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A Behavior Analytic Examination of Social Loafing

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Abstract

Social loafing is a phenomenon in which individuals working in groups exert less effort than when they work alone, resulting in substantial losses in productivity. Social loafing has a broad empirical and theoretical research base in various areas of psychology and management, but not in behavior science. Many factors have been shown to influence social loafing; however, research has not assessed the impact of coworker performance on social loafing. This study employed an online data entry task programmed to simulate partner and team performance to vary coworker productivity within subject to assess the impact on participant social loafing. Study 1 assessed participant performance when paired with fast and slow partners in cooperative and competitive conditions. The results indicated a higher prevalence of social loafing in cooperative conditions when compared to competitive conditions, and disparate performance based on the order in which participants were paired with fast and slow partners. Study 2 assessed participant performance while working in pairs or four-person teams with fast and slow coworkers. Participants performed slightly better with teams than with partners, inconsistent with social loafing research, and the apparent impact of fast and slow coworkers was incongruent with the results of Study 1. Study 3 assessed the impact of inconsistent partner performance on participant social loafing, focused on comparisons between cooperative and alone conditions, and included enhanced participant feedback on effort, ability, preference for working alone or with others, and ratings of stress, demand, and job control. Participants performed better in cooperative conditions when compared to alone conditions, again, inconsistent with social loafing research. The order in which participants worked with fast and slow partners had a significant impact on performance,

and almost half of participants reported exerting less effort on the task than they predicted exerting prior to each trial. Participants rated higher levels of stress and demand and lower levels of job control when working with partners, and the majority of participants indicated a preference to work alone on future trials. Implications for real-world work environments will be explored based on the results of these studies.

Keywords: social loafing, cooperation, teamwork, group contingencies, organizational behavior management

I enthusiastically dedicate this work to my partner in life, my husband Ron.

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Table of Contents

Abstract	i
Dedication	iii
Acknowledgements	iv
List of Tables	vii
List of Figures	xi
Introduction	1
Study 1	47
Method	47
Results	54
Discussion	66
Study 2	70
Method	71
Results	75
Discussion	86
Study 1 and Study 2 General Discussion	88
Study 3	93
Method	94
Results	101
Discussion	156
General Discussion	163
References	174

Appendix A 192

Appendix B 200

List of Tables

Table 1	"Social Loafing" in the Journal of Organizational Behavior Management	33
Table 2	Study 1 Conditions	54
Table 3	Number of Records Completed for Slow/Fast Participants	55
Table 4	Slow/Fast Participant Accuracy (%)	56
Table 5	Number of Records Completed for Fast/Slow Participants	57
Table 6	Fast/Slow Participant Accuracy (%)	57
Table 7	Performance by Trial	58
Table 8	Performance by Condition	59
Table 9	Repeated Measures ANOVA Results	61
Table 10	Means Table for Within-Subject Variables	61
Table 11	Marginal Means Contrasts for each Combination of Within-Subject Variables	62
Table 12	Mixed Model ANOVA Results	63
Table 13	Marginal Means Contrasts for each Combination of Within-Subject Variables	65
Table 14	Study 2 Conditions	75
Table 15	Number of Records Completed for Slow/Fast Participants	76
Table 16	Slow/Fast Participant Accuracy (%)	76
Table 17	Number of Records Completed for Fast/Slow Participants	77
Table 18	Fast/Slow Participant Accuracy (%)	78

Table 19	Average Performance by Trial	79
Table 20	Performance by Condition	80
Table 21	Repeated Measures ANOVA Results	81
Table 22	Means Table for Within-Subject Variables	82
Table 23	Marginal Means Contrasts for each Combination of Within-Subject Variables	82
Table 24	Mixed Model ANOVA Results	84
Table 25	Marginal Means Contrasts for each Combination of Within-Subject Variables	85
Table 26	Study 3 Conditions	99
Table 27	Fast/Slow Records Completed	102
Table 28	Fast/Slow Goal Attainment	103
Table 29	Fast/Slow Accuracy	103
Table 30	Slow/Fast Records Completed	105
Table 31	Slow/Fast Goal Attainment	106
Table 32	Slow/Fast Accuracy	106
Table 33	Solo/Slow Records Completed	108
Table 34	Solo/Slow Goal Attainment	108
Table 35	Solo/Slow Accuracy	109
Table 36	Solo/Fast Records Completed	110
Table 37	Solo/Fast Goal Attainment	110
Table 38	Solo/Fast Accuracy	111
Table 39	Solo/Solo Records Completed	112

Table 40	Solo/Solo Goal Attainment	113
Table 41	Solo/Solo Accuracy	113
Table 42	Group Comparisons	115
Table 43	Increases by Trial Number	118
Table 44	Fast/Slow Versus Slow/Fast Comparisons	123
Table 45	Repeated Measures ANOVA Results	124
Table 46	Means Table for Within-Subject Variables	124
Table 47	Marginal Means Contrasts for each Combination of Within-Subject Variables	125
Table 48	Mixed Model ANOVA Results	126
Table 49	Marginal Means Contrasts for each Combination of Within-Subject Variables	127
Table 50	Fast/Slow Versus Solo/Slow Comparison #1	129
Table 51	Mixed Model ANOVA Results	130
Table 52	Marginal Means Contrasts for each Combination of Within-Subject Variables	131
Table 53	Fast/Slow Versus Solo/Slow Comparison #2	132
Table 54	Mixed Model ANOVA Results	133
Table 55	Marginal Means Contrasts for each Combination of Within-Subject Variables	134
Table 56	Slow/Fast Versus Solo/Fast Comparison #1	136
Table 57	Mixed Model ANOVA Results	137

Table 58	Marginal Means Contrasts for each Combination of Within-Subject Variables	138
Table 59	Slow/Fast Versus Solo/Fast Comparison #2	139
Table 60	Mixed Model ANOVA Results	140
Table 61	Marginal Means Contrasts for each Combination of Within-Subject Variables	141
Table 62	Results of the Two-Tailed Paired Samples t-Tests	142
Table 63	Participant Preference for Individual or Group Work	143
Table 64	Pre-Trial vs. Post-Trial Effort Rating by Participant and Partner	147
Table 65	Pre-Trial vs. Post-Trial Effort Rating by Fast and Slow	147
Table 66	Participant Preference	153
Table 67	Observed and Expected Frequencies	154
Table 68	Participant GPA	155
Table 69	Pearson Correlation Results Between GPA and Increase_from_BL	155

List of Figures

Figure 1	The Ringelmann Effect	2
Figure 2	The Ringelmann Effect	3
Figure 3	Köhler's Weight Curling Task	5
Figure 4	Social Impact Theory	10
Figure 5	The Collective Effort Model	13
Figure 6	Cognitive Mechanisms Mediating Social Loafing	17
Figure 7	Low Versus High Instrumentality	20
Figure 8	Collective vs. Coactive Task	22
Figure 9	Social Loafing in a Rope-pulling Task	29
Figure 10	Motivation Loss vs. Coordination Loss	30
Figure 11	"Goal Setting" on Web of Science	41
Figure 12	"Group Goal" on Web of Science	42
Figure 13	Experimental Task	50
Figure 14	Performance by Trial	58
Figure 15	Performance by Condition	59
Figure 16	Performance Rating	66
Figure 17	Performance by Trial	79
Figure 18	Performance by Condition	80
Figure 19	Performance Ratings	86
Figure 20	Group Averages: Increase Over Previous Trial, Goal Attainment	114
Figure 21	Cooperation Versus Alone	116

Figure 22	Overall Group Outcomes	117
Figure 23	Performance by Trial	118
Figure 24	Average Performance by Group and Condition	119
Figure 25	Performance by Condition	120
Figure 26	Pick Up the Slack/Free Ride Measures	121
Figure 27	Fast/Slow Versus Slow/Fast	122
Figure 28	Fast/Slow Versus Solo/Slow	128
Figure 29	Slow/Fast Versus Solo/Fast	135
Figure 30	Pre-Trial Effort Rating: Self	144
Figure 31	Post-Trial Effort: Self	145
Figure 32	Pre-Trial Effort: Partner	146
Figure 33	Post-Trial Effort: Partner	146
Figure 34	Post-Trial Ability: Sel	148
Figure 35	Post-Trial Ability: Partner	149
Figure 36	Stress Ratings	150
Figure 37	Control Ratings	151
Figure 38	Demand Ratings	152

A Behavior Analytic Examination of Social Loafing

> *...we must confess that we think social loafing can be regarded as a kind of social disease. It is a "disease" in that it has negative consequences for individuals, social institutions, and societies…The "cure," however, is not to do away with groups, because despite their inefficiency, groups make possible the achievement of many goals that individuals alone could not possibly accomplish. Collective action is a vital aspect of our lives… (Latané, et al., 1979, p. 831-832)*

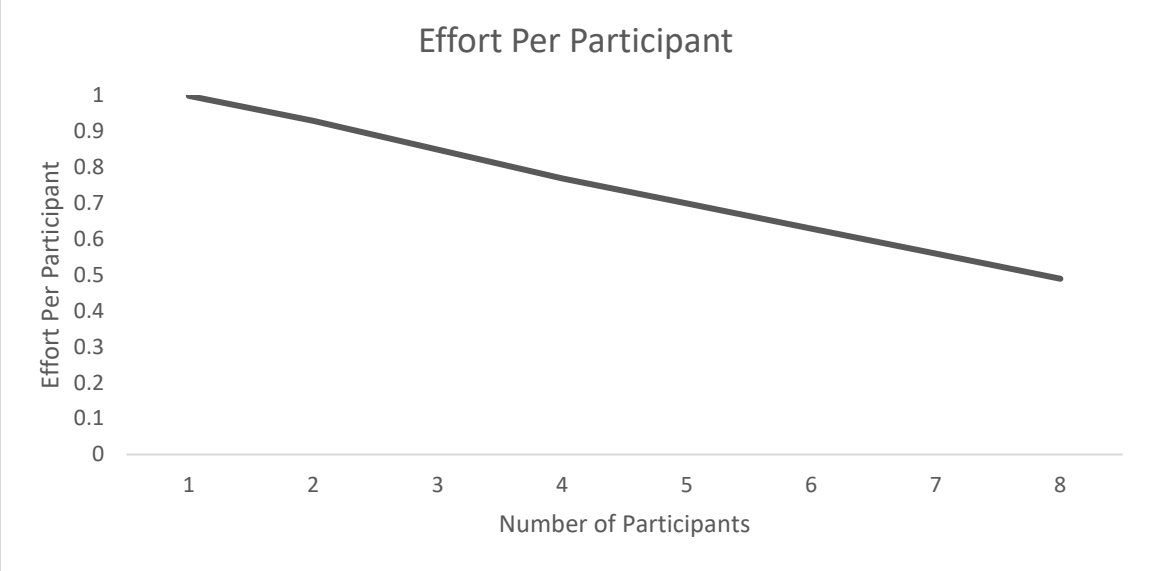
Social loafing is a term that describes a pattern of behavior wherein individuals working in a group exert less effort on a task than they would if they were working alone (Aggarwal & O'Brien, 2008). Researchers have been describing social loafing for over a century, starting with Maximilien Ringelmann, a French professor of agricultural engineering. Ringelmann was interested in coordinating the work of animals and humans to maximize productivity in agricultural work. In the 1880s, he researched the optimal number of oxen or horses required to plow a field, the optimal number of workers required to turn a mill crank at high speeds, and relevant to the work presented here, he varied the size of groups of men on a rope-pulling task to assess optimal group size to complete a physical task.

In what has become known as the first identification of social loafing, Ringelmann had groups of one to eight men pull a rope that was connected to an apparatus that measured pulling effort. He found the total effort of the group was less than the sum of the effort of each man performing the task individually (Latané et al.,

1979). In a linear relationship, individuals performed at 93% of their individual effort in dyads, 85% of their individual effort in triads, and 49% in groups of eight (Moede, 1927; see Figure 1). Ringelmann attributed this outcome to process loss due to ineffective coordination of efforts, and termed the positive relation between group size and process loss the Ringelmann Effect (Ringelmann, 1913[1]; see Figure 2). Latané and colleagues (1979) later termed the phenomenon *social loafing*: "a decrease in individual effort due to the social presence of other persons" (p. 823), and that term continues to be used today.

Figure 1

The Ringelmann Effect

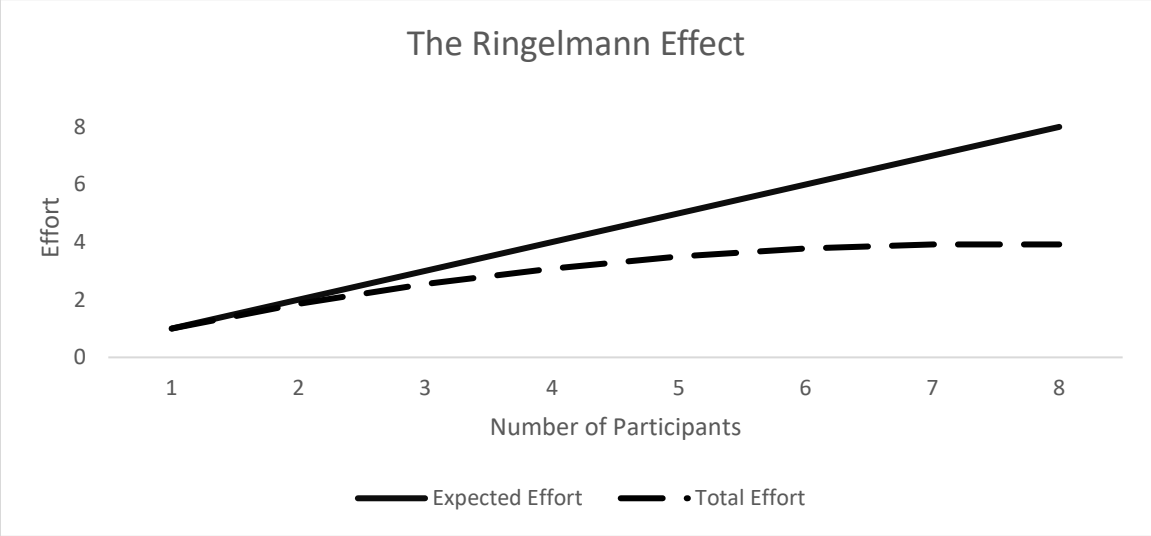


Note. Adapted from "Research on animate sources of power: The work of man," by M. Ringelmann, 1913, in *Annales de l'Institut National Agronomique* (Vol. 12, No. 2, pp. 1-40).

[1] See Kravitz & Martin, 1986

Figure 2

The Ringelmann Effect



Note. Adapted from "Research on animate sources of power: The work of man," by M. Ringelmann, 1913, in *Annales de l'Institut National Agronomique* (Vol. 12, No. 2, pp. 1-40).

Two other terms often appear in social loafing research, the *free rider effect*, and the *sucker effect.* In economic theory, a *free rider* is one who derives benefits from their membership in a group, and those benefits are disproportionately larger than their own contributions to the group (Comer, 1995). As Udéhn (1993) asserts, "the most rational course of action, for a self-interested individual, is to take a free ride; to enjoy the benefits of the collective goods without contributing to the costs" (p. 239).

Alternatively, the expectation that one's partners will engage in social loafing may result in one's own loafing to avoid being taking advantage of by free riders, and therefore ending up as the "sucker" in the group (Orbell & Dawes, 1993). Playing the

sucker is aversive as it violates social norms including the *equity norm* in which equal contribution should result in equal distribution of rewards; the *norm of social responsibility* in which there is an obligation for each member to contribute their fair share; and the *norm of reciprocity* in which one's contribution benefits the others, so others should contribute equally to reciprocate (Kerr, 1983). Research has shown that individuals may choose to fail at a task rather than exert additional effort to make up for their teammates, thereby playing the sucker (Kerr, 1983; Schnake, 1991), and individuals have been shown to increase their effort when given a reason to believe their teammates would not engage in social loafing (Harkins & Jackson, 1985; Mulvey et al., 1998; Mulvey & Klein, 1998), consistent with social norms.

Some research has found individuals will admit to social loafing (Petty et al., 1977), and "participants seemed to be aware of the amount of effort they were exerting on the task" (Williams & Karau, 1991, p. 576). Other research found individuals were either unaware of whether they engaged in social loafing, or were unwilling to report that they loafed, and their estimates of their personal effort did not correlate with their actual performance (Charbonnier, 1998).

Several theories and lines of research emerged throughout the years based on Ringelmann's original research and in contrast to this discovery, some of which will be described here.

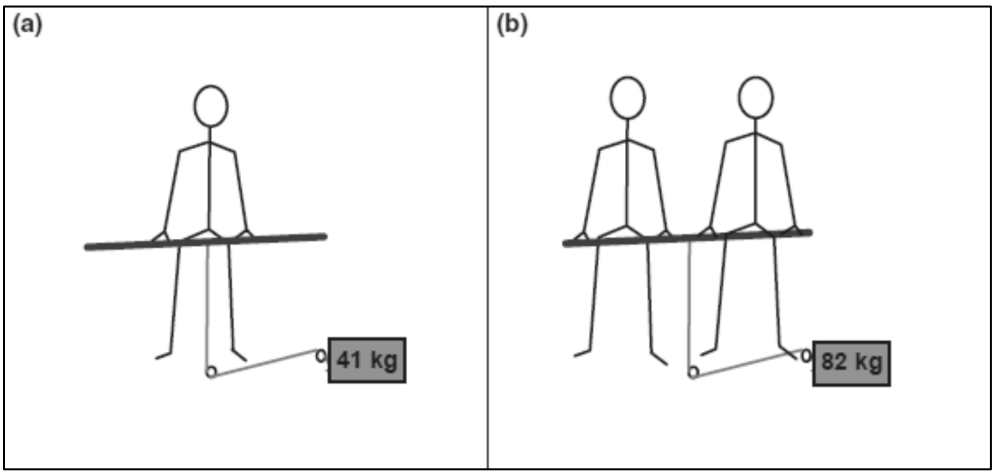
The Köhler Motivation Gain Effect

Around the time Ringelmann was completing his research, a separate line of research emerged that would one day be called the *anti-Ringelmann effect* (Witte, 1989). German industrial psychologist Wolfgang Köhler (Köhler, 1926; 1927) found pairs of

individuals performed physical tasks (e.g., bicep curls) for longer than expected based on individual performance on a comparable individual task. For example, individuals curled a weight of 41 kg alone; then pairs curled a weight of 82 kg together (see Figure 3; Kerr & Hertel, 2011). In the paired task, the weight was shared by the two, such that when one participant quit, the task was over; the other partner could not take over the task on their own. This is known as a *conjunctive task*, when the group's productivity is equal to the productivity of the least capable member. Köhler found the less capable member would push themselves beyond their usual individual performance for the benefit of the group. He called this the *Köhler motivation gain effec*t (Messé et al., 2002).

Figure 3

Köhler's Weight Curling Task



Note. Panel (a) represents one individual curling a 41 kg weight alone; panel (b) represents two individuals curling an 82 kg weight together. From "The Köhler group motivation gain: How to motivate the 'weak links' in a group," by N. L. Kerr, and G. Hertel, 2011, *Social and Personality Psychology Compass*, *5*(1), 43–55 (https://doi.org/10.1111/j.1751-9004.2010.00333.x). Copyright 2011 by The Authors.

Köhler explained the outcome as the group members "infusing" each other with enthusiasm for the task, and that the more capable partner takes a leadership role to coordinate efforts and encourage the less capable partner. More recently, researchers attributed the outcomes to a *social comparison* process or an *indispensability* explanation. With social comparison, individuals compare their own performance to that of their coworkers and revise their personal goals if they are not performing as well as others, either to perform better than their coworker or to use their coworker's performance as a standard to match (Kerr & Hertel, 2011). The indispensability explanation suggests that individuals will exert more effort when they perceive their input is necessary to reach the goal (Hertel et al., 2000). The more indispensable they perceive their contribution to be, the harder they will work. Kerr and Hertel (2011) suggest two potential motives in this case: collectivistic (emphasizing the group outcome), or individualistic (avoiding punishment or social sanctions). Both descriptions have found support in research (e.g., Weber & Hertel, 2007).

Köhler's work was largely forgotten (Kerr & Hertel, 2011) until Witte (1989) reinvigorated the line of research, and described the outcomes as the anti-Ringelmann effect. Using physical tasks similar to Köhler, anti-Ringelmann researchers replicated Köhler's outcomes (Hertel et al., 2000; Stroebe et al., 1996). Other researchers replicated the Köhler effect with a variety of motor and cognitive tasks (Hertel et al., 2003; 2008; Lount & Phillips, 2007; Wittchen et al., 2007).

Social Facilitation Theory

Contrary to the social loafing paradigm, "[c]ommon sense may suggest that working in groups should energize individuals and enhance their motivation and

performance" (Hart et al., 2004, p. 984). This viewpoint can be traced to Triplett's research in the late 1800s. Triplett (1898) examined archives of bicycle races and found that cyclists riding in the presence of other cyclists (without competing against them) raced at least 25% faster than cyclists riding alone. Triplett suggested that "the bodily presence of another rider is a stimulus to the racer in arousing the competitive instinct" (p. 516). This phenomenon was termed *social facilitation* and described as "in increase in response merely from the sight or sound of others making the same movement" (Allport, 1924, p. 262).

To test this phenomenon, Allport (1920) had participants work in separate cubicles (alone condition) or sitting around a common table (group condition) performing a variety of tasks including word association, vowel cancellation, reversible perspective, multiplication, problem solving, and judgment of odors and weights. To reduce the tendency to compete, Allport told the subjects their results would not be compared to the performance of others and would not be shown to others. In all tasks except the problem solving and judgment tasks, participants performed better in the group condition than the alone condition. Zajonc's (1965) explanation was that the presence of others has a positive impact on performance of responses that are dominant or fluent, but a negative influence on complex or unfamiliar tasks; a theory he named *social facilitation theory*. There is disagreement whether this phenomenon is due to increased drive (Zajonc, 1965; 1980), the potential for evaluation or competition (Cottrell, 1972), social monitoring (Guerin & Innes, 1982), or the thought that "the presence of others creates either explicit or implicit demands on the person to behave in some way" (Geen, 1989, p. 31).

Ringelmann (1913) and Triplett's (1898) results initiated two separate lines of

research: social loafing and social facilitation, respectively (Harkins, 1987). However, the two lines of research are complementary. The difference is the role of "others." In Ringelmann's research, "others" were partners/teammates. In social facilitation research, "others" are observers or coactors. According to Harkins and Jackson (1985):

> In facilitation research, when participants work together (coact), their outputs can be evaluated (compared) and they work harder than participants working alone. In social loafing research, when participants work together, their outputs are pooled and evaluation is not possible, leading to loafing. In both cases, evaluation potential is central. In social facilitation, working together enhances evaluation potential; in social loafing, working together reduces it. (p. 463)

Why Social Loafing Matters

Working in groups is pervasive in our lives: school or academic life, work settings, sports teams, and community groups. The business world relies on teamwork, with Stewart and colleagues (2006) pointing out the following benefits of teamwork:

(i) a greater range of knowledge and expertise,

(ii) encouragement of greater flexibility,

(iii) encouragement of working for the greater good,

(iv) improved task motivation by providing, for example, employees a stake in decision making, and

(v) provision of social support (p. 57)

On the other hand, social loafing in group work has been cited as the most significant barrier to group effectiveness and the enjoyment of group work (Aggarwal & O'Brien, 2008; Williams et al., 1991); "[i]t only takes one social loafer in a group to affect the

dynamics of the entire group" (Aggarwal & O'Brien, 2008, p. 256). Students not only report experiencing social loafing in group projects, they expect to encounter it (McCorkle et al., 1999).

F. W. Taylor, one of the first management consultants, found social loafing to be so troubling that he recommended dissolving groups whenever possible (Taylor, 1911). Latané and colleagues (1979) called social loafing a "social disease" with "negative consequences for individuals, social institutions, and societies" because it "results in a reduction in human efficiency, which leads to lowered profits and lowered benefits for all" (p. 831).

Possible Explanations for Social Loafing

In their review of the literature, Karau and Wilhau (2020) describe the four classic theories that have been tied to social loafing research: Social Impact Theory, Arousal Reduction Theory, Evaluation Potential Theory, and the Dispensability of Effort Theory. Karau and Williams (1993) additionally provide an integrative theory: the Collective Effort Model (CEM).

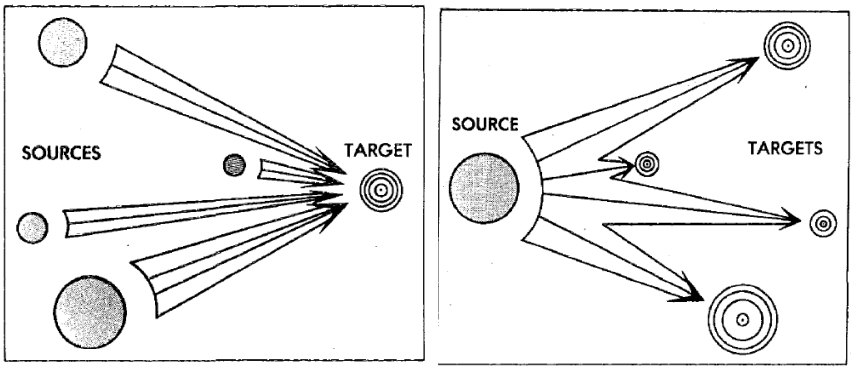
Social Impact Theory

Social impact theory describes a range of social processes likened to a "force field" similar to physical forces (e.g., gravity, light, sound). Individuals or groups act as sources or targets of social influence, impacting behavior, motivation, beliefs, and attitudes (Latané, 1981). The magnitude of social influence is impacted by the strength, immediacy, and number of individuals exerting or receiving social influence. Strength is impacted by the status, expertise, or reputation of the influencer. Immediacy is the measure of the physical or psychological distance between the influencer and their

targets. Social loafing should be reduced when the strength of the social influence is reduced based on the social status, reputation, or expertise of the sources of influence, and when immediacy is reduced based on increasing physical and psychological distance.

Figure 4

Social Impact Theory



Note. Multiple sources increase social influence experienced by a single target (left panel), while multiple targets decrease the social influence experienced by each target (right panel). From "The psychology of social impact," by B. Latané, 1981, *American Psychologist, 36*(4), 343-356, (https://doi.org/10.1037/0003-066X.36.4.343). Copyright 1981 by American Psychological Association, Inc.

As seen in Figure 4, multiple sources of influence should increase social influence and multiple recipients should decrease it. Related to social loafing, "diffusion of influence and reduced effort should increase, as the group gets increasingly larger in size" (Latané, 1981, p. 11). Further, "the magnitude of this division of social influence follows an inverse power function, with an exponent of less than one, such that each additional

group member should have less additional influence as group size increases" (p. 11), which is inconsistent with Ringelmann's linear results.

Arousal Reduction Theory

Arousal reduction is a drive theory account of motivation loss in groups based on the core assumptions of the social impact theory (Jackson & Williams, 1985). The presence of others increases drive when they are present as sources of social impact; the presence of others decreases drive when they are present as recipients of social impact (see Figure 4). In line with social facilitation theory, increased drive should result in impaired performance on simple or well-learned tasks, and enhanced performance on novel or unfamiliar tasks. The arousal reduction theory thus suggests social loafing may be reduced when individuals are working on complex, novel, or unfamiliar tasks.

Evaluation Potential Theory

The evaluation potential theory predicts social loafing is likely to occur when working collectively due to the fact or perception that individual contributions cannot be evaluated (Harkins, 1987; Williams et al., 1981). This allows individuals to "hide in the crowd" (Davis, 1969) as it is unlikely that they can be personally blamed for poor group performance, or feel "lost in the crowd" (Latané et al., 1979) in that they may not receive fair credit for their individual contributions to group performance. This theory has significant research support based on experiments that show social loafing can be reduced or eliminated by making individual performance subject to evaluation (e.g., Bartis et al., 1988; Harkins & Szymanski, 1988; 1989; Szymanski & Harkins, 1993).

Dispensability of Effort Theory

Related to the previously described *indispensability explanation* (Hertel et al.,

2000), the dispensability of effort theory suggests social loafing occurs due to the perception that individual efforts are completely or relatively unnecessary contributions to overall group performance. This theory has been supported by research that shows individuals exert less effort on *disjunctive* tasks, which are tasks in which the group succeeds if any member reaches the goal, making the contributions of everyone else in the group unnecessary (Kerr, 1983; Kerr & Bruun, 1983). This effect was found even when individual performance was identifiable.

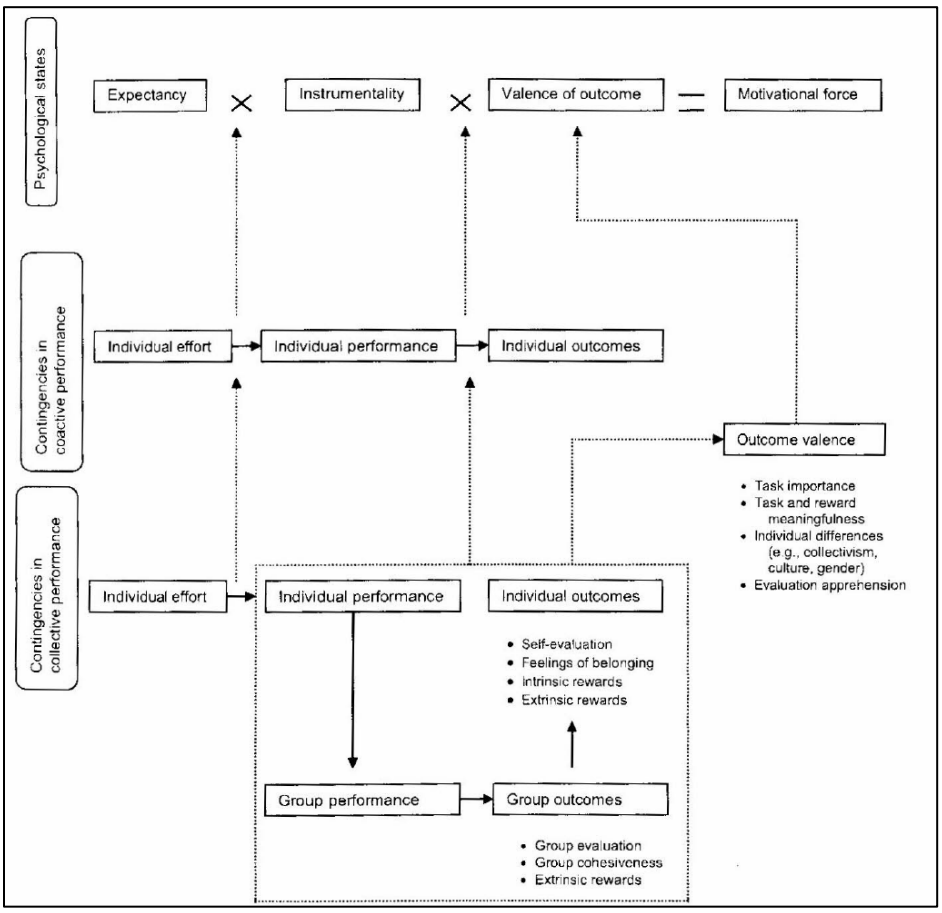
Collective Effort Model

In their 1993 review of the literature, Karau and Williams suggest a unifying theory of individual effort in collective settings, the Collective Effort Model (CEM). The CEM takes individual-level expectancy-value models of effort (Vroom, 1964), and applies them to collective work contexts. Vroom's (1964) theory is based on three factors: expectancy, instrumentality, and valence (also referred to as value). Expectancy is the perception that high levels of effort will result in high levels of performance, instrumentality is the perception that one's performance is necessary in obtaining the goal, and valence is the extent to which the outcome is desirable.

Figure 5 depicts the CEM. The top row consists of the formula described by Vroom (1964) for individual motivation. The middle row accounts for coactive work, which follows the same model as individual work. The bottom row accounts for collective work, bringing in the added contingencies associated with group performance. Motivation on collective tasks specifies that instrumentality includes three sub-factors: the perceived relationships between individual and group performance, group performance and group outcomes, and group outcomes and individual outcomes.

Figure 5

The Collective Effort Model



Note. From "Social loafing and motivation gains in groups: An integrative review," by S. J. Karau, and A. J. Wilhau, 2020, in S. J. Karau (Ed.), *Individual motivation within groups: Social loafing and motivation gains in work, academic, and sports teams* (pp. 3–51). Academic Press. (https://doi.org/10.1016/B978-0-12-849867-5.00001-X). Copyright 2020 by Elsevier Inc.

