participant no.	**NoM D (A)**	**NoM R (B)**	**NoM D (A)**	**Coop #1 (B^1)**	**NS (B^0)**	**Coop #2 (A^2)**	**NS (A^0)**	**Avg**
6745	16	16	15	17	27	16	22	*129*
7064	8	10	11	10	15	10	8	*72*
9456	11	14	18	14	20	18	21	*116*
8079	18	21	18	23	22	19	23	*144*
3538	7	9	10	12	9	9	10	*66*
2967	9	10	12	11	13	11	13	*79*
7321	15	21	22	18	22	22	22	*142*
8532	8	9	9	9	11	11	14	*71*
3765	3	5	8	7	10	8	11	*52*
2340	12	18	18	14	16	16	20	*114*
7427	9	13	13	13	14	14	14	*90*
9470	15	14	16	15	13	16	18	*107*
8019	19	18	19	22	29	25	29	*161*
6342	16	18	22	25	26	27	28	*162*
2936	15	17	17	19	20	21	23	*132*
Total	**181**	**213**	**228**	**229**	**267**	**243**	**276**	***1637***

Table 11

Participant fix partner error percent choice for each condition, broken out by group

High Conformity Group

Participant no.	NoM D (A)	NoM R (B)	NoM D (A)	Coop #1 (B^1)	NS (B^0)	Coop #2 (A^2)	NS (A^0)	Avg
2919	0%	0%	0%	83%	33%	20%	40%	*25%*
6039	0%	0%	0%	90%	0%	100%	0%	*27%*
3202	15%	33%	15%	100%	35%	65%	14%	*37%*
7826	30%	36.0%	6.0%	35%	37%	28%	25%	*28%*
6176	20%	0.0%	0%	83%	46%	18%	19%	*27%*
0997	38%	40.0%	0%	43%	0%	13%	100%	*33%*
1004	7%	29%	19%	77%	50%	45%	46%	*39%*
4092	88%	0%	0%	100%	0%	0%	0%	*27%*
6469	13%	12%	22%	88%	0%	41%	0%	*25%*
1919	0%	0%	0%	7%	0%	53%	.05%	*.09%*
3875	8%	67%	25%	100%	0%	58%	33%	*42%*
9059	45%	100%	17%	91%	8%	92%	8%	*52%*
2985	0%	100%	8%	100%	47%	100%	8%	*52%*
7118	13%	89%	10%	87%	0%	54%	8%	*37%*
2877	38%	100%	20%	100%	70%	75%	56%	*66%*
Average	**21%**	**40%**	**9%**	**79%**	**22%**	**51%**	**24%**	***35%***
SD	**0.24**	**0.40**	**0.09**	**0.28**	**0.24**	**0.32**	**0.28**	***0.27***

Low Conformity Group

Participant no.	NoM D (A)	NoM R (B)	NoM D (A)	Coop #1 (B^1)	NS (B^0)	Coop #2 (A^2)	NS (A^0)	Avg
6745	19%	0%	0%	71%	0%	100%	0%	*27%*
7064	50%	20%	45%	90%	0%	20%	25%	*36%*
9456	0%	29%	0%	93%	0%	100%	0%	*32%*
8079	44%	38%	50%	83%	64%	89%	9%	*54%*
3538	57%	44%	30%	100%	0%	100%	0%	*47%*
2967	11%	40%	33%	73%	23%	73%	8%	*37%*
7321	27%	0%	0%	100%	0%	100%	50%	*40%*
8532	0%	22%	44%	89%	36%	82%	0%	*39%*
3765	0%	0%	0%	57%	0%	63%	0%	*17%*
2340	0%	0%	0%	79%	31%	88%	0%	*28%*
7427	33%	92%	69%	62%	43%	43%	43%	*55%*
9470	27%	93%	0%	100%	31%	50%	0%	*43%*
8019	26%	83%	5%	100%	0%	100%	3%	*45%*
6342	25%	94%	0%	96%	0%	100%	0%	*45%*
2936	.07%	0%	0%	0%	0%	0%	0%	*.01%*
Average	**22%**	**37%**	**18%**	**79%**	**15%**	**74%**	**9%**	***36%***
SD	**0.19**	**0.37**	**0.24**	**0.26**	**0.21**	**0.32**	**0.17**	***0.25***

Table 12

Kruskal-Wallis Rank Sum test results used to assess for significance in experimental conditions

Conditions Tested	H-statistic	P-value	Df
Within Group Tests			
High Conformity			
B^1 & A^2	4.924	0.02648	1, 30
B^1 & B^0	15.5269	0.00008	1, 30
A^2 & A^0	5.7875	0.01614	1, 30
B^0 & A^0	.2275	0.2275	1, 30
B^1/B^0 & $A^{2/}A^0$	.9521	0.9521	1, 60
$B1/A^2$ & B^0/A^0	19.5412	<.00001	1, 60
Low Conformity			
B^1 & A^2	0.0155	0.9	1, 30
B^1 & B^0	17.2	0.0003	1, 30
A^2 & A^0	16.1875	0.0006	1, 30
B^0 & A^0	0.0968	0.755	1, 30
B^1/B^0 & $A^{2/}A^0$	0.0874	0.7647	1, 60
B^1/A^2 & B^0/A^0	33.5021	<.00001	1, 60
Between Group Tests			
B^1	0.043	0.8357	1, 30
B^0	0.8327	0.3615	1, 30
A^2	3.5617	0.0591	1, 30
A^0	4.1308	0.0421	1, 30
B^1/B^0	0.1967	0.6574	1, 60
A^2/A^0	0.0289	0.8649	1, 60
B^1/A^2	1.9314	0.1646	1, 60
B^0/A^0	3.694	0.0546	1, 60

Table 13

Selecting option fixing partner error totals for first three and last three choices across conditions

High Conformity Group

Participant no.	Coop #1 (B^1)		NS (B^0)		Coop #2 (A^2)		NS (A^0)	
	First 3	*Last 3*	*First 3*	*Last 3*	*First 3*	*Last 3*	*First 3*	*Last 3*
2919	3	2	0	1	0	1	1	2
6039	2	3	0	0	3	3	0	0
3202	3	3	1	1	2	1	0	1
7826	1	1	1	1	1	1	0	0
6176	3	3	1	1	0	0	1	2
0997	2	0	0	0	0	1	3	3
1004	3	1	2	2	1	2	1	1
4092	3	3	0	0	0	0	0	0
6469	3	3	0	0	1	0	0	0
1919	1	0	0	0	2	2	0	0
3875	3	3	0	0	2	2	0	1
9059	3	3	1	0	2	3	1	0
2985	3	3	2	2	3	3	0	0
7118	3	1	0	0	3	0	0	0
2877	3	3	2	3	3	2	1	2
Total	**39**	**32**	**10**	**11**	**23**	**21**	**8**	**12**

Low Conformity Group

Participant no.	Coop #1 (B^1)		NS (B^0)		Coop #2 (A^2)		NS (A^0)	
	First 3	*Last 3*	*First 3*	*Last 3*	*First 3*	*Last 3*	*First 3*	*Last 3*
6745	3	0	0	0	3	3	0	0
7064	2	3	0	0	1	1	1	1
9456	2	3	0	0	3	3	0	0
8079	1	3	0	3	3	1	0	0
3538	3	3	0	0	3	3	0	0
2967	2	3	0	0	3	2	0	0
7321	3	3	0	0	3	3	1	2
8532	3	3	2	0	3	3	0	0
3765	1	2	3	0	3	0	0	0
2340	2	1	1	0	3	3	0	0
7427	2	3	1	1	0	2	3	0
9470	3	3	1	1	1	2	0	0
8019	3	3	0	0	3	0	1	0
6342	3	3	0	0	3	3	0	0
2936	0	0	0	0	0	0	0	0
Total	**33**	**36**	**8**	**5**	**35**	**29**	**6**	**3**

Table 14

Mann Whitney U test results used to test for significance during first three and last three choices in experimental conditions

		Within Group Tests		
	Conditions Tested	**U-value**	**Z-score**	**P-value**
High Conformity				
First 3/Last 3	B^1	91.5	0.8503	0.1977
	B^0	111	-0.0415	0.4841
	A^2	105	0.2904	0.3859
	A^0	98	-0.5807	0.281
Low Conformity				
First 3/Last 3	B^1	90	-0.9125	0.1814
	B^0	97.5	0.6014	0.2743
	A^2	87.5	1.0162	0.1539
	A^0	98	0.5807	0.281
		Between Group Tests		
	B^1 First 3	83.5	1.1821	0.119
	Last 3	98.5	-0.56	0.2877
	B^0 First 3	98.5	0.56	0.2877
	Last 3	82.5	1.2236	0.1112
	A^2 First 3	67	-1.8665	0.0307
	Last 3	82.5	-1.2236	0.1112
	A^0 First 3	98.5	0.56	0.2877
	Last 3	74	1.5762	0.0571

Table 15

Post-experiment questionnaire responses

	High Conformity	Low Conformity	Total
WA or FPE?			
WA	12	11	23
FPE	3	4	7
Was your partner UNR student?			
Yes	4	4	8
No	1	1	2
Unknown	10	10	20
What was harder?			
WA	4	1	5
FPE	8	7	15
Same	3	7	10
Did you notice color change?			
Yes	13	14	27
No	2	1	3
Did you notice reciprocation?			
Yes	4	1	5
No	11	14	25
Did reciprocation impact FPE?			
Increase	6	3	9
Decrease	0	0	0
No effect	4	9	13
N/A	5	3	8
Did NO reciprocation impact FPE?			
Increase	0	0	0
Decrease	6	3	9
No effect	4	11	15
No response	5	1	6
Motivated by money?			
Very much	0	3	3
Somewhat	5	3	8
A little	6	4	10
Not at all	4	5	9
I didn't notice money	0	0	0
Notice Cooperation statements?			
Yes	14	13	27
No	1	2	3
Did Cooperation impact FPE?			
Increase	13	10	23
Decrease	0	0	0
No effect	0	3	3
N/A	2	1	3
No response	0	1	1
Notice Participation statements?			
Yes	15	14	29
No	0	1	1
Did Participation impact FPE			
Increase	7	5	12
Decrease	6	6	12
No effect	2	3	5
No response	0	1	1

Table 16

Generalized pliance questionnaire scores

Participant no.	GPQ Score	D IRAP Score
7064	65	-0.19
9456	63	-0.585
6039	107	0.5175
8079	81	-0.875
2919	58	0.4525
3202	101	0.2875
7826	97	0.4675
6176	47	0.2925
997	72	0.9625
1004	69	0.68
3538	40	-0.48
4092	74	0.52
6469	91	0.45
2967	74	-0.23
8532	76	-0.48
3765	72	-0.215
1919	86	0.31
7427	69	-0.36
2340	82	-0.2325
9470	80	-0.245
3875	88	0.6325
9059	104	0.6625
8019	61	-0.4
2985	78	0.37
7118	84	0.46
6342	82	-0.24
2936	79	-0.248
2877	75	0.57

Table 17

GPQ, MD IRAP, and EKG task correlational analyses

Spearman's Rank Correlation		
Variables	r_s	P-value
MD IRAP/FPE overall	-0.153	0.438
GPQ/FPE overall	-0.027	0.891
MD IRAP/FPE A^1	-0.353	0.064
GPQ/FPE A^1	0.143	0.466
MD IRAP/FPE A^0	0.499	0.008
GPQ/FPE A^0	-0.160	0.415
Pearson's Correlation Coefficient		
Variables	R, R^2	P-value
MD IRAP/GPQ	0.354, 0.125	0.064

Figures

Figure 1

Fix partner error choice for all participants (n=30) across conditions

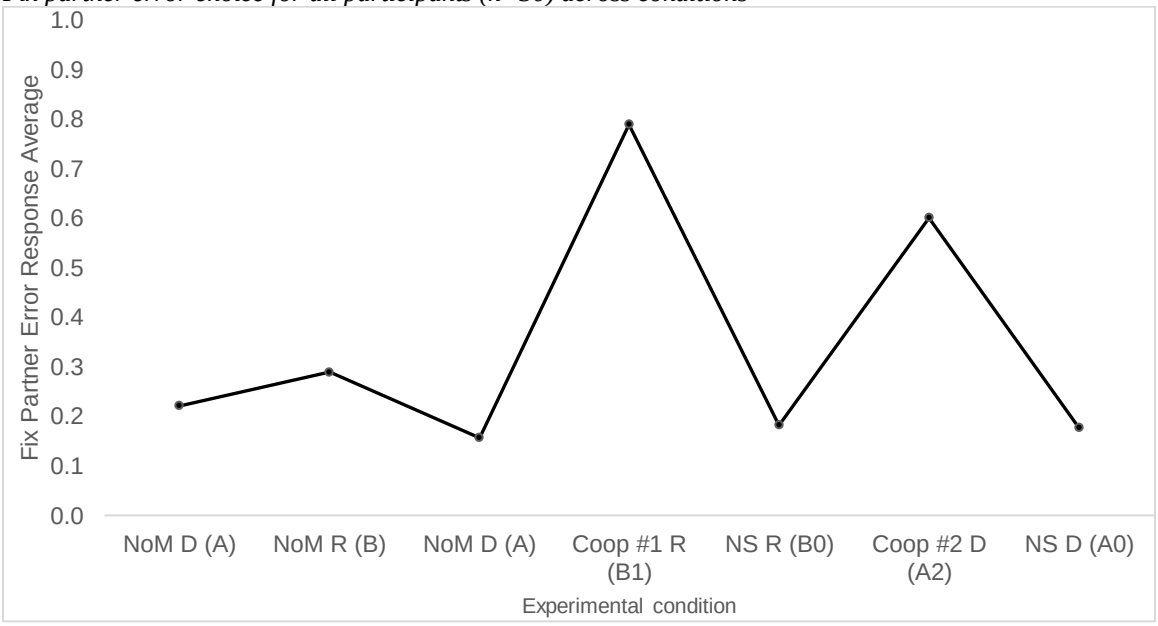


Figure 2

Total screens submitted (WA and FPE) across conditions broken out by group (high conformity, n=15; and low conformity, n=15)

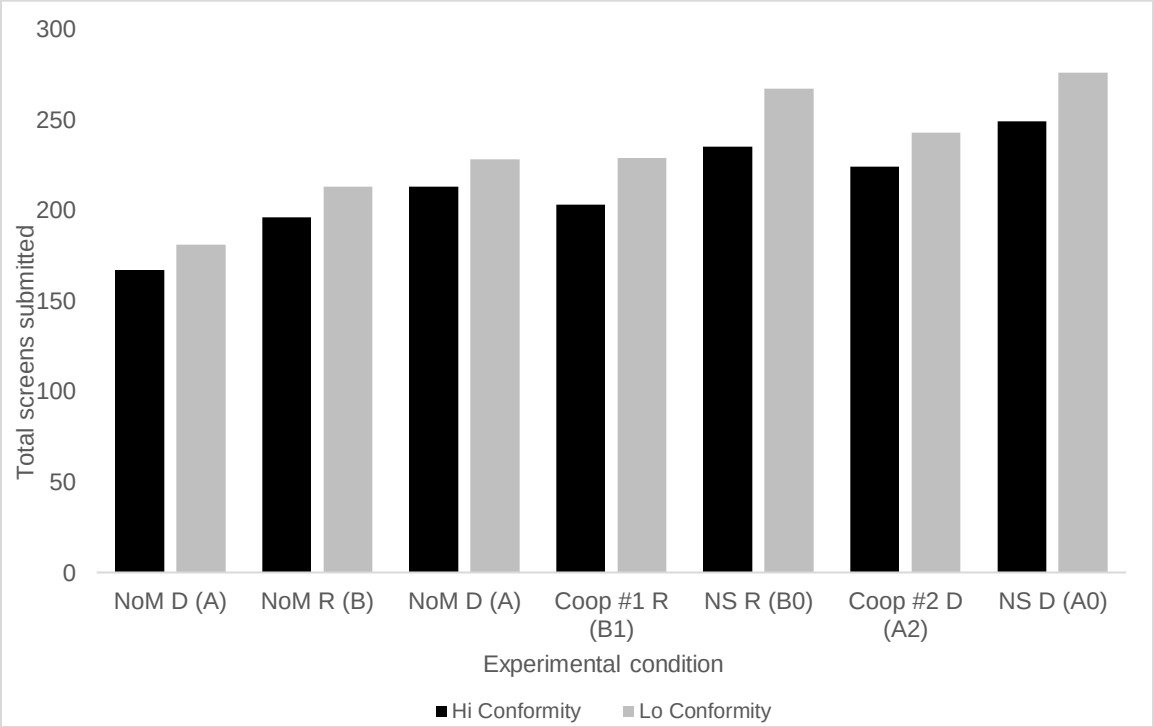


Figure 3

Group averages allocated to "fix partner error" choice in all conditions

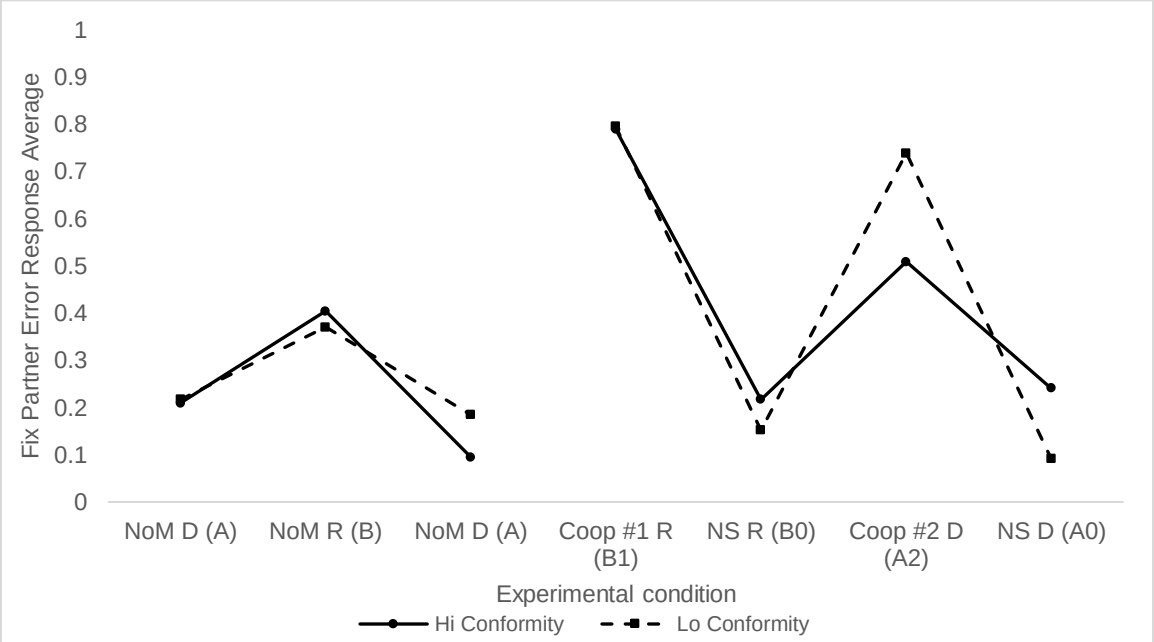


Figure 4

Group averages allocated to "fix partner error" choice in experimental conditions