Based on the CEM, the effort an individual expends on collective tasks relates to the degree to which they believe their efforts will contribute to an outcome that they

personally value (Karau & Hart, 1998). Social loafing may be predicted by the CEM model: “social loafing occurs because there is usually a stronger perceived contingency between individual effort and valued outcomes when working individually” (Karau & Williams, 1993, p. 684). In group situations, there are more variables that impact outcome than when working individually, and valued outcomes may be divided among group members. Karau and Williams call the CEM a cognitive model “because perceived rather than actual contingencies are hypothesized to influence behavior and because individuals are hypothesized to either consciously or subconsciously select a level of effort to exert on the task” (p. 685). They further suggest “some situations may lead individuals to respond automatically to a preexisting effort script, whereas other situations may lead individuals to strategically increase or decrease their collective effort” (p. 685). The CEM suggests that one may be motivated to compensate for poorly performing coworkers on a collective task when the outcome is of value (Hart et al., 2004). However, even when the outcome is of value, individuals may be more likely to engage in social loafing when they believe that their contribution is unnecessary.

Karau and Williams’ (1993) meta-analysis found support for the CEM. For example, social loafing was displayed at decreased levels in the following conditions: when the task was considered meaningful, unique, or had personal relevance, when individual contribution was unique or nonredundant (i.e., instrumental), in smaller groups as opposed to larger groups, when individual effort was identifiable and evaluated, or when performance could be compared to a standard. Karau and Wilhau (2020) caution that while the CEM is a cognitive model of motivation, it is not meant to imply that individuals engage in a deliberative process when it comes to loafing or not loafing.

Social Loafing Research

Despite the provocative results Ringelmann discovered, his study was not published until 1913, and was not replicated until 1974 (Ingham et al., 1974). Since then, a robust research base around social loafing has developed including 299 citations for "social loafing" on Web of Science since 1996, with the highest number of citations in the fields of social psychology, management, and applied psychology.[2] PsycInfo results include 350 citations since 1979.[3]

In a 2020 review of the literature, Karau and Wilhau reported "[a]cross more than 130 experimental studies of individual motivation in groups, social loafing appears to be a robust phenomenon, albeit one that can be reduced, eliminated, or even reversed under certain conditions" (p. 9). A meta-analysis found that across 78 studies, social loafing effects were moderate, with a mean effect size of $d = 0.44$ (Karau & Williams, 1993). Social loafing has been replicated in most studies despite the fact that many of the studies were designed to reduce or eliminate it. Karau and Williams (1993) report:

> [n]o studies have been designed to determine what factors increase social loafing. This emphasis on studying conditions in which the effect is not likely to occur may also result in an underestimation of the magnitude of social loafing across a wider range of situations. (p. 681)

Social loafing studies have varied by age of participant (e.g., elementary school students, college students, organizational employees), setting (e.g., laboratory, field), complexity of task (e.g., simple, complex), gender of participant, and culture of

[2] Results retrieved on August 1, 2020
[3] Results retrieved on August 1, 2020

participant (e.g., Eastern/Western culture). While much of the social loafing research has been completed in laboratory settings, there have been a variety of studies in natural settings. According to a review of the literature, “the same types of variables that moderate social loafing in the lab appear to have a similar influence on perceived loafing in the field” (Karau & Wilhau, 2020, p. 32).

Tasks used in social loafing research have included physical (e.g., rope pulling, shouting, clapping, swimming, rowing, pumping air), work-related (e.g., typing), cognitive (e.g., brainstorming), evaluative (e.g., rating advertisements, resumes, or poems), and perceptual/vigilance (e.g., signal detection, maze completion). Social loafing occurs across tasks and populations, resulting in substantial loss in productivity (Karau & Wilhau, 2020). However, Karau and Wilhau (2020) caution that there are still many unanswered or partially answered questions. They recommend continued focus on moderators and mediators of social loafing, and continued research on motivation gains in groups as opposed to social loafing, among other future directions.

Some social loafing research has focused on mental states or “individual factors” (Ying et al., 2014, p. 466) attributed to participants including self-belief, self-uniqueness, approval-oriented, rejection-threatened, narcissism, and intrinsic motivation (George, 1992; Karau & Wilhau, 2020; Ying et al., 2014). For example, George (1992) writes, “[w]hen intrinsic motivation is high, supervisors may not need to monitor workers’ efforts very closely to sustain adequate levels of performance” (p. 192). High levels of self-uniqueness may result in individuals believing their efforts are not necessary to achieve easy goals, as their special abilities are better utilized on challenging goals. Huguet and colleagues (1999) found that individuals who reported that they felt generally

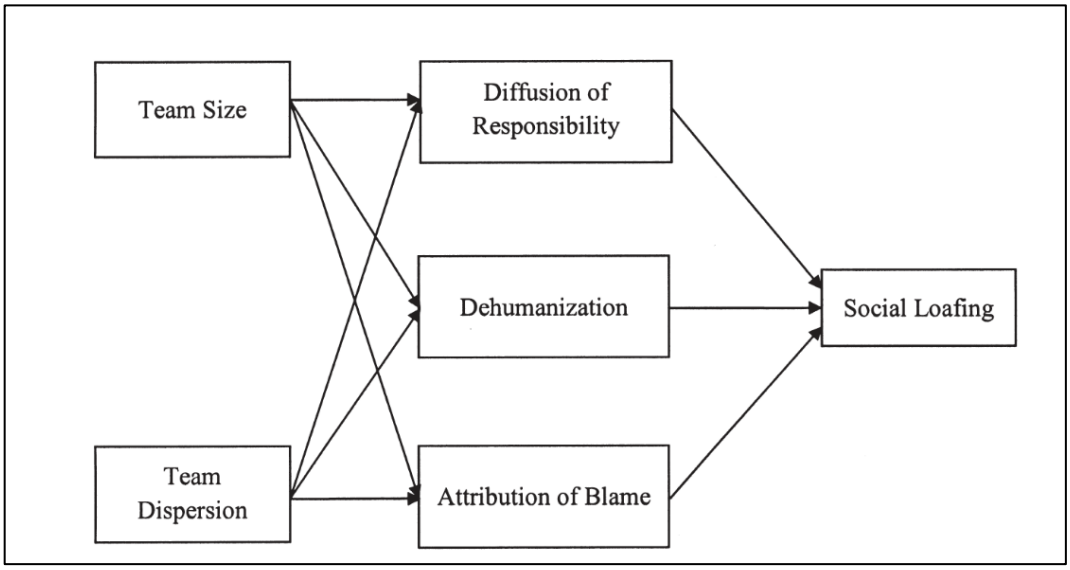
superior to others tended to engage in social loafing when faced with an easy task, but not when faced with a challenging task.

Social loafing has been called a "trait-like habitual response, or a tendency recurring in similar circumstances" (Ying et al., 2014, p. 466), and researchers have recommended measuring social loafing tendency before starting a group task with tools such as the Perceived Social Loafing Questionnaire (PSLQ; Høigaard, 2010), Self-Reported Social Loafing Questionnaire (SRSLQ; Høigaard et al., 2010), or the Social Loafing Tendency Questionnaire (SLTQ; Ying et al., 2014).

As seen in Figure 6, three primary cognitive mechanisms have been proposed to mediate the role of team size and team dispersion to social loafing: diffusion of responsibility, attribution of blame, and dehumanization (Alnuaimi et al., 2010).

Figure 6

Cognitive Mechanisms Mediating Social Loafing



Note. From "Team size, dispersion, and social loafing in technology-supported teams: A perspective on the theory of moral disengagement," by O. A. Alnuaimi, L. P. Robert, and

Diffusion of responsibility is the cognitive process by which individuals transfer accountability for work products to others (Latané & Darley, 1970). Bandura famously described this phenomenon as, “when everyone is responsible, no one really feels responsible” (Bandura, 2002, p. 107). This relates to social loafing in that individuals working in groups feel less responsible for the overall work product, and therefore exert less effort than they could. Attribution of blame is the cognitive process of “blaming recipients of antisocial behavior for bringing suffering upon themselves” (Alnuaimi, 2010, p. 212). This relates to social loafing in that individuals blame others for their own loafing. Dehumanization is a process by which individuals fail to perceive human qualities of others (Bandura, 2004) resulting in a higher likelihood of taking advantage of one that has been dehumanized. Diffusion of responsibility, attribution of blame, and dehumanization are said to increase in relation to increases in group size and group dispersion increase, potentially resulting in increased social loafing.

While many models of social loafing emphasize the importance of cognitive processes, traits, and internal factors, research has also identified environmental factors shown to affect social loafing including identifiability and accountability of individual performance (George, 1992), potential for evaluation (Harkins & Szymanski, 1989), group cohesion (Hare, 1952; Karau & Hart, 1998), task difficulty (Harkins & Petty, 1982; Mefoh & Nwanosike, 2012), meaningfulness/value of task (Williams & Karau, 1991), participant gender (Karau & Williams, 1993), group dispersion (Chidambaram, 1996),

culture of the participants (Earley, 1989), group size (Aggarwal & O'Brien, 2008; Karau & Williams, 1993), and the variables identified in the CEM (expectancy, instrumentality, valence; Karau & Williams, 1993). While a discussion of all of these variables is beyond the scope of this paper, several variables relevant to the current research will be discussed on the following pages.

Variables That Impact Social Loafing

Instrumentality/Dispensability

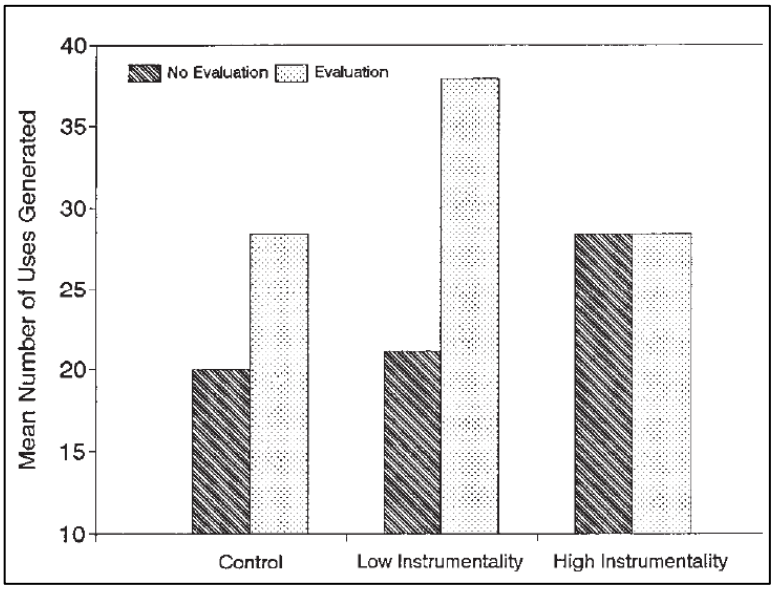
Recall that instrumentality (as described in the CEM), and dispensability refer to the perception that one's performance is necessary in obtaining a goal. In a study examining this variable, participants were told that collective performance on a brainstorming task either would or would not be rewarded, and would or would not be evaluated. Participants completed practice sessions and received feedback on their group performance. Participants in the high-instrumentality condition were told their group's performance in the practice sessions was excellent, and was therefore likely to be rewarded in subsequent sessions. Participants in the low-instrumentality condition were told their group's performance in the practice sessions was poor, and therefore not likely to be rewarded in subsequent sessions. Control participants did not receive any information about their likelihood of success (Shepperd & Taylor, 1999).

As seen in Figure 7, participants who were told their individual performances would be evaluated performed better in both the control and low-instrumentality conditions. The best performers were the participants in the low-instrumentality condition that could be individually evaluated, indicating participants exerted the most effort when they believed that only exceptional performance could help the team earn the reward, and

their individual performance could be evaluated. Participants performed poorer in the high-instrumentality condition, with the assumption that their individual contribution was less necessary to achieve the goal. Participants that could not be individually evaluated only performed at high levels when they believed there was a high probability of earning the group reward (Shepperd & Taylor, 1999).

Figure 7

Low Versus High Instrumentality



Note. From "Social loafing and expectancy-value theory," by J. A. Shepperd and K. M. Taylor, 1999, Personality and Social Psychology Bulletin, 25(9), 1147-1158, (https://doi.org/10.1177/01461672992512008). Copyright 1999 by Society for Personality and Social Psychology, Inc.

Kerr and Bruun (1983) varied perceptions of dispensability using conjunctive and disjunctive preparations of an air-blowing task. Recall that *conjunctive tasks* require the

contribution of all group members to attain a group goal. *Disjunctive tasks* require a single solution meaning the success of the group depends on the performance of the most talented member of the group. In Kerr and Bruun's (1983) conjunctive task, participants believed the pair's performance would be equal to the performance of the least productive member of the pair. In the disjunctive task, participants believed the pair's performance would be equal to the performance of the most productive member of the pair. Following a practice session, the experimenter provided information to participants to make them believe they were high performing or low performing on the task. The participants who were told they were high performers exerted greater effort on the disjunctive task than the conjunctive task, those who were told they were low performers exerted greater effort on the conjunctive task than the disjunctive task. Essentially, when participants believed their contribution was indispensable, they worked harder.

Identifiability, Comparison, Evaluation

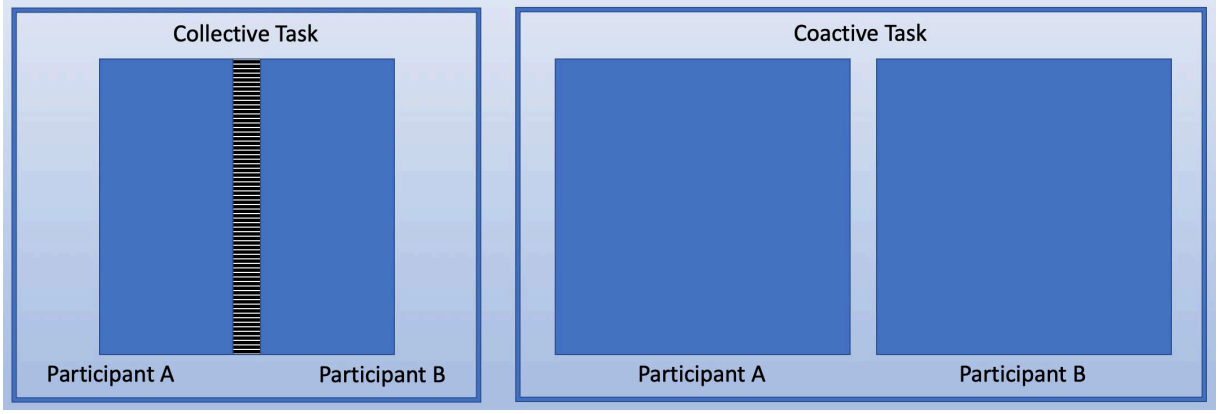
Identifiability is defined as the ability for anyone to know the contribution of individual participants to the overall outcome; *comparison* is defined as having multiple exemplars of the same task available to the actors and/or experimenters; *evaluation* is defined as having a measure of output and a standard against which the output may be defined (e.g., objective standard/goal, social standard; Harkins & Szymanski, 1989). These variables are presented together as they are often impossible to separate from each other. For example, evaluation and comparison are more likely when individual efforts are identifiable, and comparison is likely to lead to evaluation.

Identifiability. A common preparation to test the impact of identifiability in social loafing research is to compare coactive and collective tasks. Recall that coactive

tasks are completed by multiple individuals and their outputs are not pooled. Collective tasks are completed by multiple individuals and their outputs are pooled. A popular methodology in social loafing research is to have participants brainstorm ways to use common objects, write them on slips of paper, and drop them into a box. In the collective condition there is one box and each participant has a slot to place their slips of paper into. In the coactive condition each participant has their own box (see Figure 8). Presumably, individual performance is not identifiable in the collective condition, but it is in the coactive condition. However, this is a deception, as researchers put systems in place to ensure identifiability in either condition. For example, as seen in Figure 8, the large box in the collective condition has a hidden partition to capture individual inputs, or the slips of paper have some discernible quality that varies between subjects such that individual submissions may be identified and attributed to each participant. Participants perform significantly better in the coactive conditions than collective conditions, meaning identifiability reduces social loafing (Charbonnier et al., 1998).

Figure 8

Collective vs. Coactive Task



Note. In a collective task (left), participants are led to believe their outputs are pooled

with their coworkers' outputs. However, there is a hidden partition in the box (as depicted by the column in the center of the blue box) that allows experimenters to identify individual contribution. In the coactive task (right), each participant has their own box, and outputs are not pooled.

In another example, athletes in a simulated swim meet were told their individual times in multi-person relays would or would not be announced. For those whose time would be announced (identifiable), swimmers swam faster in team relays than individual competitions, and for those whose times would not be announced (not identifiable), they swam faster in individual competitions than team relays (Williams et al., 1989).

Comparison. A proposed explanation for the importance of identifiability of individual performance is that it makes comparison and evaluation possible. Harkins and Jackson (1985) attempted to separate the effects of identifiability and comparison. Participants were told their individual scores on a brainstorming task would or would not be known by the experimenter (identifiable or not identifiable), and their task was the same or different from the task being completed by other participants (comparable or not comparable). Participants in the identifiable-comparable condition performed significantly better than the participants in other conditions. Thus, comparison may be a more important factor in social loafing than identifiability alone.

Evaluation. The role of evaluation is likely one of the more obvious variables to link to social loafing research. Indeed, historically, some researchers have defined social loafing in terms of motivation loss due to decreased identifiability or evaluation (e.g., Harkins, 1987; Williams et al., 1981). According to Comer (1995), social loafing:

> seems to occur when individuals lack motivation to perform either because there is no potential for external evaluation of their individual contributions (and thus there is no risk of social rejection for profiting from others' effort while not pulling one's weight) or for internal evaluation (there is no opportunity to satisfy one's quest for knowledge about one's own ability or the ability of one's group as compared to a standard. (p. 651)

In a variety of studies, evaluation potential has significantly decreased social loafing, including evaluation from the experimenter, from co-participants, or self-evaluation (Aggarwal & O'Brien, 2008); Szymanski & Harkins, 1987). In research designed to assess the effects of identifiability and evaluation separately, Harkins and Jackson (1985) showed identifiability decreased social loafing, but only when participants believed their work could be evaluated.

Researchers have examined the effect of group evaluation on social loafing. Harkins and Szymanski (1989) had groups complete a signal detection activity in groups of four, manipulating the potential for group and individual evaluation. The potential for group evaluation was as effective at reducing social loafing as self-evaluation or evaluation by the experimenter.

Task Difficulty/Relevance/Value/Interest

The nature of tasks impacts the prevalence of social loafing, with loafing found more frequently with easy, irrelevant, or boring tasks (Karau & Wilhau, 2020). Increasing task difficulty decreases social loafing as individuals are more likely to perceive their contributions as necessary to achieve the goal, aligning with the indispensability explanation described previously. In an experiment testing task relevance as a variable,

students were asked to provide feedback on their own upcoming senior exams (relevant), future senior exams following their own graduation (less relevant), or exams at another school (least relevant). Participants with relevant tasks did not engage in social loafing even when they believed their contributions were not identifiable (Brickner et al., 1986).

In line with the CEM, as task value increases, the likelihood of social loafing decreases. Research has shown when participants are given a "meaningful" task, they exert additional effort to make up for partners who were unwilling, unable, or unreliable in contributing their fair share (Williams & Karau, 1991). In this example, the task was "meaningful" because participants were told their performance on the task was related to their intelligence.

Group Dispersion

Dispersion describes a situation in which teams are not working together in physical space, instead collaborating through electronic means. With continued improvements in technology, and as more organizations globalize, co-location for work groups is becoming less necessary (Boh et al., 2007; Powell et al., 2004). For teams working together via technology, team size and dispersion have been shown to influence social loafing (Chidambaram, 1996), with research suggesting teams are more productive when they work together in physical proximity than when they work together virtually, for example, on brainstorming tasks (Chidambaram & Tung, 2005; Dennis & Valacich, 1999; McDonough et al., 2001), and software development (McAvoy & Butler, 2006).

Expected Loafing by Group Members

Expected loafing as a variable in social loafing research is achieved by providing information to participants about how much effort their partners or coworkers will exert

on a task, not through actual observation of performance. Jackson and Harkins (1985) suggest individuals attempt to match their coworkers' expected efforts on collective tasks. In their experiment, confederate coworkers told participants one of two statements: (1) "this experiment is interesting and I'm going to try hard;" or (2) "this experiment is boring and I'm not going to try hard." Participants matched the confederate's expected effort. However, the statement that the experiment was interesting or boring was a potential confound, as task value has also been shown to impact social loafing.

In a conflicting result, Williams and Karau (1991) found individuals worked harder collectively than coactively when paired with partners who were expected to perform poorly. Their explanation was the participants believed their individual contribution was necessary to obtain the valued outcome. Further, they explained, "when individuals are aware of how hard their co-workers intend to work, they become more attentive to their own effort, possibly for strategic reasons" (Williams & Karau, 1991, p. 576). Hart and colleagues (2004) also found participants allocated more effort on individual conditions than partner conditions when paired with high performers, and the opposite when they expected their partner to perform poorly. This phenomenon has been termed *social compensation* (Williams & Karau, 1991).

Perceived Loafing by Group Members

Social loafing is an actual situation in which one exerts less effort as part of a group than individually, and perceived loafing is the perception that one's coworkers are engaging in social loafing. Although they often covary, one can occur without the other (Mulvey & Klein, 1998). Loafing may be difficult or impossible to observe, and on the other hand, loafing may be perceived when it is not actually happening. Loafing may be

misattributed to a lack of ability or vice versa (Mulvey & Klein, 1998). Regardless of actual behavior, it is the perception of loafing that is salient (Mulvey & Klein, 1998), and perception alone is often sufficient to impact behavior (Ilgen et al., 1994).

Research has shown that workers pay attention to the behavior of their coworkers, and what they see is likely to affect their own behavior (Mitchell et al., 1985). There is a perception of equity and fairness in work situations such that, "[p]ersons who perceive inequity are likely to withhold discretionary behaviors" (Schnake et al., 1995, p. 211). According to Comer (1995), "[p]erceived loafing by one's fellow group members may promote one's own loafing not only by engendering one's wish to avoid being exploited by group members, but also by reducing one's sense of influence" (p. 655). The former has been described as "retributive" loafing to avoid exploitation, the latter as "disheartened" loafing due to perceptions of diminished influence over task outcomes (Comer, 1995, p. 655). Both can be viewed as attempts to avoid being the "sucker."

Kerr (1983) tested the impact of perceived partner performance with a disjunctive task (a complex task that requires a single solution). Participants who believed they were working with competent but underperforming partners exerted less effort than when paired with partners who appeared to lack the ability to be successful at the task, or when they worked alone. Kerr's interpretation was that people are willing to pick up the slack for partners who lack the ability to be successful on their own, but not willing to step up for partners who have the capacity to be successful, but who were not working at their full capacity (e.g., social loafing). While there may be conditions under which individuals will pick up the slack, it is important to consider that this may not be sustainable; "[i]t is reasonable to believe, however, that over time, individuals would not only grow

increasingly frustrated by and resentful of shirking group members, but they would become unable to manage their mounting load of undone work" (Comer, 1995, p. 657).

Group Size

As described previously, group size was the variable that contributed to the first identification of social loafing (Ringelmann, 1913). Group size has continued to be included in many of the social loafing theories (e.g., Social Impact Theory; Latané, 1981; Theory of Moral Disengagement; Alnuaimi et al., 2010). Many studies have shown that larger groups are correlated with greater levels of social loafing (e.g., Aggarwal & O'Brien, 2008; Karau & Williams, 1993). As group size increases, individual anonymity also increases, making it more difficult to assess individual contribution resulting in a lower probability of punishment for poor individual performance, and also a lower probability for reinforcement for above average performance as reinforcement is based on performance of the group as a whole.

Alternate Explanations for Social Loafing

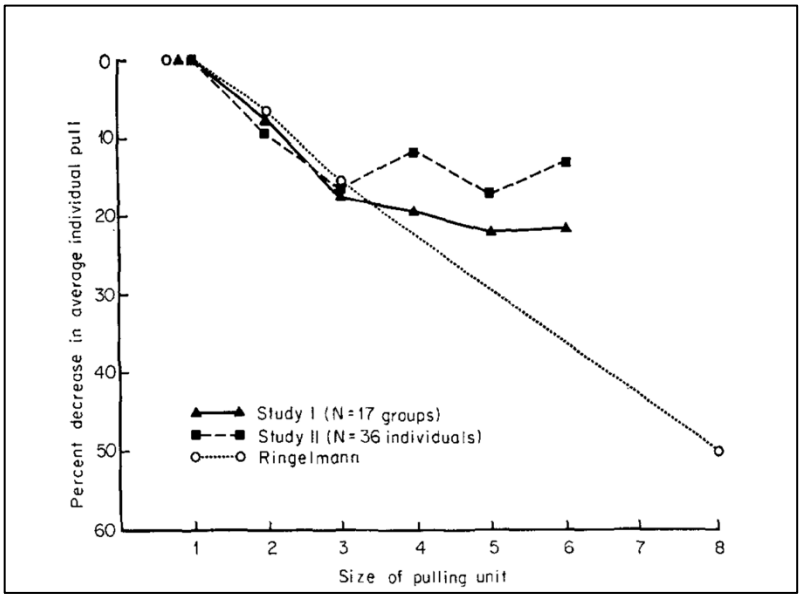
Motivation Loss vs. Coordination Loss

Steiner (1972) suggested the effects Ringelmann found may be due to two different contributors: motivation loss or coordination loss. He described coordination loss (sometimes described as process loss) as a result of the difficulty in coordinating individual efforts. Motivation loss is what is being referred to as social loafing. Steiner believed Ringelmann's results were due to group members failing to coordinate their movements while pulling the rope resulting in less efficient teamwork. For example, some might be pausing or resting while others are pulling, such that the group never reaches their maximum capacity.

To test this theory, Ingham and colleagues (1974) had participants perform a rope-pulling task blindfolded. Participants were told they were performing in a group, but some were actually performing alone (*pseudogroup* condition). They found decreased performance in the pseudogroup condition as the perceived group size increased, in line with motivation loss, and in contrast to coordination loss. Specifically, they found a 15%-18% decline in performance from the alone condition up to three-person groups, with insignificant drops in groups of larger sizes (see Figure 9) in a curvilinear relationship. This contrasts with the linear decrements found by Ringelmann.

Figure 9

Social Loafing in a Rope-pulling Task

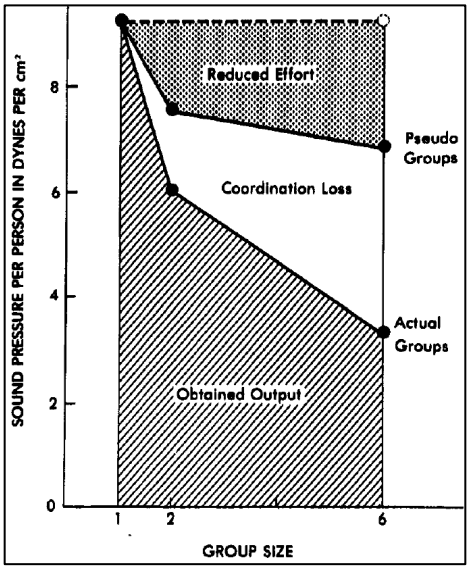


Note. From "The Ringelmann effect: Studies of group size and group performance," by A. G. Ingham, G. Levinger, J. Graves, and V. Peckham, 1974, *Journal of Experimental Social Psychology*, *10*(4), 371–384, (https://doi.org/10.1016/0022-1031(74)90033-X). Copyright 1974 by Academic Press, Inc.

Latané, Williams, and Harkins (1979) replicated this group/pseudogroup comparison with an experiment of individuals and groups asked to shout at maximum volume. Participants wore headphones playing a recording of people shouting such that they believed they were shouting in groups while they were in fact shouting alone. Each participant shouted in real groups of two or six, pseudogroups of two or six, and by themselves. As the number of actual shouters increased, the total sound increased, but at a slower rate than would be expected by the sum totals of individual efforts. The pseudogroup conditions were controls for coordination loss, as there was no actual group performance to evoke coordination loss. About half of the decrement in performance for pseudogroups was due to social loafing, and half due to coordination loss (see Figure 10).

Figure 10

Motivation Loss vs. Coordination Loss



Note. The relative contribution of coordination loss and motivation loss to lower-than-

expected outcomes in group tasks. From “Many hands make light the work: The causes and consequences of social loafing,” by B. Latané, K. Williams, and S. Harkins, 1979, *Journal of Personality and Social Psychology*, *37*(6), 822–832, (https://doi.org/10.1037/0022-3514.37.6.822). Copyright 1979 by the American Psychological Association, Inc.

Effort Conservation

Kerr and Bruun (1981) proposed an alternate explanation for social loafing when group size varied within subject; individuals attempt to conserve energy and allocate it when it is most necessary. Essentially, when participants are informed they will be completing a task in various group sizes, they may conserve energy in larger groups and expend more energy in smaller groups. To test this theory, participants were asked to pump a rubber sphygmograph bulb and were told their individual contribution could not be measured. In the between-subjects condition, participants were told they would always perform alone, as a dyad, or as a tetrad. In the within-subjects condition, participants were told they would sometimes perform alone, or in dyads, or tetrads such that participants could potentially plan to conserve energy for when they may need it the most. There were no significant differences between the within-subjects and between-subjects conditions, indicating a lack of support for the effort conservation explanation.

Allocational Strategy vs. Minimizing Strategy

Related to the effort conservation explanation, two strategies for group work may influence social loafing: an allocational strategy or a minimizing strategy (Harkins et al., 1980). The allocational strategy acknowledges that individuals have finite resources (e.g.,

energy, strength) to allocate towards tasks. As such, "[g]iven the choice between working hard when shouting with others or concentrating their efforts on shouting alone, they may decide to allocate more energy to the alone trials where their efforts can be identified and rewarded" (p. 459). The minimizing strategy suggests the tendency to minimize overall energy expenditure, in which case individuals would minimize their effort in groups in which individual efforts are hidden, versus in individual work in which individual efforts are identifiable.

Harkins and colleagues (1980) tested these two strategies with a clapping exercise. In a within-subjects design, participants believed they worked both alone and with a partner, and in the between-subjects design, participants either worked alone or believed they worked with a partner. The within-subjects participants made 75% less noise when they believed they were working with a partner. Those who believed they always clapped with a partner produced 62% of the sound as participants who always clapped alone. These results are inconsistent with an allocational strategy in that those who always performed in groups (and therefore had no reason to reserve energy to allocate to individual trials) performed worse than those who always performed alone. Instead, Harkins and colleagues suggest the minimizing strategy was at play.

Social Loafing in Behavior Analysis

In the field of behavior analysis, social loafing would most likely be of interest in the subdiscipline of organizational behavior management (OBM). However, the term "social loafing" is sparse in OBM research. It only appears in eight articles in the *Journal of Organizational Behavior Management*, the field's major outlet for OBM research (see Table 1); none of the appearances of are as a topic of empirical research.

Table 1

"Social Loafing" in the Journal of Organizational Behavior Management

Year	Author(s)	Title
1992	Fleming	Book Review: A theoretical analysis of rule-governed behavior and an OBM intervention within structural and cultural constraints
1997	Smoot & Duncan	The search for the optimum individual monetary incentive pay system: A comparison of the effects of flat pay and linear and non-linear incentive pay systems on worker productivity
2000	Ludwig & Geller	Intervening to Improve the Safety of Delivery Drivers
2001	Mawhinney	OBM today and tomorrow: Then and now
2002	Ludwig, Biggs, Wagner, & Geller	Using public feedback and competitive rewards to increase the safe driving of pizza deliverers
2009	Abernathy	Walden Two revisited: Optimizing behavioral systems
2011	DeNisi	Managing performance to change behavior
2013	Goltz	A behavior analysis of individuals' use of the fairness heuristic when interacting with groups and organizations

Smoot and Duncan (1997), seeking the optimum monetary incentive pay system, suggest "another situational factor which provides a fertile ground for incentive research is the social psychology phenomenon of 'social loafing'" (p. 69). They relate social loafing to the absence of evaluation, the free rider effect, and the sucker effect. They propose worker motivation is weakened in some way by the presence of other workers and caution "[g]iven the proliferation of work teams in business and industry, an investigation of the existence of social loafing is imperative" (p. 69).

Goltz (2013) references social loafing in her article describing the *groups as patches* framework, proposed as an integrated model of social behavior (Goltz, 2009; 2010). Groups as patches is informed by both behavioral ecology and behavior analysis and relates group selection to foraging patches with varying reinforcer densities. Foraging

models assume animals have finite energy and effort to engage in foraging behaviors, and thus attempt to allocate their time and effort towards the most rewarding patches. Similarly, Goltz (2013) explains individual behavior is shaped by fairness as a heuristic in terms of matching effort to group consequences; "fairness is thought to help individuals choose how to allocate their limited time and energy to numerous possible groups and organizations, each of which have competing demands on the individual as well as different schedules of reinforcement" (p. 6). The concept of fairness may serve as a rule impacting individual behavior to support equity among group member effort and reinforcement. Goltz' research on fairness is more focused on choices to join groups, rather than individual behavior within groups, however her work can be generalized to social loafing situations. For example, she reports people expect allocation of positive reinforcement to be proportional to individuals' effort, in other words, "positive reinforcement will generally be viewed as being fair as long as individuals are aware of and understand the basis for reinforcement and as long as the distribution of the reinforcers across individuals is proportional to their responses" (p. 17).