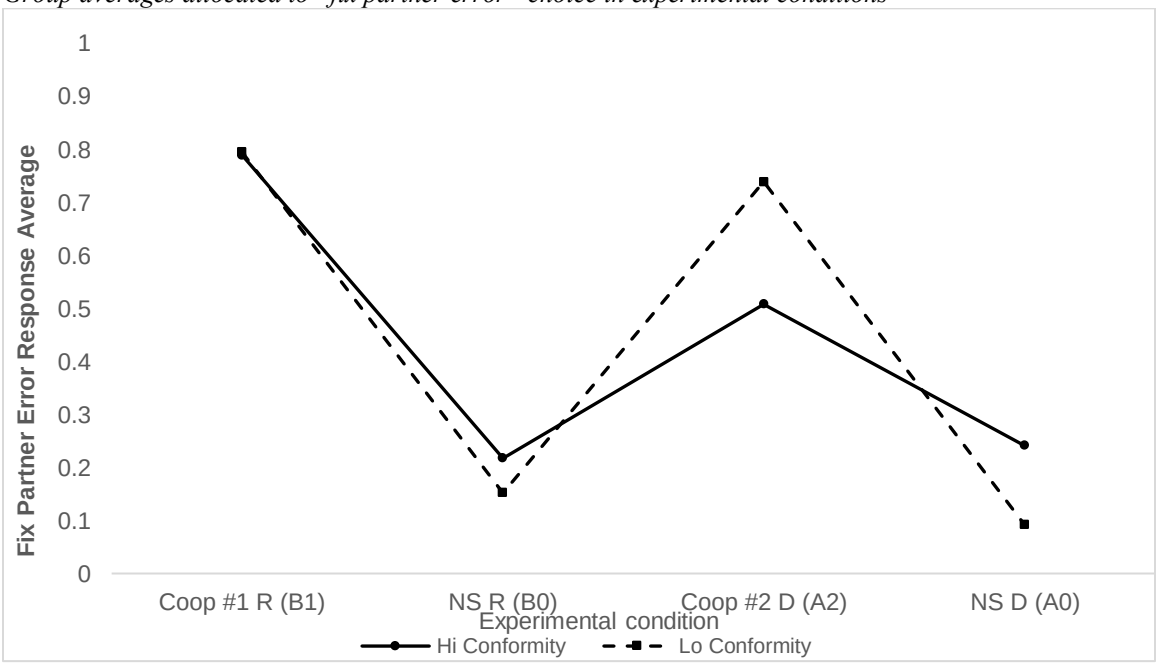


Figure 5

First three and last three fix partner error choice totals for each condition broken out by group

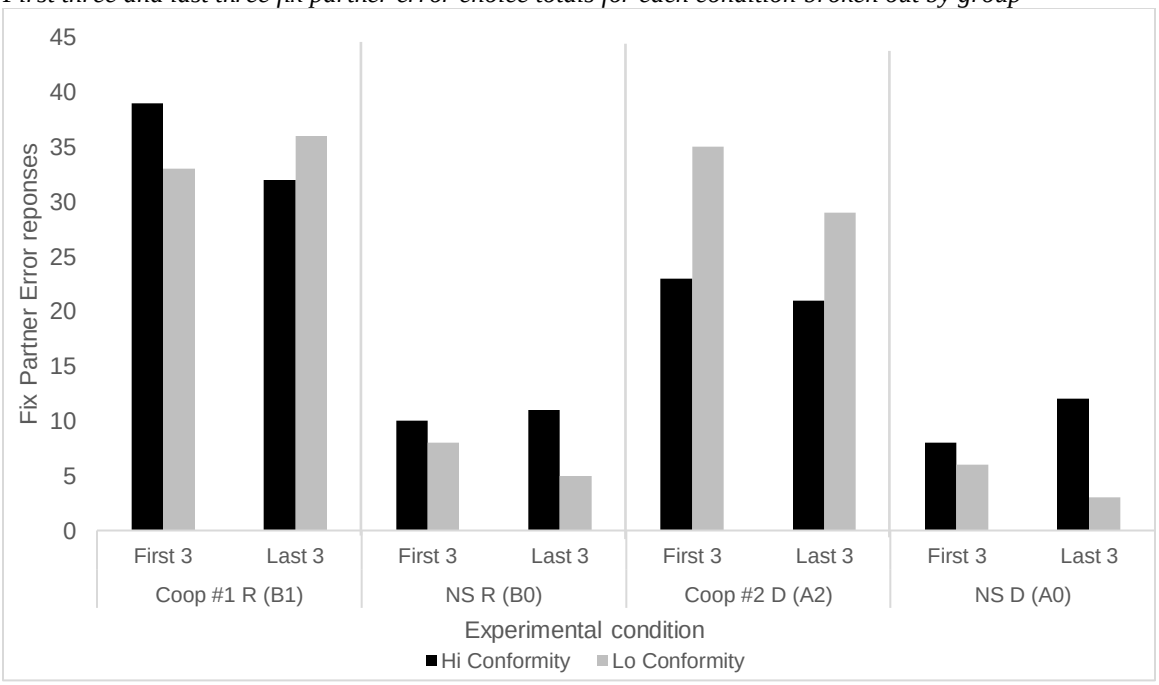


Figure 6

Participant 1004 (high conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

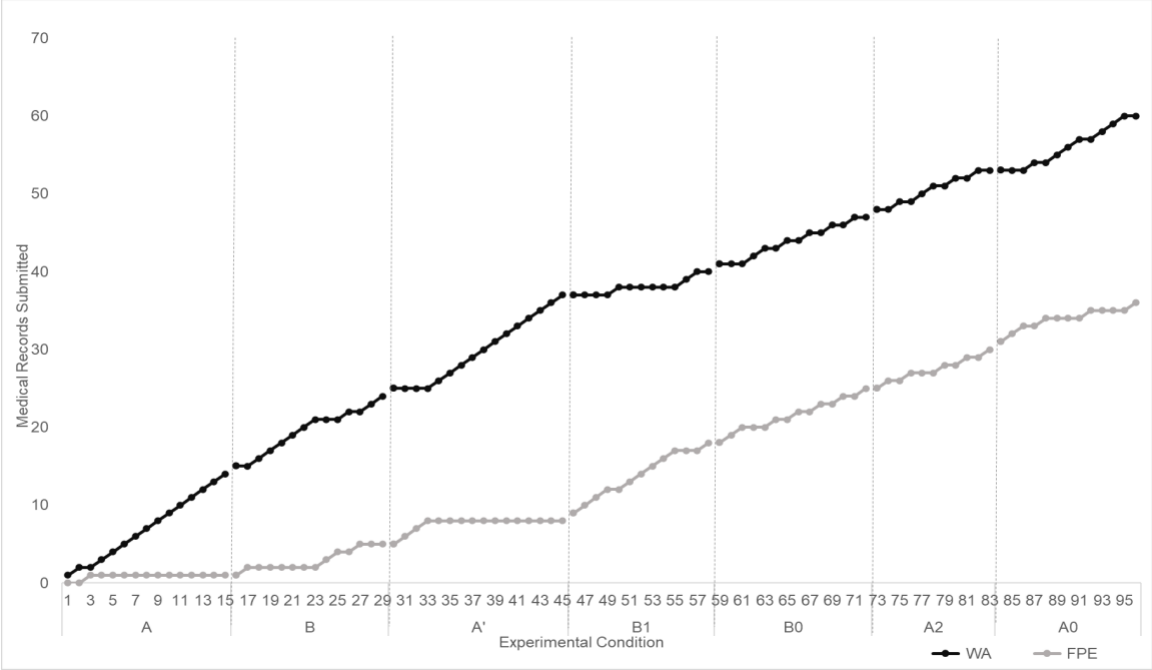


Figure 7

Participant 2877 (high conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

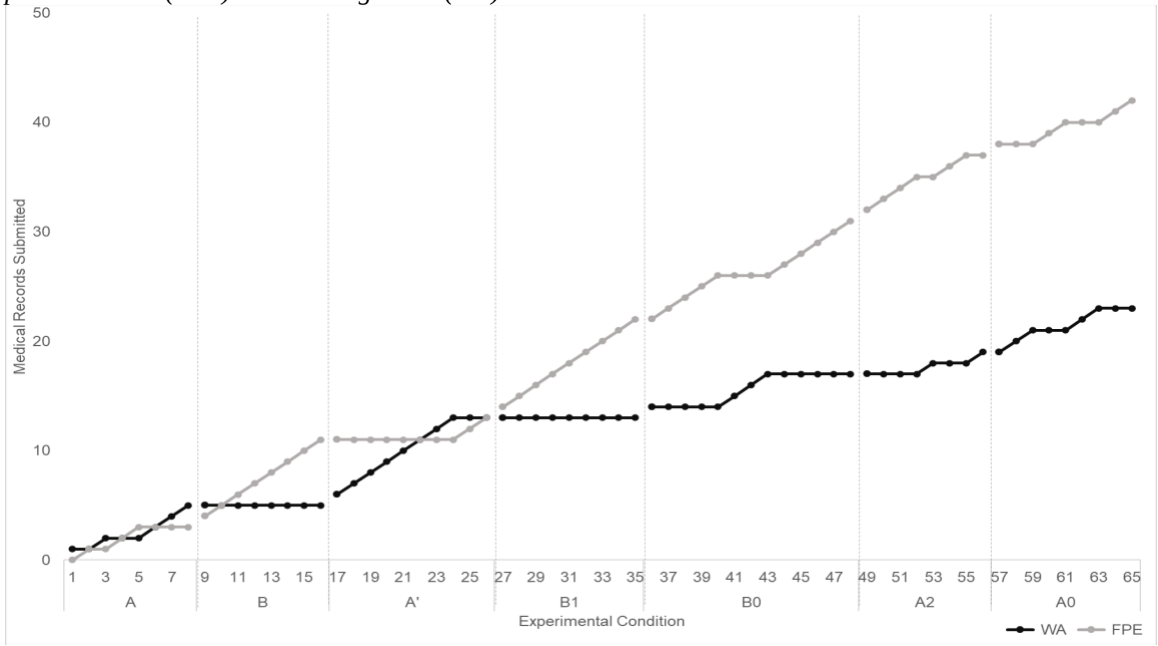


Figure 8

Participant 7118 (high conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

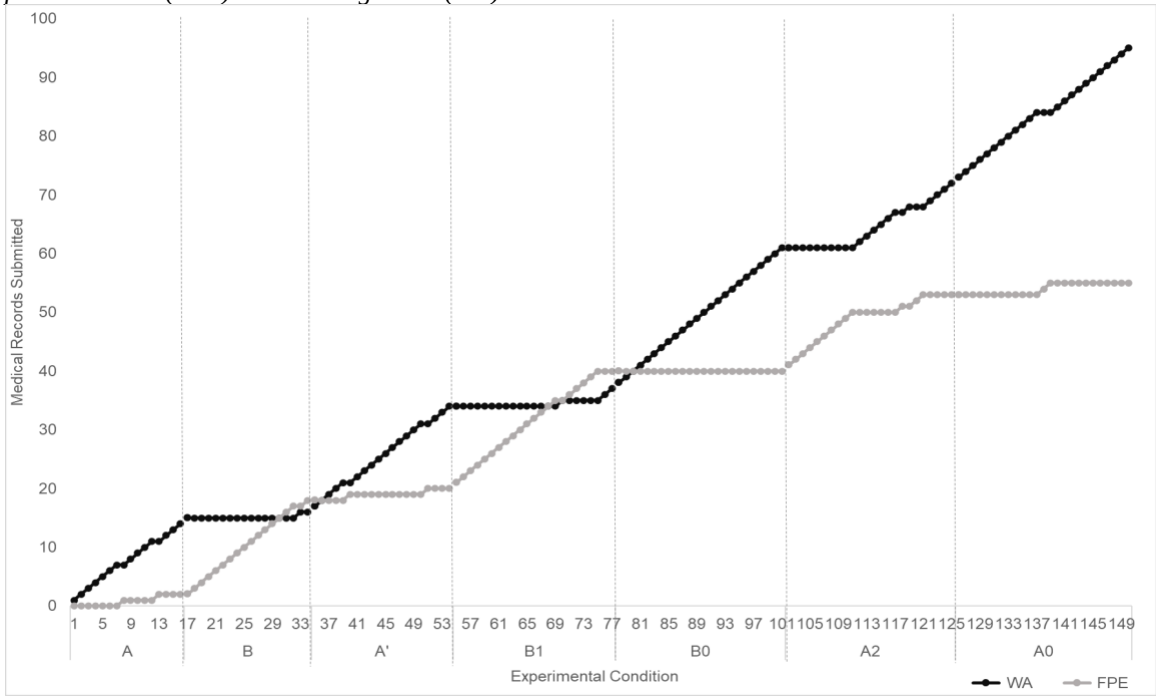


Figure 9

Participant 3202 (high conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

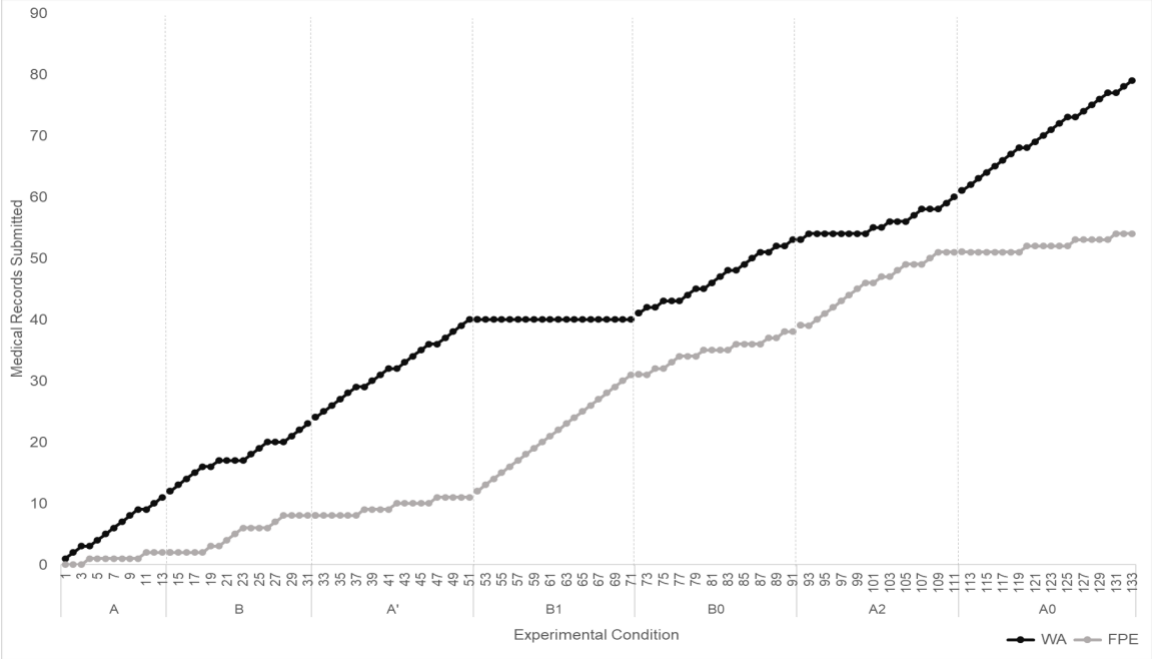


Figure 10

Participant 4092 (high conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

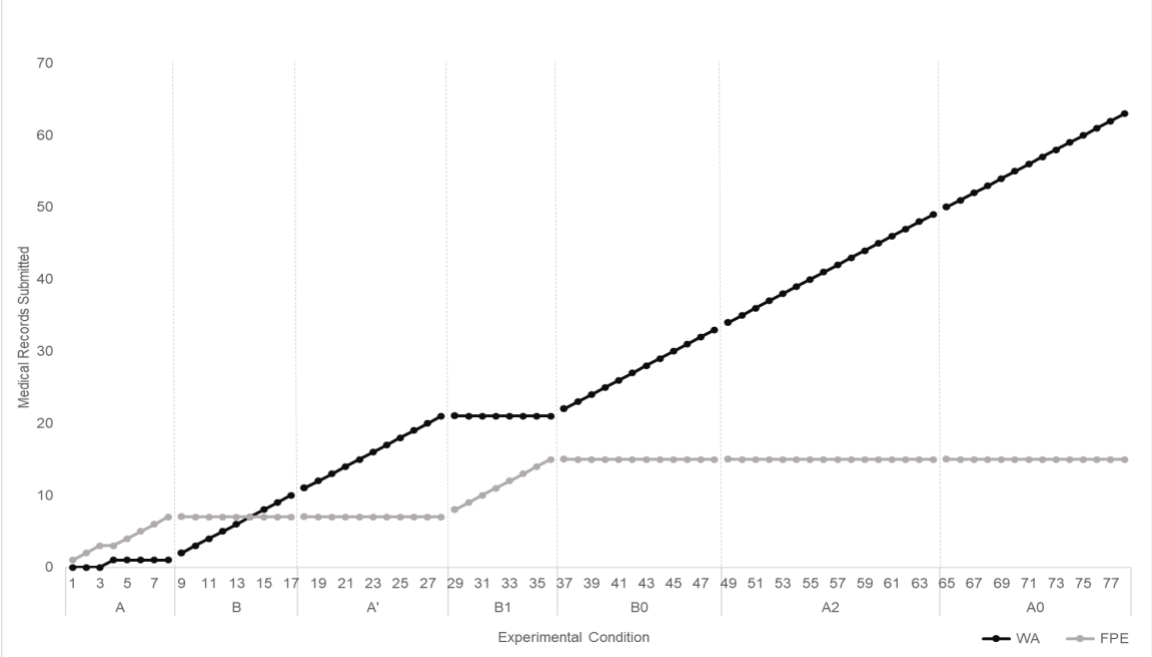


Figure 11

Participant 6176 (high conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

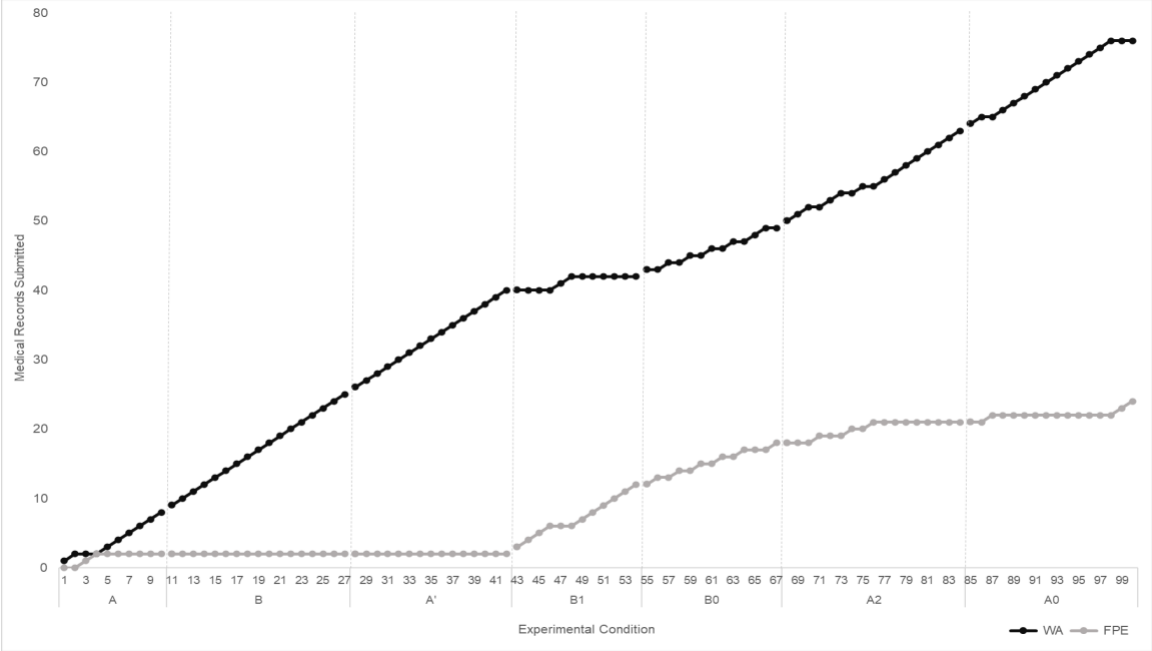


Figure 12

Participant 6469 (high conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

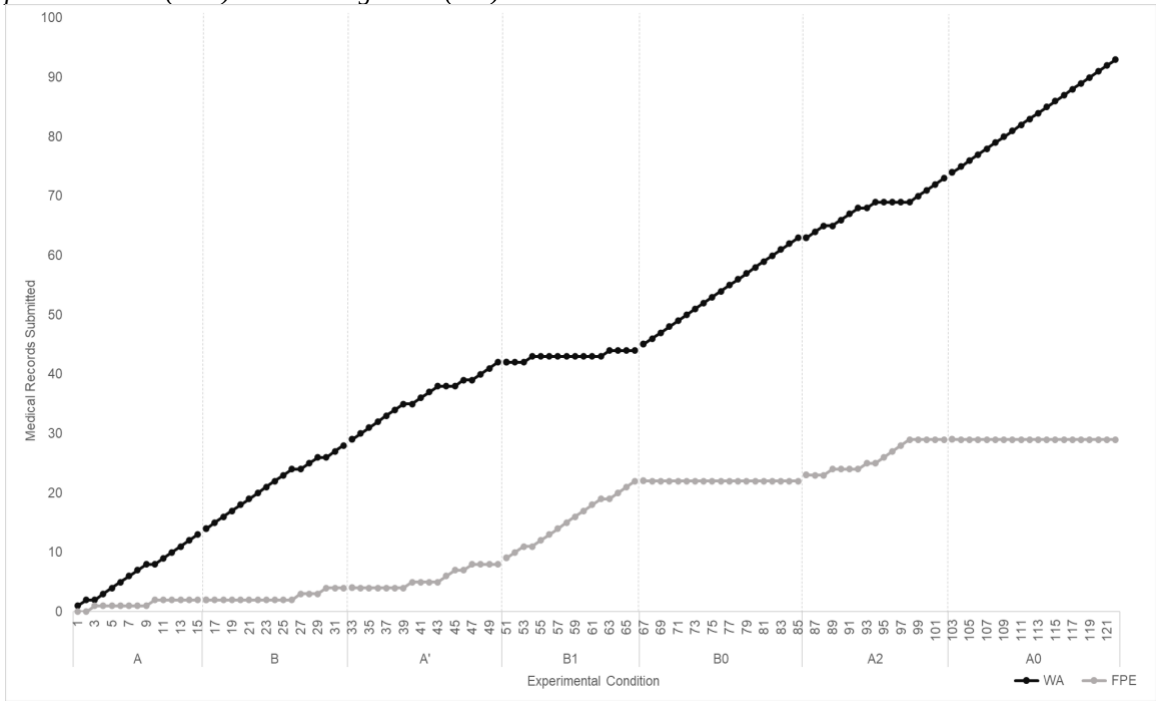


Figure 13

Participant 0997 (high conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

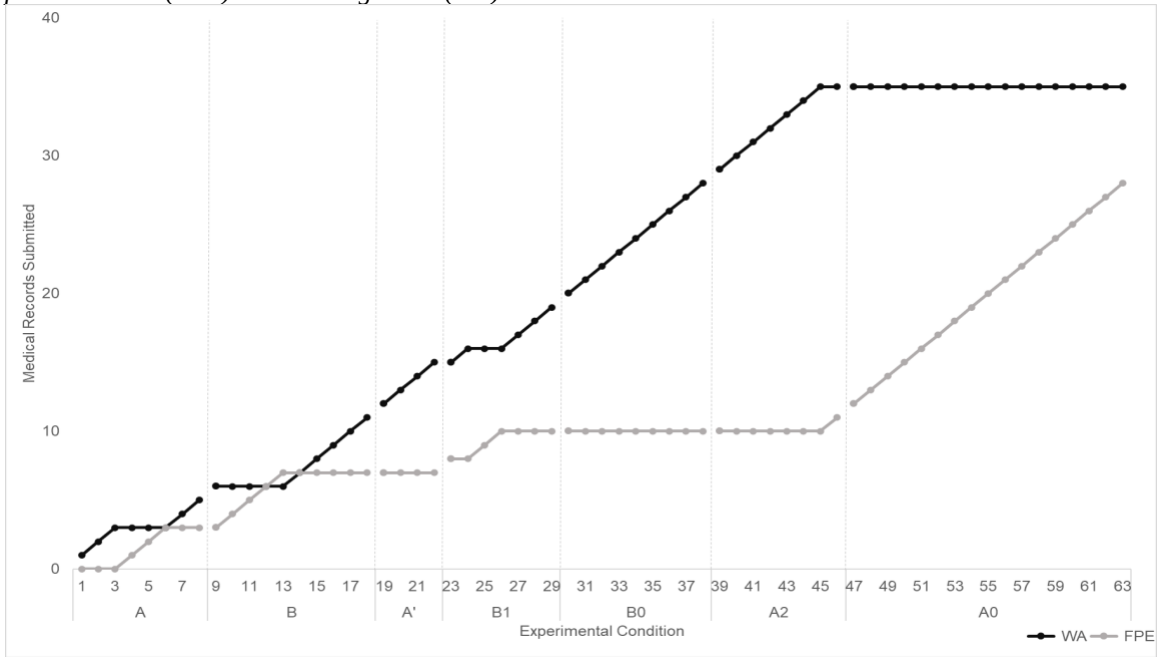


Figure 14

Participant 1919 (high conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

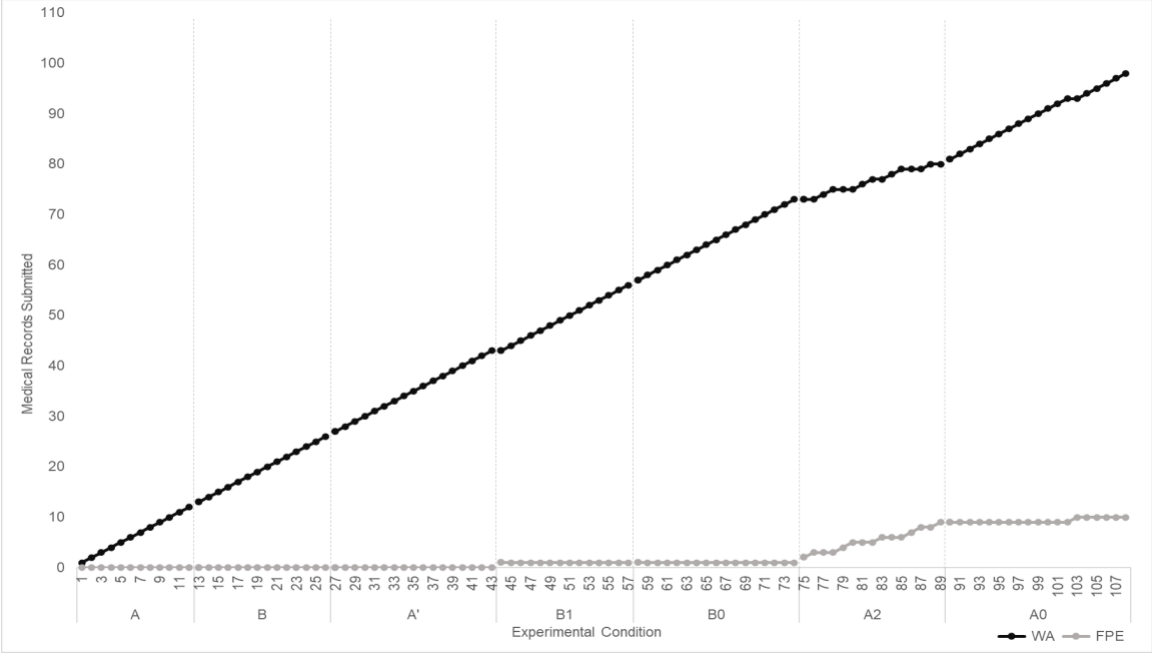


Figure 15

Participant 2985 (high conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

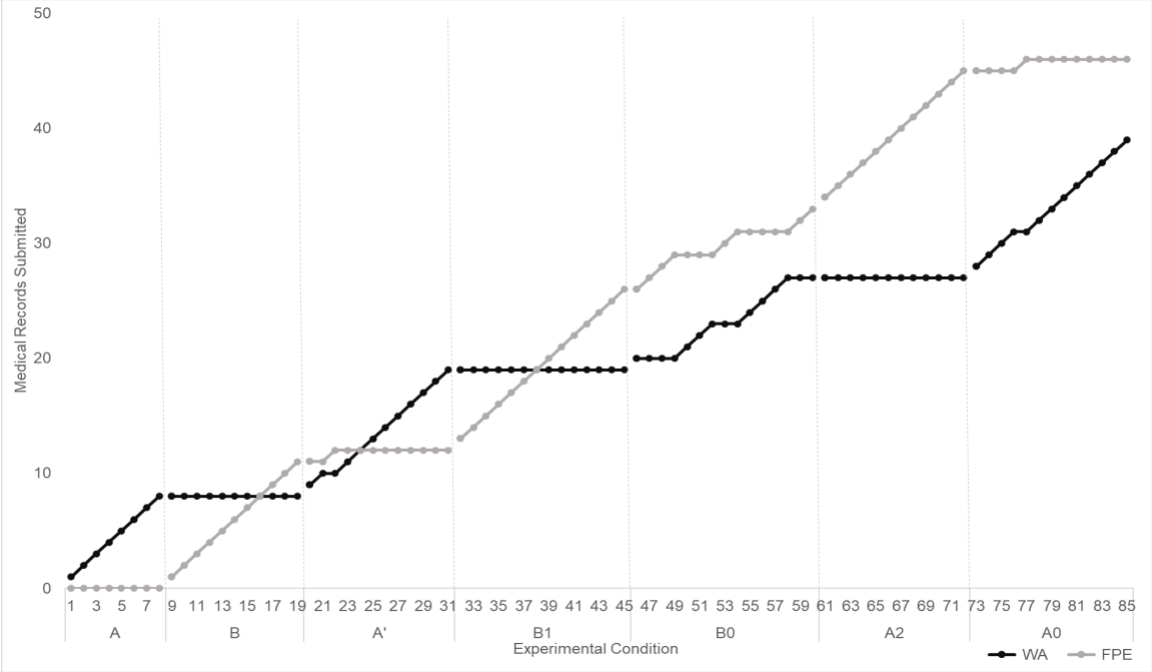


Figure 16

Participant 6039 (high conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

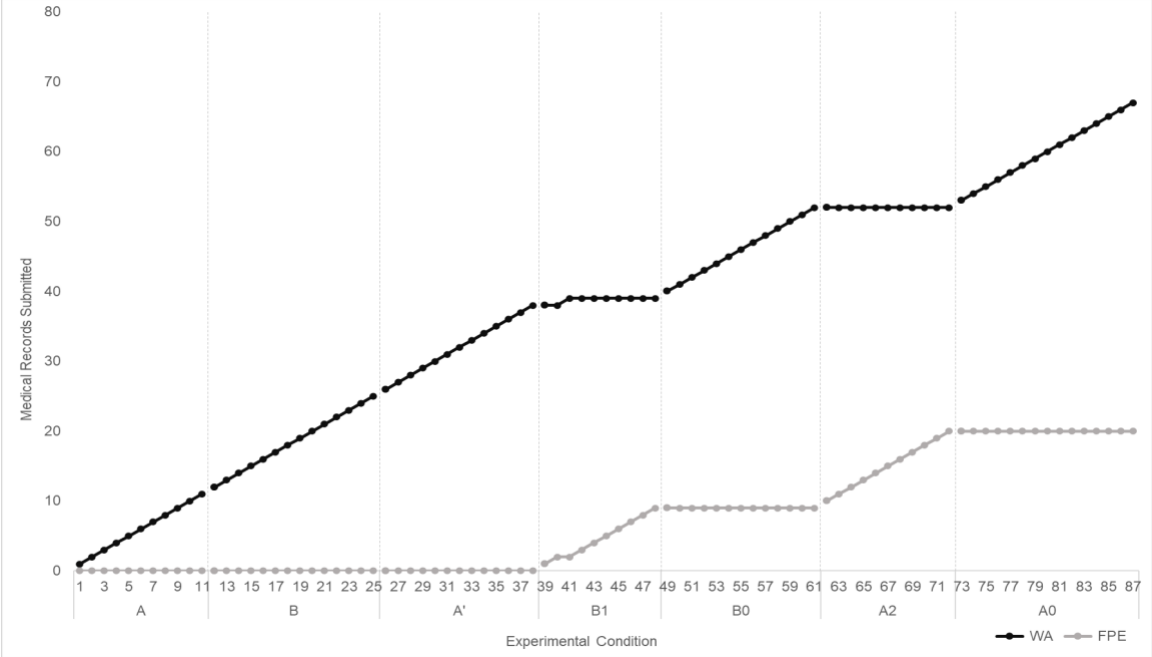


Figure 17

Participant 7826 (high conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

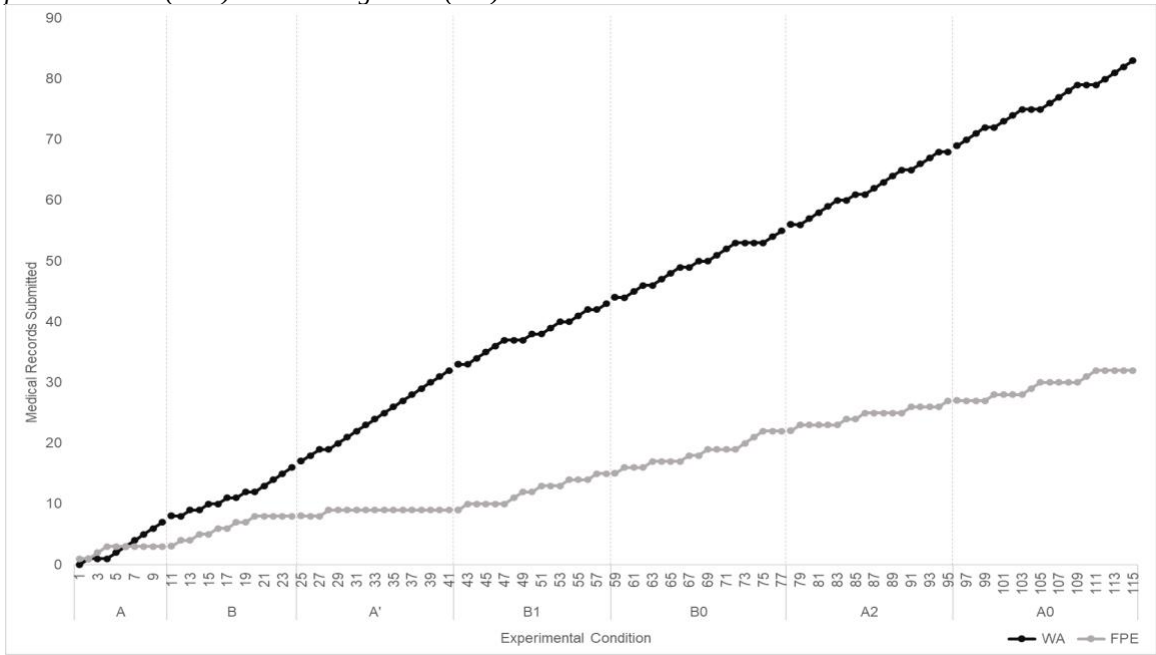


Figure 18

Participant 2919 (high conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

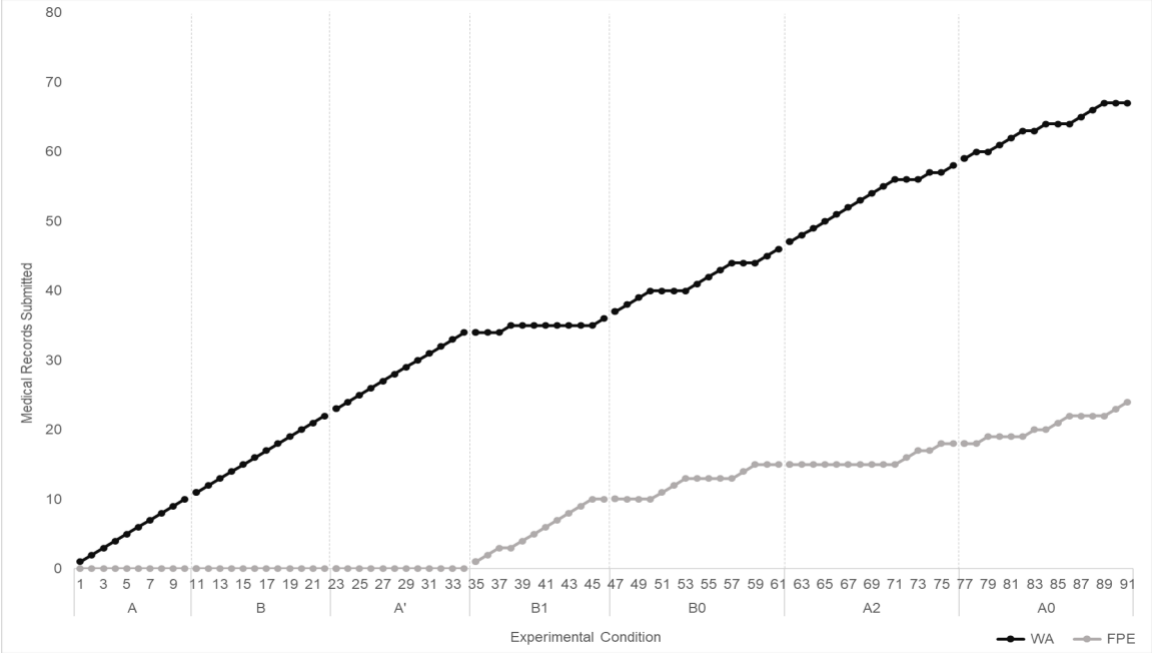


Figure 19

Participant 3875 (high conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

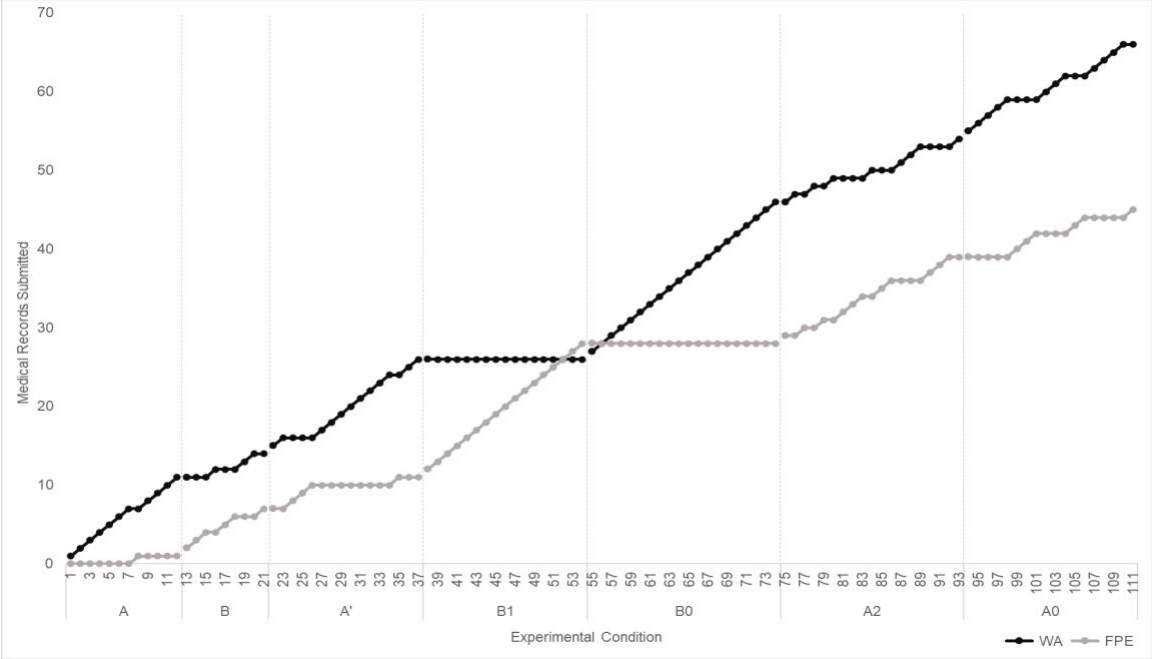


Figure 20

Participant 9059 (high conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

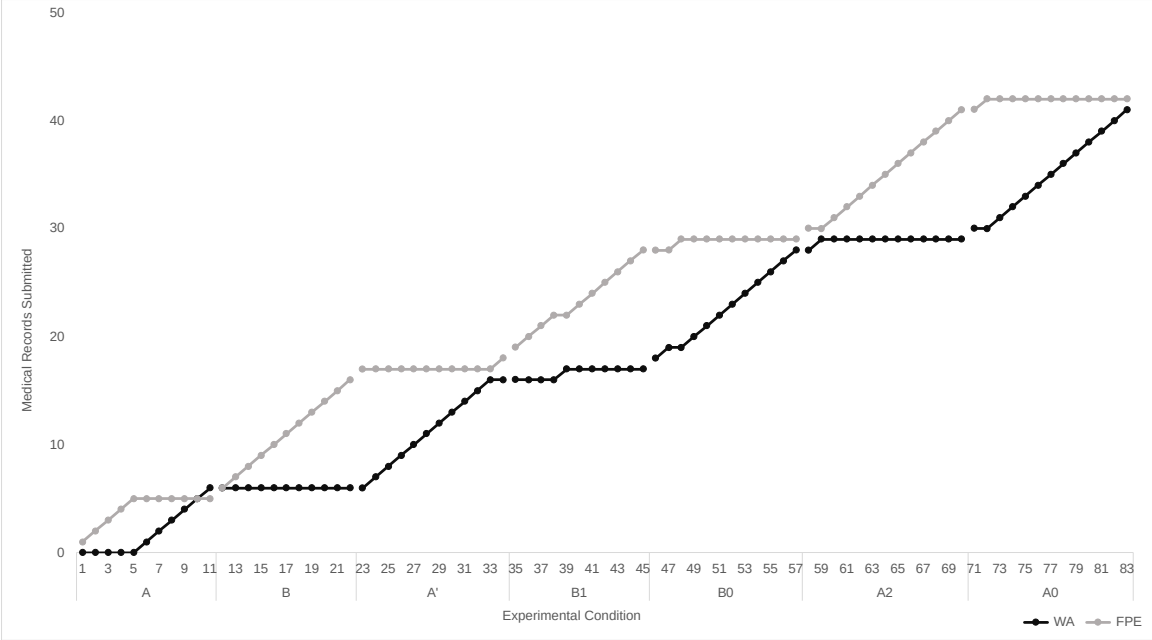


Figure 21

Participant 6745 (low conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

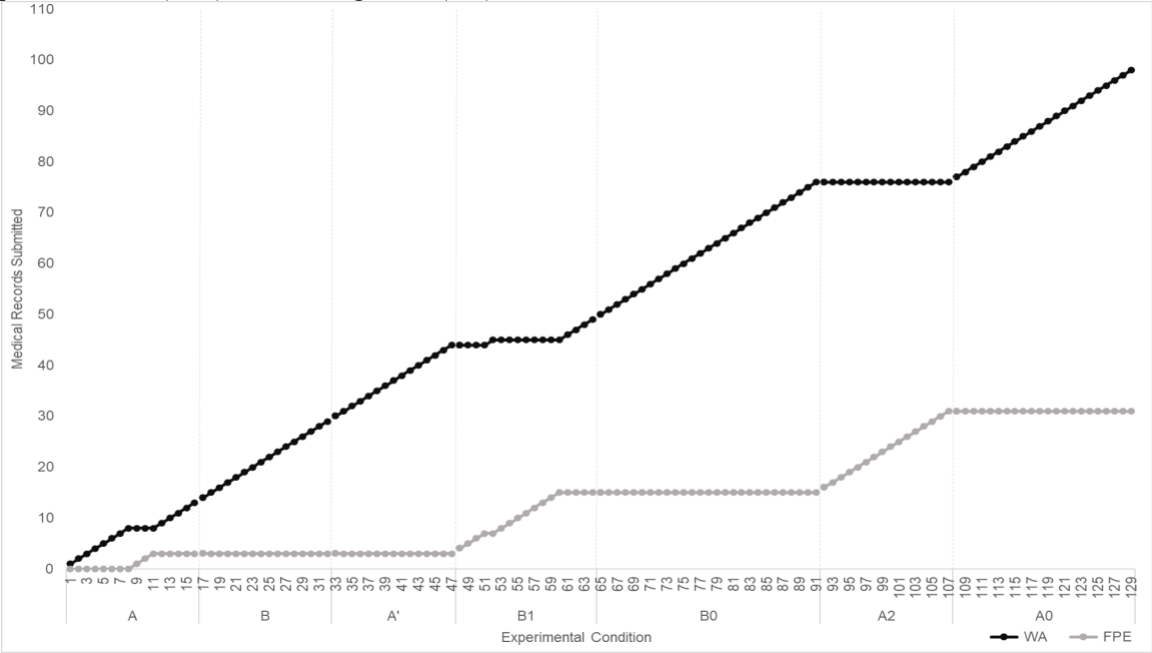


Figure 22

Participant 3538 (low conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

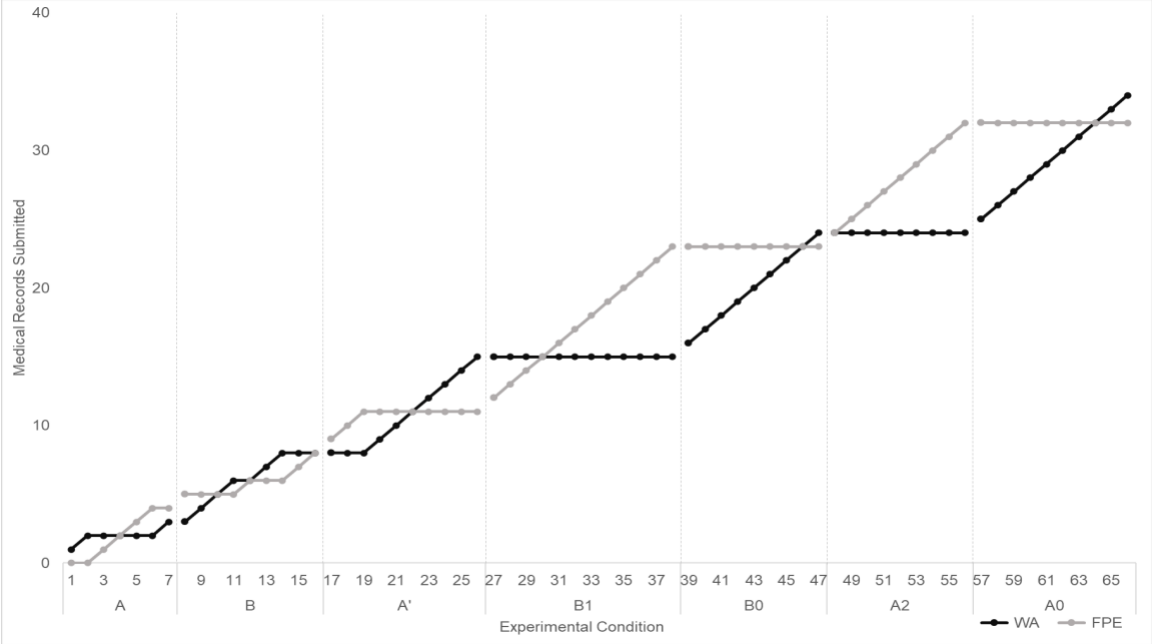