The remaining JOBM articles mention social loafing in passing. Ludwig and Geller (2000) make reference to social loafing once, explaining that with group goals, without public posting of individual performance, "'social loafing' can be expected" (p. 41), aligning with the evaluation-based theories of social loafing. Ludwig, Biggs, Wagner, and Geller (2002) referred to social loafing in the context of group goals, citing research (Ludwig et al., 2000) showing "over half of their participants did not respond to a group-based goal when group feedback was presented," and attributing the results to social loafing. In a review of Skinner's (1948) utopian novel *Walden Two*, Abernathy

(2009) cautions against socialist utopias in which community goods and services are distributed equally regardless of individual contributions. Abernathy argues such noncontingent reinforcement has the potential to result in social loafing or free riding. Mawhinney (2001) cautions that group-based incentive systems may result in free riding and social loafing. DeNisi (2011) suggests that in cases in which organizations or supervisors rely solely on team performance and ignore individual performance, free riding and social loafing may occur. Fleming's (1992) review of a chapter on apathy and irresponsibility in P. A. Lamal's (1991) *Behavioral analysis of societies and cultural practices* states that the chapter (Kunkel, 1991), and its review of social loafing research, "provides compelling reasons for behavior analysts to look at some of the social psychology literature" (Fleming, 1992, p. 142).

The term "social loafing" is not present in several other major behavior journals, including the *Journal of Applied Behavior Analysis*, *Behavior Analysis in Practice*, *Behavior and Social Issues,* and *Perspectives on Behavior Science*. However, because the term comes from the field of social psychology, behavior analytic research may not address the topic without including the term "social loafing." Behavior analysts are more likely to describe social loafing in terms of contingencies supporting high levels of productivity while working alone or with others. Specifically, individual versus group productivity, group contingencies, cooperation, or group goals may uncover research related to social loafing without mentioning the term. Additionally, the variables that contribute to social loafing previously described (e.g., indispensability, group size, perceived loafing) may be reframed in behavior analytic terms relating to reinforcement and punishment.

Group Contingencies

Skinner (1965) specified "[i]t is always an individual who behaves" (p. 311) while acknowledging the "enormous tendency to behave as others are behaving" (p. 312). He also points out that by joining a group, the potential to contact reinforcement increases, and the reinforcement achieved by a group may "easily exceed" the sum of the reinforcement that might be achieved by each individual member of the group (p. 312).

Group rewards negatively impact highly productive workers if they find their earnings reduced due to less productive workers, and poor performers continue to perform poorly as they benefit from the rest of the group members (Dierks & McNally, 1987). Further, "in some group contingencies, there is the possibility that the contingency may reinforce substandard task performance or behavior that is unrelated to the task" (Schmitt, 1984, p. 380).

Much of the research on group contingencies in OBM involves various pay or incentive systems. Honeywell-Johnson and Dickinson (1999) provide a succinct explanation in terms of individual versus group incentive plans:

> Individual incentives provide the strongest connection between performance and pay, because incentives are based solely on the performance of the individual. With group incentives, the worker's pay depends upon the group's productivity, and hence workers have less control over their earnings. Furthermore, that control decreases as the group size increases. As a result, performance may suffer accordingly. (p. 100)

Honeywell-Johnson and Dickinson (1999) reviewed seven studies comparing group and individual incentives on performance (Allison et al., 1992; Farr, 1976;

Honeywell et al., 1997; London & Oldham, 1977; Roberts & Leary, 1990; Smoot & Duncan, 1997; Stoneman & Dickinson, 1989). In one example, Farr (1976) compared hourly pay, individual incentives, equally distributed group incentives, and group incentives distributed based on individual performance (e.g., the highest percentage for the top performer, and lower percentages for lower performers). Hourly pay was the least effective, followed by individual and equally distributed group incentives. Group incentives distributed unevenly relative to individual performance were the most effective at evoking high levels of performance. Results were consistent among the seven studies; all found small group incentives to be at least as effective as individual incentives while working in groups, but no significant differences between the two.

While behavior analytic research comparing individual and group contingencies in relation to payment or incentive systems is important, these types of arrangements potentially ignore 59% of the American workforce who are paid hourly wages (USA Facts, 2019). Hourly workers are paid for time without additional financial incentive for higher levels of productivity. As Abernathy (2009) famously wrote, "[w]hen you pay for time, you get time. When you pay for results, you get results" (p. 179). Hourly workers "do not work to earn their pay, they work to avoid losing it" (Abernathy, 2000), meaning that without any additional incentive, hourly workers may be likely to work just hard enough to avoid being fired. Clearly, linking money to performance whether directly through bonuses or a pay-for performance system, or indirectly through a group cost-sharing arrangement, will impact performance. However, financial incentives are certainly not necessary or sufficient to maintain exceptional performance for all workers, suggesting the importance in understanding the conditions under which individuals might

expend discretionary effort, and under what conditions employees are likely to engage in social loafing.

Cooperation vs. Competition vs. Individual Work

Cooperation, one type of group contingency, is a situation in which "the reinforcement of two or more individuals depends upon the behavior of both or all of them" (Skinner, 1965, p. 311), or "the combined behavior of two or more organisms is needed to procure positive, or remove negative, reinforcement for either" (Keller & Schoenfeld, 1950, p. 357). The key element in a cooperative contingency is mutual reinforcement, such that all participants are rewarded if their performance meets a specified criterion. While competition is not typically related to social loafing research, it is included here as most research comparing individual and cooperative work includes a comparison of competition as well. According to Skinner (1965), in competition, "[t]wo individuals come into competition when the behavior of one can be reinforced only at the cost of the reinforcement of the other" (p. 311).

Johnson and colleagues (1981) completed a meta-analysis of 122 studies comparing cooperative, competitive, and individual work scenarios on productivity. Johnson identified four categories: cooperation, cooperation with intergroup competition, interpersonal competition, and individual work and presented three major disagreements among researchers:

1. Which results in higher productivity: cooperation or competition?
2. Which results in higher productivity: cooperation or individual work?
3. Is cooperation on its own is an effective contingency, or is intergroup competition necessary?

Johnson et al. (1981) concluded with the following:

1. Cooperation is superior to competition in promoting achievement and productivity.
2. Cooperation is superior to individualistic efforts in promoting achievement and productivity.
3. Cooperation without intergroup competition promotes higher achievement and productivity than cooperation with intergroup competition
4. There is no significant difference between interpersonal competitive and individualistic goal structures on achievement and productivity.

This study was criticized for disregarding substantial variability in the outcomes, and because few of the reviewed studies related to tasks that might be found in an employment setting (e.g., categorization, motor skills, verbal problem solving; Allison et al., 1992). Allison and colleagues designed a study to test Johnson et al.'s (1981) results comparing competitive, cooperative, and individual incentive contingencies. Staff at a day treatment program were told they would receive bonuses contingent upon the observation of a variety of behaviors. In the cooperative condition, bonuses earned by all staff were added together and divided equally among all staff. In the competitive condition, only the top three performers earned bonuses, and in the independent condition, staff earned incentives based on their own performance. Cooperation produced the highest productivity, significantly better than individual work, although there was little difference between the other conditions. The findings by Johnson and colleagues and Allison and colleagues run contrary to social loafing findings.

Ludwig and colleagues (2002) examined a competitive pay contingency to

improve safe driving for pizza delivery drivers. They found positive results, but noted some concerns in using competitive contingencies. Specifically, not all participants will experience reinforcement in a competitive contingency; therefore, conditions must be arranged to ensure all participants experience derived or vicarious reinforcement in the absence of winning to maintain target behaviors. They instead suggest that cooperative contingencies may be more effective than competitive contingencies while acknowledging the need for additional research.

Goals

Goals have been described as discriminative stimuli such that goal attainment often results in positive consequences or the removal of negative stimulation (Fellner & Sulzer-Azaroff, 1984). Alternatively, goals may function as rules, describing the contingency between the goal and the consequences of meeting the goal, or establishing operations which increase the value of meeting the goal based on previous history with reinforcement for meeting goals (Agnew, 1997). From the perspective of relational frame theory (RFT; Hayes, Barnes-Holmes, & Roche, 2001), goals identify a specific level or criteria for performance, and simultaneously establish a relationship between current performance and goal performance. When current performance is in a “less than” relationship with the level of performance specified by the goal, behavior that closes the gap reduces the “less than” relationship, resulting in derived reinforcement for the goal directed behavior (O’Hora & Maglieri, 2006).

Research on goal setting is one of the most robust areas of psychological research with a 2006 meta-analysis indicating over 1,000 studies had been conducted on goal setting utilizing more than 88 different types of tasks, with over 40,000 participants, in a

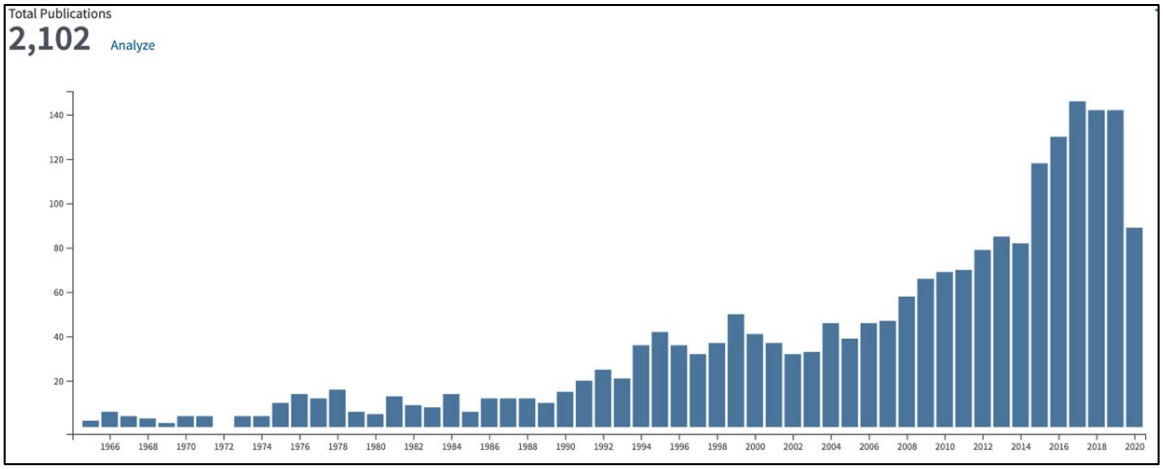
variety of contexts (Locke & Latham, 2006). Research is clear that difficult goals produce higher levels of responding when compared to easier goals, and specific goals produce higher levels of responding than vague goals, such as "do your best" (Locke & Latham, 2006).

Group Goals

While goal setting has been researched for over a century, recent research has indicated that the focus on individual behavior in goal setting research is out of sync with the current trend of teamwork in business settings (e.g., Kleingeld et al., 2011; Kozlowski & Bell, 2003). Note the vast discrepancy between a search for the terms "goal setting" and "group goal" in Web of Science[4] in the domains and subdomains of psychology and management (see Figure 11 and Figure 12) including the discrepancy in number of articles and the later onset of research on group goals.

Figure 11

"Goal Setting" on Web of Science

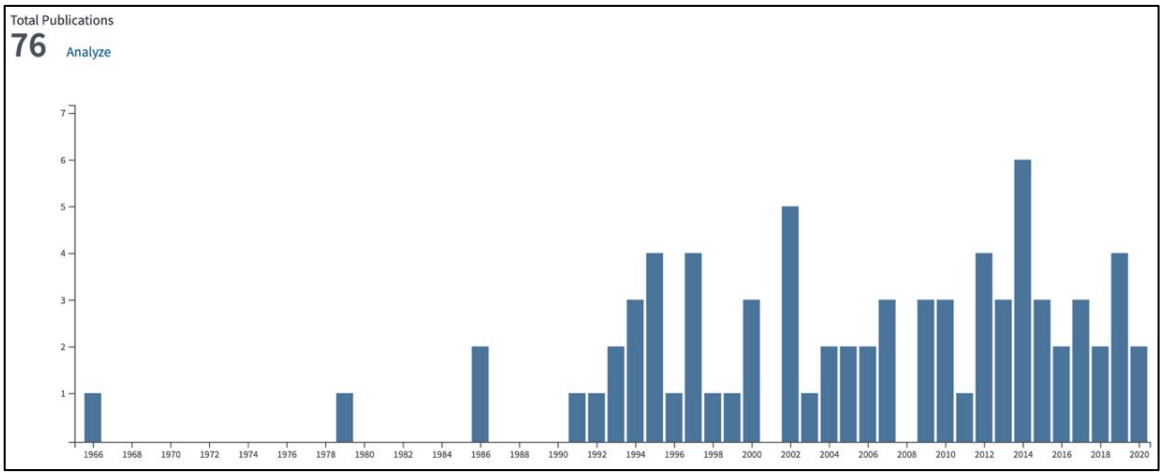


Note. From Web of Science.

[4] Retrieved on July 19, 2020

Figure 12

"Group Goal" on Web of Science



Note. From Web of Science.

In a meta-analysis of group goal setting research, group goals were found to have a significantly positive effect on performance (O'Leary-Kelly et al., 1994). However, the analysis did not compare group goals to individual goals, only the efficacy of group goals compared to no goals or low goals. The complexity with group goals is the potential for individual goals embedded within group goals. Locke and Latham (1984) stated, "the optimal strategy, of course, is to set goals for the group as well as for each individual within the group" (p. 37). Mitchell and Silver (1990) suggest four conditions must be examined: individual goals, group goals, individual goals plus group goals, and a no goal ("do your best") control condition. A few studies have indicated group goals with or without individual goals result in higher levels of productivity than individual goals or no goals (e.g., Likert, 1967; Matsui et al., 1987). Thus, the connection between this body of research and social loafing is lacking in significant strength.

Group goal setting does have some advantages over individual goals in organizations. Some operational advantages include creating one performance standard for the whole group rather than individual standards for every job, and measuring only group performance as opposed to all individual performances (Stoneman & Dickinson, 1989). A more important outcome is, "the group itself becomes a source of reinforcement which augments the value of material reinforcement" (Huber, 1985, p. 59). Huber also suggests competition and jealousy are reduced because the contingency is the same for all members of the group. However, in the case of social loafing, jealousy may actually be a significant outcome if it is apparent that group members are free riding and gaining access to group reinforcement on the basis of the performances of the rest of the group.

Variables That Impact Social Loafing

All of the variables previously provided relating to social loafing (instrumentality, dispensability, identifiability, comparison, evaluation, task difficulty, relevance, value, group dispersion, expected loafing, perceived loafing) may be reinterpreted in terms of reinforcement, punishment, and other behavior analytic terms and concepts. With regards to instrumentality and dispensability, when individuals believe their contribution is essential to achieving the goal, they may expend more effort to attain reinforcement and avoid punishment. When they believe their coworker(s) are capable of achieving the goal without their own significant effort, they may be more likely to loaf to conserve energy, thereby contacting reinforcement or avoiding punishment for less effort.

Identifiability, comparison, and evaluation increase the likelihood of individual reinforcement or punishment for individual performance. Rather than being able to hide poor personal performance and access reinforcement based on the efforts of coworkers,

these variables add another layer of potential reinforcement or punishment (at the individual level and at the group level). While reinforcement and punishment for completing the task or achieving the goal impact performance, the task itself may be reinforcing or punishing for participants based on its difficulty, relevance, or value to the individual. The qualities of the task may have an additive impact on performance if the task itself is reinforcing and the outcome is reinforcing. The opposite may also be true; if the task is boring or irrelevant to the individual, and the outcome is not considered valuable, social loafing may be more likely. Group dispersion may decrease the likelihood of social reinforcement for good performance (e.g., praise) and social punishment for poor performance (e.g., blame) from coworkers as a team interaction may be less salient when coworkers are not co-located.

Expected and perceived loafing may impact behavior in a variety of ways. When coworkers are expected or perceived to be engaging in social loafing, the "less than" relationship between the group goal and personal performance may increase substantially, resulting in the perception of an unreasonable goal. Previous research has found individuals presented with an unreasonable goal will exert less effort than individuals presented with a challenging, but reasonable goal (Roose & Williams, 2017). Thus, if individuals perceive that reaching the goal is impossible, they may engage in social loafing rather than expend the effort with little chance of reinforcement. Additionally, "[t]here may be a natural inclination to be reinforcing to those who reinforce us, as there seems to be to attack those who attack us" (Skinner, 1971, p. 45), meaning individuals who expect or perceive social loafing (attack), may attack back (engage in social loafing).

It should be noted that while social loafing appears to be a fairly universal phenomenon, it does not happen in all cases with all individuals. One would expect that individual histories of reinforcement will impact social loafing regardless of the variables in effect, as has been found with other OBM interventions such as the impact of feedback (Houmanfar & Hayes, 1998). The consequence of personal learning histories is that certain individuals with a rich history of reinforcement for high levels of performance may be less likely to engage in social loafing in any situation, regardless of the variables in effect. Individuals with a strong history of being praised for cooperation or helping others may engage in what would be considered "sucker" behavior, and exert maximum effort to pick up the slack for partners who are unwilling or unable to contribute their fair share. Alternatively, individuals may "impose their own contingencies on nonresponders in attempts to induce more equal contributions" (Schmitt, 1984, p. 380).

Additionally, values and rules may evoke behavior aligning with or contrary to social loafing. For example, the value of "fairness" is likely to evoke effort matching the effort of coworkers, while a value aligned with "achievement" or "success" may evoke high levels despite poor coworker performance. Similarly, individuals with a history of reinforcement for rule following will be more likely to expend effort to achieve their goal regardless of partner behavior.

Summary and Specific Aims

The present review of the social loafing research has uncovered a robust body of support for the prevalence and strength of social loafing, from Ringelmann's early study to current research, mostly in the fields of social psychology, management, and applied psychology. In a country in which a majority of the workforce is paid for time rather than

the quantity or quality of their work, it is essential to understand the conditions under which they may be more or less likely to exert maximum effort towards the goals of the organization in the absence of a pay for performance contingency or bonus structure.

Experimental outcomes have resulted in a long list of variables shown to influence social loafing, and many theories about why social loafing occurs. While some research has focused on cognitive processes and other variables not typically addressed by behavior scientists, plenty of environmental and manipulable variables have also been identified as influencing social loafing. The support for social loafing under a variety of conditions is indisputable, and the present research will not attempt to replicate those results with a standard comparison of individual and group work. Instead, this research will focus on an unexamined variable that might increase or decrease social loafing.

Little attention has been paid to the impact of coworker performance on social loafing. One challenge with studying social loafing in response to coworker performance is the limited ability to control coworker performance within subject. For example, in a rope pulling task, the experimenter could determine baseline performance among a group of participants, categorize participants on a continuum of strong to weak, and match participants with varying levels of performers, but the experimenter could not control actual performance, only predicted performance. Confederates could be used, but it would be difficult to precisely modulate the speed, strength, or effort of the confederate as an experimental variable.

Instead, some researchers have utilized a type of deception in telling participants what level of performance or effort to expect; however, those preparations have relied on statements from the experimenter or the confederate telling participants what to expect

from coworkers, not by the participant actually witnessing coworker performance and potentially making modifications to their own performance based on what they witness.

The focus of this research was the impact of partner and teammate performance on individual performance on an online data entry task. Specifically, this research used computer simulated coworkers to vary performance within subject, matching participants with coworkers programmed to complete the data entry task with high or low levels of productivity. Study 1 was designed to examine the impact of fast and slow partners in cooperative and competitive conditions on participant performance and social loafing. Study 2 paired participants with fast or slow partners and teams of three to assess the impact of coworker performance and group size on participant performance and social loafing. Finally, Study 3 paired participants with partners whose performance was inconsistent, working fast on some trials, and slow on others, to assess the impact of inconsistent participant performance and social loafing.

Study 1

Study 1 was designed to assess the impact of slow and fast partners on participant social loafing in cooperation and competition conditions on an online data entry task. The partners were computer simulations. Study 1 used a within-subjects mixed methods design, with cooperative and competitive conditions and fast and slow partners.

Study 1 Method

Participants

Participants were undergraduate students enrolled in a psychology course at the University of Nevada, Reno. Students signed up for the study on the University's SONA system and received one credit for participation. Twenty-one participants completed the

experiment. After the 21st participant, the COVID-19 pandemic prompted the closure of the University.

Apparatus and Setting

The setting was the Knowledge Center (i.e., library) of the University of Nevada, Reno; the apparatus used by participants was a Dell Computer running Windows 10.

Experimental Task

The data entry task used in this study was developed to simulate typical electrocardiogram data that a medical professional might enter into a database. This task was selected for this study as a task that is easy to learn and requires little training, and has been used in previous studies, resulting in historical data to support estimations of average performance. Additionally, the task is repetitive and likely to be neutral in terms of value or meaningfulness for participants, and therefore more likely to evoke social loafing than a meaningful task.

The simulation was originally created in the Performance System Technologies Lab at the University of Nevada, Reno, first used by Maglieri (2007), and later modified for additional studies (e.g., Roose & Williams, 2017; Smith, 2013; Tammemagi et al., 2013), and was modified again for this study. The original version of the experimental task was programmed with Visual Basic. The current version was re-programmed using Typescript, which is a super set of JavaScript. The user interface is Angular[5], and the server is NestJS.[6] The application is hosted on Digital Ocean droplet.[7]

The experimental task (see Figure 13) contains fictional medical information that

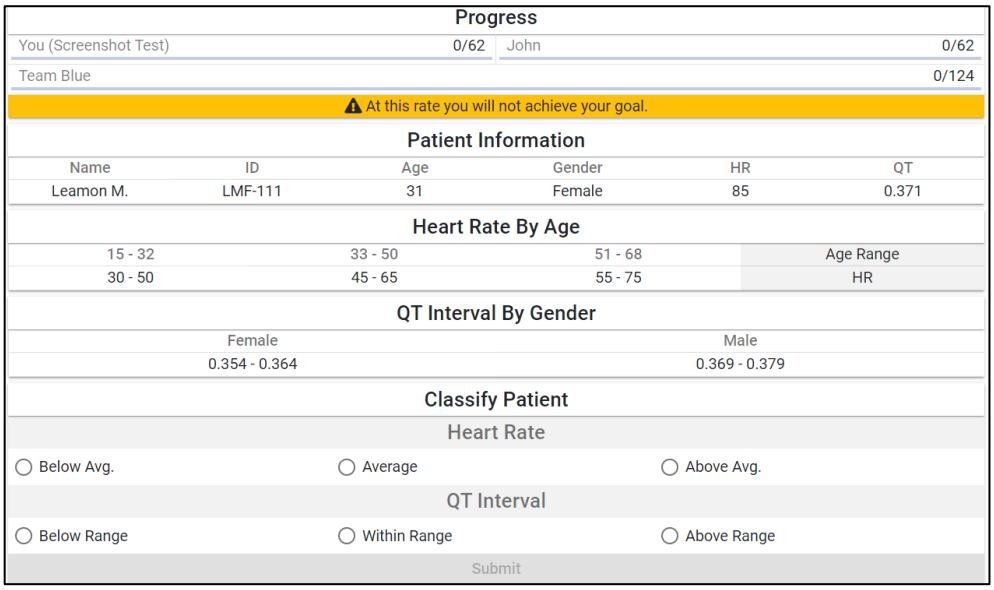
[5] https://angular.io/
[6] https://nestjs.com
[7] https://www.digitalocean.com

would be recorded following an electrocardiogram (EKG) reading populated on the screen using a randomizing formula. The EKG readings include heart rate and QT interval, which is a measurement of heart activity, specifically the latency between the Q wave and T wave in the heart's electrical activity. Participants complete several steps upon each presentation of patient data. Information from the Patient Information row is compared to the standard ranges of heart rates (Heart Rate by Age row), and QT intervals (QT Interval By Gender row). The participant checks the Patient Information row for the "Age" and the heart rate ("HR") and compares that number to the "normal" ranges for the age ranges in the Heart Rate By Age row. The participant determines if the heart rate is below average, average, or above average, and clicks the button corresponding to "Below Avg.," "Average," or "Above Avg." Next, the participant checks the Patient Information row for the value of "Gender" to determine if the patient is male or female, then reads the QT interval and compare that number to the "normal" ranges for males and females to determine if the reading is within or outside of the normal range. Once the participant determines whether the reading is within range or out of range, they click the button corresponding to their decision, either "Below Range," "Within Range," or "Above Range." Finally, the participant clicks the "Submit" button. Number lines at the top of the screen keep track of the number of correct responses in each trial. After each response, the score is updated if the response is correct and remains the same if the response was incorrect. Participants also see a green popup box indicating a correct answer and a red popup box indicating an incorrect answer. The screen then refreshes with new patient data for a new trial. At the end of each trial, participants are informed whether they or their team met their goal.

When participants work with coworkers (computer simulated), the coworkers' scores advance on a separate number line. In cooperative conditions, there is a number line representing the combined or total goal of all cooperative participants. A green popup box appears on the screen whenever a coworker completes a correct record.

Figure 13

Experimental Task



The program has an administrative user interface in which the experimenter has the ability to set the variables including the number of trials, type of trial (e.g., Solo, Solo Plus Goal, Cooperative, Competitive, 4-person Cooperative), goal, trial duration, response latencies for the simulated partners and teammates, and whether the participant will keep the same partner for multiple trials, or change partners (see Figure A1).

Conditions

Condition A: Baseline. During the baseline condition, participants were presented with a welcome screen indicating, "In this trial you will work alone. Do your

best!" A running total of correct responses was presented on the screen (see Figure A2).

Condition B: Two-person Cooperative: Slow Partner or Fast Partner. Participants were matched with a partner (computer simulated). Participants were presented with the following message prior to each trial: "In this trial you will work with a partner. Your goal is to complete a total of 62 records together." The goal of 62 records was selected as a challenging goal based on previous research utilizing the same computer program (Roose & Williams, 2017) which indicated that 62 was a challenging but not unreasonable goal. Slow partners were programmed to achieve 75% of their portion of the goal (one half of the cooperative goal) by the end of the trial. Fast partners were programmed to achieve 125% of their portion of the goal (one half of the cooperative goal) by the end of the trial. The 125% benchmark for fast partners was selected based on previous research that indicated that 125% of a goal was a reasonable and challenging goal that evoked highly productive performance (Roose & Williams, 2017), and performance higher than that might reveal the deception of computer simulated partners if their performance appeared unreasonable. The 75% benchmark for slow partners was based on the same research, as participants would need to perform at 125% of their goal performance to pick up the slack for their partner. Throughout the trial, participants were presented with continuous feedback about whether they were on track to meet the goal by the end of the trial. For example, participants should have completed 50% of the goal halfway through the trial. If the participant was behind that pace, the message "At this rate you will not achieve your goal" was displayed on the screen. If the participant was ahead of that pace, the message "At this rate you will achieve your goal" was displayed on the screen (see Figure A3).

Condition C: Competitive: Slow Partner or Fast Partner. Participants were matched with a partner (computer simulated). Participants were presented with the following message prior to each trial: "In this trial you will work against your partner. Your goal is to complete more records than your partner." While there was no number goal in this condition (the goal was to complete more records than their partner), slow and fast partners were programmed at the same speed as the partners in the cooperative conditions to maintain consistency throughout all conditions (see Figure A4).

Procedures

Pre-experiment

Participants were greeted in the lobby of the Knowledge Center by a research assistant, then escorted to a library computer. The research assistant read a script to orient the participant to the task and to set up the deception that they would be working with other participants:

> This is a multi-site study and I'm in contact with the other site where the other participants are also getting ready. You'll need your NetID to log in to a computer, and I will set you up on the experiment website. You will first read the consent form and click the box if you agree to participate. Next, the program will lead you through a tutorial and five experimental conditions. I will be waiting in the lobby where we met. Please come find me at the end of the study, if you have any trouble with the program, or if your partner stops participating.

The research assistant assisted the participant with accessing the website on the library computer, provided the instruction to start, and left the area.

Informed consent is programmed into the experiment, and participants could not

begin the experiment without checking a box to indicate that they agreed with the terms and conditions of participation (see Figure A5).

Tutorial

The experimental task includes an automated tutorial to orient participants to the task (see Figure A6). The tutorial describes the task, walks the participant through one data entry record, then prompts the participant to complete three records on their own. Three records must be completed correctly before the participant is able to begin the experiment.

Independent Variables

The independent variables for Study 1 included:

- Trial Type:
    - Two-person Cooperative: Participants work with a partner to meet a shared goal.
    - Competitive: Participants complete against their partner.
- Partner Speed:
    - Slow Partner: Programmed to meet 75% of the goal by the end of the trial.
    - Fast Partner: Programmed to meet 125% of the goal by the end of the trial.

Dependent Variables

Dependent variables included the number of correct responses, improvement over previous trials, individual and group goal attainment, accuracy, and ratings of personal performance and partner performance.

Research Design

Study 1 utilized a mixed factorial design with two within-subject factors and one

between-groups factor. The two within-subjects factors included two types of partners (fast or slow) and two types of interaction (cooperation or competition); the between-groups factor was group assignment. The two groups were counterbalanced to control for order effects. Trials were ten minutes in length. Fast/Slow started with a baseline condition (Condition A), followed by a cooperative condition (Condition B) with a fast partner, a competitive condition (Condition C) with the same fast partner, then a cooperative condition (Condition B) with a new, slow partner, followed by a competitive condition (Condition C) with the same slow partner. Slow/Fast was counterbalanced to account for order effects, starting with a slow partners, then switching to fast partners (see Table 2).

Table 2

Study 1 Conditions

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Fast/Slow N=11	Condition A: Baseline	Condition B: Cooperative Fast Partner New Partner	Condition C: Competitive Fast Partner Keep Partner	Condition B: Cooperative Slow Partner New Partner	Condition C: Competitive Slow Partner Keep Partner
Slow/Fast N=10	Condition A: Baseline	Condition B: Cooperative Slow Partner New Partner	Condition C: Competitive Slow Partner Keep Partner	Condition B: Cooperative Fast Partner New Partner	Condition C: Competitive Fast Partner Keep Partner

Study 1 Results

Individual Results

Twenty-one participants completed Study 1. Eleven participants were assigned to the Slow/Fast group, and ten were assigned to the Fast/Slow group.

Slow/Fast Participants

Slow/Fast participants were paired with slow partners first, followed by fast partners. As shown in Table 3, eight of eleven Slow/Fast participants improved performance across all trials. One increased on all trials except for one in which their performance was equal to the trial prior. Two participants decreased from one trial to the next one time, both on the Cooperative Fast condition. Overall, Slow/Fast participants improved performance in 91% of cooperative trials, 95% of competitive trials, 91% of fast trials, and 95% of slow trials. Participants hit their portion of the goal (62 records) in 73% of cooperative trials and beat their partner in 91% of competitive trials. Participants met their goal in 77% of slow trials and 86% of fast trials.

As seen in Table 4, accuracy for all participants and all trials is relatively high ranging from 79% to 100%. Out of 55 trials, 39 trials (71%) were completed with at least 95% accuracy and 49 trials (89%) were completed with at least 90% accuracy.

Table 3

Number of Records Completed for Slow/Fast Participants

Condition	Participant Number										
	1	2	3	4	5	6	7	8	9	10	11
Baseline	50	34	68	41	42	69	58	34	37	49	37
Cooperative Slow	62	51	81	57	63	83	70	50	49	67	55
Competitive Slow	77	71	83	61	65	89	83	58	56	67	68
Cooperative Fast	82	81	78	65	78	92	87	51	70	90	80
Competitive Fast	98	91	82	74	85	102	99	78	72	94	81

Note: Yellow = Flat performance, Red = Decreased performance

Table 4

Slow/Fast Participant Accuracy (%)

Condition	Participant Number										
	1	2	3	4	5	6	7	8	9	10	11
Baseline	89	100	99	100	88	100	98	92	100	98	97
Cooperative Slow	94	100	95	100	90	100	99	94	100	97	96
Competitive Slow	92	97	95	97	93	100	99	91	100	83	100
Cooperative Fast	95	98	94	100	94	99	99	84	99	79	99
Competitive Fast	96	99	92	95	97	99	100	98	97	81	99

Fast/Slow Participants

Fast/Slow participants were paired with fast partners followed by slow partners. As shown in Table 5, two of ten Fast/Slow participants improved performance across all trials. Six participants each had one trial in which their performance decreased from the previous trial; one participant had one trial in which they showed no improvement from the trial prior and had another trial that showed a decrease from the trial prior; one participant had two trials with decreasing performance. Overall, Fast/Slow participants increased performance in 60% of cooperative trials, 90% of competitive trials, 85% of fast trials, and 65% of slow trials. Participants hit their goal in 55% of cooperative trials, and 70% of competitive trials, and in 45% of fast trials and 80% of slow trials.

As seen in Table 6, accuracy for all participants and all trials was relatively high ranging from 74% to 100%, although out of 50 trials, 26 trials (52%) were completed with at least 95% accuracy and 45 trials (90%) were completed with at least 90% accuracy.

Table 5

Number of Records Completed for Fast/Slow Participants

Condition	Participant Number										
	12	13	14	15	16	17	18	19	20	21	22
Baseline	44	37	49	41	47	63	54	32	41	25	
Cooperative Fast	39	53	65	40	74	67	69	27	65	47	
Competitive Fast	54	54	78	44	84	84	87	41	71	71	
Cooperative Slow	54	68	83	27	79	88	86	50	75	57	
Competitive Slow	68	69	77	50	89	89	101	56	74	66	

Note: Yellow = Flat performance, Red = Decreased performance

Table 6

Fast/Slow Participant Accuracy (%)

Condition	Participant Number										
	12	13	14	15	16	17	18	19	20	21	22
Baseline	96	95	91	98	90	100	95	97	91	74	
Cooperative Fast	91	95	97	95	91	94	96	90	97	77	
Competitive Fast	95	90	90	98	94	98	96	93	99	91	
Cooperative Slow	93	92	93	96	92	99	93	100	94	80	
Competitive Slow	100	87	94	100	96	100	98	98	99	86	

Group Results

Results by Trial Number

Upon review of results based on trial number, both groups exhibited an overall upward trend in performance (see Table 7 and Figure 14), although the Fast/Slow group exhibited a small decrease in one condition. This decrease occurred when the Fast/Slow group switched from competing against a fast partner to cooperating with a slow partner. The Slow/Fast group had a higher average baseline performance (47.2 versus 43.3), and the group's performance remained higher than the Fast/Slow group throughout all trials. Aside from trial four with the slight decrease in performance by the Fast/Slow group, the two groups showed fairly similar increases in the other trials.

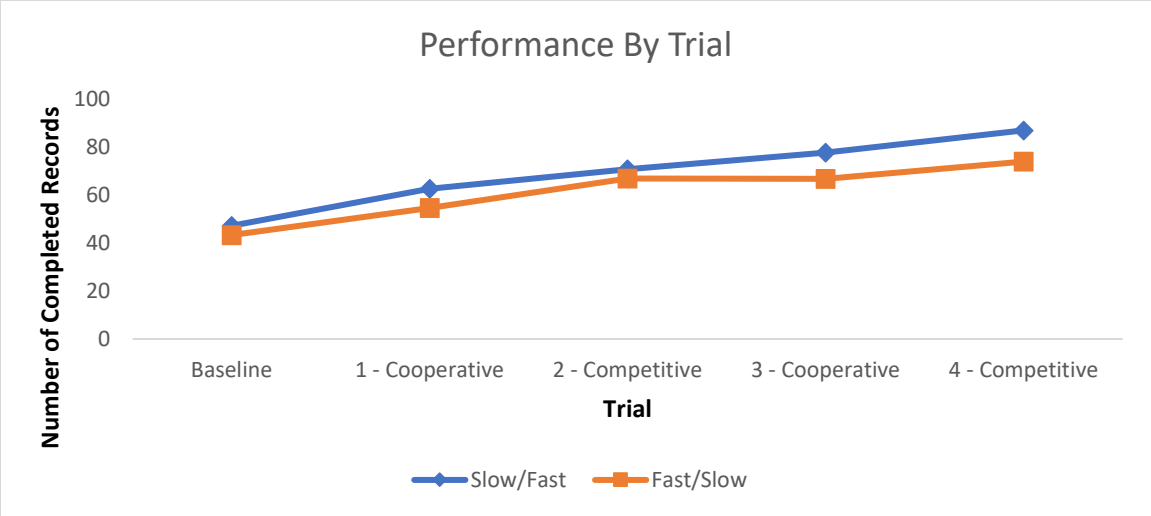
Table 7

Performance by Trial

Trial	Slow/Fast		Fast/Slow	
	Score	Change from Previous Trial	Score	Change from Previous Trial
1 - Baseline	47.2	0	43.3	0
2 - Cooperative	Slow - 62.5	+15.4	Fast - 54.6	+11.3
3 - Competitive	Slow - 70.7	+8.2	Fast - 66.8	+12.2
4 - Cooperative	Fast - 77.6	+6.9	Slow - 66.7	-0.1
5 - Competitive	Fast - 86.9	+9.3	Slow - 73.9	+7.2

Figure 14

Performance by Trial



Results by Condition

Upon review of results based on the condition (see Table 8 and Figure 15), productivity was the lowest in the cooperative condition with slow partners (excluding the baseline condition), and highest in the competitive condition with fast partners. Overall, competitive conditions produced higher scores than cooperative conditions, and fast conditions produced higher scores than slow conditions. The two slow conditions showed less variability between the two groups, with ranges of 4.2 and 3.2 between

group averages. The two fast conditions showed ranges of 23.0 and 20.1 between group averages. Overall, participants met their goal in 64% of cooperative conditions and in 81% of the competitive conditions, and in 67% of fast conditions and 79% of slow conditions. Participants increased their performance in 76% of cooperative conditions, 69% of competitive conditions, 88% of fast conditions, and 81% of slow conditions. Regarding the slow cooperative conditions, only six out of 21 participants exerted sufficient effort to pick up the slack for their slow partners and meet the group goal.

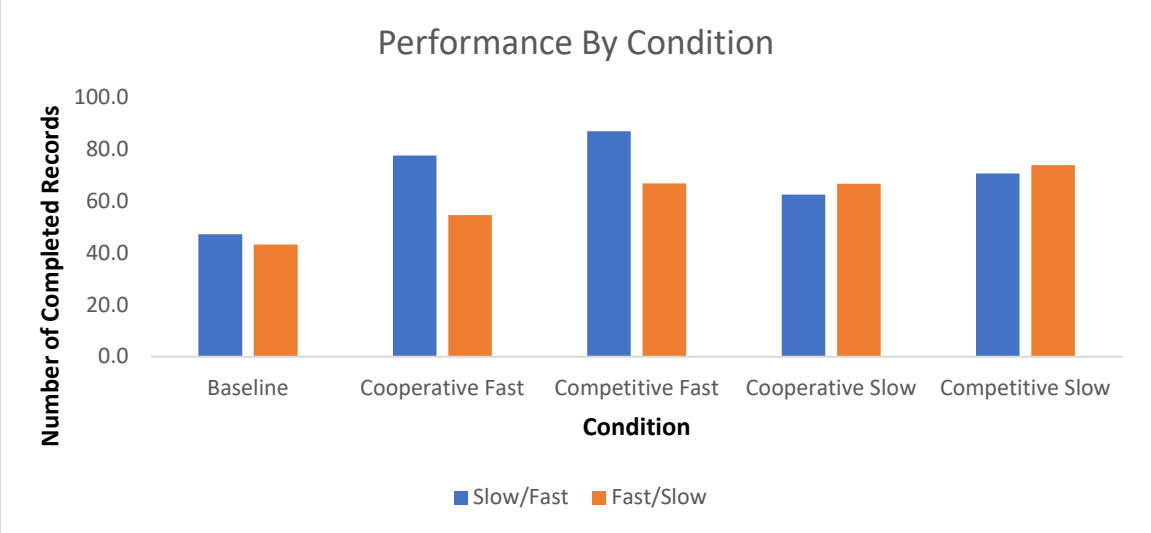
Table 8

Performance by Condition

	Slow/Fast	Fast/Slow	Range	Average
Baseline	47.2	43.3	3.9	45.2
Cooperative Fast	77.6	54.6	23.0	66.1
Competitive Fast	86.9	66.8	20.1	76.9
Cooperative Slow	62.5	66.7	4.2	64.6
Competitive Slow	70.7	73.9	3.2	72.3

Figure 15

Performance by Condition



Repeated Measures ANOVA[8]

A power analysis was conducted in G*Power. For a repeated measures ANOVA with five measurements, a power of 0.80, an alpha level of 0.05, a correlation of .5 among the repeated measurements, and a medium effect size (f = .25) (Faul et al., 2013), the required sample size was 21. Twenty-one participants completed the study.

A repeated measures analysis of variance (ANOVA) with one within-subjects factor was conducted to determine whether significant differences exist among the experimental conditions. In these analyses the following abbreviations will apply:

Cooperative Slow: Coop_Slow

Competitive Slow: Comp_Slow

Cooperative Fast: Coop_Fast

Competitive Fast: Comp_Fast.

Results

The results were examined based on an alpha of 0.05. The p-values for the within-subjects factor and the interactions with the within-subjects factor were calculated using the Greenhouse-Geisser correction to adjust for the violation of the sphericity assumption (Greenhouse & Geisser, 1959). The main effect for the within-subjects factor was significant, $F(4, 80) = 35.71$, $p < .001$, indicating there were significant differences between the values of Baseline, Coop_Slow, Comp_Slow, Coop_Fast, and Comp_Fast. Table 9 presents the ANOVA results. The means of the within-subjects factor are presented in Table 10.

[8] All statistical tables and narrative were created using the online software Intellectus Statistics™ (Intellectus Statistics, 2019), or JASP (JASP Team, 2020), and consultation with statisticians at Statistics Solutions™.

Table 9

Repeated Measures ANOVA Results

Source	*df*	*SS*	*MS*	*F*	*p*	η_p^2
Within-Subjects						
Within Factor	4	12474.91	3118.73	35.71	< .001**	0.64
Residuals	80	6987.09	87.34			

Note. *$p < .05$. **$p < .001$

Table 10

Means Table for Within-Subject Variables

Variable	*M*	*SD*
Baseline	45.33	11.83
Coop_Slow	64.52	15.67
Comp_Slow	72.24	13.17
Coop_Fast	66.67	17.92
Comp_Fast	77.33	17.16

Note. $n = 21$.

Post-hoc. The mean contrasts utilized Tukey comparisons based on an alpha of 0.05. Tukey comparisons were used to test the differences in the estimated marginal means.

Within Effects. Baseline was significantly less than Coop_Slow, $t(20) = -7.80$, $p < .001$, Baseline was significantly less than Comp_Slow, $t(20) = -13.15$, $p < .001$, Baseline was significantly less than Coop_Fast, $t(20) = -6.50$, $p < .001$, and Baseline was significantly less than Comp_Fast, $t(20) = -9.99$, $p < .001$. Coop_Slow was significantly less than Comp_Slow, $t(20) = -4.78$, $p < .001$ and Coop_Slow was significantly less than Comp_Fast, $t(20) = -3.72$, $p = .011$. Coop_Fast was significantly less than

Comp_Fast, $t(20) = -6.78$, $p < .001$. No other significant differences were found (see Table 11).

Table 11

The Marginal Means Contrasts for each Combination of Within-Subject Variables for the Repeated Measures ANOVA

Contrast	Difference	*SE*	*df*	*t*	*p*
Baseline - Coop_Slow	-19.19	2.46	20	-7.80	< .001**
Baseline - Comp_Slow	-26.90	2.05	20	-13.15	< .001**
Baseline - Coop_Fast	-21.33	3.28	20	-6.50	< .001**
Baseline - Comp_Fast	-32.00	3.20	20	-9.99	< .001**
Coop_Slow - Comp_Slow	-7.71	1.61	20	-4.78	< .001**
Coop_Slow - Coop_Fast	-2.14	3.75	20	-0.57	.978
Coop_Slow - Comp_Fast	-12.81	3.45	20	-3.72	.011*
Comp_Slow - Coop_Fast	5.57	3.44	20	1.62	.504
Comp_Slow - Comp_Fast	-5.10	3.01	20	-1.69	.461
Coop_Fast - Comp_Fast	-10.67	1.57	20	-6.78	< .001**

Note. Tukey Comparisons were used to test the differences in estimated marginal means, *$p < .05$. **$p < .001$

Mixed Model ANOVA

To assess for order effects relating to the two groups (Fast/Slow and Slow/Fast), a mixed model analysis of variance (ANOVA) with one within-subjects factor and one between-subjects factor was conducted to determine whether significant differences exist among the experimental conditions between the levels of Group. A power analysis for a mixed model ANOVA with two groups and five measurements was conducted in G-POWER to determine a sufficient sample size using an alpha of 0.05, a power of 0.80, a

correlation of .5 among the repeated measurements, and a medium effect size ($f = 0.25$) (Faul et al., 2013). Based on these assumptions, the desired sample size is 22. Twenty-one participants completed this study.

Results

The results were examined based on an alpha of 0.05. The main effect for Group was not significant, $F(1, 19) = 2.11$, $p = .162$, indicating the levels of Group were similar for experimental conditions. The main effect for the within-subjects factor was significant, $F(4, 76) = 66.29$, $p < .001$, indicating there were significant differences between the experimental conditions. The interaction effect between the within-subjects factor and Group was significant, $F(4, 76) = 18.73$, $p < .001$, indicating the relationships between the experimental conditions differed significantly between the levels of Group. Table 12 presents the ANOVA results.

Table 12

Mixed Model ANOVA Results

Source	*df*	*SS*	*MS*	*F*	*p*	η_p^2
Between-Subjects						
Group	1	1651.14	1651.14	2.11	.162	0.10
Residuals	19	14848.82	781.52			
Within-Subjects						
Within Factor	4	12274.52	3068.63	66.29	< .001**	0.78
Group:Within.Factor	4	3468.81	867.20	18.73	< .001**	0.50
Residuals	76	3518.28	46.29			

Note. *$p < .05$. **$p < .001$

Post-hoc. The mean contrasts utilized Tukey comparisons based on an alpha of

0.05. Tukey comparisons were used to test the differences in the estimated marginal means.

Between Effects. For the Fast/Slow category of Group, Baseline was significantly less than Coop_Slow, $t(19) = -6.87$, $p < .001$, Baseline was significantly less than Comp_Slow, $t(19) = -10.90$, $p < .001$, Baseline was significantly less than Coop_Fast, $t(19) = -3.06$, $p = .045$, and Baseline was significantly less than Comp_Fast, $t(19) = -5.98$, $p < .001$. Coop_Slow was significantly less than Comp_Slow, $t(19) = -3.01$, $p = .050$. Coop_Slow was significantly greater than Coop_Fast, $t(19) = 3.71$, $p = .011$. Comp_Slow was significantly greater than Coop_Fast, $t(19) = 7.15$, $p < .001$ and Comp_Fast, $t(19) = 3.14$, $p = .038$. Coop_Fast was significantly less than Comp_Fast, $t(19) = -5.33$, $p < .001$.

For the Slow/Fast category of Group, Baseline was significantly less than Coop_Slow, $t(19) = -4.73$, $p = .001$, Baseline was significantly less than Comp_Slow, $t(19) = -8.80$, $p < .001$, Baseline was significantly less than Coop_Fast, $t(19) = -8.64$, $p < .001$, and Baseline was significantly less than Comp_Fast, $t(19) = -10.61$, $p < .001$. Coop_Slow was significantly less than Comp_Slow, $t(19) = -3.59$, $p = .015$, Coop_Fast, $t(19) = -4.85$, $p < .001$, and Comp_Fast, $t(19) = -8.07$, $p < .001$. Comp_Slow was significantly less than Comp_Fast, $t(19) = -7.52$, $p < .001$. Coop_Fast was significantly less than Comp_Fast, $t(19) = -4.25$, $p = .003$. No other significant differences were found for Group. Table 13 presents the marginal means contrasts for the Mixed Model ANOVA.

Table 13

The Marginal Means Contrasts for each Combination of Within-Subject Variables for the Mixed Model ANOVA

Contrast	Difference	*SE*	*df*	*t*	*p*
Group|Fast/Slow					
Baseline - Coop_Slow	-23.40	3.41	19	-6.87	< .001**
Baseline - Comp_Slow	-30.60	2.81	19	-10.90	< .001**
Baseline - Coop_Fast	-11.30	3.70	19	-3.06	.045*
Baseline - Comp_Fast	-23.50	3.93	19	-5.98	< .001**
Coop_Slow - Comp_Slow	-7.20	2.39	19	-3.01	.050*
Coop_Slow - Coop_Fast	12.10	3.26	19	3.71	.011*
Coop_Slow - Comp_Fast	-0.10	3.17	19	-0.03	1.000
Comp_Slow - Coop_Fast	19.30	2.70	19	7.15	< .001**
Comp_Slow - Comp_Fast	7.10	2.26	19	3.14	.038*
Coop_Fast - Comp_Fast	-12.20	2.29	19	-5.33	< .001**
Group|Slow/Fast					
Baseline - Coop_Slow	-15.36	3.25	19	-4.73	.001*
Baseline - Comp_Slow	-23.55	2.68	19	-8.80	< .001**
Baseline - Coop_Fast	-30.45	3.52	19	-8.64	< .001**
Baseline - Comp_Fast	-39.73	3.74	19	-10.61	< .001**
Coop_Slow - Comp_Slow	-8.18	2.28	19	-3.59	.015*
Coop_Slow - Coop_Fast	-15.09	3.11	19	-4.85	< .001**
Coop_Slow - Comp_Fast	-24.36	3.02	19	-8.07	< .001**
Comp_Slow - Coop_Fast	-6.91	2.57	19	-2.68	.094
Comp_Slow - Comp_Fast	-16.18	2.15	19	-7.52	< .001**
Coop_Fast - Comp_Fast	-9.27	2.18	19	-4.25	.003*

Note. Tukey Comparisons were used to test the differences in estimated marginal means. *$p < .05$. **$p < .001$

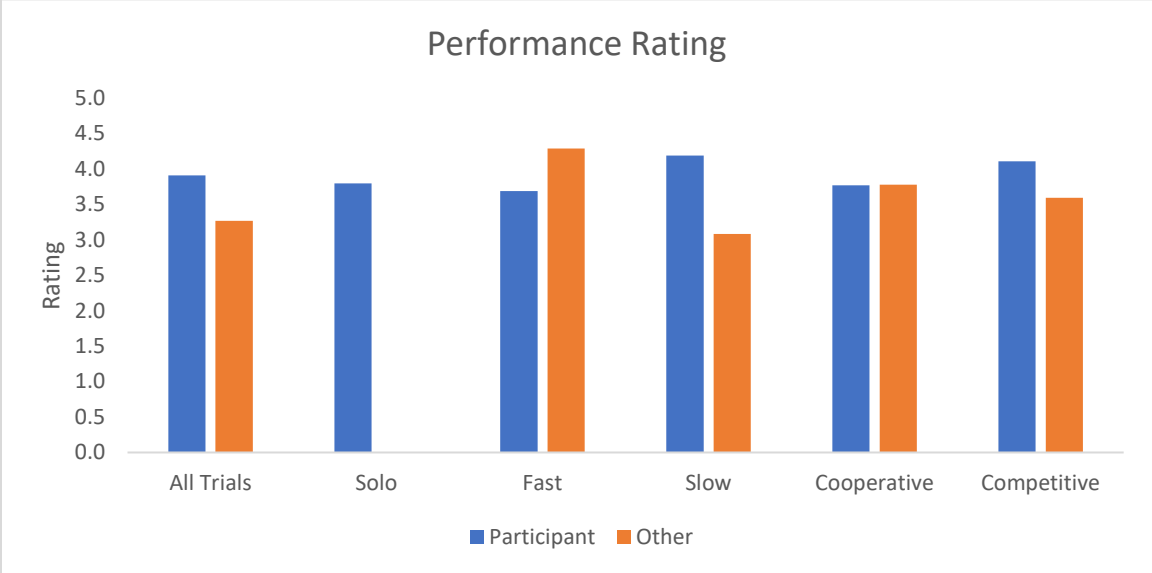
Performance Ratings

Participants were required to rate their own performance and the performance of their partners and competitors (collectively referred to as “Other” in this analysis) on a simple one- to five-star system, with the results available in Figure 16. Across all trials, participants rated themselves higher than their partners and competitors (3.9 vs. 3.3).

Participants rated themselves higher when they worked with a slow partner or competitor than with a fast partner or competitor (4.2 vs. 3.7), and higher during competition trials when compared to cooperation trials (4.1 vs. 3.8). Participants scored their partners and competitors higher when they worked fast when compared to when they worked slow (4.3 vs. 3.1), and when they were cooperating as compared to when they were competing (3.8 vs. 3.6).

Figure 16

Performance Rating



Study 1 Discussion

Study 1 was designed to assess the impact of slow and fast partners and cooperation and competition conditions on social loafing. Social loafing is a behavior pattern in which individuals working in a group contribute less than they would contribute if they were working alone. In Study 1, the baseline condition is performed

alone. The competition condition is considered an alone condition for the purposes of social loafing research as competition is not a collective task in which participants work together towards a common or shared goal. The cooperation condition is a group of two (the participant and a computer simulated partner) working towards a shared goal. A comparison of the baseline and competition conditions to the cooperative condition may reveal social loafing, while taking into consideration that improvement in performance across all trials is likely as participants increase fluency with the task.

The Slow/Fast group did not appear to engage in a significant amount of social loafing, with eight of eleven participants improving across all trials, which is what one would expect as participants become more fluent with the task. Improvements may be attributable to nothing more than practice effects across conditions without being significantly impacted by coworker performance. Alternatively, consistent improvements across trials for most participants may have been the result of matching the perceived effort of their partners, with slower partners first, and improving their performance with fast partners next, aligning with Skinner's (1971) assertion that individuals will be reinforcing to those who reinforce them. Overall, this group was highly effective and accurate, improving performance in 93% of trials, and hitting their goal in 82% of trials.

In contrast to the Slow/Fast group, only two of ten Fast/Slow participants improved across all trials. Three decreased performance in Trial 2, moving from the baseline condition ("do your best") to working cooperatively with a fast partner. Based on previous research, this could be considered "free riding" as participants observed the speed with which their participant was working, and exerted less effort as it appeared their partner would be able to pick up their slack. All Fast/Slow participants improved on

the next trial, which was a competition trial against a fast partner, indicating either practice effects or that the competition contingency was effective at improving performance. Of the ten participants, only five improved performance on the next condition in which they cooperated with a slow partner. A possible explanation is participants decreased performance to match the perceived effort of their partner, or, in the absence of reinforcement from their partner (poor effort), the participants withheld reinforcement (good performance) from their partner. Alternatively, consistent with the dispensability perspective, it is possible that participants, upon observing the poor performance of their partner, essentially gave up as the goal appeared to be out of reach, in line with goal setting research (Roose & Williams, 2017). In the final trial, competing against a slow partner, two of ten participants decreased performance, again resulting in an overall improvement in performance in a competition condition. This group had a lower rate of goal attainment when compared to the Slow/Fast group, which is consistent with the low rate of improvements across all trials.

The apparent impact of the order of fast and slow partners is in line with previous research suggesting individuals are less likely to pick up the slack for partners they believe have the capacity but lack the motivation to perform to standard. For the participants in the Fast/Slow condition, once the participant observed their first partner performing well the task, being subsequently paired with a slow partner may have resulted in the perception that the slow partner was not exerting reasonable effort, and the participant reduced effort to avoid being taken for the sucker. This is supported by research that has shown individuals are not likely to pick up the slack for competent but underperforming partners (Kerr, 1983), or for partners that appear to be loafing either

because they are matching the perceived effort of their partner, or because they believe their personal contribution would be insufficient to make up for the poor performance of their partner (Jackson & Harkins, 1985; Schnake et al., 1995).

In the analysis of the impact of the conditions, the two groups performed similarly in the baseline and slow conditions, but had significantly different performances in the fast conditions. This outcome indicates the fast conditions potentially had a stronger impact on discretionary effort. While participants hit their goals more frequently in slow conditions when compared to fast conditions, fast conditions produced more increases in performance than slow conditions when compared to the previous trial.

The competitive conditions resulted in higher average scores and more goals attained than the cooperative conditions, which is inconsistent with previous research that has indicated cooperation is superior to competition in promoting achievement and productivity (Johnson et al., 1981). This outcome may be based on a potential limitation in experimental design as the competitive conditions followed cooperative conditions, as such, the increases from cooperative to competitive conditions could have been the result of practice effects. However, six out of 21 participants decreased performance when switching from a cooperative condition to a competitive condition even while working with the same partner. This outcome runs contrary to practice effects, suggesting that the trial type impacted behavior, resulting in the decrease.

Participants in general rated their performance higher than their partners and competitors. Participants rated themselves higher than their slow partners and lower than their fast partners, which is to be predicted in relation to partner performance. Additionally, participants hit their goals more frequently in the slow conditions than the

fast conditions. They rated themselves slightly higher than their partners in competitive conditions, but the same on cooperative conditions. This appears to be correlated to participant success rates, with 64% of participants meeting their goal in cooperative conditions and 81% of participants meeting their goal in competitive conditions by completing more records than their partner.

While cooperation and competition conditions provided the foundation for the participant and partner interaction, the variable of interest in this line of research is coworker speed. Several outcomes related to coworker speed deserve additional examination. Coworker speed did appear to impact partner performance, but not consistently across all participants. Instead, it appeared to be the order in which the participants experience fast and slow partners that had the largest impact, not the fast and slow partners themselves. Another inconsistency was the range of performances when paired with fast and slow partners. There was a wide range of performances during the fast conditions and narrow range of performances during the slow conditions deserves additional examination as it may indicate use of or withholding of discretionary effort. Finally, a limitation of Study 1 is the use of a competitive condition, which is not typically used in social loafing research. Study 2 was designed to follow up on the outcomes and limitations of Study 1.

Study 2

Study 2 was designed to assess the impact of slow and fast partners and group size (two or four) on participant social loafing while completing an online data entry task. As with Study 1, all partners are computer simulations. Study 2 used a mixed factorial design with partner and team conditions, and fast and slow conditions.

Study 2: Method

Participants

Participants were undergraduate students enrolled in a psychology course at the University of Nevada, Reno. Students signed up for the study on the University's SONA system and received one credit for participation. Thirty-two participants completed the study.

Apparatus and Setting

The setting for Study 2 was online. The apparatus was each participant's personal computer, a desktop or laptop.

Experimental Task

The experimental task is the same task used for Study 1. One new condition, Condition D, was introduced in Study 2 as described below.

Conditions

Condition A. Baseline: Condition A in Study 2 was the same as Condition A in Study 1.

Condition B. Two-person Cooperative: Slow Partner or Fast Partner: Condition B in Study 2 was the same as Condition B in Study 1.

Condition D. Four-person Cooperative: Slow Team or Fast Team. Participants were matched with three teammates (computer simulations). Participants were presented the following message on the screen: "In this trial you will work in a team of four. Your goal is to complete a total of 248 records together." The teammate scores were calculated to advance regularly throughout the trial. Slow teams were programmed to achieve 75% of their portion of the goal (75% of the cooperative goal) by the end of the trial. Fast

teams were programmed to achieve 125% of their portion of the goal (75% of the cooperative goal) by the end of the trial. The 125% benchmark for fast partners was selected based on previous research that indicated that 125% of a goal was a reasonable and challenging goal that evoked productive performance (Roose & Williams, 2017), and performance higher than that might reveal the deception of computer simulated partners by appearing unreasonable. The 75% benchmark for slow partners was based on the same research, as participants would need to perform at 125% of their goal performance to pick up the slack for their partner, and 125% of the goal was found to be a reasonable expectation in previous research (Roose & Williams, 2017). Participants were presented with continuous feedback about whether or not they were on track to meet the goal by the end of the trial. For example, participants should have completed 50% of the goal halfway through the trial. If the participant was behind that pace, the message "At this rate you will not achieve your goal" was displayed on the screen. If the participant was ahead of that pace, the message "At this rate you will achieve your goal" was displayed on the screen (see Figure A3).

Procedures

Pre-experiment

When participants signed up for the study, the researcher or the research assistant sent the participant an email with the following:

> Thank you for registering for this study. To complete this study, you will need a laptop or desktop computer. This study cannot be completed on a tablet or smart phone. You will also need to have a desk or table, and be in a mostly private/quiet workspace to simulate a work environment.

At the time of their scheduled appointment, the researcher or research assistant emailed the participant the following script:

This is a multi-site study and I'm in contact with the other site where other participants are also getting ready.

Are you using a desktop or laptop computer?

Are you sitting at a desk or table?

Is your environment mostly private and quiet?

Please enter medicaldataentry.app into your browser.

You will first read the consent form and click the box if you agree to participate. Next, the program will lead you through a tutorial and five experimental conditions. Please send me an email once you complete the study, if you have any trouble with the program, or if your partner stops responding. I will process your SONA credit at that time.

Informed consent is programmed into the experiment, and participants could not begin the experiment without checking a box to indicate that they agree with the terms and conditions of participation.

Independent Variables

The independent variables for Study 2 included:

- Trial Type:
    - Two-person Cooperative: Work with a partner to meet a shared goal.
    - Four-person Cooperative: Work with three teammates to meet a shared goal.
- Partner Speed:

    - Slow Partner: Programmed to meet 75% of the goal by the end of the trial.
    - Fast Partner: Programmed to meet 125% of the goal by the end of the trial.
- Team Speed
    - Slow Team: Programmed to meet 75% of the goal by the end of the trial.
    - Fast Team: Programmed to meet 125% of the goal by the end of the trial.

Dependent Variables

Dependent variables included the number of correct and incorrect responses, improvement over the previous trial, goal attainment, accuracy, and ratings of personal, partner, and team performance.

Research Design

This experiment utilized a mixed factorial design with two within-subjects variables, and one between-groups variable. The within-subjects factors were two types of partners (fast or slow) and two group sizes (two or four); the between-groups factor was group assignment. The between-groups factor was designed to control for order effects. Trials were each ten minutes in length. Fast/Slow participants started with a baseline condition (Condition A), followed by a two-person cooperative condition (Condition B) with a fast partner, then a four-person cooperative condition (Condition D) with the same partner plus two additional group members with an overall fast pace, then a two-person cooperative condition (Condition B) with a new, slow partner, followed by a four-person cooperative condition (Condition D) with the same slow partner plus two additional group members, with an overall slow pace. Slow/Fast participants experienced the same conditions, but started with slow partners and teammates, followed by fast partners and teammates (see Table 14).

Table 14

Study 2 Conditions

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Fast/Slow N=16	Condition A: Baseline	Condition B: Cooperative Fast Partner	Condition D: Cooperative Team of 4 Fast Team Keep Partner	Condition B: Cooperative Slow Partner	Condition D: Cooperative Team of 4 Slow Team Keep Partner
Slow/Fast N=16	Condition A: Baseline	Condition B: Cooperative Slow Partner	Condition D: Cooperative Team of 4 Slow Team Keep Partner	Condition B: Cooperative Fast Partner	Condition D: Cooperative Team of 4 Fast Team Keep Partner

Study 2: Results

Individual Results

Study 2 was completed by 32 participants. Sixteen participants were assigned to the Slow/Fast group, and sixteen were assigned to the Fast/Slow group.

Slow/Fast Participants

Slow/Fast participants were paired with slow partners and teams first, followed by fast partners and teams. As seen in Table 15, three of sixteen Slow/Fast participants improved their performance across all trials, six had one trial each in which their performance decreased from the previous trial, four had two decreasing trials, one had one flat performance, and two had one flat performance and one decreasing performance each. Participants improved their performance in 88% of two-person cooperative trials, 53% of four-person cooperative trials, 56% of fast trials, and 84% of slow trials.

Participants hit their goal in 44% of two-person cooperative trials, and 47% of four-person cooperative trials, and in 38% of slow conditions and 53% of fast conditions.

Table 16 shows the accuracy for this group was fairly high ranging from 76% to 100%. Out of 80 trials, 47 trials (58%) were completed with at least 95% accuracy and 67 trials (84%) were completed with at least 90% accuracy.

Table 15

Number of Records Completed for Slow/Fast Participants

Condition	Participants															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Baseline	65	34	26	34	64	32	43	35	60	31	51	34	48	31	22	65
Slow Partner	82	47	29	45	77	44	61	43	72	36	59	55	69	57	31	71
Slow Team	96	61	39	49	83	44	73	49	82	39	66	54	62	49	27	78
Fast Partner	94	69	42	34	88	40	76	57	87	34	71	51	75	75	53	80
Fast Team	108	72	52	37	88	51	72	46	82	34	52	57	62	68	47	66

Note: Yellow = Flat performance, Red = Decreased performance

Table 16

Slow/Fast Participant Accuracy (%)

Condition	Participants															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Baseline	98	89	93	97	98	97	90	97	95	100	96	87	100	100	88	100
S Partner	99	92	76	94	99	92	95	96	95	90	98	98	100	100	97	97
S Team	100	92	93	100	98	96	99	98	98	93	97	95	100	94	93	100
F Partner	99	85	89	94	95	89	99	93	96	92	96	85	99	99	95	96
F Team	99	88	93	100	98	96	99	87	96	94	91	81	100	96	89	96

Note: S = Slow, F = Fast

Fast/Slow Participants

Fast/Slow participants were paired with fast partners and teams first, followed by

slow partners and teams. Five of sixteen Fast/Slow participants improved their performance across all trials. One participant had one flat performance when compared to the prior trial, six participants had one trial with decreased performance, two had two trials with decreased performance, one had 3 trials with decreased performance. One participant stopped responding in the fourth trial, then declined to complete trial 5 (see Table 17). Participants improved performance in 81% of two-person cooperative trials, 69% of four-person cooperative trials, 81% of fast trials, and 69% of slow trials. Participants hit their goal in 47% of two-person cooperative trials and 66% of four-person cooperative trials, and in 44% of fast trials and 69% of slow trials.