Figure 23

Participant 8532 (low conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

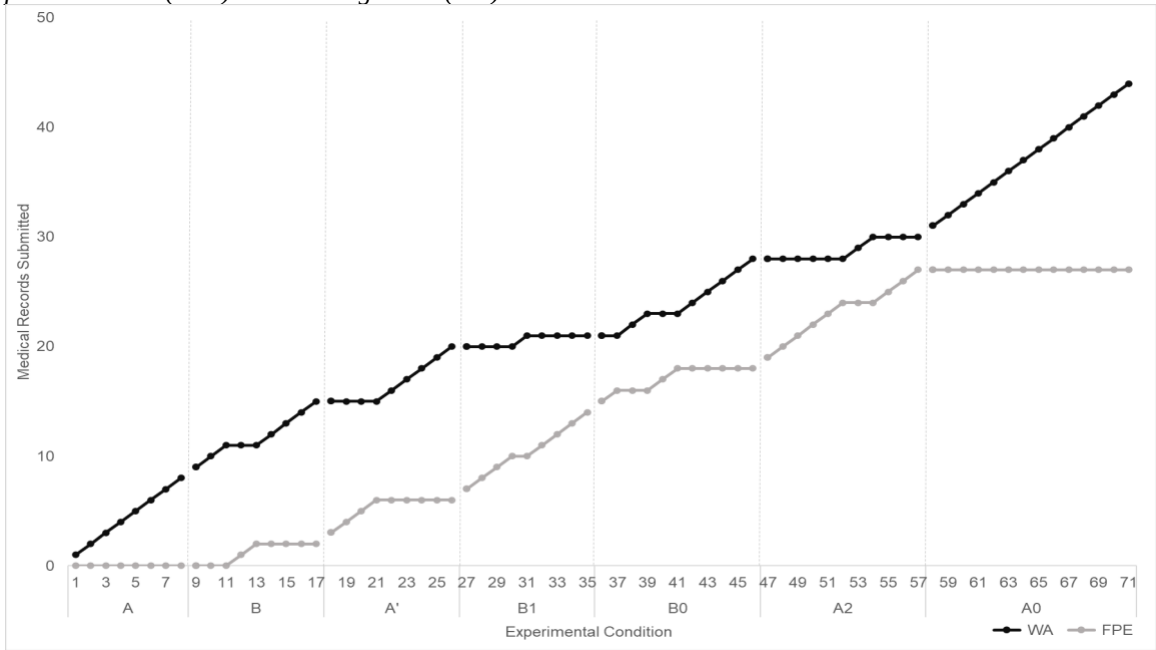


Figure 24

Participant 2340 (low conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

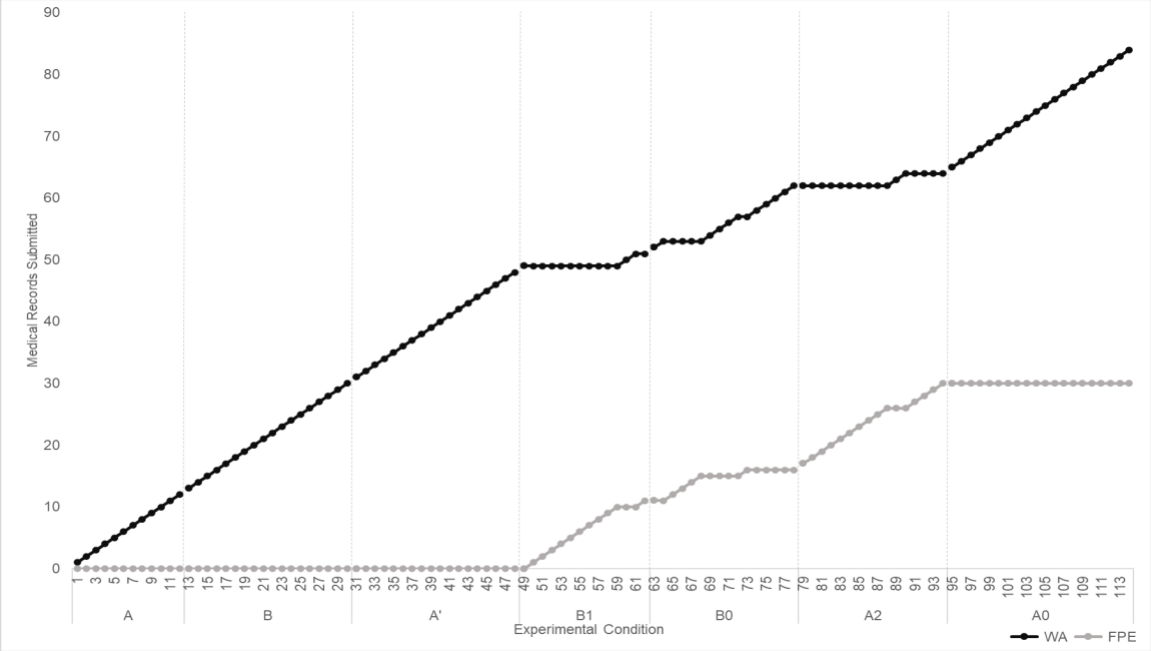


Figure 25

Participant 7064 (low conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

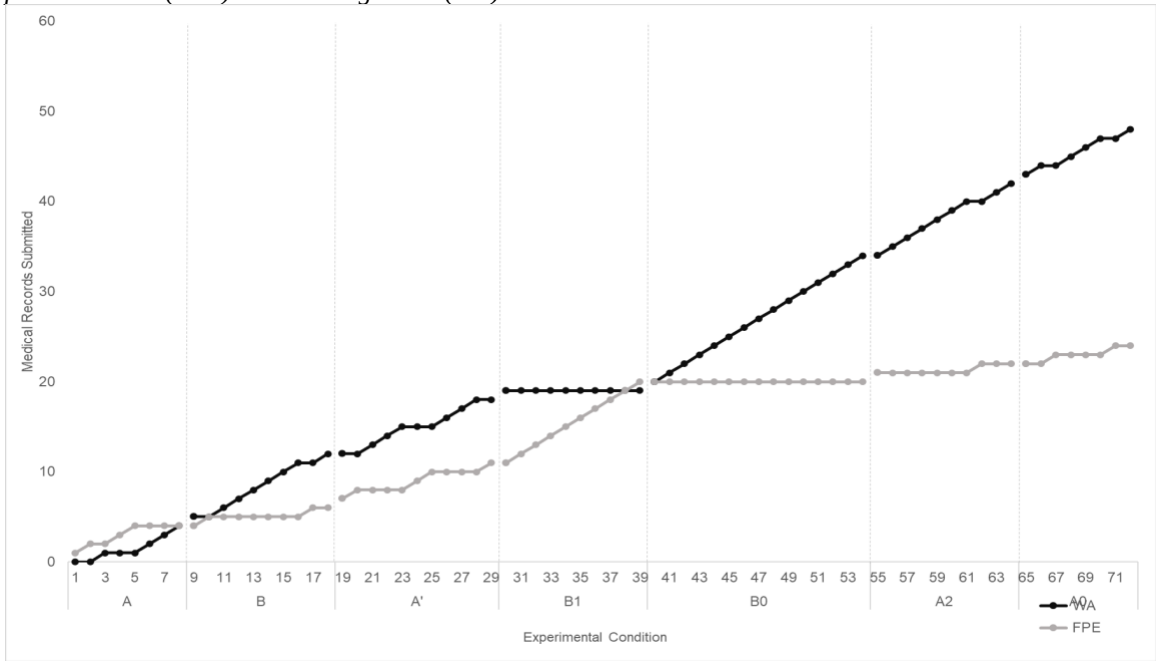


Figure 26

Participant 8079 (low conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

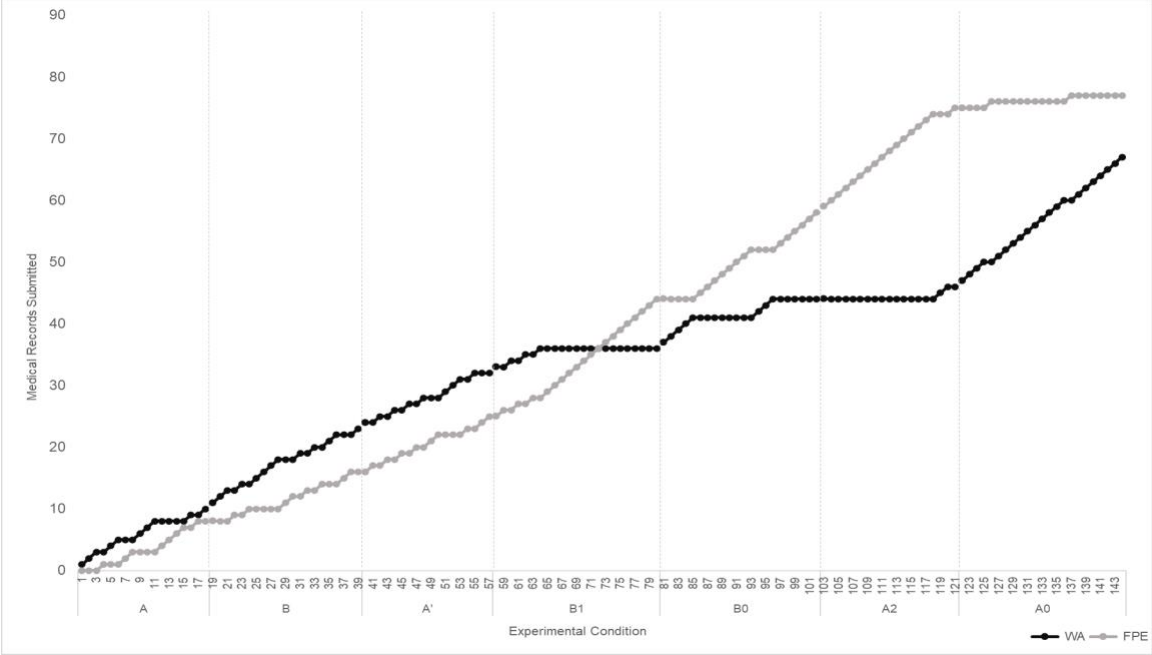


Figure 27

Participant 2936 (low conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

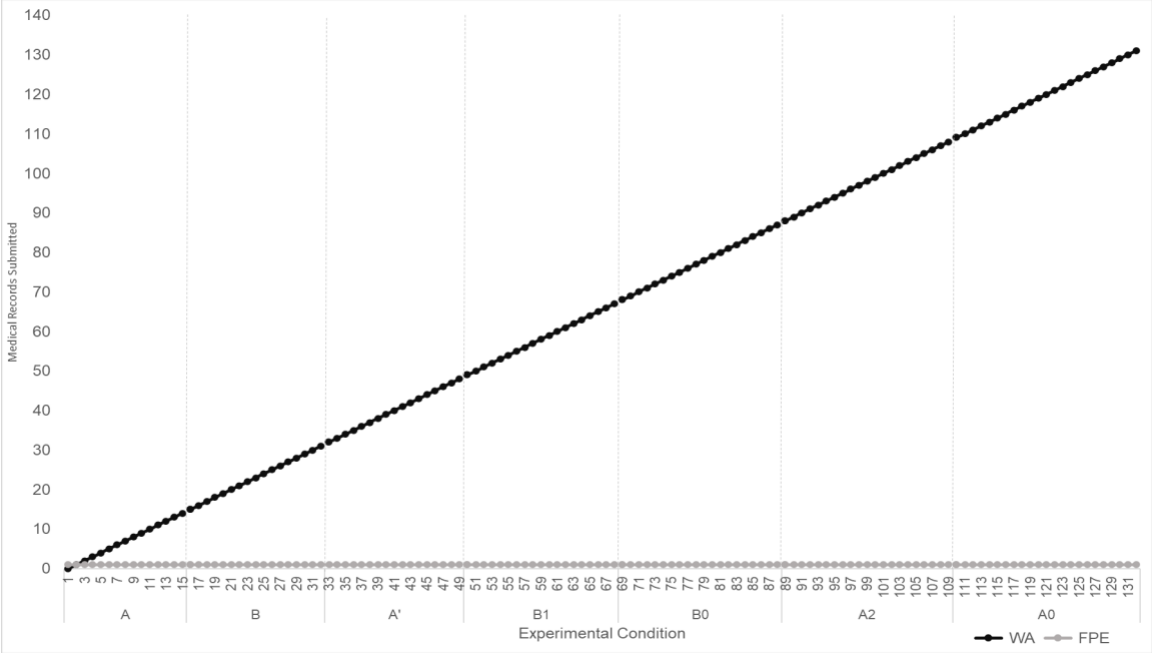


Figure 28

Participant 2967 (low conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

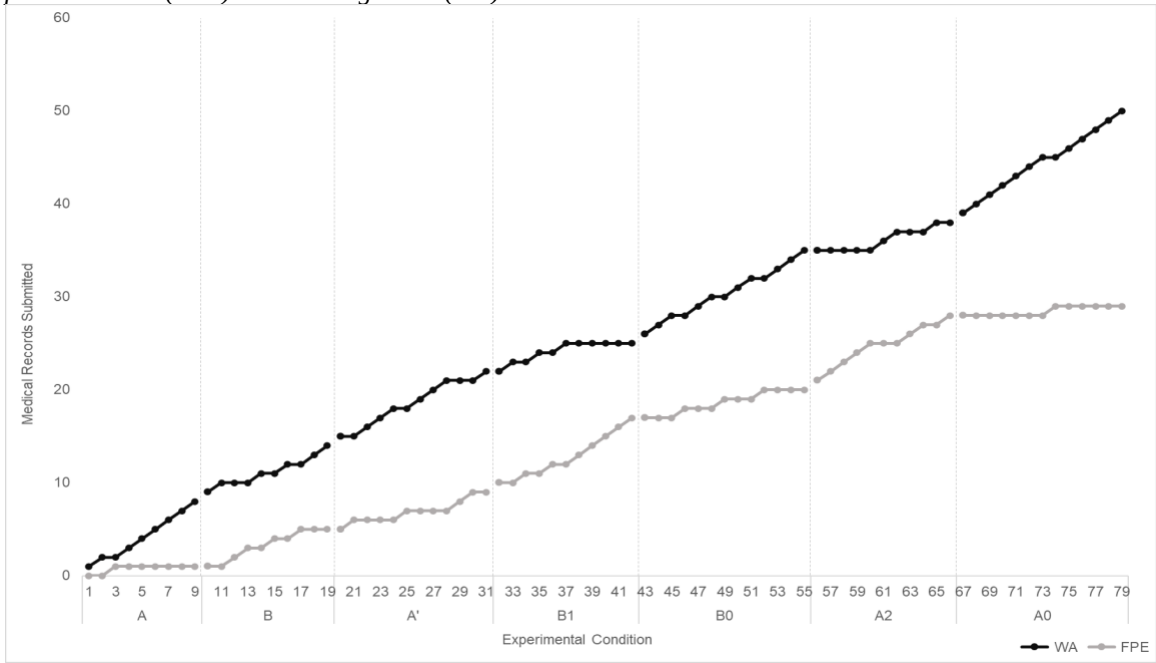


Figure 29

Participant 3765 (low conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

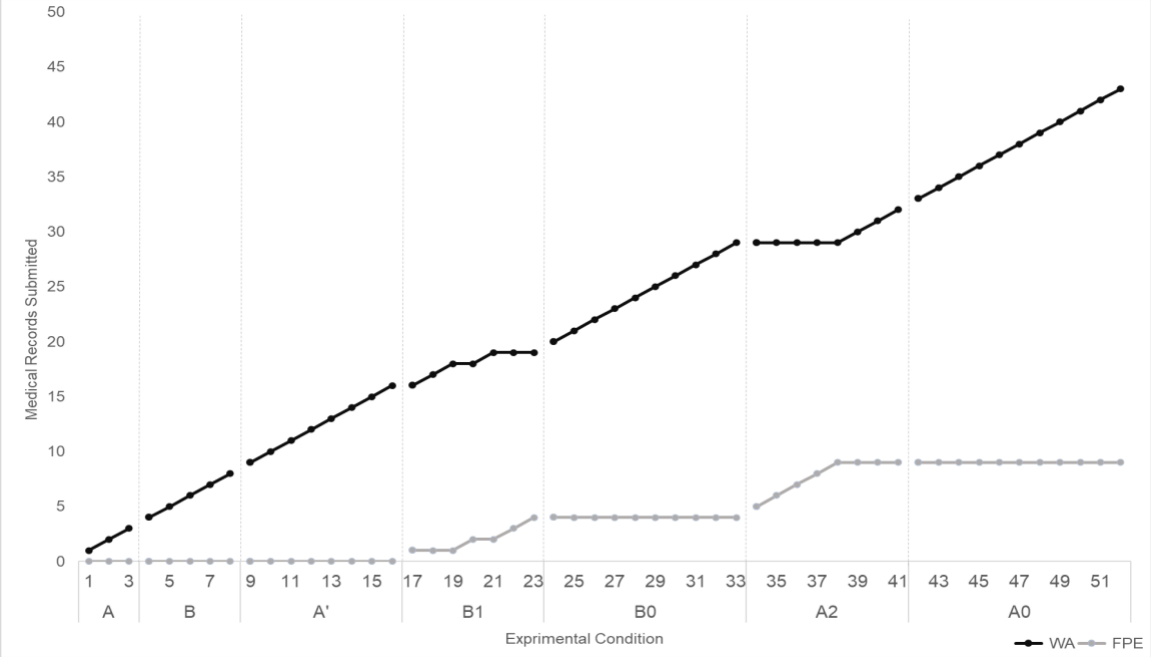


Figure 30

Participant 7321 (low conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

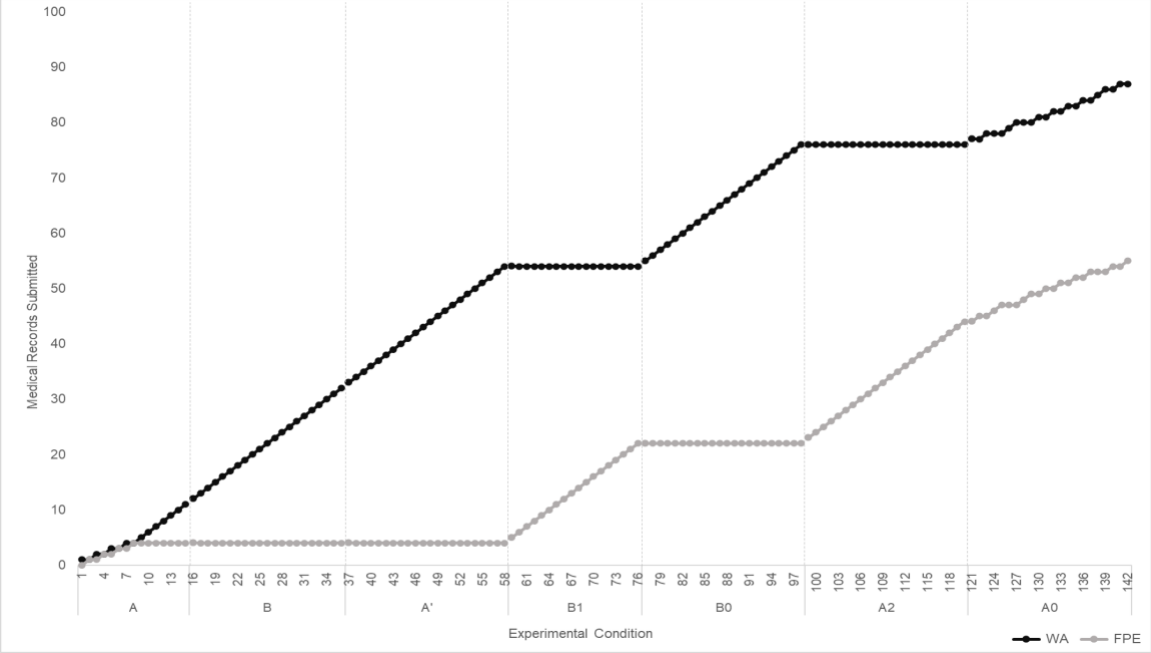


Figure 31

Participant 9456 (low conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

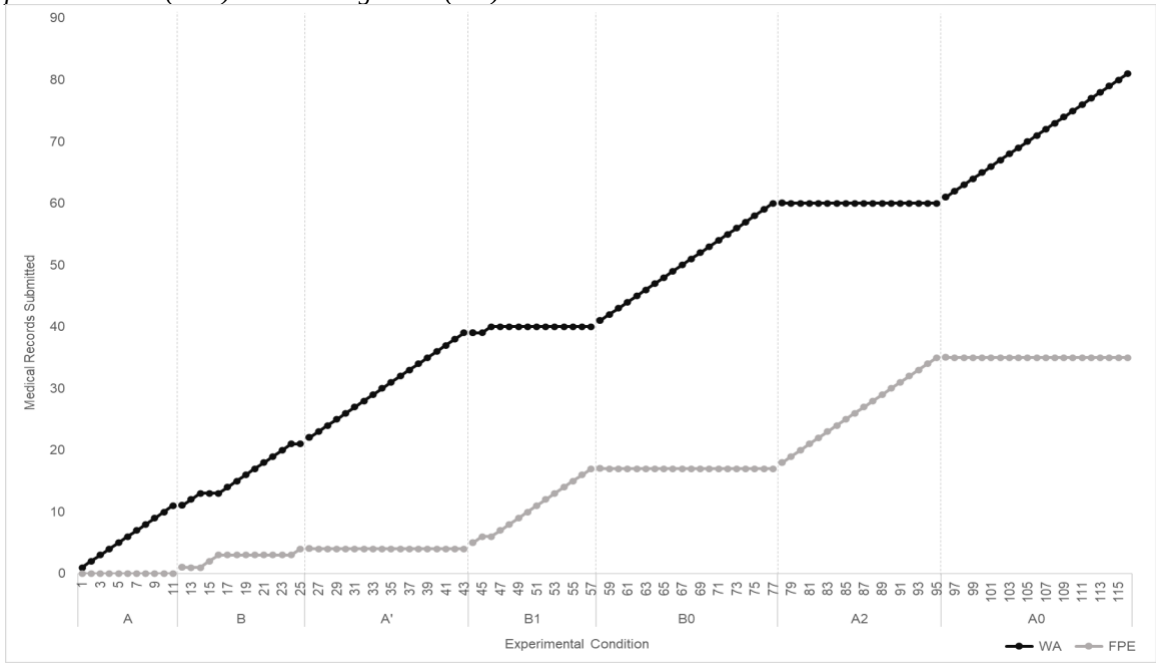


Figure 32

Participant 6342 (low conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

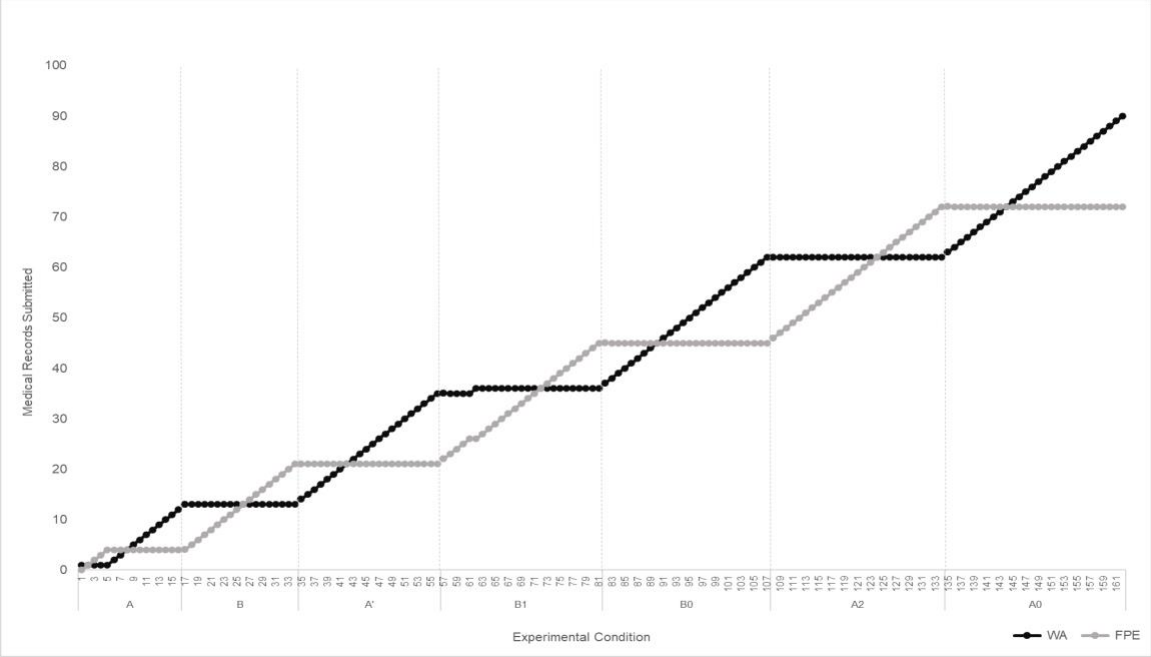


Figure 33

Participant 8019 (low conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

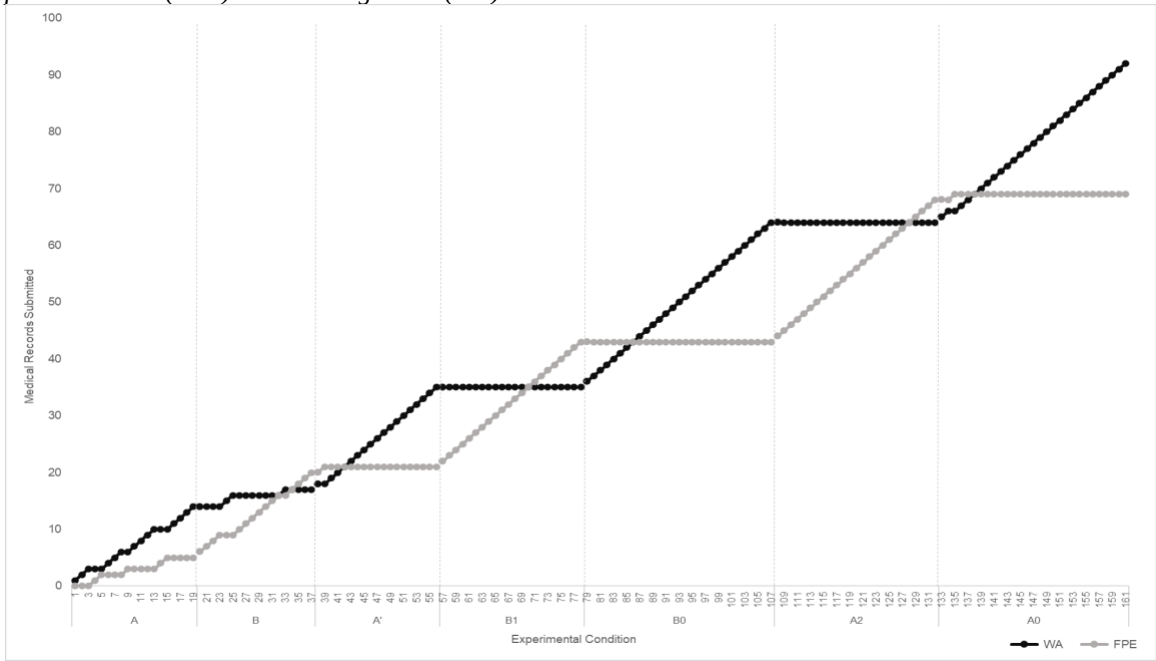


Figure 34

Participant 9470 (low conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions

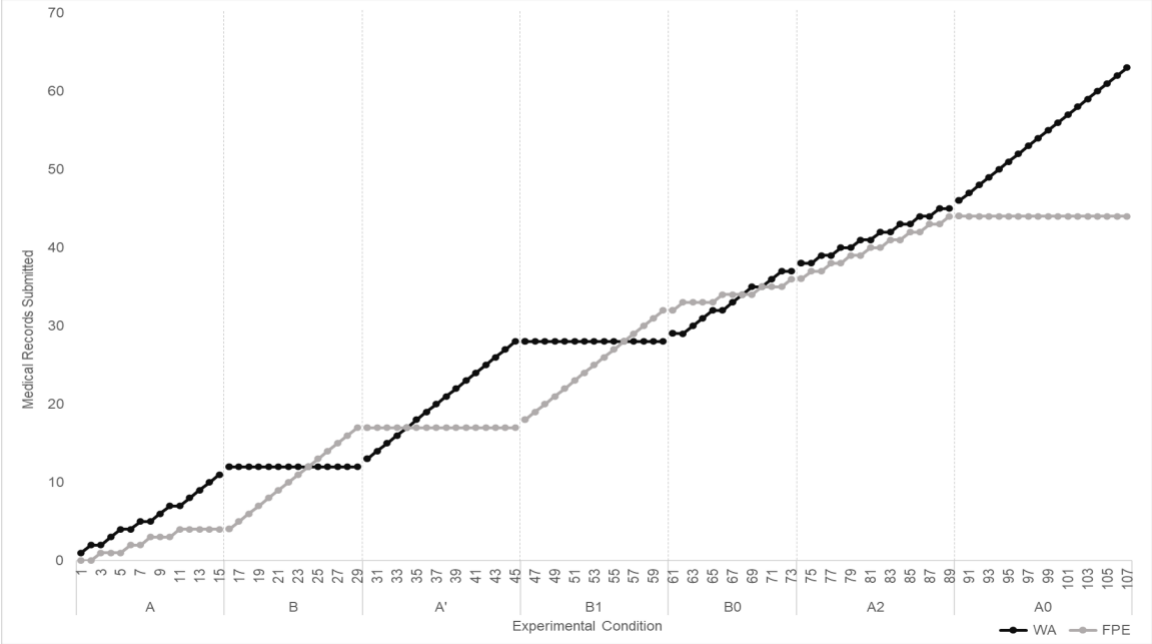
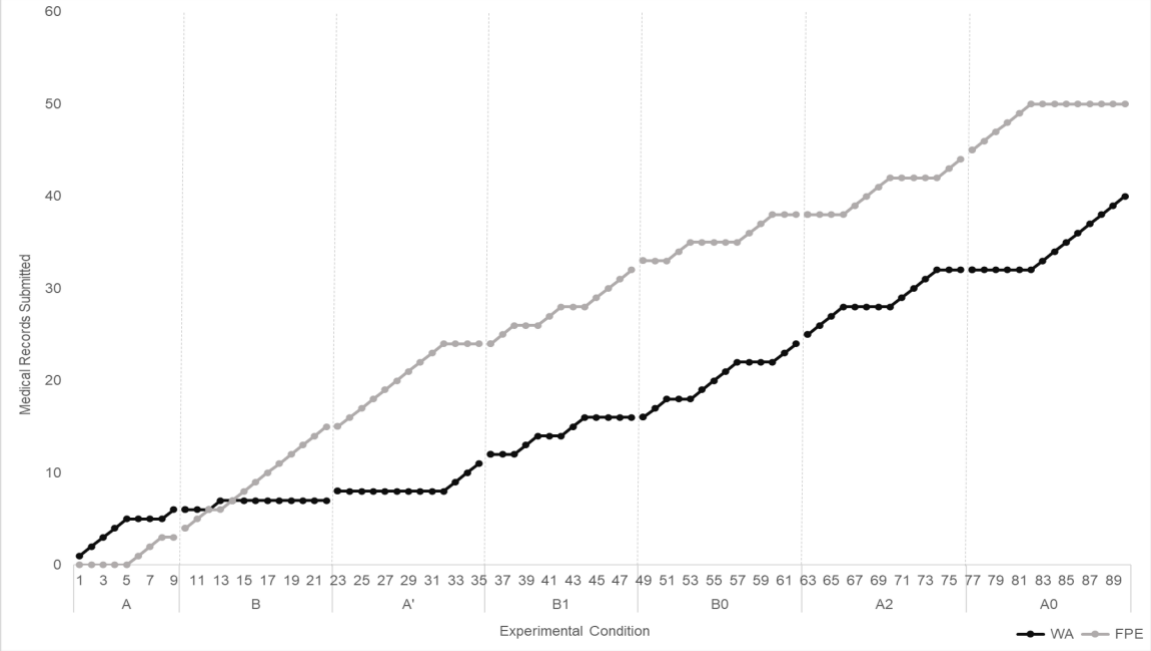


Figure 35

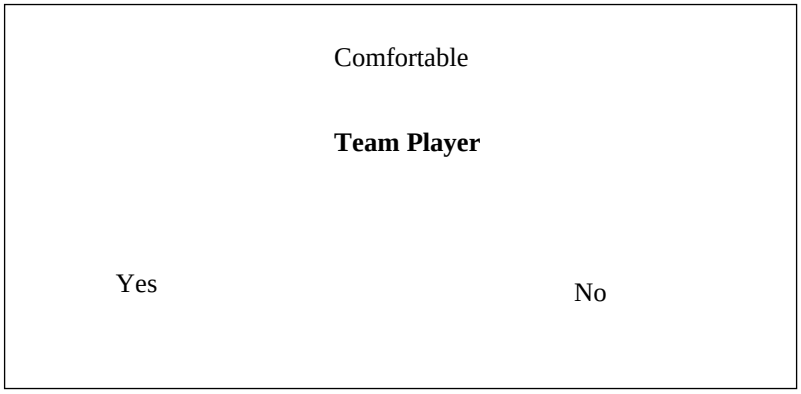
Participant 7427 (low conformity group) cumulative medical records submitted for response options fixing partner errors (FPE) and working alone (WA) across all conditions



Appendices

Appendix A

Sample MD IRAP screen



Appendix B

Initial email communication to participants

Subject line: 2-Part Study: Word Assessment and Medical Data Entry Task: PART 1 LINK

Thank you for signing up for this study. Please copy your username and password below to access the experimental portion of this study. The link to participate is below. Part 1 moves very fast and requires your full attention. Please find a quiet place to complete Part 1 with no distractions. You must complete this part of the study by 2pm, Tuesday, December 8th.