Accuracy for this group was the lowest between the four groups in Study 1 and Study 2, ranging from 65% to 100%. Out of 80 trials, 33 trials (41%) were completed with at least 95% accuracy and 50 trials (63%) were completed with at least 90% accuracy (see Table 18).

Table 17

Number of Records Completed for Fast/Slow Participants

Condition	Participants															
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Baseline	38	52	21	36	41	47	56	10	45	58	53	13	91	49	41	55
Fast Partner	39	65	30	33	48	71	51	35	47	72	59	33	109	47	46	90
Fast Team	46	70	72	38	46	71	61	53	66	77	78	42	119	64	43	77
Slow Partner	49	81	41	64	48	82	78	3	77	86	91	60	136	85	37	73
Slow Team	51	78	100	71	43	83	79	- [a]	81	82	96	72	138	65	34	94

Note: Yellow = Flat performance, Red = Decreased performance

[a] This participant did not complete this trial

Table 18

Fast/Slow Participant Accuracy (%)

Condition	Participants															
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	21
Baseline	100	100	78	86	98	87	89	100	94	97	83	65	100	94	93	65
S Partner	100	100	77	72	98	88	85	92	87	99	78	94	100	90	100	66
S Team	100	99	87	88	90	68	86	98	93	99	85	89	99	94	98	87
F Partner	98	99	69	89	94	80	92	100	94	95	83	98	98	93	100	81
F Team	98	99	76	93	90	81	87	-[a]	100	90	100	100	97	100	92	100

Note: F = Fast, S = Slow

[a] This participant did not complete this trial

Group Results

Results by Trial Number

Upon analysis of the results based on trial number without consideration of the order of conditions for each group, the Fast/Slow group exhibited an overall upward trend across all trials, while the Slow/Fast group initially increased, then trended downward on the final trial when the group experienced the fast four-person cooperative condition. As seen in Table 19, the two groups had similar baseline performance (42.2 versus 44.1) and similar increases across trials with graphed results overlapping or nearly overlapping for several data points. The largest increase in performance was the move from the baseline trial to the first experimental trial. This similar performance between the two groups continued until the final trial in which the Slow/Fast group decreased by 2.0 records and the Fast/Slow group increased by 9.6 records, resulting in an increase in the range between the two groups. The same results are graphed in Figure 17.

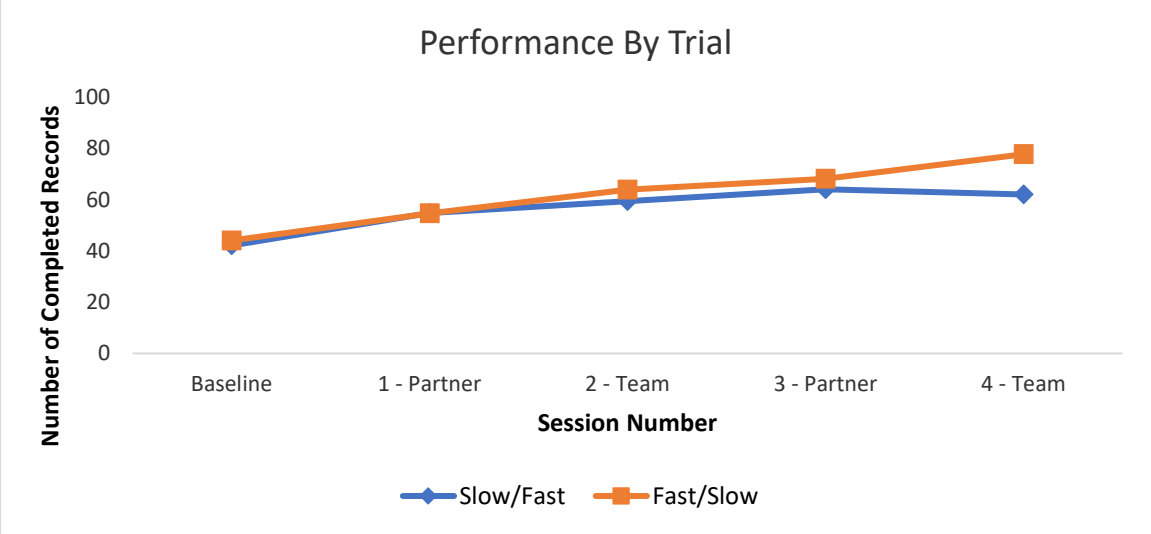
Table 19

Average Performance by Trial

	Slow/Fast		Fast/Slow	
Trial	Score	Change from Previous Trial	Score	Change from Previous Trial
1 - Baseline	42.2	0	44.1	0
2 - Partner	Slow – 54.9	+12.7	Fast – 54.7	+10.6
3 - Team	Slow – 59.4	+4.6	Fast – 63.9	+9.3
4 - Partner	Fast – 64.1	+4.7	Slow – 68.2	+4.3
5 - Team	Fast – 62.1	-2.0	Slow – 77.8	+9.6

Figure 17

Performance by Trial



Results by Condition

As seen in Table 20 and Figure 18, productivity was lowest in two-person cooperative conditions with fast partners (aside from the baseline), and highest in four-person cooperative conditions with slow teammates. Overall, the team conditions produced higher scores than the partner conditions, and the slow conditions produced higher scores than the fast conditions. The two fast conditions showed less variability

between the two groups, with ranges of 1.8 and 9.4 between group averages. The two slow conditions showed ranges of 13.8 and 18.4 between group averages. Overall, participants hit their goal in 45% of the two-person cooperative conditions and 56% of the four-person cooperative conditions, and 48% of fast conditions and 53% of slow conditions. Participants improved performance in 84% of two-person cooperative trials, 61% of four-person cooperative trials, 69% of fast trials, and 77% of slow trials.

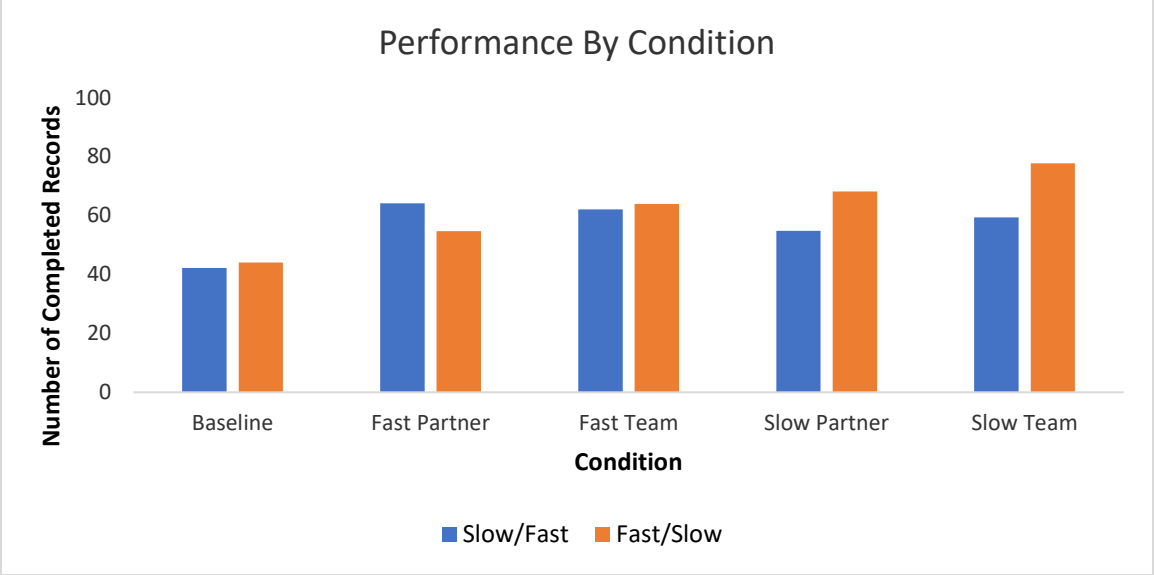
Table 20

Performance by Condition

Condition	Slow/Fast	Fast/Slow	Range	Average
Baseline	42.2	44.1	1.9	43.2
Fast Partner	64.1	54.7	9.4	59.4
Fast Team	62.1	63.9	1.8	63.0
Slow Partner	54.9	68.2	13.3	61.5
Slow Team	59.4	77.8	18.4	68.6

Figure 18

Performance by Condition



Repeated Measures ANOVA

A power analysis was conducted in G*Power on a repeated measures ANOVA with five measurements, a power of 0.80, an alpha level of 0.05, a correlation of .5 among the repeated measurements, and a medium effect size (f = .25) (Faul et al., 2013). Based on the aforementioned requirements, the required sample size is 21.

A repeated measures analysis of variance (ANOVA) with one within-subjects factor was conducted to determine whether significant differences exist among Baseline, Slow_Partner, Slow_Team, Fast_Partner, and Fast_Team.

Results

The results were examined based on an alpha of 0.05. The *p*-values for the within-subjects factor and the interactions with the within-subjects factor were calculated using the Greenhouse-Geisser correction to adjust for the violation of the sphericity assumption (Greenhouse & Geisser, 1959). The main effect for the within-subjects factor was significant, $F(4, 124) = 17.17$, $p < .001$, indicating there were significant differences between the experimental conditions. Table 21 presents the ANOVA results. The means of the within-subjects factor are presented in Table 22.

Table 21

Repeated Measures ANOVA Results

Source	*df*	*SS*	*MS*	*F*	*p*	η_p^2
Within-Subjects						
Within Factor	4	9969.04	2492.26	17.17	< .001**	0.36
Residuals	124	17994.96	145.12			

Note. *$p < .05$. **$p < .001$

Table 22

Means Table for Within-Subject Variables

Variable	*M*	*SD*
Baseline	43.16	16.91
Slow_Partner	61.53	24.47
Slow_Team	66.19	26.31
Fast_Partner	59.00	21.23
Fast_Team	61.31	21.82

Note. $n = 32$.

Post-hoc. The mean contrasts utilized Tukey comparisons based on an alpha of 0.05.

Within Effects. Baseline was significantly less than Slow_Partner, $t(31) = -7.83$, $p < .001$, Slow_Team, $t(31) = -7.23$, $p < .001$, Fast_Partner, $t(31) = -6.82$, $p < .001$, and Fast_Team, $t(31) = -6.47$, $p < .001$. No other significant differences were found. Table 23 presents the marginal means contrasts for the Repeated Measures ANOVA.

Table 23

Marginal Means Contrasts for each Combination of Within-Subject Variables

Contrast	Difference	*SE*	*df*	*t*	*p*
Baseline - Slow_Partner	-18.38	2.35	31	-7.83	< .001**
Baseline - Slow_Team	-23.03	3.19	31	-7.23	< .001**
Baseline - Fast_Partner	-15.84	2.32	31	-6.82	< .001**
Baseline - Fast_Team	-18.16	2.81	31	-6.47	< .001**
Slow_Partner - Slow_Team	-4.66	2.25	31	-2.07	.257
Slow_Partner - Fast_Partner	2.53	3.46	31	0.73	.947
Slow_Partner - Fast_Team	0.22	3.39	31	0.06	1.000
Slow_Team - Fast_Partner	7.19	3.91	31	1.84	.371
Slow_Team - Fast_Team	4.88	3.30	31	1.48	.584
Fast_Partner - Fast_Team	-2.31	2.66	31	-0.87	.906

Note. Tukey Comparisons were used to test the differences in estimated marginal means.

*$p < .05$. **$p < .001$

Mixed Model ANOVA

Two account for potential order effects between the groups (Fast/Slow and Slow/Fast), a mixed model analysis of variance (ANOVA) with one within-subjects factor and one between-subjects factor was conducted to determine whether significant differences exist among the experimental conditions between the levels of Group.

A power analysis for a mixed model ANOVA with 2 groups and 5 measurements was conducted in G-POWER to determine a sufficient sample size using an alpha of 0.05, a power of 0.80, a correlation of .5 among the repeated measurements, and a medium effect size ($f = 0.25$) (Faul et al., 2013). Based on the aforementioned assumptions, the desired sample size is 22.

Results

The results were examined based on an alpha of 0.05. The main effect for Group was not significant, $F(1, 30) = 0.44$, $p = .514$, indicating the levels of Group were all similar for all conditions. The *p*-values for the within-subjects factor and the interactions with the within-subjects factor were calculated using the Greenhouse-Geisser correction to adjust for the violation of the sphericity assumption (Greenhouse & Geisser, 1959). The main effect for the within-subjects factor was significant, $F(4, 120) = 20.03$, $p < .001$, indicating there were significant differences between the values of the experimental conditions. The interaction effect between the within-subjects factor and Group was significant, $F(4, 120) = 6.15$, $p = .001$, indicating the relationships between the experimental conditions differed significantly between the levels of Group. Table 24 presents the ANOVA results.

Table 24

Mixed Model ANOVA Results

Source	*df*	*SS*	*MS*	*F*	*p*	η_p^2
Between-Subjects						
Group	1	855.63	855.63	0.44	.514	0.01
Residuals	30	58767.35	1958.91			
Within-Subjects						
Within Factor	4	9969.04	2492.26	20.03	< .001**	0.40
Group:Within.Factor	4	3061.81	765.45	6.15	< .001**	0.17
Residuals	120	14933.15	124.44			

Note. *$p < .05$. **$p < .001$

Post-hoc. The mean contrasts utilized Tukey comparisons based on an alpha of 0.05. Tukey comparisons were used to test the differences in the estimated marginal means for each combination of between-subject and within-subject effects.

Between Effects. For the Fast/Slow category of Group, Baseline was significantly less than Slow_Partner, $t(30) = -7.92$, $p < .001$, Slow_Team, $t(30) = -6.65$, $p < .001$, Fast_Partner, $t(30) = -3.31$, $p = .019$, and Fast_Team, $t(30) = -4.85$, $p < .001$. Slow_Partner was significantly greater than Fast_Partner, $t(30) = 3.64$, $p = .008$. Slow_Team was significantly greater than Fast_Partner, $t(30) = 4.04$, $p = .003$. Fast_Partner was significantly less than Fast_Team, $t(30) = -2.95$, $p = .044$. For the Slow/Fast category of Group, Baseline was significantly less than Slow_Partner, $t(30) = -4.18$, $p = .002$, Slow_Team, $t(30) = -3.98$, $p = .003$, Fast_Partner, $t(30) = -7.44$, $p < .001$, and Fast_Team, $t(30) = -4.18$, $p = .002$. No other significant differences were found. Table 25 presents the marginal means contrasts for the Mixed Model ANOVA.

Table 25

Marginal Means Contrasts for each Combination of Within-Subject Variables

Contrast	Difference	*SE*	*df*	*t*	*p*
Group|Fast/Slow					
Baseline - Slow_Partner	-24.06	3.04	30	-7.92	< .001**
Baseline - Slow_Team	-28.81	4.33	30	-6.65	< .001**
Baseline - Fast_Partner	-9.75	2.95	30	-3.31	.019*
Baseline - Fast_Team	-19.50	4.02	30	-4.85	< .001**
Slow_Partner - Slow_Team	-4.75	3.23	30	-1.47	.588
Slow_Partner - Fast_Partner	14.31	3.94	30	3.64	.008*
Slow_Partner - Fast_Team	4.56	4.74	30	0.96	.870
Slow_Team - Fast_Partner	19.06	4.72	30	4.04	.003*
Slow_Team - Fast_Team	9.31	4.60	30	2.02	.280
Fast_Partner - Fast_Team	-9.75	3.30	30	-2.95	.044*
Group|Slow/Fast					
Baseline - Slow_Partner	-12.69	3.04	30	-4.18	.002*
Baseline - Slow_Team	-17.25	4.33	30	-3.98	.003*
Baseline - Fast_Partner	-21.94	2.95	30	-7.44	< .001**
Baseline - Fast_Team	-16.81	4.02	30	-4.18	.002*
Slow_Partner - Slow_Team	-4.56	3.23	30	-1.41	.624
Slow_Partner - Fast_Partner	-9.25	3.94	30	-2.35	.157
Slow_Partner - Fast_Team	-4.13	4.74	30	-0.87	.906
Slow_Team - Fast_Partner	-4.69	4.72	30	-0.99	.856
Slow_Team - Fast_Team	0.44	4.60	30	0.10	1.000
Fast_Partner - Fast_Team	5.13	3.30	30	1.55	.538

Note. Tukey Comparisons were used to test the differences in estimated marginal means.

*$p < .05$. **$p < .001$

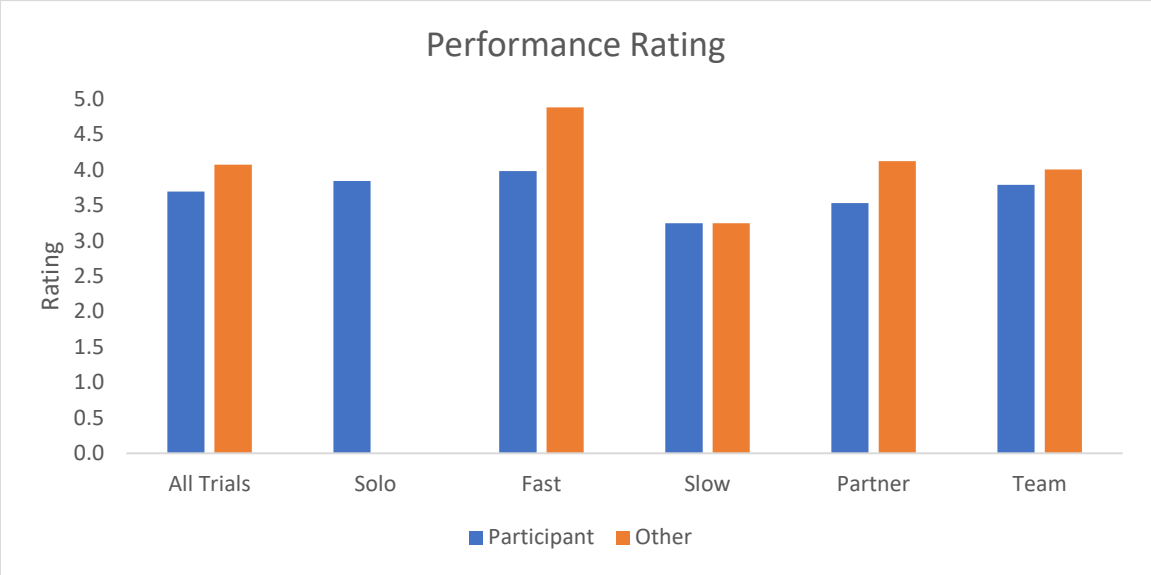
Performance Ratings

Participants were required to rate their own performance and the performance of their partners and competitors (collectively referred to as “Other” in this analysis) on a simple one- to five-star system. As seen in Figure 19, across all trials, participants rated their teammates higher than themselves (3.7 vs. 4.1). Participants rated themselves higher

when they worked with fast partners and teams than slow partners and teams (4.0 vs. 3.2), and higher during team trials than partner trials (3.8 vs. 3.5). Participants scored their teammates higher when they were fast than when they were slow (4.9 vs. 3.2) and higher when working with one teammate than when working with three teammates (4.1 vs. 4.2).

Figure 19

Performance Ratings



Study 2 Discussion

Study 2 was designed to test group sizes and fast and slow coworkers and two-person and four-person cooperative tasks on social loafing. A comparison of the baseline condition to the cooperative conditions may reveal social loafing if participant performance decreases in cooperation conditions, or potentially if their performance fails to increase across sessions as would be predicted by practice effects. Lack of goal attainment may also indicate social loafing.

As opposed to Study 1, in which the Fast/Slow group exhibited a higher prevalence of social loafing, in Study 2, the Slow/Fast appeared to engage in higher levels of social loafing, although the discrepancy was much less pronounced in Study 2 than in Study 1. Three of sixteen participants in the Slow/Fast group improved across all trials. Social loafing increased later in the experiment, with almost three times as many decreases in performance in the fast trials than the slow trials. By not loafing in slow trials, and loafing on fast trials, participants may have engaged in social loafing as a result of the perception that their effort would not be required to access reinforcement for meeting the goal. There were also more flat and decreasing performances in team trials when compared to partner trials, suggesting participants believed their group would meet the goal without significant effort on their part, and therefore exerted less effort.

Five of sixteen participants in the Fast/Slow group improved across all trials. This group exhibited minimal differentiation between the fast and slow conditions and the two-person and four-person cooperative conditions. Like the Slow/Fast group, there was more loafing in the final two trials, however, the discrepancy is not as pronounced with this group. This group had the only participant in either study that quit the experiment; participant 24 completed only three records in trial four, then declined to complete trial five. This group's accuracy was the lowest of all groups in Study 1 and Study 2.

The four-person team conditions resulted in higher average scores and more goals attained than in two-person team conditions, which is inconsistent with previous research that has indicated that social loafing becomes more prevalent as group size increases. Slow conditions resulted in higher average scores and more goals attained than fast conditions, suggesting participants exerted more effort to pick up the slack for their low-

performing partners and teammates and higher levels of loafing in fast conditions. Contrary to Study 1, in which greater variability was found in the fast conditions, in Study 2, greater variability was found in the slow conditions. Variability may indicate the use or lack of use of discretionary effort indicating each group was more or less willing to pick up the slack for their partner or teammates. The prevalence of decreasing performances in the two final trials, regardless of the order of conditions, may indicate fatigue or boredom rather than social loafing.

Participants in general rated their performance lower than their partners and teams. Participants rated fast partners and teams higher than they rated themselves, and overall participants rated their partners higher than themselves, and their teams higher than themselves, although the discrepancy between participant and team performance scores was minimal. The larger discrepancy between participant and partner and participant and team may indicate participants distributed credit and blame more equally between themselves and their team, and less so when only working with one other partner.

Study 1 and Study 2 General Discussion

A direct comparison of Study 1 and Study 2 found some conflicting outcomes. Study 1 saw differences between the Slow/Fast and Fast/Slow groups, with the Fast/Slow performing at lower levels than the Slow/Fast group. The differences between the two groups in Study 2 was not nearly so pronounced. The results of Study 1 are potentially due to a situation in which fast partners set the expectation for partner performance. When slow partners followed the fast partners, participants loafed to avoid the “sucker effect.” However, the same effect was not seen in Study 2, in which the Slow/Fast group

engaged in more pronounced social loafing. For Study 2, a possible explanation is participants matched their effort to the perceived effort of their slow partners for the first two experimental trials. Then, when paired with a fast partner, they took a "free ride."

Another disparate finding was the range between group performances, or the difference between the Fast/Slow and Slow/Fast group averages in each condition. In Study 1, there was a higher discrepancy in the fast conditions. In Study 2, there was a higher discrepancy in the slow conditions. It is possible the wide range is an indicator of whether or not discretionary effort was used, meaning some participants chose to exert a high level of effort or to engage in social loafing, resulting in a wide range of scores.

In Study 1, the Fast/Slow group hit their goal in 41% less fast trials than the Slow/Fast group. A possible explanation is that the Fast/Slow group loafed due to the perception that their contribution was unnecessary in the cooperative condition because their partner appeared to be highly productive, and the participants themselves did not yet have enough practice time with the task to be able to match performance. In Study 2, the Slow/Fast group hit their goal in 31% less slow trials than the Fast/Slow group. A possible explanation for this finding is that the Slow/Fast group loafed due to the perception that their contribution would not be sufficient to make up for the poor performance of their partner as the participants themselves did not yet have enough practice time with the task to be able to pick up the slack for their partner.

When reviewing the results of Study 1 and Study 2 overall, without taking into consideration group assignment, goals were achieved in more trials with slow coworkers than with fast coworkers (63% versus 56%). This suggests that rather than engaging in social loafing, participants were more likely to pick up the slack for underperforming

partners. However, only a small proportion of participants in Study 1 or 2 successfully exerted sufficient effort to make up for underperforming coworkers to meet their goal.

Participants in Study 1 rated themselves higher than their partners, and the opposite was true in Study 2. The biggest contributor to the high personal ratings in Study 1 appears to be the high rating participants gave themselves and the low ratings they gave their partners in the slow conditions, more in the competitive condition. This is consistent with actual performance as participants did perform slightly better on average than their partners. The biggest contributor to the high partner and team ratings in Study 2 appears to be the high rating participants gave to their partners and teammates in the fast conditions – more in the partner condition than in the team condition. This is consistent with actual performance as participants did perform slightly worse on average than their partners and teammates.

Some researchers have found goal setting itself to be problematic in research. It has been argued goals may inadvertently cap performance as participants meet their goal and reduce effort or stop responding altogether (Lorenzi, 1988). However, this phenomenon was not found in previous research using the same experimental task (Roose & Williams, 2017), and the present study indicates many participants worked well past their individual goals when embedded in cooperative goals.

Limitations

There are some limitations in Study 1 and Study 2. First, the lack of a control group to assess average improvements in performance across trials in the absence of any coworkers. While the assumption that individuals should improve across all trials was based on previous research that indicated the same (Roose & Williams, 2017), a control

group is needed to confirm this assumption.

Another limitation is that when participants kept their partners, those partners maintained the same rate of responding in all trials. For example, if the partner was programmed as "slow" for one trial, they were programmed as "slow" for the following trial. Therefore, there were no instances in which participants experienced working with a partner who performed well, then subsequently performed poorly. When poor performance is attributed to motivation rather than ability, individuals may loaf themselves to avoid being the "sucker" (Orbell & Dawes, 1993). It is possible Study 1 showed this effect when participants worked with fast partners followed by slow partners. Those participants exhibited social loafing potentially due to the perception participants in general had the capacity to perform fast, but failed to do so in following trials. However, this is an assumption, as perceptions were not directly measured. The performance rating was intended to assess participant perception of performance; however, perceived ability and perceived effort may impact performance in different ways, however, they were not measured independently to determine differential impact.

In real-world work situations, workers are likely to categorize coworkers based on how they perceive them to contribute to the overall workload. For example, certain employees likely have a reputation for being high performers while others have a reputation for being slackers. This fact alone may impact individual performance, as workers learn to moderate their effort based on the necessary individual contribution to a group goal. However, when coworkers fail to perform at their expected level (e.g., a highly productive employee has an "off day"), they cannot be assured that their coworkers will pick up their slack.

Additionally, there are other moderators of worker productivity, for example, stress, demand, and job control. Stress in the workplace has been linked to concerns with mental and physical health, and most workplace stress is related to workplace demands (Ganster et al., 2011). Research has indicated that providing employees with control over their work results in better performance, mental health, and job satisfaction (Bond & Flaxman, 2006). Job control may be conceptualized as influence over the contingencies that impact work. For example, workers that have flexibility in how they may interact with customers have more job control than workers who must follow strict guidelines. Control may also be related to group work in that when working alone, individuals have control over their own performance and therefore access to reinforcement. When reinforcement is contingent on group performance, there is less control.

Finally, individuals participating in research bring with them their learning and reinforcement histories. Culturally, the United States is typically categorized as emphasizing individual success, whereas other cultures, for example, some Asian cultures, are considered more collectivistic. The result is that individual achievement is richly reinforced in the United States and cooperation and teamwork are richly reinforced in collectivistic cultures. One would expect that this type of difference in reinforcement history will have an impact on social loafing, and research has indeed supported this, with one study finding that under the same conditions, American professionals engaged in social loafing, but Chinese professionals not only did not, they actually performed better in group settings than when working individually (Earley, 1989).

Based on the results and limitations of Study 1 and Study 2, Study 3 was designed to further the research on how coworker performance impacts productivity and social

loafing. Several enhancements were made. Ten five-minute trials were used instead of five ten-minute trials to allow for within-subject replication. A control group was included in which participants worked alone throughout the entire experiment to assess performance without any partner interaction. Control conditions were embedded into other groups to allow for more precise comparison of different combinations of groups. Partner performance was varied with partner to simulate situations in which coworkers do not perform as expected based on their history of performance and productivity. Finally, Study 3 includes a variety of new feedback options to assess whether participants enter the experiment with pre-determined preference for individual or group work, and the impact of that preference on performance, whether participants attend to the effort and ability of their partner, and whether those perceptions impact their own performance, and how the performance of a partner impacts the participants' preference to work alone or work with a partner in future trials.

Study 3

Study 3 was designed to assess the impact of inconsistent partner performance on participant social loafing. This includes coworkers who establish a trend of fast performance then switch to slow performance, and coworkers who establish a trend of slow performance then switch to fast performance. Study 3 also includes a control group with participants working individually throughout the entire experiment. This study also included enhanced participant feedback to assess perceived loafing, effort, preference for working alone or with a partner, and measures of stress, demand, and job control.

Study 3: Methods

Participants

Participants were undergraduate students enrolled in a psychology course at the University of Nevada, Reno. Students signed up for the study on the University's SONA system and received one credit for participation. Forty participants completed the study.

Apparatus and Settings

The setting for Study 3 was online. The apparatus was the participant's computer, a desktop or laptop. Tablets and smart phones were not allowable for this study.

Experimental Task

The experimental task was the same task used for Study 1 and Study 2 with several modifications, to be described in the following sections.

Pre-Experiment Rating

Participants were presented with a sliding scale to rate the relative importance of meeting a personal goal versus meeting a group goal with the question "When working in a group, is it more important to contribute your fair share, or to ensure the group meets their overall goal?" The scale slides from 5 on the side of "individual contribution" to zero in the middle to 5 on the side of "overall group goal" (see Figure A7).

Pre-Trial Ratings

Prior to all cooperative trials, participants completed the following ratings:

- How much effort will you exert on the next trial?
- How much effort do you predict your partner will exert on the next trial? (see Figure A8).

Post-Trial Ratings

After all solo trials, participants completed the following ratings:

- Rate your ability on this task
- Rate your effort on this task
- How stressful did you find this trial?
    - Not stressful at all
    - Somewhat stressful
    - Stressful
    - Very stressful
    - Extremely stressful
- How demanding did you find this trial?
    - Not demanding at all
    - Somewhat demanding
    - Demanding
    - Very demanding
    - Extremely demanding
- How much control do you feel you have over successfully meeting your goal?
    - No control at all
    - Some control
    - Enough control
    - More than enough control
    - Extreme control

After all cooperative trials, participants completed the preceding ratings, and also

answered the following questions:

- Rate your partner's ability on this task
- Rate your partner's effort on this task (see Figure A9)

Post-Experiment Feedback

All participants except the Solo/Solo participants answered all of the following questions at the end of the experiment; Solo/Solo participants only answered the last two questions:

- Would you prefer to work alone or with your partner on the next trial?
  - Alone
  - With my partner
- What did you think about your partner? (10 character minimum)
- How many years of college/university have you completed?
- What is your cumulative GPA? (see Figure A10)

Conditions

Condition A. Baseline: Condition A in Study 3 was the same as Condition A in Studies 1 and 2.

Condition B. Two-person Cooperative: Slow Partner or Fast Partner: Condition B in Study 3 was same as Condition B in Studies 1 and 2.

Condition E. Solo Plus Goal: Condition E was the same as Condition A (Baseline), except for the addition of a goal. During this condition, a welcome screen indicated, "In this trial you will work alone. Your goal is to complete 32 records." A running total of the number of correct responses was displayed on the screen. The goal of 32 was selected as a challenging goal based on previous research utilizing the same

computer program (Roose & Williams, 2017). Participants were given continuous feedback about whether they were on track to meet the goal by the end of the trial. For example, participants should have completed 50% of the goal halfway through the trial. If the participant was behind that pace, the message "At this rate you will not achieve your goal" was displayed on the screen. If the participant was ahead of that pace, the message "At this rate you will achieve your goal" was displayed on the screen (see Figure A3).

Procedures

The procedures for Study 3 were the same as the procedures for Study 2.

Independent Variables

The independent variables for Study 3 included:

- Trial Type:
    - Two-person Cooperative: Work with a partner to meet a shared goal
    - Solo Plus Goal: Participants work alone to meet an individual goal
- Partner Speed (for Two-person Cooperative conditions only):
    - Slow Partner: Programmed to meet 75% of the goal by the end of the trial
    - Fast Partner: Programmed to meet 125% of the goal by the end of the trial

Dependent Variables

Dependent variables include the number of correct responses, increases over previous trials, goal attainment, accuracy, pre-experiment ratings, pre-trial ratings, performance measures, and post-experiment measures. Special attention will be paid to comparing these measures in trials completed alone (baseline and solo plus goal) versus trials completed with a partner (cooperative) to maintain focus on social loafing.

Additional dependent variables include whether the participant picked up the

slack for their partner in slow conditions, or if participants took a “free ride” with fast participants. Picking up the slack for a slow partner is defined as participants performing well enough to make up for their slow partners such that they meet their overall group goal. Taking a free ride is defined as trials in which participants do not meet their individual goal, but with the efforts of their partner, they meet their overall group goal.