Username:
Password:

Begin Study

Or copy and paste the link below:
https://unr.az1.qualtrics.com/jfe/form/SV_aeYrE2tLm1nctmZ

Appendix C

Pre-experiment survey

We are conducting a 2-part research study to learn the effect words have in relationship to the probability of responding.

If you volunteer to be in this study, you will be asked to *potentially* participate in two phases of a study. The first phase will be a computer assessment asking you to respond in agreement or disagreement with particular words being “good” or “bad”.

Your participation in the first part of the study should take approximately 15-30 minutes. You must complete Part 1 to be eligible for Part 2. Participants will be randomly selected to move to Phase two. If you are not selected to move on to Part 2, the researcher will contact you to let you know and grant you 1 SONA credit. If you are eligible for Part 2, the researcher will contact you with instructions to access Part 2.

In the second phase of the study, you will be participating in a computer-based medical entry task. Benefits of doing research are not definite; but we hope to better understand the conditions under which a person is likely to respond in a specific way. There are no direct benefits to you in this study activity.

Your participation in the second part of the study should take approximately 30 minutes. You must complete Part 2 to be eligible to receive 2 SONA credits and an Amazon e-gift card for the amount you earn during Part 2.

The researchers and the University of Nevada, Reno will treat your identity and the information collected about you with professional standards of confidentiality and protect it to the extent allowed by law. You will not be personally identified in any reports or publications that may result from this study. The US Department of Health and Human Services, the University of Nevada, Reno Research Integrity Office, and the Institutional Review Board may look at your study records.

You may ask questions of the researcher at any time by calling Elizabeth Ghezzi, 775-813-2597 or by sending an email to Elizabeth.Ghezzi@nevada.unr.edu. Your participation in this study is completely voluntary. You may stop at any time. Declining to participate or stopping your participation will not have any negative effects on your grade.