Research Design

This study used a mixed factorial design with five groups. Each participant completed ten trials, and trials were five minutes in length. Following Trials 1-5, each trial was repeated, such that Trials 6-10 were equivalent to Trials 1-5. Groups will be referred to with group names based on the order in which the conditions are experienced. Fast/Slow participants started with a baseline condition (Condition A), then they were paired with a fast partner to complete two cooperative trials (Condition B), then they kept the same partner for two more cooperative trials (Condition B), except their partner was programed to slow down to become a slow partner for the second two cooperative trials. The participant then experienced the same trials in the same order for a second time. Slow/Fast was identical to Fast/Slow except the order of fast and slow were reversed. Solo/Slow participants began with a baseline condition (Condition A), followed by two solo plus goal conditions (Condition E), then two cooperative conditions (Condition B) with slow partners, then repeated the same five trials. Solo/Fast was identical to Solo/Slow except the partners were programmed to be fast. Solo/Solo served as a control group, with participants first completing a baseline condition (Condition A), then four solo plus goal conditions (Condition E), then repeating the same five trials (see Table 26).

Table 26

Study 3 Conditions

Group	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trials 6-10
Fast/Slow N=8	Condition A: Baseline	Condition B: Cooperative Fast Partner New Partner	Condition B: Cooperative Fast Partner Keep Partner	Condition B: Cooperative Slow Partner Keep Partner	Condition B: Cooperative Slow Partner Keep Partner	Repeat Trials 1-5
Slow/Fast N=8	Condition A: Baseline	Condition B: Cooperative Slow Partner New Partner	Condition B: Cooperative Slow Partner Keep Partner	Condition B: Cooperative Fast Partner Keep Partner	Condition B: Cooperative Fast Partner Keep Partner	Repeat Trials 1-5
Solo/Slow N=8	Condition A: Baseline	Condition E: Solo + Goal (24)	Condition E: Solo + Goal (24)	Condition B: Cooperative Slow Partner New Partner	Condition B: Cooperative Slow Partner Keep Partner	Repeat Trials 1-5
Solo/Fast N=8	Condition A: Baseline	Condition E: Solo + Goal (40)	Condition E: Solo + Goal (40)	Condition B: Cooperative Fast Partner New Partner	Condition B: Cooperative Fast Partner Keep Partner	Repeat Trials 1-5
Solo/Solo N=8	Condition A: Baseline	Condition E: Solo + Goal	Condition E: Solo + Goal	Condition E: Solo + Goal	Condition E: Solo + Goal	Repeat Trials 1-5

Note: Unless otherwise specified in parentheses, the goal for each trial using Condition B or Condition E was 32.

The groups for this study were designed specifically to account for changes in coworker performance. In real-world work environments, workers are likely to categorize coworkers as high and low performers, and to notice aberrations in performance. Three main pairwise comparisons were developed for Study 3:

Fast/Slow vs. Slow/Fast

Fast/Slow vs. Solo/Slow

Slow/Fast vs. Solo/Fast

The comparison of Fast/Slow and Slow/Fast was to compare results to Study 1 and Study 2 with one added variable. In Study 1 and Study 2, the shift from fast to slow or slow to fast coincided with a shift from partner to partner or team to team. In Study 3, it was the same coworker displaying inconsistent performance.

The comparison of Fast/Slow and Solo/Slow focused on two sets of matched trials. First, performance in the slow trials of both groups to determine the impact of being paired with a partner that worked fast and then slow during those slow trials. The Solo/Slow group controlled for that change in performance to be able to directly compare performance on the slow trials. The goal of this comparison was to tease apart the impact of slow trials alone and the impact of the inconsistent partner performance while completing the slow trials. Second, to compare the fast trials in the Fast/Slow group with the solo plus goal trials in the Solo/Slow group to directly compare alone and cooperative conditions. The comparison of Slow/Fast and Solo/Fast followed the same design, except that the first comparison was made in the fast trials, and the second comparison was made between the slow trials for Slow/Fast group and the solo plus goal trials in the Solo/Fast group.

The goals for the solo plus goal conditions were not set at 32 as they served as controls for fast or slow conditions. For Solo/Slow, the solo plus goal trials were controls were fast trials, and fast partners completed 125% of their portion of the goal, meaning that participants in fast trials only needed to complete 24 records for the two to hit their combined goal of 64 in cooperative trials. Thus, the goal set for Solo/Slow participants in solo plus goal conditions was 24 instead of 32. For Solo/Fast, the solo plus goal trials

were controls for slow trials, and slow partners completed 75% of their portion of the goal, meaning that participants in slow trials needed to complete 40 records for the two to hit their combined goal of 64 in cooperative trials. Thus, the goal set for Solo/Fast participants in solo plus goal conditions was 40 instead of 32.

Study 3: Results

Forty participants completed Study 3. Eight participants were assigned to each of the five groups. In the present section, individual results and within-group results will be reviewed. In the following section, between group results will be reviewed. The following analyses will focus on the dependent measures, which overall represent measures of participant productivity. These measures include improvements over previous trials (completing more records than were completed in the previous trial), individual goals attained, group goals attained, accuracy, picking up the slack for slow partners, and taking a free ride when paired with fast partners. Emphasis will be placed on comparisons between cooperative condition and alone conditions (baseline, solo plus goal). Trial 1 (baseline) will be excluded from the analysis of improvement over previous trial as the first trial has no prior trial to improve over, and will be excluded from the goal attainment measures as participants are not exposed to any goal at that point in time. Trial 6 (baseline) will be included in the increase from the previous trial analyses, and will be included in the goal attainment analyses. Although Trial 6 does not provide a goal to participants, 32 is the average goal provided to all participants in cooperative trials, so a goal of 32 will be assumed for the purpose of comparison to the cooperative trials.

Fast/Slow

Fast/Slow participants were paired with computer simulated partners who were

programmed to work fast for two trials, building a history of good performance. Then the same partners were programmed to switch to a slow performance for two trials. This whole series was then repeated. The goal in all cooperative conditions was 64.

Table 27

Fast/Slow Records Completed

Condition	Participants							
	1	2	3	4	5	6	7	8
Baseline	13	38	28	26	26	20	28	19
Coop Fast	20	47	38	43	17	12	33	26
Coop Fast	27	52	42	48	25	24	37	32
Coop Slow	27	49	46	41	20	26	39	33
Coop Slow	31	40	48	44	28	26	23	37
Baseline	27	38	47	53	23	29	28	35
Coop Fast	25	38	51	42	23	23	36	35
Coop Fast	37	39	48	62	26	26	34	38
Coop Slow	39	43	45	47	25	30	36	39
Coop Slow	36	44	46	63	17	33	35	45

Note: Yellow = Flat performance, Red = Decreased performance

As seen in Table 27, none of the participants improved across all trials, and there were decreases in performance in all trials except the third trial in which participants were paired with a fast partner for a second trial in a row. Fast/Slow participants increased in 69% of fast trials, 59% of slow trials, and in 38% of the Trial 6 baseline trials. Participants hit their portion of the goal (32 records) in 63% of fast trials and 69% of slow trials, and the two-person teams hit their overall goal (64 records) in 88% of fast trials and 38% of slow trials (see Table 28). Although there was no goal in Trial 6, to provide a comparison, 38% of participants completed at least 32 records in Trial 6. As seen in Table 29, accuracy ranged from 59% to 100%. Out of 80 trials, 65 (81%) were

completed with at least 90% accuracy, and 53 (66%) were completed with at least 95% accuracy.

Table 28

Fast/Slow Goal Attainment

Condition	Participants							
	1	2	3	4	5	6	7	8
Baseline	13	38	28	26	26	20	28	19
Coop Fast	20	47	38	43	17	12	33	26
Coop Fast	27	52	42	48	25	24	37	32
Coop Slow	27	49	46	41	20	26	39	33
Coop Slow	31	40	48	44	28	26	23	37
Baseline	27	38	47	53	23	29	28	35
Coop Fast	25	38	51	42	23	23	36	35
Coop Fast	37	39	48	62	26	26	34	38
Coop Slow	39	43	45	47	25	30	36	39
Coop Slow	36	44	46	63	17	33	35	45

Note: Green = Individual Goal Attained, Grey = No Individual Goal

Table 29

Fast/Slow Accuracy

Condition	Participants							
	1	2	3	4	5	6	7	8
Baseline	68%	95%	100%	100%	100%	91%	100%	90%
Coop Fast	100%	100%	97%	98%	77%	67%	97%	96%
Coop Fast	96%	90%	95%	96%	96%	89%	100%	97%
Coop Slow	90%	96%	100%	87%	87%	100%	98%	100%
Coop Slow	97%	98%	98%	90%	90%	81%	100%	100%
Baseline	96%	95%	98%	91%	96%	88%	100%	97%
Coop Fast	86%	100%	96%	95%	100%	59%	97%	95%
Coop Fast	97%	100%	92%	89%	100%	87%	94%	95%
Coop Slow	95%	98%	94%	96%	100%	83%	100%	93%
Coop Slow	95%	98%	98%	91%	77%	87%	100%	98%

Focusing on the comparison between baseline and cooperative conditions, only three of eight participants increased from trial 5 to trial 6, which is the return to baseline (solo), and following the return to baseline, when moving from trial 6 to trial 7, only two participants increased performance. While there was no goal for Trial 6 (baseline), participants had been subject to a goal of 32 for the prior four trials. Four of the five participants with a pattern of meeting their goal in cooperative conditions (Participants 2, 3, 4, and 8) also met or surpassed 32 records in Trial 6. Overall, 64% of cooperative trials were increases from the previous trial, compared to 38% of Trial 6; goals were attained in 66% of cooperative trials, compared to 38% of Trial 6.

Slow/Fast

Slow/Fast participants were paired with computer simulated partners who were programmed to work slow for two trials, building a history of slow performance. Then the same partners were programmed to switch to a fast performance for two trials. This whole series was then repeated. The goal in all cooperative conditions was 64.

As seen in Table 30, none of the participants improved across all trials, and there were decreases in performance in all trials except the seventh trial in which participants moved from the second baseline condition to a cooperative slow condition. Slow/Fast participants increased in 56% of fast trials, 69% of slow trials, and in 25% of Trial 6 baseline trials. Participants hit their portion of the goal (32 records) in 66% of fast trials and 53% of slow trials, and the two-person teams hit their overall goal (64 records) in 81% of fast trials and 22% of slow trials (see Table 31). Although there was no goal in Trial 6, to provide a comparison, 38% of participants completed at least 32 records in Trial 6. As seen in Table 32, accuracy ranged from 74% to 100%. Out of 80 trials, 63

(79%) were completed with at least 90% accuracy, and 51 (64%) were completed with at least 95% accuracy.

Focusing on the comparison between baseline and cooperative conditions, only two of eight participants increased from trial 5 to trial 6, which is the return to baseline, and following the return to baseline, however, when moving from trial 6 to trial 7, all eight participants increased performance. While there was no goal for the baseline condition (Trial 6), participants had been subject to a goal of 32 for the prior four trials. Three of the four participants with a pattern of meeting their goal in cooperative conditions (Participants 1, 3, and 4) also met or surpassed 32 records in the return to baseline condition. Overall, 63% of cooperative trials were increases from the previous trial, compared to 25% of Trial 6 (baseline); goals were attained in 59% of cooperative trials, compared to 38% of Trial 6 (baseline).

Table 30

Slow/Fast Records Completed

Condition	Participant							
	1	2	3	4	5	6	7	8
Baseline	28	17	21	26	17	17	20	20
Coop Slow	38	20	25	36	26	25	14	23
Coop Slow	32	24	31	23	28	23	24	25
Coop Fast	36	20	35	36	31	29	19	23
Coop Fast	38	17	40	34	32	31	29	29
Baseline	32	23	37	35	30	30	24	24
Coop Slow	42	25	41	38	35	41	45	32
Coop Slow	41	22	40	37	39	36	42	39
Coop Fast	35	19	39	40	38	35	33	38
Coop Fast	45	21	37	45	40	37	32	41

Note: Yellow = Flat performance, Red = Decreased performance

Table 31

Slow/Fast Goal Attainment

Condition	Participant							
	1	2	3	4	5	6	7	8
Baseline	28	17	21	26	17	17	20	20
Coop Slow	38	20	25	36	26	25	14	23
Coop Slow	32	24	31	23	28	23	24	25
Coop Fast	36	20	35	36	31	29	19	23
Coop Fast	38	17	40	34	32	31	29	29
Baseline	32	23	37	35	30	30	24	24
Coop Slow	42	25	41	38	35	41	45	32
Coop Slow	41	22	40	37	39	36	42	39
Coop Fast	35	19	39	40	38	35	33	38
Coop Fast	45	21	37	45	40	37	32	41

Note: Green = Individual Goal Attained, Grey = No Individual Goal

Table 32

Slow/Fast Accuracy

Condition	Participants							
	1	2	3	4	5	6	7	8
Baseline	100%	100%	100%	87%	94%	94%	91%	87%
Coop Slow	97%	100%	96%	100%	100%	100%	74%	92%
Coop Slow	97%	100%	100%	77%	100%	85%	86%	89%
Coop Fast	90%	100%	97%	95%	100%	97%	79%	88%
Coop Fast	97%	89%	98%	89%	100%	97%	91%	97%
Baseline	97%	100%	97%	90%	100%	100%	83%	89%
Coop Slow	95%	100%	100%	93%	100%	93%	98%	91%
Coop Slow	95%	96%	100%	86%	98%	92%	88%	98%
Coop Fast	95%	100%	95%	98%	100%	90%	87%	95%
Coop Fast	100%	100%	97%	98%	98%	100%	82%	95%

Solo/Slow

Following a baseline condition, Solo/Slow participants completed two sessions alone with a goal of 24 records (solo plus goal condition), then they were paired with computer simulated partners programmed to work slow for two trials. This whole series

was then repeated. The goal in all cooperative conditions was a total of 64. The goals in the solo plus goal conditions was 24.

As seen in Table 33, none of the participants improved across all trials, and there were decreases in performance in all trials. Solo/Slow participants increased in 63% of slow trials, 63% of solo plus goal trials, and 50% of Trial 6 baseline trials. Participants hit their portion of the goal (32 records) in 56% of slow trials and 78% of solo plus goal trials (see Table 34). Two-person teams hit their goal (64 records) in 22% of slow trials. Although there was no goal in Trial 6, to provide a comparison, 50% of participants completed at least 32 records in Trial 6. Accuracy ranged from 79% to 100%. Out of 80 trials, 63 (79%) were completed with at least 90% accuracy, and 48 (60%) were completed with at least 95% accuracy (see Table 35).

Focusing on the comparison between baseline, solo plus goal, and cooperative conditions, Solo/Slow participants worked alone for three trials before being paired with a partner. Four of eight participants increased from trial 3 to 4 (moving from solo plus goal to cooperative), four of eight participants increased from trial 5 to 6 (return to baseline), and five participants increased performance moving from trial 8 to 9 (moving from solo plus goal to cooperation). While there was no goal for Trial 6 (baseline), participants had been subject to a goal of 32 for the prior two trials. Three of the four participants with a pattern of meeting their goal in cooperative conditions (Participants 1, 3, and 8) also met or surpassed 32 records in Trial 6 (baseline), Participant 4 did meet their goal one time in a cooperative condition, but did not complete at least 32 records in Trial 6 (baseline), and Participant 5 did not meet their goal in the cooperative conditions, but did surpass 32 in Trial 6 (baseline). Overall, 63% of cooperative trials were increases

from the previous trial, compared to 50% of Trial 6 (baseline); goals were attained in 67% of cooperative trials, compared to 50% of Trial 6 (baseline).

Table 33

Solo/Slow Records Completed

Condition	Participants							
	1	2	3	4	5	6	7	8
Baseline	27	20	30	22	24	15	15	27
Solo + G	32	22	34	25	28	18	20	26
Solo + G	32	27	37	33	37	12	23	29
Coop Slow	34	25	41	28	30	23	23	31
Coop Slow	35	27	47	35	27	19	28	33
Baseline	37	23	54	30	35	17	23	34
Solo + G	36	26	54	24	42	9	29	37
Solo + G	34	25	47	25	44	20	27	35
Coop Slow	41	19	55	32	41	21	32	35
Coop Slow	37	22	55	32	45	22	36	40

Note: Yellow = Flat performance, Red = Decreased performance

Table 34

Solo/Slow Goal Attainment

Condition	Participants							
	1	2	3	4	5	6	7	8
Baseline	27	20	30	22	24	15	15	27
Solo + G	32	22	34	25	28	18	20	26
Solo + G	32	27	37	33	37	12	23	29
Coop Slow	34	25	41	28	30	23	23	31
Coop Slow	35	27	47	35	27	19	28	33
Baseline	37	23	54	30	35	17	23	34
Solo + G	36	26	54	24	42	9	29	37
Solo + G	34	25	47	25	44	20	27	35
Coop Slow	41	19	55	32	41	21	32	35
Coop Slow	37	22	55	32	45	22	36	40

Note: Green = Individual Goal Attained, Grey = No Individual Goal

Table 35

Solo/Slow Accuracy

Condition	Participants							
	1	2	3	4	5	6	7	8
Baseline	100%	100%	97%	81%	96%	83%	88%	100%
Solo + G	100%	100%	100%	89%	93%	82%	83%	96%
Solo + G	100%	100%	100%	94%	100%	100%	85%	100%
Coop Slow	100%	100%	100%	88%	94%	100%	85%	100%
Coop Slow	100%	100%	96%	92%	79%	90%	97%	100%
Baseline	100%	92%	98%	94%	97%	94%	82%	100%
Solo + G	97%	93%	93%	100%	98%	90%	94%	97%
Solo + G	100%	100%	92%	89%	100%	83%	93%	95%
Coop Slow	100%	86%	98%	97%	95%	88%	94%	100%
Coop Slow	100%	100%	98%	97%	90%	88%	95%	98%

Solo/Fast

Following a baseline condition, Solo/Fast participants completed two sessions alone with a goal of 40 records (solo plus goal condition), then they were paired with computer simulated partners who were programmed to work fast for two trials. This whole series then repeated. The goal in all cooperative conditions was a total of 64. The goals in the solo plus goal conditions was 40.

As seen in Table 36, none of the participants improved across all trials, and there were decreases in performance in all trials except the third trial which was a solo plus goal condition, and the fifth trial, which was a cooperative fast condition. Solo/Fast participants increased in 50% of cooperative fast trials, 69% of solo plus goal trials, and 63% of Trial 6 baseline trials. Participants hit their portion of the goal (32 records) in 59% of cooperative fast trials and 25% of solo plus goal trials, and the two-person teams hit their overall goal (64 records) in 88% of cooperative fast trials (see Table 37). Although there was no goal in Trial 6, to provide a comparison, 63% of participants

completed at least 32 records in Trial 6. As seen in, accuracy ranged from 74% to 100%. Out of 80 trials, 62 (78%) were completed with at least 90% accuracy, and 47 (59%) were completed with at least 95% accuracy (see Table 38).

Table 36

Solo/Fast Records Completed

Condition	Participants							
	1	2	3	4	5	6	7	8
Baseline	13	21	16	17	25	15	24	18
Solo + G	16	28	14	25	34	19	37	26
Solo + G	23	38	17	35	37	21	39	28
Coop Fast	21	31	17	33	36	17	33	30
Coop Fast	26	37	26	34	47	25	38	35
Baseline	25	50	18	33	49	35	45	39
Solo + G	23	40	21	30	46	31	47	43
Solo + G	25	40	27	28	51	31	51	42
Coop Fast	28	39	28	38	50	31	46	39
Coop Fast	35	33	17	27	41	39	47	42

Note: Yellow = Flat performance, Red = Decreased performance

Table 37

Solo/Fast Goal Attainment

Condition	Participants							
	1	2	3	4	5	6	7	8
Baseline	13	21	16	17	25	15	24	18
Solo + G	16	28	14	25	34	19	37	26
Solo + G	23	38	17	35	37	21	39	28
Coop Fast	21	31	17	33	36	17	33	30
Coop Fast	26	37	26	34	47	25	38	35
Baseline	25	50	18	33	49	35	45	39
Solo + G	23	40	21	30	46	31	47	43
Solo + G	25	40	27	28	51	31	51	42
Coop Fast	28	39	28	38	50	31	46	39
Coop Fast	35	33	17	27	41	39	47	42

Note: Green = Individual Goal Attained, Grey = No Individual Goal

Table 38

Solo/Fast Accuracy

Condition	Participants							
	1	2	3	4	5	6	7	8
Baseline	87%	100%	84%	94%	100%	94%	96%	86%
Solo + Goal	89%	93%	82%	93%	100%	95%	100%	100%
Solo + Goal	100%	90%	89%	100%	95%	95%	100%	93%
Coop Fast	100%	74%	85%	97%	97%	94%	100%	100%
Coop Fast	100%	84%	93%	100%	100%	100%	95%	100%
Baseline	100%	94%	95%	94%	98%	100%	100%	100%
Solo + Goal	96%	87%	88%	97%	90%	100%	98%	100%
Solo + Goal	100%	85%	93%	90%	96%	97%	100%	100%
Coop Fast	93%	78%	90%	97%	88%	97%	96%	98%
Coop Fast	97%	79%	71%	87%	87%	100%	100%	98%

Focusing on the comparison between baseline, solo plus goal, and cooperative conditions, Solo/Fast participants worked alone for three trials before being paired with a partner. Only one participant increased from trial 3 to trial 4 (moving from solo plus goal to cooperative), five of eight participants increased from trial 5 to trial 6, which is the return to baseline, and three participants increased performance moving from trial 8 to 9 (moving from solo plus goal to cooperation). While there was no goal for Trial 6 (baseline), participants had been subject to a goal of 32 for the prior two trials. All five participants that had previously met that goal at least once in cooperative conditions also met or surpassed 32 records in Trial 6 (Participants 2, 4, 5, 7, 8), and Participant 6 did not meet their goal in the cooperative conditions, but did surpass 32 in Trial 6. Overall, 59% of cooperative trials were increases from the previous trial, compared to 50% of Trial 6; goals were attained in 42% of cooperative trials, compared to 63% of Trial 6.

Solo/Solo

Solo/Solo participants worked alone for all trials. The completed a baseline session with no partner and no goal, then four solo plus goal conditions with a goal of 32. They then repeated the same trials.

As seen in Table 39, none of the participants improved across all trials, and there were decreases in performance in all trials. Solo/Solo participants increased in 55% of solo plus goal conditions, and 50% of Trial 6 (baseline). Solo/Solo participants hit their goal in 52% of solo plus goal conditions, and 63% of Trial 6 (see Table 40). Accuracy ranged from 63% to 100%. Out of 80 trials, 65 (81%) were completed with at least 90% accuracy, and 45 (56%) were completed with at least 95% accuracy (see Table 41).

Table 39

Solo/Solo Records Completed

Condition	Participants							
	1	2	3	4	5	6	7	8
Baseline	13	23	13	21	22	20	21	14
Solo + G	18	29	21	17	32	25	17	25
Solo + G	33	30	28	18	31	29	25	23
Solo + G	33	39	29	19	36	29	25	28
Solo + G	34	33	18	22	37	37	30	26
Baseline	33	37	27	13	37	43	30	33
Solo + G	33	33	32	21	36	37	28	33
Solo + G	32	33	33	26	36	46	22	36
Solo + G	34	33	34	17	34	40	15	35
Solo + G	32	33	38	12	38	39	32	36

Note: Yellow = Flat performance, Red = Decreased performance

Table 40

Solo/Solo Goal Attainment

Condition	Participant							
	1	2	3	4	5	6	7	8
Baseline	13	23	13	21	22	20	21	14
Solo + G	18	29	21	17	32	25	17	25
Solo + G	33	30	28	18	31	29	25	23
Solo + G	33	39	29	19	36	29	25	28
Solo + G	34	33	18	22	37	37	30	26
Baseline	33	37	27	13	37	43	30	33
Solo + G	33	33	32	21	36	37	28	33
Solo + G	32	33	33	26	36	46	22	36
Solo + G	34	33	34	17	34	40	15	35
Solo + G	32	33	38	12	38	39	32	36

Note: Green = Individual Goal Attained, Grey = No Individual Goal

Table 41

Solo/Solo Accuracy

Condition	Participant							
	1	2	3	4	5	6	7	8
Baseline	93%	88%	100%	95%	92%	100%	100%	88%
Solo + Goal	100%	97%	95%	77%	100%	93%	100%	100%
Solo + Goal	100%	91%	100%	82%	97%	97%	100%	96%
Solo + Goal	77%	100%	100%	100%	97%	91%	93%	93%
Solo + Goal	83%	94%	86%	92%	97%	100%	91%	96%
Baseline	85%	93%	96%	93%	97%	100%	97%	100%
Solo + Goal	80%	97%	100%	88%	90%	90%	97%	97%
Solo + Goal	65%	92%	100%	90%	95%	100%	81%	100%
Solo + Goal	79%	94%	97%	94%	94%	95%	100%	97%
Solo + Goal	63%	94%	100%	100%	100%	100%	73%	95%

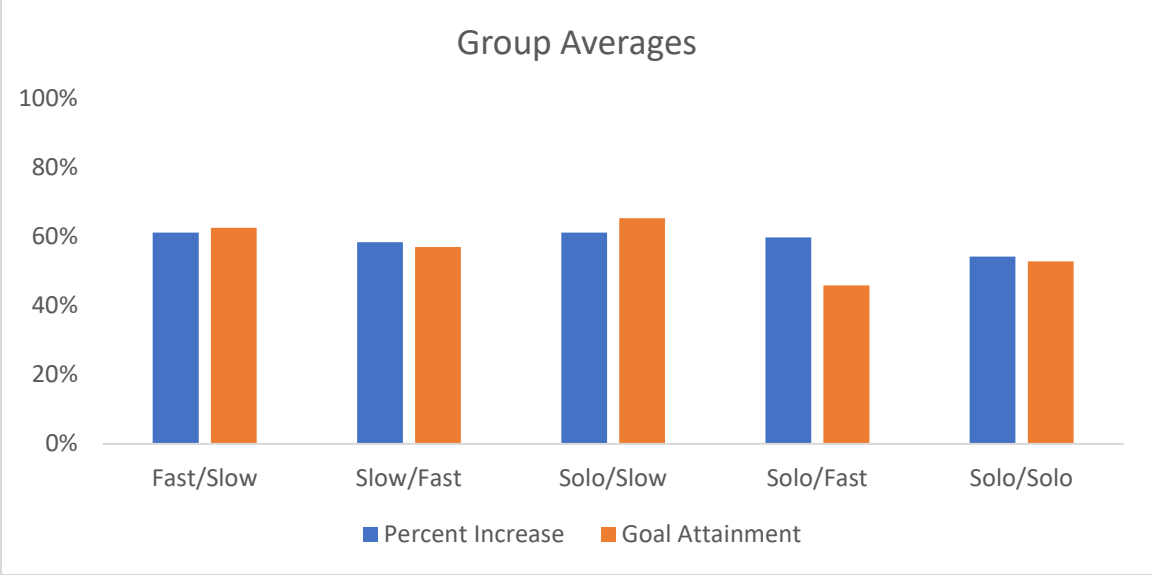
Group Results

Figure 20 represents the total average increase over previous trial and goal attainment for each group. Goal attainment and increase over previous trial are again

presented together to aid in comparison between the two related measures. Increases over previous trials for all groups except for Solo/Solo were very similar, each group showing increases in 58%-61% of all trials. This was only slightly higher than Solo/Solo, in which participants increased over previous trials in 54% of trials. There was also minimal difference between the groups in the percent of individual goals hit, ranging from 46% (Solo/Fast) to 65% (Solo/Slow). The highest overall goal attainment was in the Solo/Slow group, the lowest in the Solo/Fast group.

Figure 20

Group Averages: Increase Over Previous Trial, Goal Attainment



Upon evaluation of trials in which participants hit their individual goal in the fast conditions for Fast/Slow, Slow/Fast, and Solo/Fast participants was 63%, 66%, and 59% of trials, respectively (see Table 42). There was a bit more of a difference in the slow trials, with Fast/Slow, Slow/Fast, and Solo/Slow hitting their individual goals in 69%,

53%, and 56% of trials, respectively. The rates of group goal attainment are largely driven by the type of partner, with 22%-38% of group goal attainment in slow conditions and 81%-88% group goal attainment in fast conditions. Fast/Slow picked up the slack for their slow partner most frequently, in 38% of slow trials. Slow/Fast and Solo/Slow picked up the slack in 22% of slow trials. Solo/Fast took a free ride the most frequently, in 28% of fast trials. Fast/Slow took a free ride in 25% of trials, and Slow/Fast took a free ride in 16% of trials.

Table 42

Group Comparisons

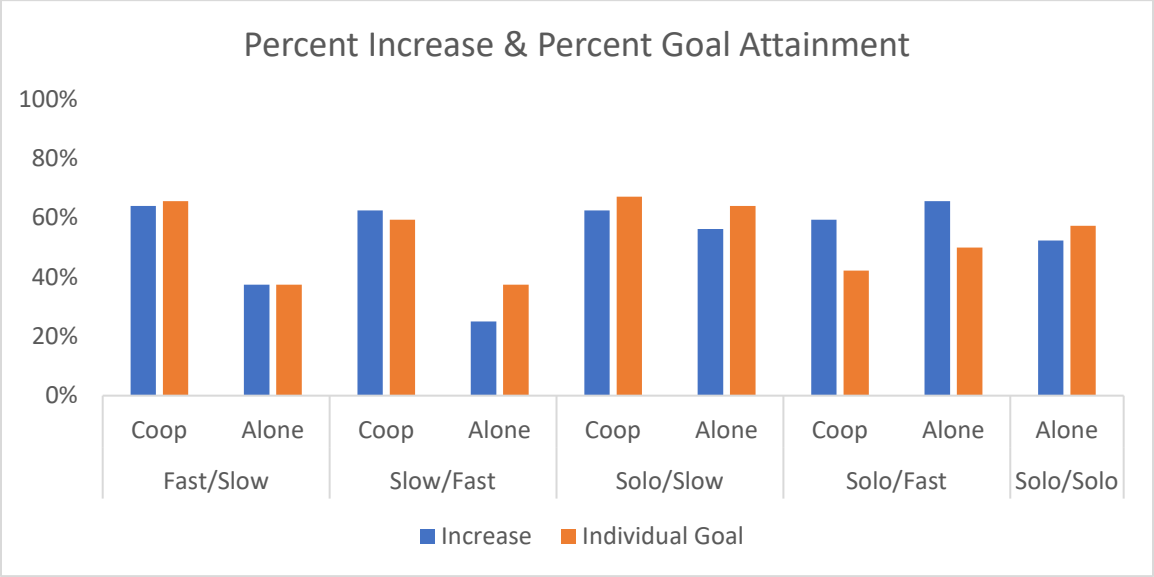
Group	Condition	Increase	Individual Goal	Group Goal	Picked up Slack	Free Ride
Fast/Slow	Coop Fast	69%	63%	88%		
	Coop Slow	59%	69%	38%	38%	25%
	Baseline	38%	38%			
Slow/Fast	Coop Slow	69%	53%	22%	22%	
	Coop Fast	56%	66%	81%		16%
	Baseline	25%	38%			
Solo/Slow	Solo + G	63%	78%			
	Coop Slow	63%	56%	22%	22%	
	Baseline	50%	50%			
Solo/Fast	Solo + G	69%	25%			
	Coop Fast	50%	59%	88%		28%
	Baseline	63%	75%			
Solo/Solo	Solo + G	55%	52%			
	Baseline	50%	63%			

Note. Blank cells denote a measure irrelevant to the group

Figure 21 presents are more focused comparison of the cooperative conditions and the alone conditions (Trial 6 baseline, and solo plus goal conditions). In Fast/Slow, Slow/Fast, and Solo/Slow, increase over previous trial and individual goal attainment were higher in the cooperative conditions when compared to the alone conditions. In Solo/Fast, increase and goal attainment were both higher in the alone conditions.