You may ask about your rights as a research participant. If you have questions, concerns, or complaints about this research, you may report them (anonymously if you so choose) by calling the University of Nevada, Reno Research Integrity Office at 775.327.2368.

Thank you for your participation in this study!

1) Are you under the age of 18?
- -Yes
- -No

2) Do you experience, or have you experienced, an arthritic condition or a repetitive stress injury in your hands or neck?
- -Yes
- -No

3) Do you have difficulties reading and/or speaking English?
- -Yes
- -No

If you answered "yes" to any of the previous questions, then you are ineligible to participate in this study. Otherwise, click the link below to begin Part 1 of this research. Please use the unique username and password that was emailed to you to access Part 1.

https://myirap.azurewebsites.net/loginpage.html

Appendix D

MD IRAP instructions

Thank you for participating in this assessment! Your results will be kept anonymous. We ask that you provide responses as accurately as possible. Please inform your Canvas instructor if you require this assessment to be in a more accessible format.

Press *space* to continue.

This assessment is very fast-paced and requires your full attention and concentration. This assessment is not a standard survey or question-based assessment. The following pages will describe in detail how the assessment works.

Press *space* to continue

The more accurately you answer, the faster you will complete the assessment. You should expect a time commitment of approximately 5-10 minutes to complete this particular assessment.

Press *space* to continue

Pairs of words will be presented to you on the screen, and you will be asked to match these words (e.g., GOOD and FLOWER) to a particular response (YES or NO). You should read these words as a sentence, such as *FLOWERS are GOOD: YES or NO?* You will make your response of YES or NO using the *D* and *K* keys, respectively, on the keyboard. The YES/NO response associated with each key will stay the same from one trial to the next. You must make these responses each time as QUICKLY and ACCURATELY as possible.