Figure 21

Cooperation Versus Alone

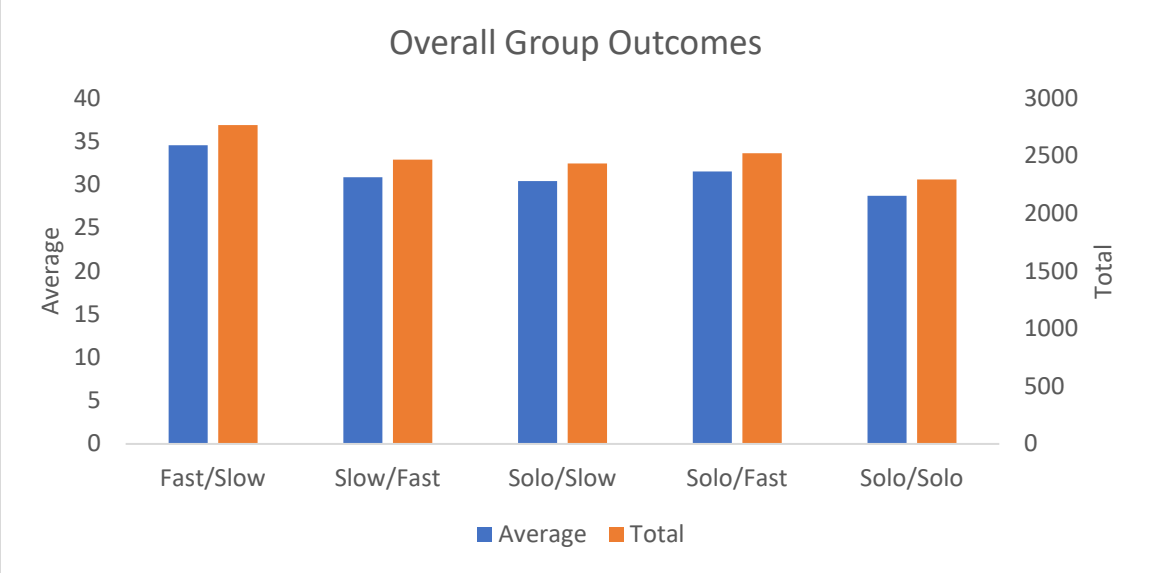


Upon comparison of records completed by group, Fast/Slow had the highest average and highest total records completed across all participants and all trials. Solo/Fast had the next highest average and total, although the differences between Groups Slow/Fast, Solo/Slow, and Solo/Fast were minimal. Solo/Solo had the lowest average and total number of records completed (see Figure 22). Fast/Slow participants completed a total of 2,765 records across the ten trials, compared to 2,295 records completed by the Solo/Solo participants. This amounts to a difference of 470 records between the highest

performing and lowest performing groups. When taken as averages, the Fast/Slow group averaged 34.6 records per trial, and the Solo/Solo group completed and average of 28.7 records per trial.

Figure 22

Overall Group Outcomes



Upon review of results based only on trial number without consideration of the condition, while each group exhibited some drops in average performance across trials, they each exhibited an overall upward trend in performance. Table 43 shows increases or decreases of group averages from trial to trial, and Figure 23 shows the same data in a graph. Upon visual inspection, Fast/Slow appears to trend slightly higher than the rest of the groups, and Solo/Solo appears to trend slightly lower than the bulk of the groups.

Participants increased in 67% of cooperative trials (an equivalent number of fast and slow trials), and 71% of trials in which they worked alone (with or without a goal). Out of nine opportunities to improve in performance, Fast/Slow improved in five trials,

Slow/Fast, Solo/Fast, and Solo/Solo in six trials, and Solo/Slow in eight trials. Overall, Slow/Fast and Solo/Fast showed the largest improvement from baseline to the final trial, followed by Fast/Slow, Solo/Solo, and Solo/Slow.

Table 43

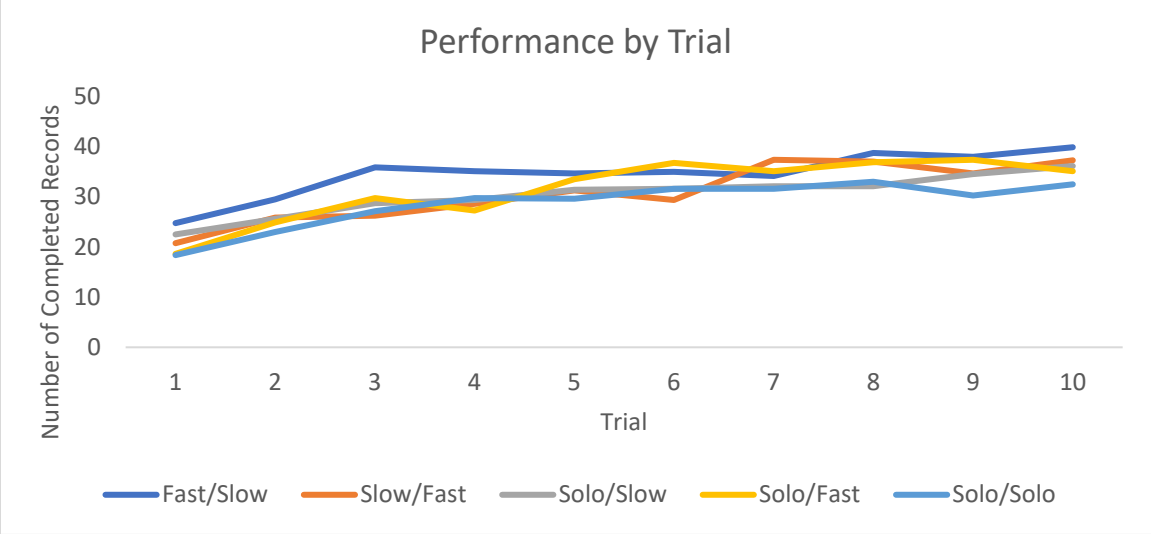
Increases by Trial Number

Trial	Group Number				
	Fast/Slow	Slow/Fast	Solo/Slow	Solo/Fast	Solo/Solo
1	0	0	0	0	0
2	4.8	5.1	3.1	6.3	4.6
3	6.4	0.4	3.1	4.9	4.1
4	-0.8	2.4	0.6	-2.5	2.6
5	-0.5	2.6	2.0	6.3	-0.1
6	0.4	-1.9	0.3	3.3	2.0
7	-0.9	8.0	0.5	-1.6	0.0
8	4.6	-0.4	0.0	1.8	1.4
9	-0.8	-2.4	2.4	0.5	-2.8
10	1.9	2.6	1.6	-2.3	2.3
Total Increase	15.1	16.5	13.6	16.5	14.1

Note. Gray shaded boxes are cooperative conditions

Figure 23

Performance by Trial

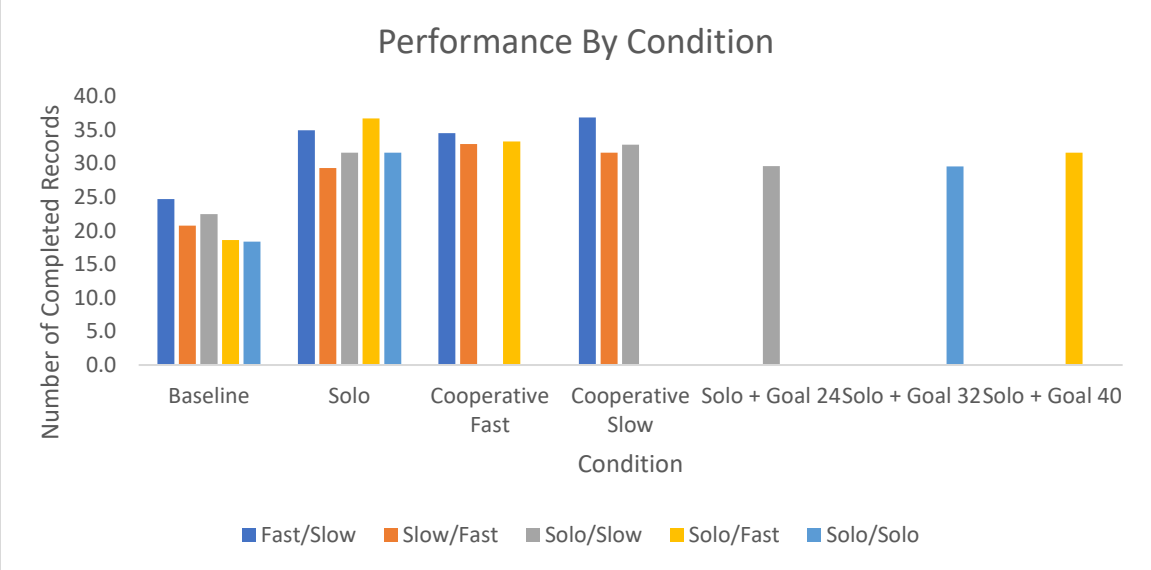


Results by Condition

Upon evaluation of results based on the condition (see Figure 24), the lowest average number of records completed aside from the Trial 1 baseline condition was in the solo condition (Trial 6 return to baseline) for the Slow/Fast group, followed closely by the solo plus goal condition for the Solo/Solo group. The highest average number of records completed was by the Fast/Slow group in the cooperative slow condition. Overall, the cooperative conditions produced the highest average number of records completed, but only slightly higher than the Trial 6 solo/return to baseline conditions. The Trial 6 solo conditions also produced higher performances than the solo conditions with goals.

Figure 24

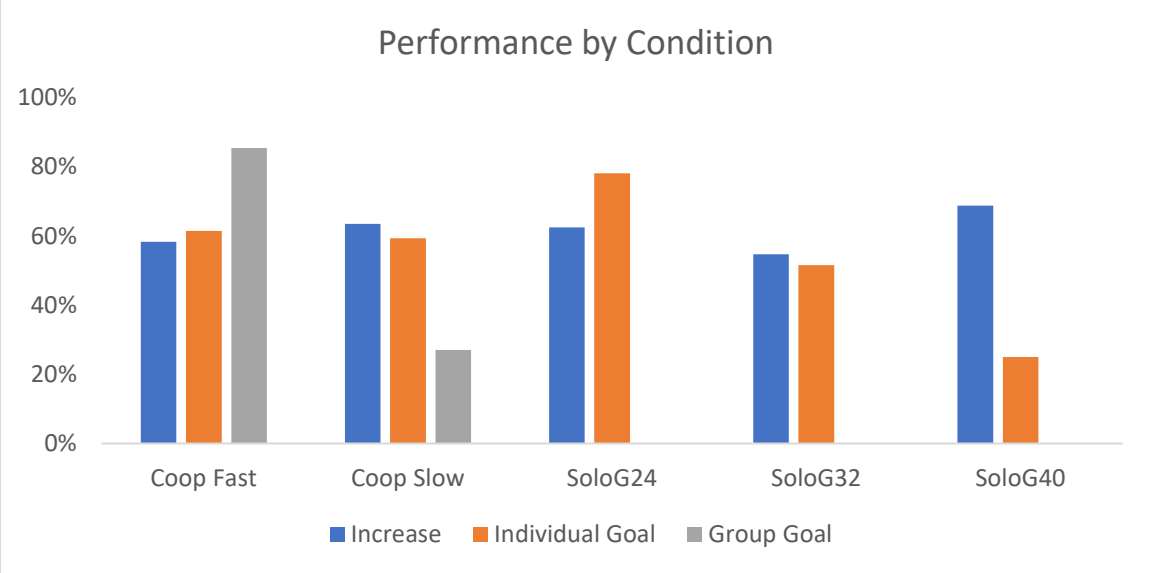
Average Performance by Group and Condition



As seen in Figure 25, participants showed increases in performance in 58% of trials with fast partners and 64% of trials with slow partners. In the solo plus goal conditions with goals of 24, 32, and 40, participants showed increases in performance in 63%, 55%, and 69% of trials, respectively. Participants met their individual goals in 61% of trials with fast partners and 59% of trials with slow partners. In the solo plus goal conditions with goals of 24, 32, and 40, participants hit their goals in 78%, 52%, and 25% of trials, respectively. Group goals were achieved in 85% of trials with fast partners and 27% of trials with slow partners.

Figure 25

Performance by Condition



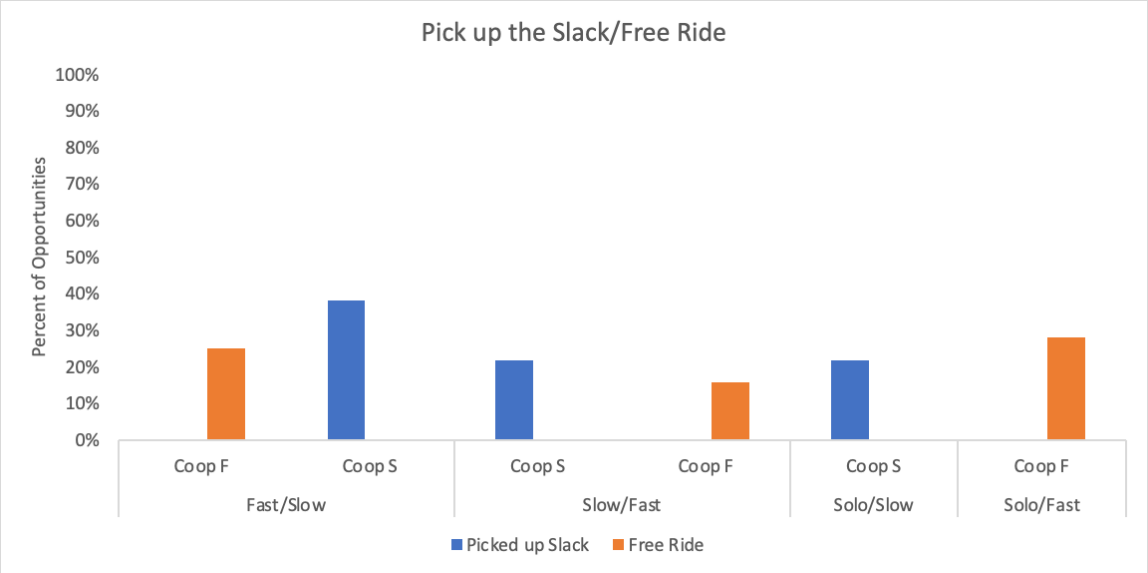
Free Ride/Pick Up the Slack

When participants worked with fast partners, they had an opportunity to take a free ride, which is defined here as trials in which the participant did not hit their portion

of the goal, but the pair did hit their overall goal. When participants worked with slow partners, they had an opportunity to pick up the slack, which is defined here as trials in which the participant worked fast enough to make up for their underperforming partner, and the pair hit their overall goal. As seen in Figure 26, rates of each were relatively low, with the Solo/Fast group taking the most free rides (28% of trials), followed closely by the Fast/Slow group (25% of trials). The Fast/Slow group picked up the slack for their slow partners in 38% of slow trials, followed by Slow/Fast (22%) and Solo/Slow (22%).

Figure 26

Pick Up the Slack/Free Ride Measures



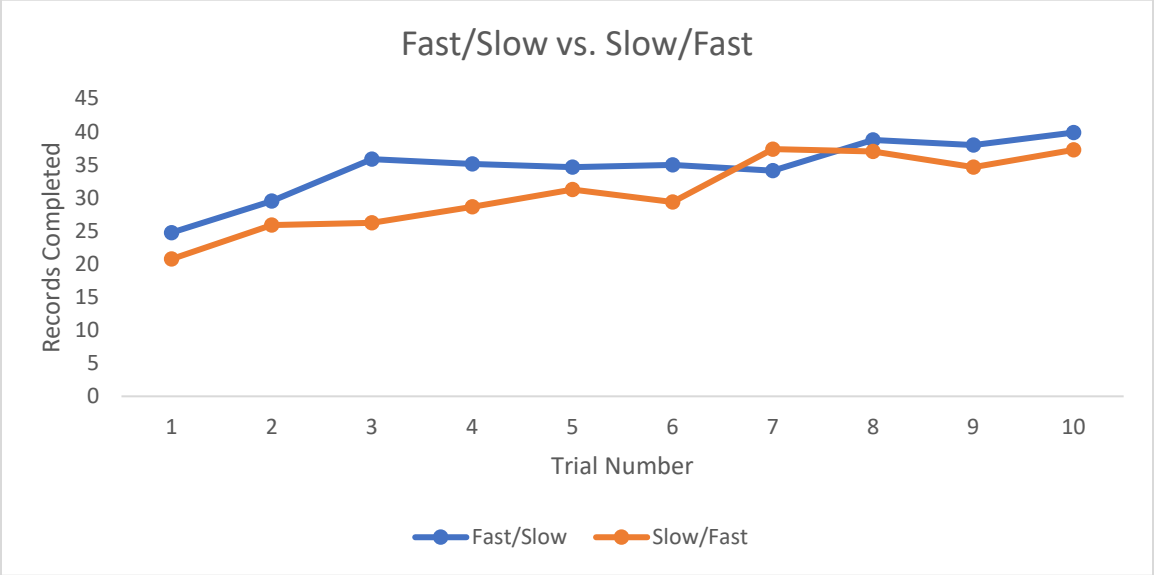
Fast/Slow versus Slow/Fast

The designs of Fast/Slow and Slow/Fast may be compared to the groups in Study 1 and Study 2 as the two groups are counterbalanced with fast partners followed by slow partners or slow partners followed by fast partners. Fast/Slow improved performance

through the third trial (the second fast trial), then went on a slight downward trend starting with the fourth trial (the first slow trial) until the seventh trial. Slow/Fast improved on a slower trend, peaking in the seventh trial (fast trial). Except for the seventh trial, Fast/Slow outperformed Slow/Fast throughout the experiment (see Figure 27).

Figure 27

Fast/Slow Versus Slow/Fast



Repeated Measures ANOVA: Fast/Slow and Slow/Fast

For the following analysis, identical consecutive trials were averaged (see Table 44) to compare to the outcomes of Study 1 and Study 2.

Table 44

Fast/Slow Versus Slow/Fast Comparisons

Fast/Slow	Measures	Slow/Fast	Measures
1: Baseline	1: Baseline	1: Baseline	1: Baseline
2: Fast	2: Fast 1 (F1)	2: Slow	2: Slow 1 (S1)
3: Fast		3: Slow	
4: Slow	3: Slow 1 (S1)	4: Fast	3: Fast 1 (F1)
5: Slow		5: Fast	
6: Baseline		6: Baseline	
7: Fast	4: Fast 2 (F2)	7: Slow	4: Slow 2 (S2)
8: Fast		8: Slow	
9: Slow	5: Slow 2 (S2)	9: Fast	5: Fast 2 (F2)
10: Slow		10: Fast	

A repeated measures analysis of variance (ANOVA) with one within-subjects factor was conducted to determine whether significant differences exist among fast and slow conditions. A power analysis for a repeated measures ANOVA with two groups and five measurements was conducted in G-POWER to determine a sufficient sample size using an alpha of 0.05, a power of 0.80, a correlation of .7 among the repeated measurements, and a medium effect size ($f = 0.25$) (Faul et al., 2013). Based on the aforementioned assumptions, the desired sample size is 14.

Results

The results were examined based on an alpha of 0.05. The *p*-values for the within-subjects factor and the interactions with the within-subjects factor were calculated using the Greenhouse-Geisser correction to adjust for the violation of the sphericity assumption (Greenhouse & Geisser, 1959). The main effect for the within-subjects factor was significant, $F(4, 60) = 14.83$, $p < .001$, indicating there were significant differences

between the values of each of the trials. Table 45 presents the ANOVA results. The means of the within-subjects factor are presented in Table 46.

Table 45

Repeated Measures ANOVA Results

Source	*df*	*SS*	*MS*	*F*	*p*	η_p^2
Within-Subjects						
Within Factor	4	1792.01	448.00	14.83	< .001**	0.50
Residuals	60	1812.29	30.20			

Note. *$p < .05$. **$p < .001$

Table 46

Means Table for Within-Subject Variables

Variable	*M*	*SD*
BL	22.75	6.22
F1	34.94	9.30
S1	35.41	7.75
F2	31.25	9.44
S2	34.44	9.53

Note. $n = 16$.

Post-hoc. The mean contrasts utilized Tukey comparisons based on an alpha of 0.05. Tukey comparisons were used to test the differences in the estimated marginal means for each combination of within-subject effects.

Within Effects. BL was significantly less than F1, $t(15) = -6.09$, $p < .001$, S1, $t(15) = -7.07$, $p < .001$, F2, $t(15) = -4.19$, $p = .006$, and S2, $t(15) = -5.22$, $p < .001$ F2 was significantly less than S2, $t(15) = -3.16$, $p = .043$. No other significant differences were

found. Table 47 presents the marginal means contrasts for the Repeated Measures ANOVA.

Table 47

The Marginal Means Contrasts for each Combination of Within-Subject Variables for the Repeated Measures ANOVA

Contrast	Difference	*SE*	*df*	*t*	*p*
BL - F1	-12.19	2.00	15	-6.09	< .001**
BL - S1	-12.66	1.79	15	-7.07	< .001**
BL - F2	-8.50	2.03	15	-4.19	.006*
BL - S2	-11.69	2.24	15	-5.22	< .001**
F1 - S1	-0.47	1.34	15	-0.35	.996
F1 - F2	3.69	2.51	15	1.47	.596
F1 - S2	0.50	2.36	15	0.21	.999
S1 - F2	4.16	1.93	15	2.16	.247
S1 - S2	0.97	1.76	15	0.55	.980
F2 - S2	-3.19	1.01	15	-3.16	.043*

Note. Tukey Comparisons were used to test the differences in estimated marginal means. *$p < .05$. **$p < .001$

Mixed Model ANOVA: Fast/Slow vs. Slow/Fast

A mixed model analysis of variance (ANOVA) with one within-subjects factor and one between-subjects factor was conducted to determine whether significant differences exist among baseline, the fast and slow conditions between the levels of group. A power analysis for a mixed model ANOVA with two groups and five measurements was conducted in G-POWER to determine a sufficient sample size using an alpha of 0.05, a power of 0.80, a correlation of .7 among the repeated measurements, and a medium effect size ($f = 0.25$) (Faul et al., 2013). Based on the aforementioned assumptions, the desired sample size is 14.

Results

The results were examined based on an alpha of 0.05. The main effect for Group was not significant, $F(1, 14) = 1.04$, $p = .325$, indicating the levels of Group were all similar for BL, F1, S1, F2, and S2. The main effect for the within-subjects factor was significant, $F(4, 56) = 21.59$, $p < .001$, indicating there were significant differences between the values of BL, F1, S1, F2, and S2. The interaction effect between the within-subjects factor and Group was significant, $F(4, 56) = 7.83$, $p < .001$, indicating that the relationships between BL, F1, S1, F2, and S2 differed significantly between the levels of Group. Table 48 presents the ANOVA results.

Table 48

Mixed Model ANOVA Results

Source	*df*	*SS*	*MS*	*F*	*p*	η_p^2
Between-Subjects						
Group	1	253.83	253.83	1.04	.325	0.07
Residuals	14	3412.37	243.74			
Within-Subjects						
Within Factor	4	1792.01	448.00	21.59	< .001**	0.61
Group:Within.Factor	4	650.25	162.56	7.83	< .001**	0.36
Residuals	56	1162.04	20.75			

Note. *$p < .05$. **$p < .001$

Post-hoc. The mean contrasts utilized Tukey comparisons based on an alpha of 0.05. Tukey comparisons were used to test the differences in the estimated marginal means for each combination of between-subject and within-subject effects.

Between Effects. For Fast/Slow, BL was significantly less than F1, $t(14) = -3.24$, $p = .040$, S1, $t(14) = -4.15$, $p = .007$, F2, $t(14) = -4.31$, $p = .005$, and S2, $t(14) = -4.52$, $p =$

.004. For Slow/Fast, BL was significantly less than F1, $t(14) = -6.72$, $p < .001$ and S1, $t(14) = -6.22$, $p < .001$. F1 was significantly greater than F2, $t(14) = 4.71$, $p = .003$ and S2, $t(14) = 3.12$, $p = .050$. S1 was significantly greater than F2, $t(14) = 5.46$, $p < .001$ and S2, $t(14) = 3.47$, $p = .026$. No other significant differences were found for the level of Group. Table 49 presents the marginal means contrasts for the Mixed Model ANOVA.

Table 49

The Marginal Means Contrasts for each Combination of Within-Subject Variables for the Mixed Model ANOVA

Contrast	Difference	*SE*	*df*	*t*	*p*
Group|Fast/Slow					
BL - F1	-7.94	2.45	14	-3.24	.040*
BL - S1	-10.12	2.44	14	-4.15	.007*
BL - F2	-11.69	2.71	14	-4.31	.005*
BL - S2	-14.19	3.14	14	-4.52	.004*
F1 - S1	-2.19	1.84	14	-1.19	.759
F1 - F2	-3.75	2.36	14	-1.59	.528
F1 - S2	-6.25	2.32	14	-2.69	.106
S1 - F2	-1.56	1.81	14	-0.86	.905
S1 - S2	-4.06	1.73	14	-2.35	.187
F2 - S2	-2.50	1.45	14	-1.72	.452
Group|Slow/Fast					
BL - F1	-16.44	2.45	14	-6.72	< .001**
BL - S1	-15.19	2.44	14	-6.22	< .001**
BL - F2	-5.31	2.71	14	-1.96	.333
BL - S2	-9.19	3.14	14	-2.93	.070
F1 - S1	1.25	1.84	14	0.68	.958
F1 - F2	11.12	2.36	14	4.71	.003*
F1 - S2	7.25	2.32	14	3.12	.050*
S1 - F2	9.88	1.81	14	5.46	< .001**
S1 - S2	6.00	1.73	14	3.47	.026*
F2 - S2	-3.88	1.45	14	-2.67	.110

Note. Tukey Comparisons were used to test the differences in estimated marginal means.

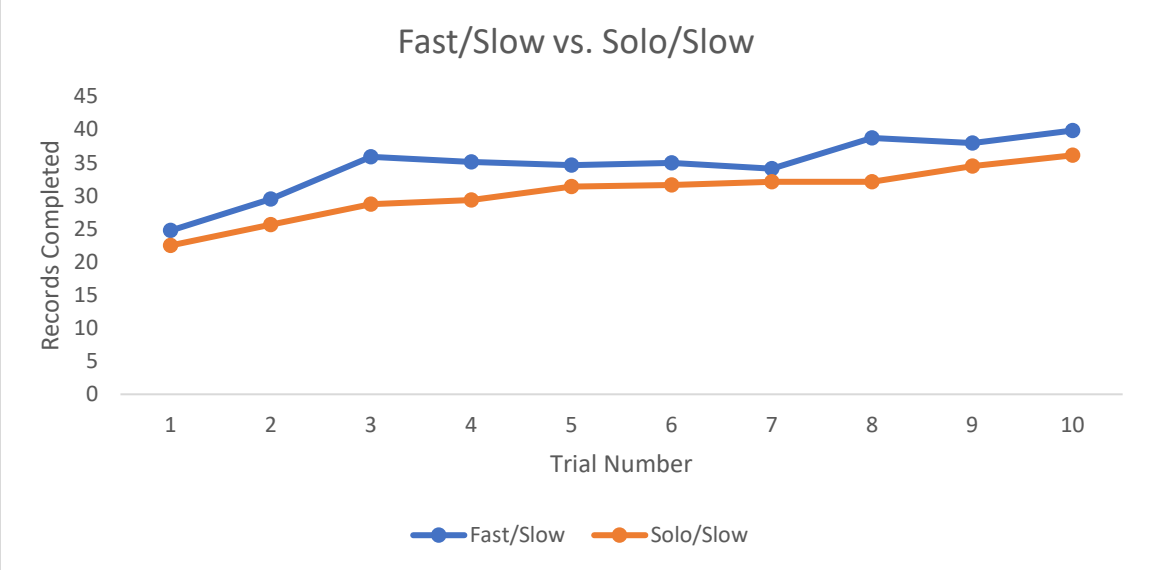
*$p < .05$. **$p < .001$

Fast/Slow vs. Solo/Slow

The designs of Fast/Slow versus Solo/Slow allows for two comparisons. First, a comparison of slow partner conditions. Fast/Slow started with fast partners, then switched to slow partners. Solo/Slow started with solo plus goal conditions, then switched to slow partners. Fast/Slow improved performance through the third trial (the second fast trial), then went on a slight downward trend starting with the fourth trial (the first slow trial) until the seventh trial. Solo/Slow improved on a slower trend, dropping slightly in three trials, but maintaining an overall upward trend. Fast/Slow outperformed Solo/Slow throughout the experiment (see Figure 28). Two focused comparisons were analyzed, and the results will be presented on the following pages.

Figure 28

Fast/Slow Versus Solo/Slow



Mixed Model ANOVA: Fast/Slow vs. Solo/Slow

For the following analyses, identical consecutive trials were averaged (see Table 50). This analysis compares the performance of the two groups in the slow trials to determine if switching from a fast partner to a slow partner (Fast/Slow group) or switching from a solo plus goal session to a slow partner (Solo/Slow) had differential impacts on performance in the slow trials.

Table 50

Fast/Slow Versus Solo/Slow Comparison #1

Fast/Slow	Measures	Solo/Slow	Measures
1: Baseline	1: Baseline	1: Baseline	1: Baseline
2: Fast		2: Solo + Goal	
3: Fast		3: Solo + Goal	
4: Slow	2: Slow 1	4: Slow	2: Slow 1
5: Slow	3: Slow 2	5: Slow	3: Slow 2
6: Baseline		6: Baseline	
7: Fast		7: Solo + Goal	
8: Fast		8: Solo + Goal	
9: Slow	4: Slow 3	9: Slow	4: Slow 3
10: Slow	5: Slow 4	10: Slow	5: Slow 4

A mixed model analysis of variance (ANOVA) with one within-subjects factor and one between-subjects factor was conducted to determine whether significant differences exist among the experimental conditions between the levels of Group. A power analysis for a mixed model ANOVA with 2 groups and 5 measurements was conducted in G-POWER to determine a sufficient sample size using an alpha of 0.05, a power of 0.80, a correlation of .7 among the repeated measurements, and a medium effect size ($f = 0.25$) (Faul et al., 2013). Based on the aforementioned assumptions, the desired

sample size is 14.

Results

The results were examined based on an alpha of 0.05. The main effect for Group was not significant, $F(1, 14) = 0.86$, $p = .370$, indicating the levels of Group were all similar for BL, Slow1, Slow2, Slow3, and Slow4. The *p*-values for the within-subjects factor and the interactions with the within-subjects factor were calculated using the Greenhouse-Geisser correction to adjust for the violation of the sphericity assumption (Greenhouse & Geisser, 1959). The main effect for the within-subjects factor was significant, $F(4, 56) = 17.11$, $p < .001$, indicating there were significant differences between the values of BL, Slow1, Slow2, Slow3, and Slow4. The interaction effect between the within-subjects factor and Group was not significant, $F(4, 56) = 0.23$, $p = .922$, indicating that the relationships between BL, Slow1, Slow2, Slow3, and Slow4 were similar between the levels of Group. Table 51 presents the ANOVA results.

Table 51

Mixed Model ANOVA Results

Source	*df*	*SS*	*MS*	*F*	*p*	η_p^2
Between-Subjects						
Group	1	273.80	273.80	0.86	.370	0.06
Residuals	14	4471.75	319.41			
Within-Subjects						
Within Factor	4	1973.00	493.25	17.11	< .001**	0.55
Group:Within.Factor	4	26.20	6.55	0.23	.922	0.02
Residuals	56	1614.00	28.82			

Note. *$p < .05$. **$p < .001$

Post-hoc. The mean contrasts utilized Tukey comparisons based on an alpha of 0.05.

Between Effects. For Slow/Fast, BL was significantly less than Slow1, $t(14) = -5.32$, $p < .001$, Slow2, $t(14) = -3.62$, $p = .020$, Slow3, $t(14) = -4.35$, $p = .005$, and Slow4, $t(14) = -3.72$, $p = .016$. For Solo/Slow, BL was significantly less than Slow1, $t(14) = -3.52$, $p = .024$, Slow2, $t(14) = -3.26$, $p = .039$, Slow3, $t(14) = -3.94$, $p = .011$, and Slow4, $t(14) = -3.36$, $p = .032$. No other significant differences were found for Group. Table 52 presents the marginal means contrasts for the Mixed Model ANOVA.

Table 52

The Marginal Means Contrasts for each Combination of Within-Subject Variables

Contrast	Difference	*SE*	*df*	*t*	*p*
Group|Fast/Slow					
BL - Slow1	-10.38	1.95	14	-5.32	< .001**
BL - Slow2	-9.88	2.73	14	-3.62	.020*
BL - Slow3	-13.25	3.05	14	-4.35	.005*
BL - Slow4	-15.12	4.06	14	-3.72	.016*
Slow1 - Slow2	0.50	2.23	14	0.22	.999
Slow1 - Slow3	-2.88	2.21	14	-1.30	.694
Slow1 - Slow4	-4.75	2.94	14	-1.61	.512
Slow2 - Slow3	-3.38	2.14	14	-1.58	.534
Slow2 - Slow4	-5.25	2.88	14	-1.82	.400
Slow3 - Slow4	-1.88	1.92	14	-0.98	.860
Group|Solo/Slow					
BL - Slow1	-6.88	1.95	14	-3.52	.024*
BL - Slow2	-8.88	2.73	14	-3.26	.039*
BL - Slow3	-12.00	3.05	14	-3.94	.011*
BL - Slow4	-13.62	4.06	14	-3.36	.032*
Slow1 - Slow2	-2.00	2.23	14	-0.90	.893
Slow1 - Slow3	-5.12	2.21	14	-2.32	.195
Slow1 - Slow4	-6.75	2.94	14	-2.29	.203
Slow2 - Slow3	-3.12	2.14	14	-1.46	.602
Slow2 - Slow4	-4.75	2.88	14	-1.65	.494
Slow3 - Slow4	-1.62	1.92	14	-0.85	.911

Note. Tukey Comparisons were used to test the differences in estimated marginal means.

*$p < .05$. **$p < .001$

This analysis compares the performance of Fast/Slow and Solo/Slow in trials 2, 3, 7, and 8 in which the Fast/Slow group completed fast trials and the Solo/Slow group completed solo plus goal trials to compare cooperative and alone conditions. For this analysis, identical consecutive trials were averaged (see Table 53).