Press *space* to continue.

You will now go through some practice trials to familiarize you with the task. If you answer too slowly, you will be told to 'GO FASTER!'

Press *space* to continue.

You will see words that pertain to flowers and insects. For this practice phase, you must answer as though FLOWERS are GOOD and INSECTS are BAD.

Press *space* to continue.

Appendix E

Post phase one emails to participants

Failed IRAP

Subject line: 2-Part Study: Word Assessment and Medical Data Entry Task

Thank you for participating in Part 1 of our 2-part study. Unfortunately, you did not pass the assessment portion of the study and are therefore ineligible to move on to Part 2. Your 1 SONA credit for participating in Part 1 of this study will be granted shortly and you will be removed from the Part 2 timeslot. Please email Elizabeth Ghezzi at Elizabeth.ghezzi@nevada.unr.edu should you have any questions or concerns.

NOT going to Part 2

Subject line: 2-Part Study: Word Assessment and Medical Data Entry Task

Thank you for participating in Part 1 of our 2-part study. Unfortunately, you have not been randomly selected to move on to Part 2. Your 1 SONA credit for participating in Part 1 will be released shortly and you will be excused from Part 2. Please email Elizabeth Ghezzi at Elizabeth.ghezzi@nevada.unr.edu should you have any questions or concerns.

Moving on to Part 2

Subject line: 2-Part Study: Word Assessment and Medical Data Entry Task: PART 2 LINK

Thank you for participating in Part 1 of our 2-part study. Congratulations, you have been randomly selected to move on to Part 2. Your 1 SONA credit for Part 1 will be released shortly. Please copy your 4-digit username below as it is required in order to complete the survey at the end of Part 2, receive your 2 SONA credits, and receive an Amazon e-gift card in the $ amount you earn during Part 2. You must complete this part of the study by 2pm on Thursday, Dec. 10th.

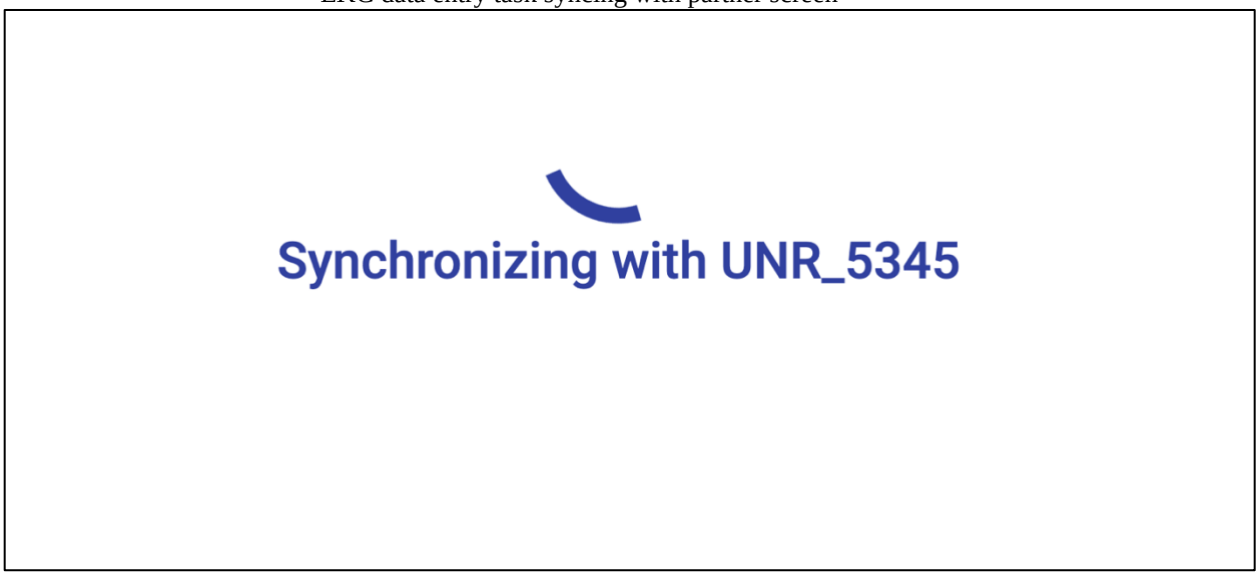
Username:

Begin study

Or copy and paste the link below:

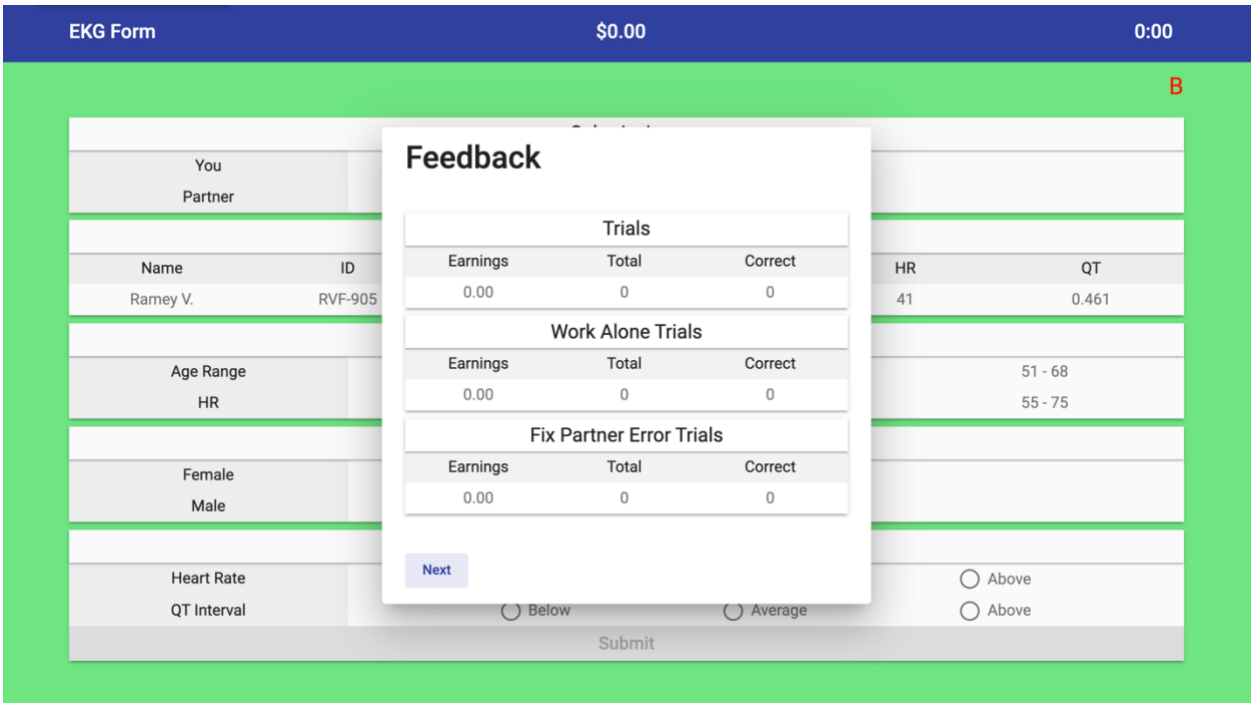
Appendix F

EKG data entry task syncing with partner screen



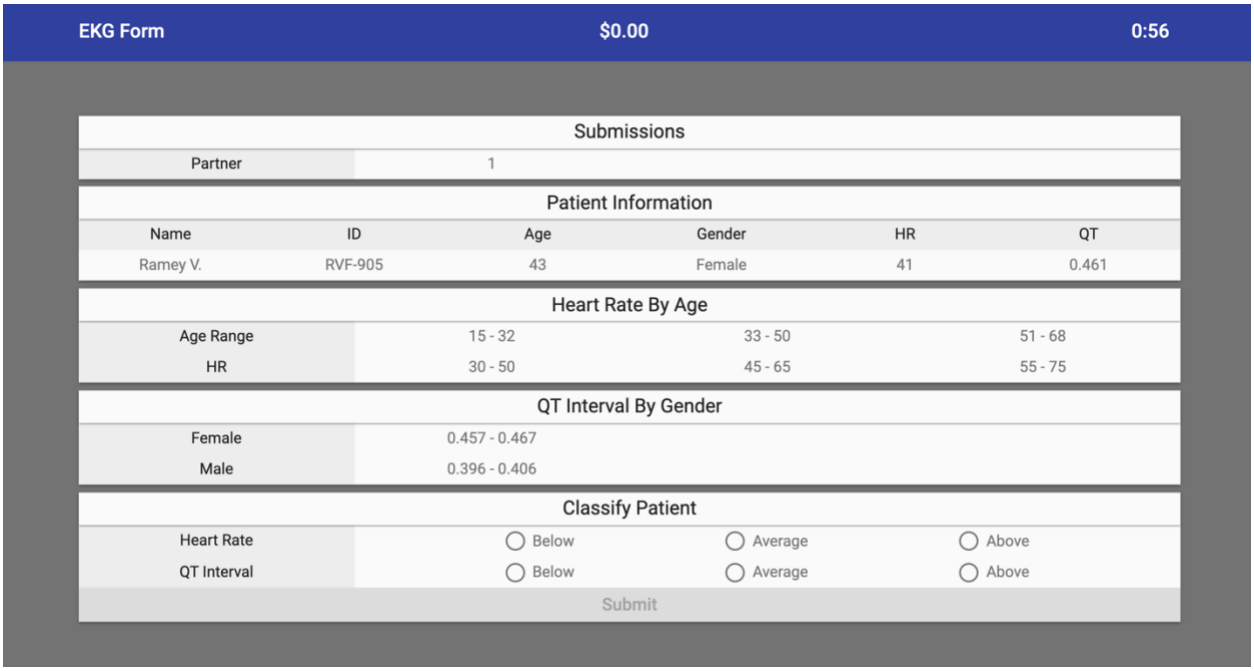
Appendix G

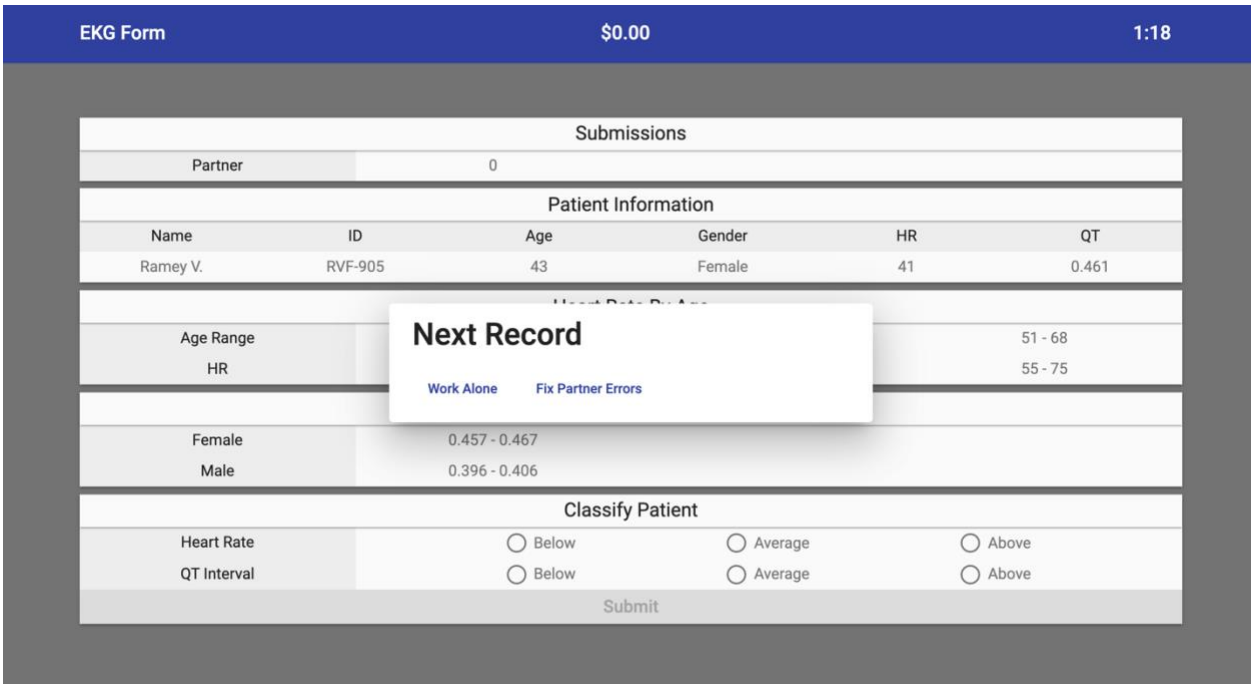
EKG data entry task feedback text box



Appendix H

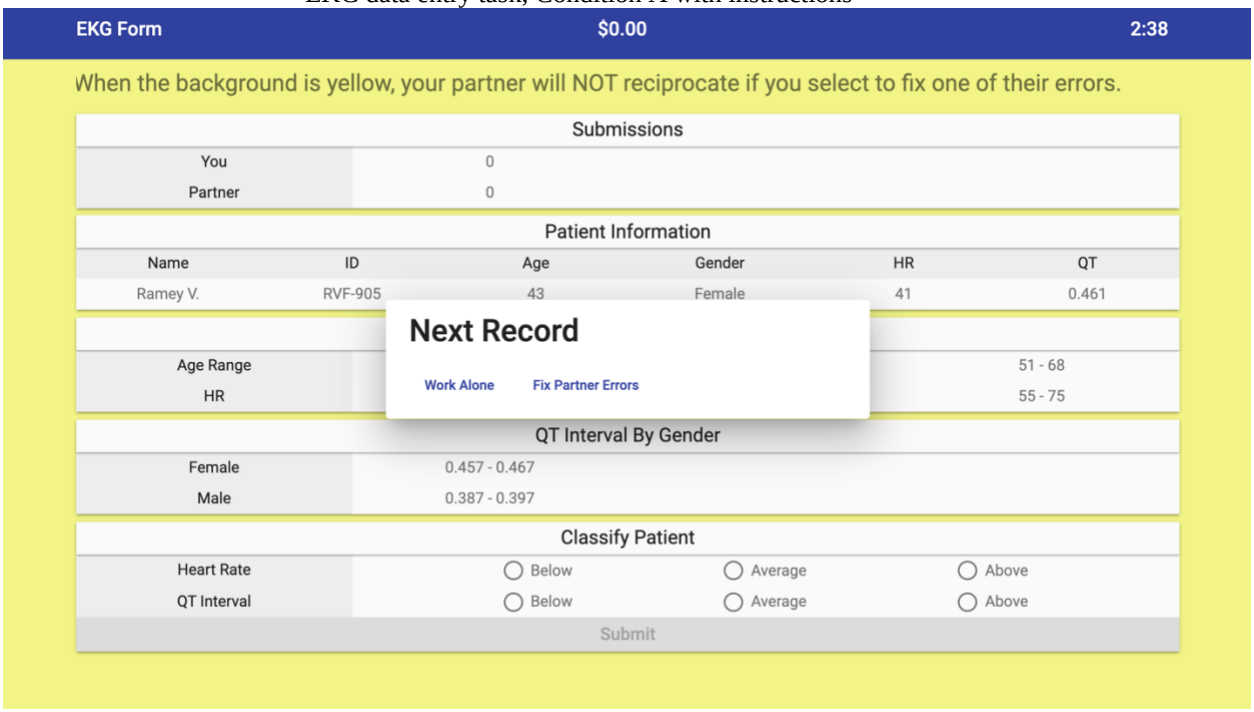
Basic EKG task screens





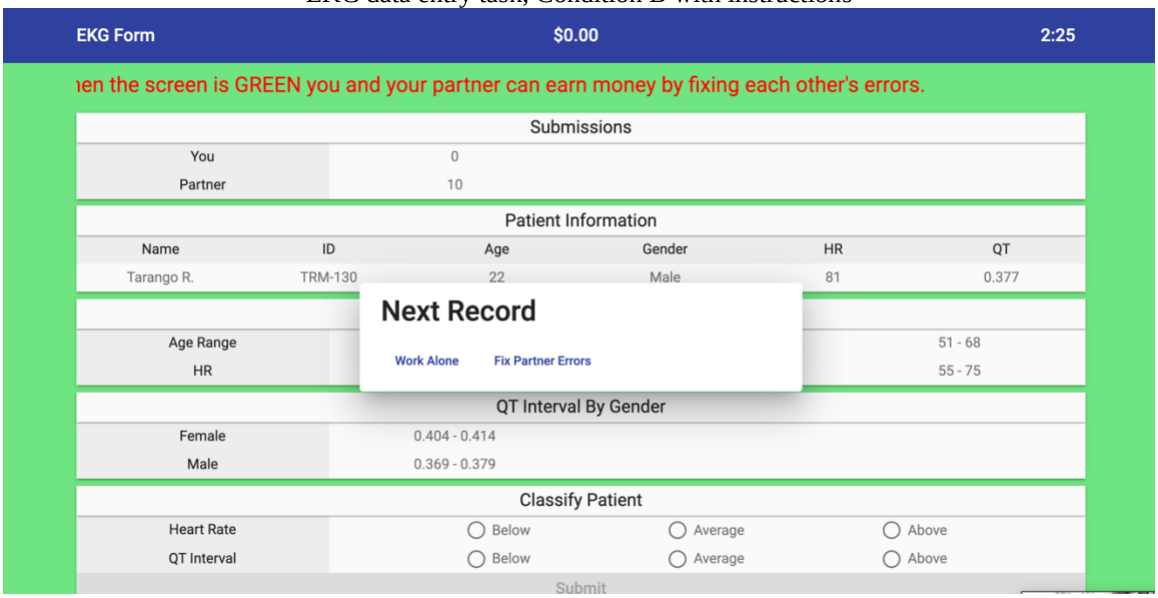
Appendix I

EKG data entry task, Condition A with instructions



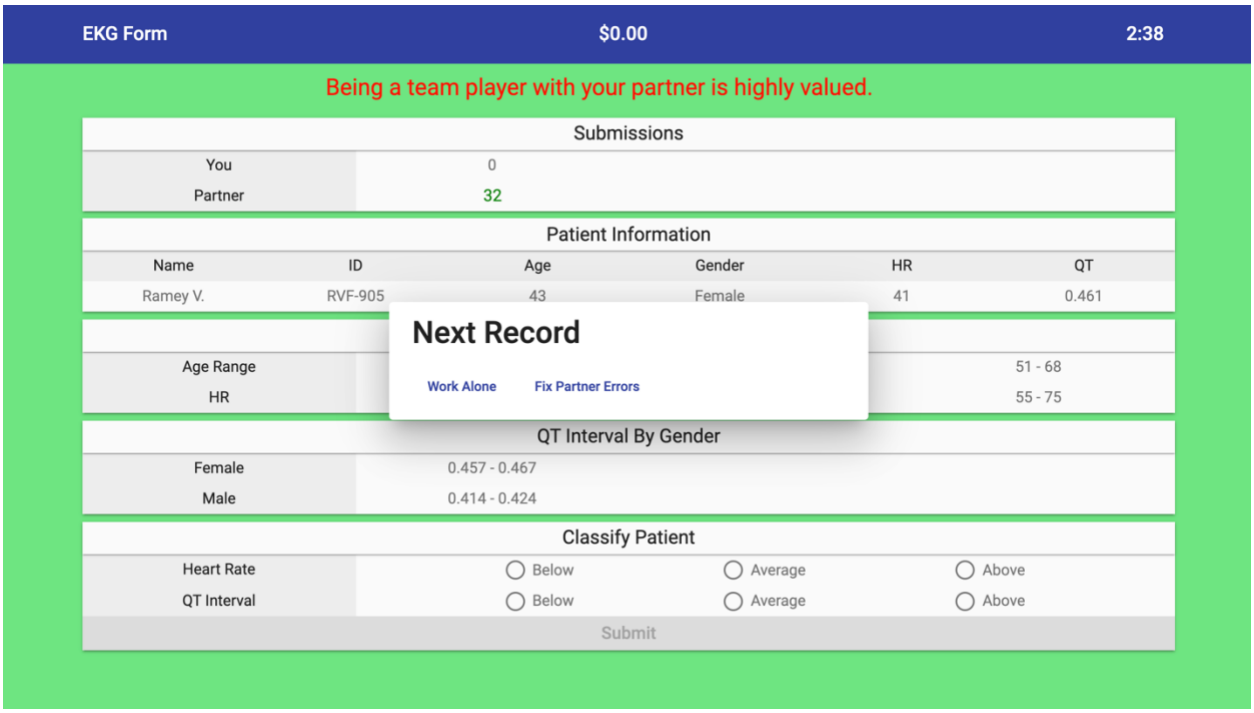
Appendix J

EKG data entry task, Condition B with instructions



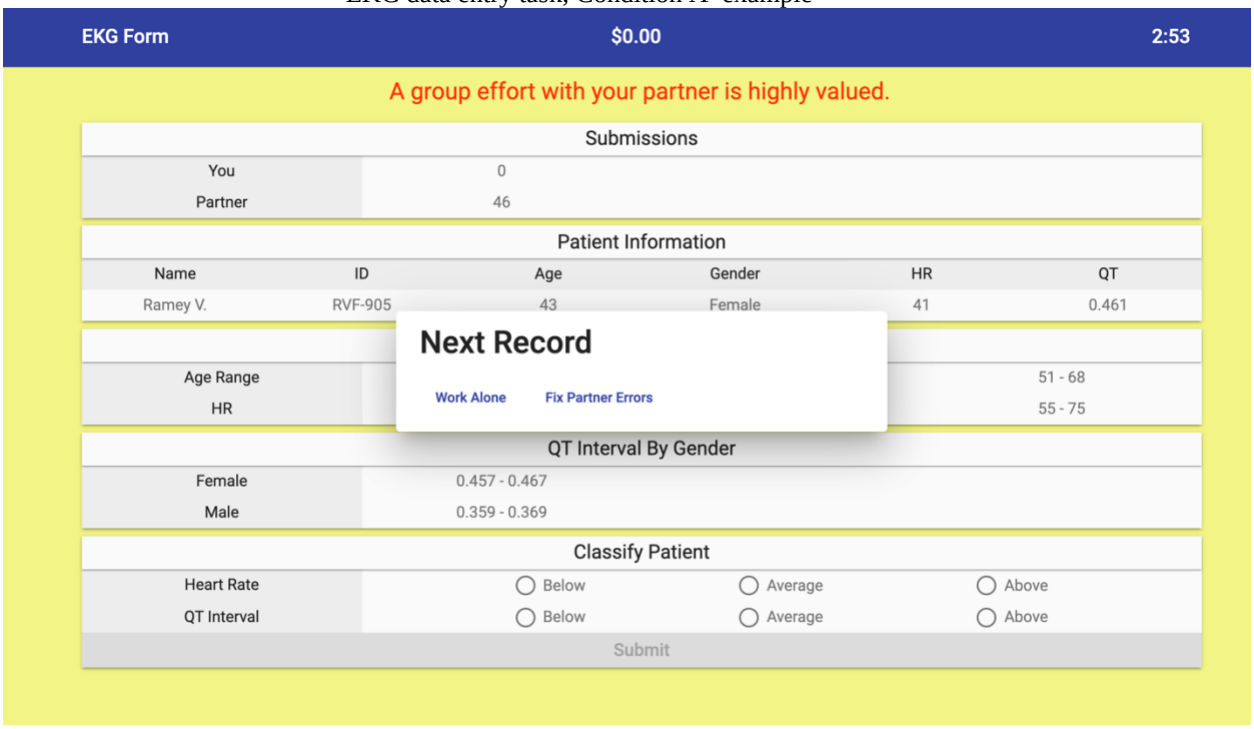
Appendix K

EKG data entry task, Condition B[1] example



Appendix L

EKG data entry task, Condition A^2 example



Appendix M

Phase two consent information and instructions

Your participation in the second part of the study should take approximately 30 minutes. **You MUST complete Part 2 to be eligible to receive your 2 SONA credits and receive an Amazon gift card for the $ you earn in Part 2**. You will need to complete Part 2 in one sitting. Please make sure your screen is maximized, all other windows are closed, and you are completing this part of the study with no distractions on a laptop or desktop device (please do not use a mobile device).

The researchers and the University of Nevada, Reno will treat your identity and the information collected about you with professional standards of confidentiality and protect it to the extent allowed by law. You will not be personally identified in any reports or publications that may result from this study. The US Department of Health and Human Services, the University of Nevada, Reno Research Integrity Office, and the Institutional Review Board may look at your study records.

You may ask questions of the researcher at any time by calling Elizabeth Ghezzi, 775-813-2597 or by sending an email to Elizabeth.Ghezzi@nevada.unr.edu.

Your participation in this study is completely voluntary. You may stop at any time. Declining to participate or stopping your participation will not have any negative effects on your grade.
<
You may ask about your rights as a research participant. If you have questions, concerns, or complaints about this research, you may report them (anonymously if you so choose) by calling the University of Nevada, Reno Research Integrity Office at 775.327.2368.

Thank you for your participation in this study!

Appendix N

EKG data entry task tutorial

You will be working as an Electrocardiography (ECG) Technician for a medical records company named Medical, Incorporated. One of the main responsibilities of ECG Technicians is to review and compare patient heart rates and rhythms against normal ranges.

Being that accuracy of reporting for this job is extremely important, you will be working with a partner to correct each other's mistakes.

To ensure correct screens, at any time, you can either choose to work on your own data entry screen or fix your partner's errors.

If you choose to "work alone" the patient's information will appear for you to complete. If you choose to "fix partner's errors" your partner's screen will appear for you to correct any mistakes.

You will be shown everything you need to know to report 1) The patient's QT interval (i.e., patient gender and QT interval) and 2) The Patient's Heart Rate (i.e., patient age and heart rate).

The patient's information is shown blinking above.

The heart rate by age classification table is blinking above.

The QT interval by gender classification table is blinking above.

To determine QT interval: You will compare your patient's QT Interval value with the normal QT interval range for both genders as presented on the screen. You will then select the "below range", "within range" or "above range" option depending upon where your current patient's value lies.

To compare Heart Rate: You will compare the patient's presented heart rate to a series of ranges based on the person's indicated age. Then, you will select if it is "below average", "average" or "above average" and then "submit" to complete the screen.

Once you have determined the patient classifications you can enter them into the classify patient form, see blinking section above.

You might be shown the submission table, blinking above. It shows your total submissions, and the submissions that your partner has made.

If your submission is correct, you may be issued a payment. The earnings are shown blinking at the top of the form.

You will continue completing patient data screens until each work session ends. At the conclusion of each session, you will be provided with feedback, which will indicate how many screens you completed correctly and how much money you have earned for doing so.

The time remaining in the trial is shown here, see blinking section in header.

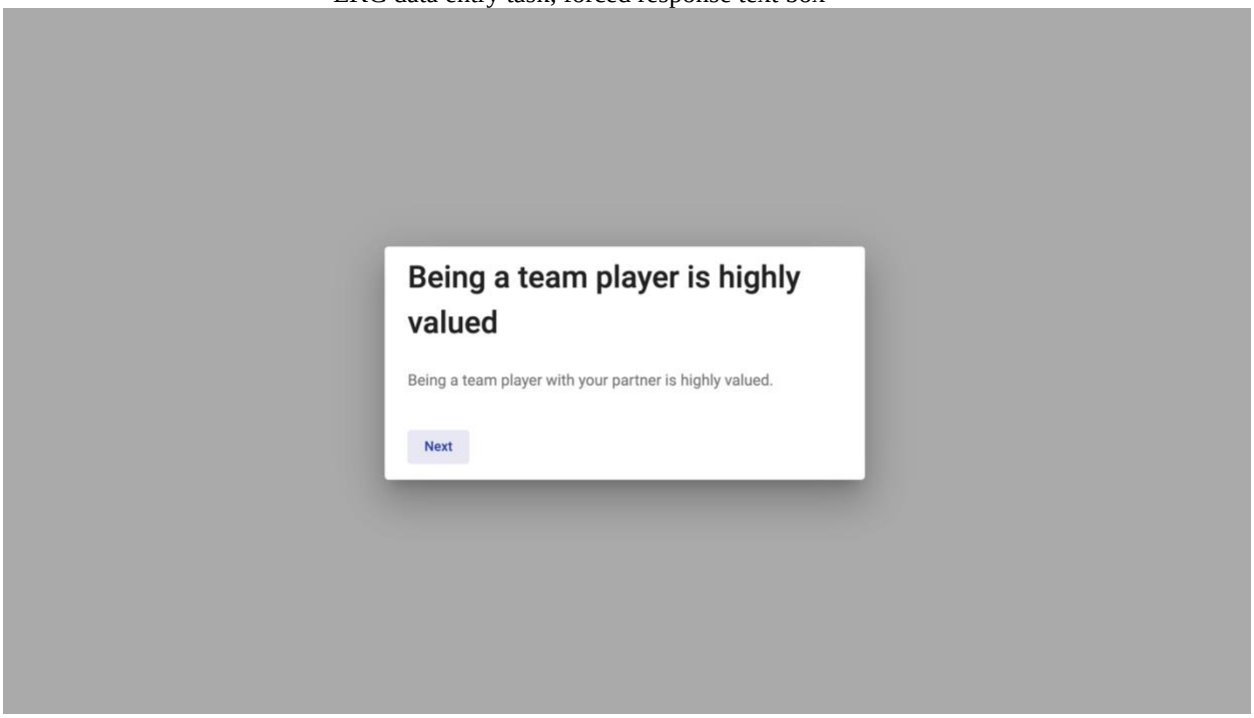
Lastly, you will notice that the background color changes – you'll want to pay attention to these colors since it's related to how you get paid in the work task.

We will begin with a practice trial.

At the end of the entire work session, you will be directed to a survey that will ask you questions about your experience during the study. After, we will release your SONA credits, and you will have completed your participation in this study!

Appendix O

EKG data entry task, forced response text box



Appendix P

EKG data entry task, text presented to participants upon completion

Appendix Q
Post-experiment questionnaire

Please enter the 4-digit username provided by the researcher below

_____

During the medical data entry task, did you primarily work alone or fix partner errors?

- ○ Work alone
- ○ Fix partner errors

Explain why you chose one over the other

_____

Was your partner another UNR student?

- ○ Yes
- ○ No
- ○ I don't know

If you answered "no" or "I don't know", who do you think your partner was?

_____

How did your partner effect your level of cooperation? (cooperating = fixing partner errors)

_____

Which one of the tasks, working alone and fixing partner errors, was more difficult?

- ○ Working alone
- ○ Fixing partner errors
- ○ Same level of difficulty

Did you notice the background color changing?

- ○ No
- ○ Yes

If you answered yes, what were the colors?

_____

What do you think it meant when the background colors changed?

_____

Did you notice in some conditions that when you selected "fix partner errors" your partner would fix your error in return?

- ○ Yes
- ○ No

When you partner was fixing your errors in return, it:

- ○ Increased my level of cooperation
- ○ Decreased my level of cooperation
- ○ Did not affect my level of cooperation
- ○ None of the above

When your partner was NOT fixing your errors in return, it:

- ○ Increased my level of cooperation
- ○ Decreased my level of cooperation
- ○ Did not affect my level of cooperation
- ○ None of the above

How motivated were you by the money you were earning?

- ○ Not at all
- ○ A little
- ○ Somewhat
- ○ Very much

There were written statements scrolling throughout the experiment related to cooperation. Did you notice the statements?

- ○ Yes
- ○ No

If you did notice the scrolling cooperation statements, how did they affect your level of cooperation (selecting to fix partner errors)?

- ○ Increased my level of cooperation
- ○ Decreased my level of cooperation
- ○ Did not affect my level of cooperation
- ○ None of the above

There were written statements that were scrolling throughout the experiment related to participation. Did you notice the statements?

- ○ Yes
- ○ No

If you did notice the scrolling participation statements, how did they affect your level of cooperation (selecting to fix partner errors)?

- ○ Increased my level of cooperation
- ○ Decreased my level of cooperation
- ○ Did not affect my level of cooperation
- ○ None of the above

Overall, how did the statements influence how you behaved towards your partner?

_____

During Phase one (the word assessment), did you think any of the words were particularly hard or confusing?

- ○ No
- ○ Yes

If you answered yes, which words were hard?

_____

Had you heard about this study before participating?

- ○ Yes
- ○ No

Please select the following gender you most identify with:

- ○ Female
- ○ Male
- ○ Transgender/Other
- ○ Prefer not to answer

Select the age range you fit into:

- ○ 18-25
- ○ 26-35
- ○ 36-45
- ○ 46+
- ○ Prefer not to answer

Select one or more of the race/ethnicities that you consider yourself to be:

- [ ] White/Caucasian
- [ ] Black or African American
- [ ] Native American or Alaska Native
- [ ] Asian
- [ ] Native Hawaiian or Pacific Islander
- [ ] Latina, Latino, Latinx
- [ ] Other
- [ ] Prefer not to answer

Please select the religion you most identify with:

- ○ Christianity
- ○ Islam
- ○ Hinduism
- ○ Buddhism
- ○ Judaism
- ○ None
- ○ Other

Do you have any other observations about this study you'd like to share?

_____

Below you will find a list of statements. Please rate how true each statement is for you by circling a number next to it. Use the scale below to make your choice.

1	2	3	4	5	6	7
never true	**very seldom true**	**seldom true**	**sometimes true**	**frequently true**	**almost always true**	**always true**

1. My mood depends on what my friends think of me.	1	2	3	4	5	6	7
2. I care a lot about what my friends think of me.	1	2	3	4	5	6	7
3. If other people don't value my work, I feel as though it was not worth the effort.	1	2	3	4	5	6	7
4. It's very important for me to feel accepted by other people.	1	2	3	4	5	6	7
5. In order to be happy, I need people to value me.	1	2	3	4	5	6	7
6. My self-worth depends on what other people think and say about me.	1	2	3	4	5	6	7
7. My main goal in life is to be recognized and respected by those around me.	1	2	3	4	5	6	7
8. My decisions are very much influenced by other people's opinions.	1	2	3	4	5	6	7
9. I worry a lot about presenting a perfect image of myself.	1	2	3	4	5	6	7
10. What I do would be pointless if people couldn't see it.	1	2	3	4	5	6	7
11. Hard work is only worth it if people recognize it.	1	2	3	4	5	6	7
12. It's essential that other people have a good impression of me.	1	2	3	4	5	6	7
13. To feel good about myself, I need other people's approval.	1	2	3	4	5	6	7
14. I can't disappoint other people's expectations of me.	1	2	3	4	5	6	7
15. Before making a decision, I need other people to understand my reasons.	1	2	3	4	5	6	7
16. When making a decision, I value other people's advice more than my own opinion.	1	2	3	4	5	6	7
17. Before doing important things, I ask for other people's advice.	1	2	3	4	5	6	7
18. Fear of criticism prevents me from doing things.	1	2	3	4	5	6	7