Table 53

Fast/Slow Versus Solo/Slow Comparison #2

Fast/Slow	Measures	Solo/Slow	Measures
1: Baseline	1: Baseline	1: Baseline	1: Baseline
2: Fast	2: Trial 1	2: Solo + Goal	2: Trial 1
3: Fast	3: Trial 2	3: Solo + Goal	3: Trial 2
4: Slow		4: Slow	
5: Slow		5: Slow	
6: Baseline		6: Baseline	
7: Fast	4: Trial 3	7: Solo + Goal	4: Trial 3
8: Fast	5: Trial 4	8: Solo + Goal	5: Trial 4
9: Slow		9: Slow	
10: Slow		10: Slow	

A mixed model analysis of variance (ANOVA) with one within-subjects factor and one between-subjects factor was conducted to determine whether significant differences exist among Baseline, Trial_2, Trial_3, Trial_7, and Trial_8 between the levels of Group. A power analysis for a mixed model ANOVA with 2 groups and 5 measurements was conducted in G-POWER to determine a sufficient sample size using an alpha of 0.05, a power of 0.80, a correlation of .7 among the repeated measurements, and a medium effect size ($f = 0.25$) (Faul et al., 2013). Based on the aforementioned assumptions, the desired sample size is 14.

Results

The results were examined based on an alpha of 0.05. The main effect for Group was not significant, $F(1, 14) = 1.01$, $p = .332$, indicating the levels of Group were all similar for Baseline, Trial_2, Trial_3, Trial_7, and Trial_8. The main effect for the within-subjects factor was significant, $F(4, 56) = 13.19$, $p < .001$, indicating there were significant differences between the values of Baseline, Trial_2, Trial_3, Trial_7, and Trial_8. The interaction effect between the within-subjects factor and Group was not significant, $F(4, 56) = 0.84$, $p = .506$, indicating that the relationships between Baseline, Trial_2, Trial_3, Trial_7, and Trial_8 were similar between the levels of Group. Table 54 presents the ANOVA results.

Table 54

Mixed Model ANOVA Results

Source	*df*	*SS*	*MS*	*F*	*p*	η_p^2
Between-Subjects						
Group	1	382.81	382.81	1.01	.332	0.07
Residuals	14	5300.98	378.64			
Within-Subjects						
Within Factor	4	1446.58	361.64	13.19	< .001**	0.49
Group:Within.Factor	4	92.12	23.03	0.84	.506	0.06
Residuals	56	1534.90	27.41			

Note. *$p < .05$. **$p < .001$

Post-hoc. The mean contrasts utilized Tukey comparisons based on an alpha of 0.05.

Between Effects. For the 1 category of Group, Baseline was significantly less than Trial_3, $t(14) = -5.13$, $p = .001$ and Trial_8, $t(14) = -3.96$, $p = .011$. Trial_2 was significantly less than Trial_3, $t(14) = -4.71$, $p = .003$, and Trial_8, $t(14) = -3.49$, $p =$

.025. No other significant differences were found for Group. Table 55 presents the marginal means contrasts for the Mixed Model ANOVA.

Table 55

The Marginal Means Contrasts for each Combination of Within-Subject Variables for the Mixed Model ANOVA

Contrast	Difference	*SE*	*df*	*t*	*p*
Group|Fast/Slow					
Baseline - Trial_2	-4.75	2.28	14	-2.08	.281
Baseline - Trial_3	-11.12	2.17	14	-5.13	.001*
Baseline - Trial_7	-9.38	3.24	14	-2.89	.075
Baseline - Trial_8	-14.00	3.54	14	-3.96	.011*
Trial_2 - Trial_3	-6.38	1.35	14	-4.71	.003*
Trial_2 - Trial_7	-4.62	2.88	14	-1.61	.516
Trial_2 - Trial_8	-9.25	2.65	14	-3.49	.025*
Trial_3 - Trial_7	1.75	2.57	14	0.68	.957
Trial_3 - Trial_8	-2.88	2.55	14	-1.13	.791
Trial_7 - Trial_8	-4.62	2.32	14	-2.00	.317
Group|Solo/Slow					
Baseline - Trial_2	-3.12	2.28	14	-1.37	.656
Baseline - Trial_3	-6.25	2.17	14	-2.88	.076
Baseline - Trial_7	-9.62	3.24	14	-2.97	.065
Baseline - Trial_8	-9.62	3.54	14	-2.72	.101
Trial_2 - Trial_3	-3.12	1.35	14	-2.31	.198
Trial_2 - Trial_7	-6.50	2.88	14	-2.26	.215
Trial_2 - Trial_8	-6.50	2.65	14	-2.45	.158
Trial_3 - Trial_7	-3.38	2.57	14	-1.32	.687
Trial_3 - Trial_8	-3.38	2.55	14	-1.32	.683
Trial_7 - Trial_8	0.00	2.32	14	0.00	1.000

Note. Tukey Comparisons were used to test the differences in estimated marginal means.

*$p < .05$. **$p < .001$

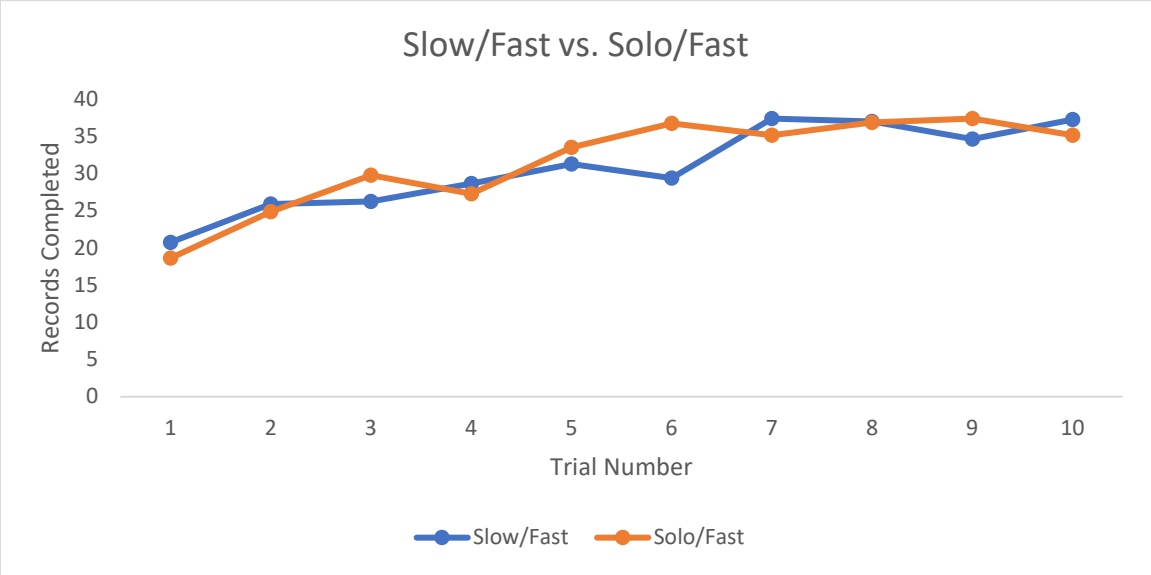
Slow/Fast Versus Solo/Fast

The designs of Slow/Fast versus Solo/Fast allows for a comparison of fast partner

conditions. Slow/Fast started with slow partners, then switched to fast partners. Solo/Fast started with solo plus goal conditions, then switched to fast partners. The two groups had very similar performances, crossing over each other multiple times, starting and ending with very similar performances (see Figure 29).

Figure 29

Slow/Fast Versus Solo/Fast



Mixed Model ANOVA: Slow/Fast vs. Solo/Fast

This analysis compares the performance of the two groups in the fast trials to determine if switching from a slow partner to a fast partner (Slow/Fast group) or switching from a solo plus goal session to a fast partner (Solo/Fast) had differential impacts on performance in the fast trials. For the following analyses, identical consecutive trials were averaged (see Table 56).

Table 56

Slow/Fast Versus Solo/Fast Comparison #1

Fast/Slow	Measures	Solo/Fast	Measures
1: Baseline	1: Baseline	1: Baseline	1: Baseline
2: Slow		2: Solo + Goal	
3: Slow		3: Solo + Goal	
4: Fast	2: Fast 1	4: Fast	2: Fast 1
5: Fast	3: Fast 2	5: Fast	3: Fast 2
6: Baseline		6: Baseline	
7: Slow		7: Solo + Goal	
8: Slow		8: Solo + Goal	
9: Fast	4: Fast 3	9: Fast	4: Fast 3
10: Fast	5: Fast 4	10: Fast	5: Fast 4

A mixed model analysis of variance (ANOVA) with one within-subjects factor and one between-subjects factor was conducted to determine whether significant differences exist among the experimental conditions between the levels of Group. A power analysis for a mixed model ANOVA with 2 groups and 5 measurements was conducted in G-POWER to determine a sufficient sample size using an alpha of 0.05, a power of 0.80, a correlation of .7 among the repeated measurements, and a medium effect size ($f = 0.25$) (Faul et al., 2013). Based on the aforementioned assumptions, the desired sample size is 14.

Results

The results were examined based on an alpha of 0.05. The main effect for Group was not significant, $F(1, 14) = 0.00$, $p = .968$, indicating the levels of Group were all similar for BL, Fast1, Fast2, Fast3, and Fast4. The main effect for the within-subjects factor was significant, $F(4, 56) = 45.83$, $p < .001$, indicating there were significant

differences between the values of BL, Fast1, Fast2, Fast3, and Fast4. The interaction effect between the within-subjects factor and Group was not significant, $F(4, 56) = 1.42$, $p = .240$, indicating that the relationships between BL, Fast1, Fast2, Fast3, and Fast4 were similar between the levels of Group. Table 57 presents the ANOVA results.

Table 57

Mixed Model ANOVA Results

Source	*df*	*SS*	*MS*	*F*	*p*	η_p^2
Between-Subjects						
Group	1	0.31	0.31	0.00	.968	0.00
Residuals	14	2683.78	191.70			
Within-Subjects						
Within Factor	4	3033.12	758.28	45.83	< .001**	0.77
Group:Within.Factor	4	93.88	23.47	1.42	.240	0.09
Residuals	56	926.60	16.55			

Note. *$p < .05$. **$p < .001$

Post-hoc. The mean contrasts utilized Tukey comparisons based on an alpha of 0.05.

Between Effects. For Slow/Fast, BL was significantly less than Fast1, $t(14) = -4.17$, $p = .007$, Fast2, $t(14) = -6.04$, $p < .001$, Fast3, $t(14) = -7.18$, $p < .001$, and Fast4, $t(14) = -6.39$, $p < .001$. Fast1 was significantly less than Fast3, $t(14) = -3.48$, $p = .026$ and Fast4, $t(14) = -3.23$, $p = .041$. For Solo/Fast, BL was significantly less than Fast1, $t(14) = -4.57$, $p = .003$, Fast2, $t(14) = -8.55$, $p < .001$, Fast3, $t(14) = -9.70$, $p < .001$, and Fast4, $t(14) = -6.39$, $p < .001$. Fast1 was significantly less than Fast2, $t(14) = -4.76$, $p = .002$ and Fast3, $t(14) = -5.87$, $p < .001$. Fast2 was significantly less than Fast3, $t(14) = -3.46$, $p = .027$. No other significant differences were found for Group (see Table 58).

Table 58

The Marginal Means Contrasts for each Combination of Within-Subject Variables

Contrast	Difference	*SE*	*df*	*t*	*p*
Group|Slow/Fast					
BL - Fast1	-7.88	1.89	14	-4.17	.007*
BL - Fast2	-10.50	1.74	14	-6.04	< .001**
BL - Fast3	-13.88	1.93	14	-7.18	< .001**
BL - Fast4	-16.50	2.58	14	-6.39	< .001**
Fast1 - Fast2	-2.62	1.31	14	-2.00	.316
Fast1 - Fast3	-6.00	1.72	14	-3.48	.026*
Fast1 - Fast4	-8.62	2.67	14	-3.23	.041*
Fast2 - Fast3	-3.38	1.12	14	-3.01	.060
Fast2 - Fast4	-6.00	2.55	14	-2.35	.185
Fast3 - Fast4	-2.62	2.19	14	-1.20	.752
Group|Solo/Fast					
BL - Fast1	-8.62	1.89	14	-4.57	.003*
BL - Fast2	-14.88	1.74	14	-8.55	< .001**
BL - Fast3	-18.75	1.93	14	-9.70	< .001**
BL - Fast4	-16.50	2.58	14	-6.39	< .001**
Fast1 - Fast2	-6.25	1.31	14	-4.76	.002*
Fast1 - Fast3	-10.12	1.72	14	-5.87	< .001**
Fast1 - Fast4	-7.88	2.67	14	-2.95	.068
Fast2 - Fast3	-3.88	1.12	14	-3.46	.027*
Fast2 - Fast4	-1.62	2.55	14	-0.64	.966
Fast3 - Fast4	2.25	2.19	14	1.03	.839

Note. Tukey Comparisons were used to test the differences in estimated marginal means. *$p < .05$. **$p < .001$

This analysis compares the performance of the Slow/Fast and Solo/Fast groups in trials 2, 3, 7, and 8 in which the Fast/Slow group completed fast trials and the Solo/Slow group completed solo plus goal trials to compare cooperative and alone conditions. For the following analyses, identical consecutive trials were averaged (see Table 59).

Table 59

Slow/Fast Versus Solo/Fast Comparison #2

Fast/Slow	Measures	Solo/Fast	Measures
1: Baseline	1: Baseline	1: Baseline	1: Baseline
2: Slow	2: Trial 1	2: Solo + Goal	2: Trial 1
3: Slow	3: Trial 2	3: Solo + Goal	3: Trial 2
4: Fast		4: Fast	
5: Fast		5: Fast	
6: Baseline		6: Baseline	
7: Slow	4: Trial 3	7: Solo + Goal	4: Trial 3
8: Slow	5: Trial 4	8: Solo + Goal	5: Trial 4
9: Fast		9: Fast	
10: Fast		10: Fast	

A mixed model analysis of variance (ANOVA) with one within-subjects factor and one between-subjects factor was conducted to determine whether significant differences exist among Baseline, Trial_2, Trial_3, Trial_7, and Trial_8 between the levels of Group. A power analysis for a mixed model ANOVA with 2 groups and 5 measurements was conducted in G-POWER to determine a sufficient sample size using an alpha of 0.05, a power of 0.80, a correlation of .7 among the repeated measurements, and a medium effect size ($f = 0.25$) (Faul et al., 2013). Based on the aforementioned assumptions, the desired sample size is 14.

Results

The results were examined based on an alpha of 0.05. The main effect for Group was not significant, $F(1, 14) = 0.02$, $p = .902$, indicating the levels of Group were all similar for Baseline, Trial_2, Trial_3, Trial_7, and Trial_8. The main effect for the within-subjects factor was significant, $F(4, 56) = 46.95$, $p < .001$, indicating there were

significant differences between the values of Baseline, Trial_2, Trial_3, Trial_7, and Trial_8. The interaction effect between the within-subjects factor and Group was not significant, $F(4, 56) = 1.20$, $p = .322$, indicating that the relationships between Baseline, Trial_2, Trial_3, Trial_7, and Trial_8 were similar between the levels of Group. Table 60 presents the ANOVA results.

Table 60

Mixed Model ANOVA Results

Source	*df*	*SS*	*MS*	*F*	*p*	η_p^2
Between-Subjects						
Group	1	3.20	3.20	0.02	.902	0.00
Residuals	14	2842.60	203.04			
Within-Subjects						
Within Factor	4	3457.88	864.47	46.95	< .001**	0.77
Group:Within.Factor	4	88.17	22.04	1.20	.322	0.08
Residuals	56	1031.15	18.41			

Note. *$p < .05$. **$p < .001$

Post-hoc. The mean contrasts utilized Tukey comparisons based on an alpha of 0.05. Tukey comparisons were used to test the differences in the estimated marginal means for each combination of between-subject and within-subject effects.

Between Effects. For the Slow/Fast category of Group, Baseline was significantly less than Trial_7, $t(14) = -7.24$, $p < .001$ and Trial_8, $t(14) = -7.18$, $p < .001$. Trial_2 was significantly less than Trial_7, $t(14) = -4.52$, $p = .004$, and Trial_8, $t(14) = -4.40$, $p = .005$. Trial_3 was significantly less than Trial_7, $t(14) = -4.88$, $p = .002$, and Trial_8, $t(14) = -4.52$, $p = .004$. For the Solo/Fast category of Group, Baseline was significantly less than Trial_2, $t(14) = -3.54$, $p = .023$, Baseline was significantly less than Trial_3,

$t(14) = -6.21$, $p < .001$, Baseline was significantly less than Trial_7, $t(14) = -7.19$, $p < .001$, Baseline was significantly less than Trial_8, $t(14) = -8.07$, $p < .001$, Trial_2 was significantly less than Trial_7, $t(14) = -4.03$, $p = .009$, and Trial_2 was significantly less than Trial_8, $t(14) = -4.75$, $p = .002$. No other significant differences were found for Group. Table 61 presents the marginal means contrasts for the Mixed Model ANOVA.

Table 61

The Marginal Means Contrasts for each Combination of Within-Subject Variables for the Mixed Model ANOVA

Contrast	Difference	*SE*	*df*	*t*	*p*
Group|Slow/Fast					
Baseline - Trial_2	-5.12	1.76	14	-2.91	.073
Baseline - Trial_3	-5.50	1.79	14	-3.07	.054
Baseline - Trial_7	-16.62	2.29	14	-7.24	< .001
Baseline - Trial_8	-16.25	2.26	14	-7.18	< .001
Trial_2 - Trial_3	-0.38	2.02	14	-0.19	1.000
Trial_2 - Trial_7	-11.50	2.55	14	-4.52	.004
Trial_2 - Trial_8	-11.12	2.53	14	-4.40	.005
Trial_3 - Trial_7	-11.12	2.28	14	-4.88	.002
Trial_3 - Trial_8	-10.75	2.38	14	-4.52	.004
Trial_7 - Trial_8	0.38	1.24	14	0.30	.998
Group|Solo/Fast					
Baseline - Trial_2	-6.25	1.76	14	-3.54	.023
Baseline - Trial_3	-11.12	1.79	14	-6.21	< .001
Baseline - Trial_7	-16.50	2.29	14	-7.19	< .001
Baseline - Trial_8	-18.25	2.26	14	-8.07	< .001
Trial_2 - Trial_3	-4.88	2.02	14	-2.41	.168
Trial_2 - Trial_7	-10.25	2.55	14	-4.03	.009
Trial_2 - Trial_8	-12.00	2.53	14	-4.75	.002
Trial_3 - Trial_7	-5.38	2.28	14	-2.36	.185
Trial_3 - Trial_8	-7.12	2.38	14	-2.99	.062
Trial_7 - Trial_8	-1.75	1.24	14	-1.41	.629

Note. Tukey Comparisons were used to test the differences in estimated marginal means.

Group Comparisons

Two-tailed paired samples *t*-tests were conducted to examine whether the mean differences between the group averages was significantly different from zero.

Results

The results of the two-tailed paired samples *t*-tests are shown in Table 62. Significant results indicate that the difference between the means of the pair is significantly different from zero. The group average for Fast/Slow was significantly higher than all of the other groups and the group average for Solo/Solo was significantly lower than all of the other groups. There were no other significant differences.

Table 62

Results of the Two-Tailed Paired Samples t-Tests

Measure 1			Measure 2						
Group	Mean	SD	Group	Mean	SD	t	df	p	Cohen's d
Fast/Slow	34.563	4.496	Slow/Fast	30.837	5.684	3.530	9	0.006*	1.116
Fast/Slow	34.563	4.496	Solo/Slow	30.413	4.041	7.462	9	< .001**	2.360
Fast/Slow	34.563	4.496	Solo/Fast	31.525	6.254	2.911	9	0.017*	0.921
Fast/Slow	34.563	4.496	Solo/Solo	28.688	4.666	9.652	9	< .001**	3.052
Slow/Fast	30.837	5.684	Solo/Slow	30.413	4.041	0.497	9	0.631	0.157
Slow/Fast	30.837	5.684	Solo/Fast	31.525	6.254	-0.682	9	0.513	-0.216
Slow/Fast	30.837	5.684	Solo/Solo	28.688	4.666	2.470	9	0.036*	0.781
Solo/Slow	30.413	4.041	Solo/Fast	31.525	6.254	-1.178	9	0.269	-0.372
Solo/Slow	30.413	4.041	Solo/Solo	28.688	4.666	2.883	9	0.018*	0.912
Solo/Fast	31.525	6.254	Solo/Solo	28.688	4.666	3.408	9	0.008*	1.078

Note. Student's t-test, *p < .05, **p < .001

Performance Ratings

Pre-Experiment Rating

At the start of the experiment, all participants were asked, "When working in a group, is it more important to contribute your share, or to ensure the group meets their overall goal?" Participants were presented with a sliding scale to indicate their preference, with a zero indicating equal importance between the two, a negative five indicating extreme preference for individual contribution, and a positive five indicating extreme preference for overall group goals. The results may be found in Table 63. Notably, the majority of ratings are zero or higher (only four participants leaned towards individual goals), indicating higher overall emphasis on group goals, rather than individual goals, with nine participants neutral.

Table 63

Participant Preference for Individual or Group Work

Group	Participant							
	1	2	3	4	5	6	7	8
Fast/Slow	3	2	0	5	-3	5	3	4
Slow/Fast	3	4	5	5	4	3	3	3
Solo/Slow	0	2	5	5	-4	5	2	0
Solo/Fast	1	5	-2	0	0	2	-1	0
Solo/Solo	2	0	3	2	0	0	3	3

Pre- and Post-Trial Ratings: Effort and Ability

Prior to each cooperative trial, participants were asked to rate how much effort they expected to personally exert. Ratings were made on a scale of one to five, with one

being low effort, and five being high effort. As seen in Figure 30, the average across all participants and all groups was close to five (maximum effort). The one outlier appears to be Fast/Slow, in which participants indicated lower levels of expected effort throughout the trials, although the ratings barely dropped below four.

Following every trial, participants rated the amount of effort they exerted on the prior trial on a scale of one to five, with one being low effort, and five being high effort. As seen in Figure 31, ratings were high across all participants and trials. Visual inspection indicates that Fast/Slow and Solo/Solo rated themselves as exerting less effort across most trials when compared to the other groups.

Figure 30

Pre-Trial Effort Rating: Self

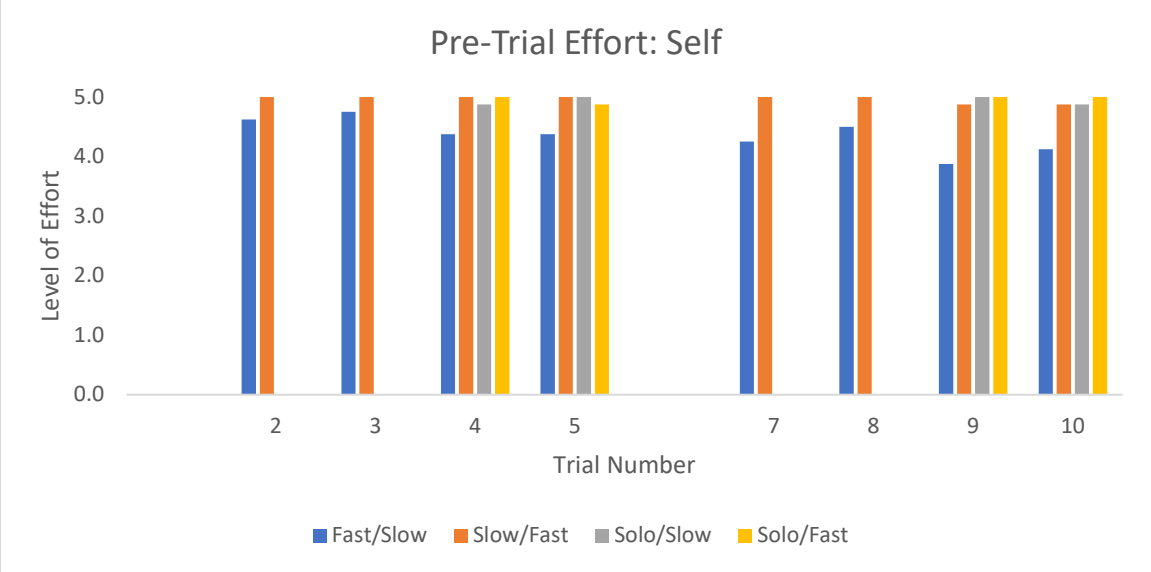
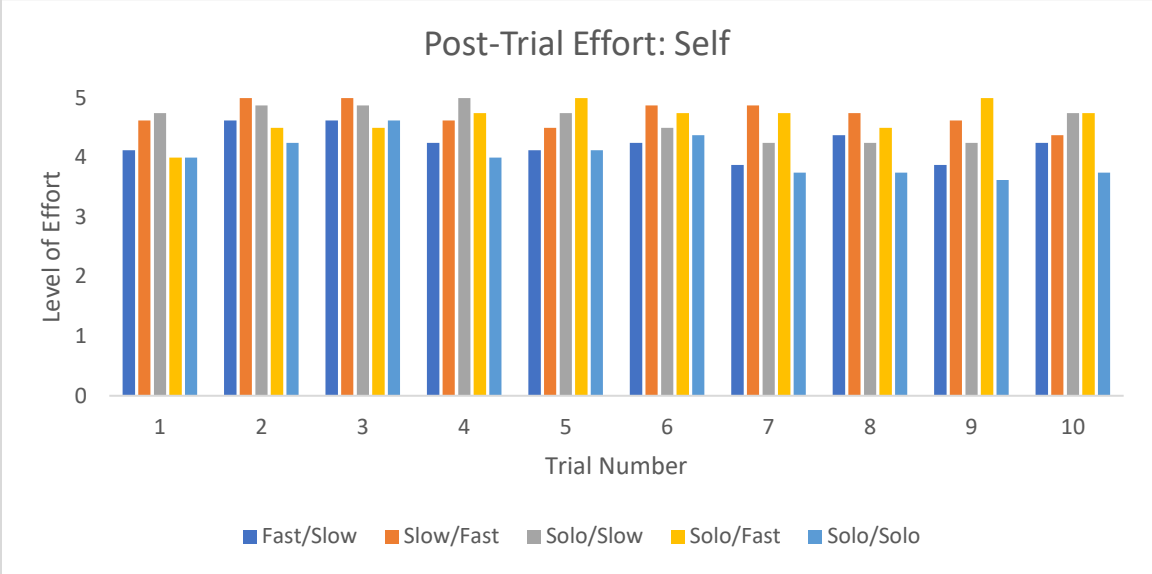


Figure 31

Post-Trial Effort: Self



Prior to each cooperative trial, participants rated how much effort they expected their partner to exert on a scale of one to five, with one being low effort, and five being high effort. As seen in Figure 32, the average across all participants and all groups was between four and five (high effort). Partner expected effort appears to be slightly lower for Fast/Slow, although the ratings only dropped down to a rating of four.

Following every cooperative trial, participants rated the amount of effort they believed their partner exerted on the prior trial on a scale of one to five, with one being low effort, and five being high effort. As seen in Figure 33, ratings were variable between groups and trials, with the lowest overall ratings found for Fast/Slow, and the next lowest ratings for Solo/Slow, with Slow/Fast and Solo/Fast at ratings at or close to five for all trials.

Figure 32

Pre-Trial Effort: Partner

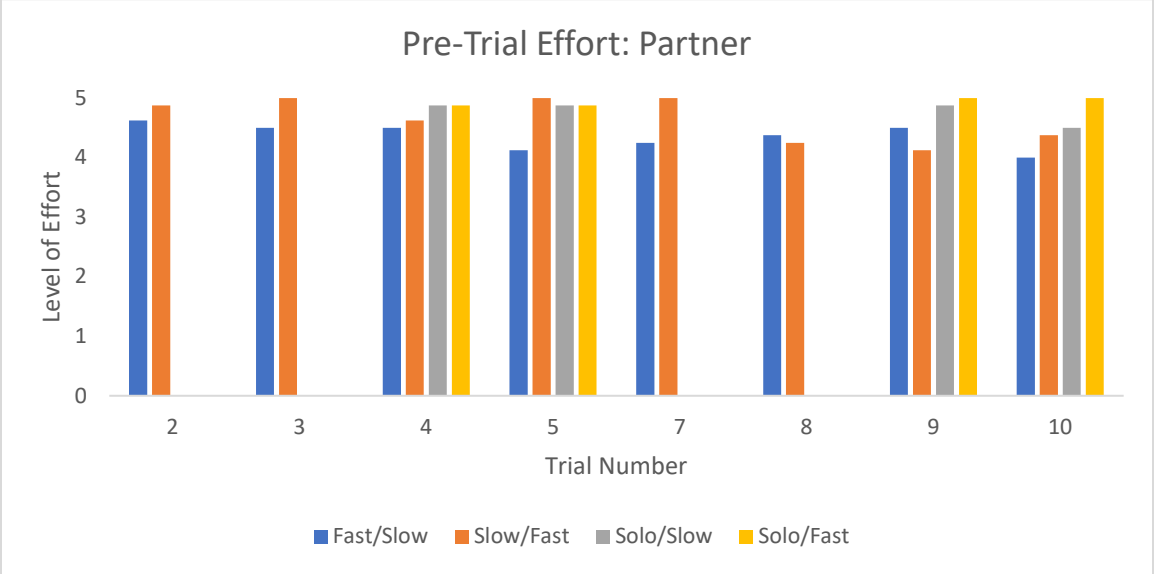


Figure 33

Post-Trial Effort: Partner

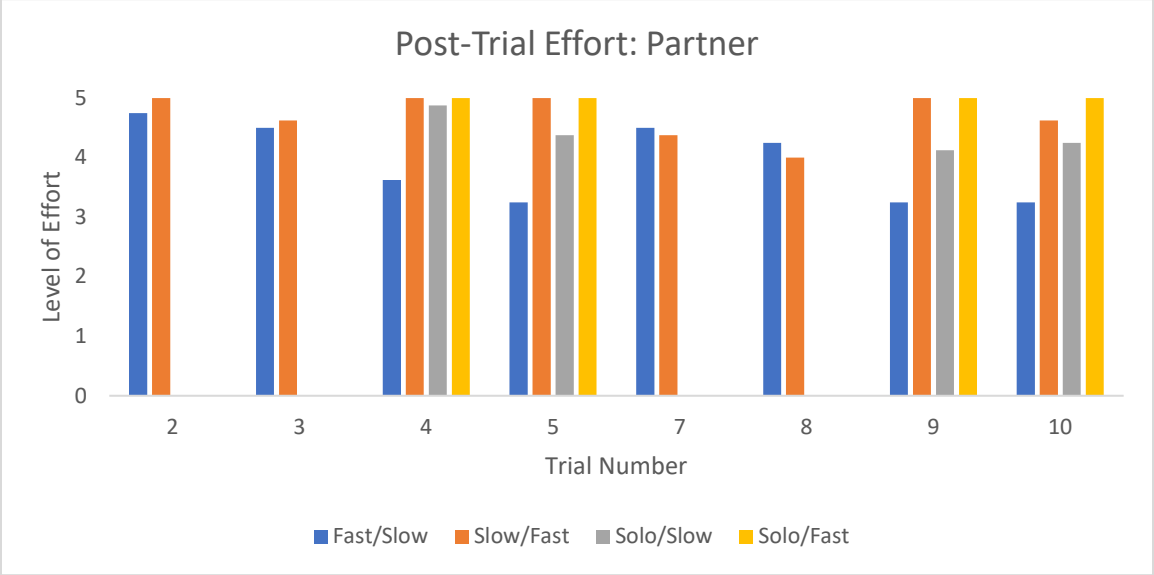


Table 64 shows a summation of the differences between pre- and post-trial effort ratings on all cooperative trials; Table 65 shows participant drops in effort from the pre-

trial to post-trial ratings broken down by fast and slow conditions. For example, Fast/Slow's post-trial effort self-ratings were seven points lower than their pre-trial effort ratings. This indicates that the participants ended up exerting less effort that they predicted they would at the beginning of the trial. Slow/Fast showed the most significant drop from predicted effort to actual effort at 16; three of those dropped points were during slow trials, and 13 were during fast trials. The difference of seven for Fast/Slow was also mainly from fast trials (five of seven points). Solo/Slow was only paired with slow partners, so their eight dropped points were all in cooperative slow conditions. Fast/Slow and Solo/Slow both indicated worse effort than expected from their partners, and Slow/Fast and Solo/Fast both indicated better effort than expected from their partners

Table 64

Pre-Trial vs. Post-Trial Effort Rating by Participant and Partner

	Fast/Slow	Slow/Fast	Solo/Slow	Solo/Fast
Self	-7	-16	-8	-3
Partner	-28	3	-12	2

Table 65

Pre-Trial vs. Post-Trial Effort Rating by Fast and Slow

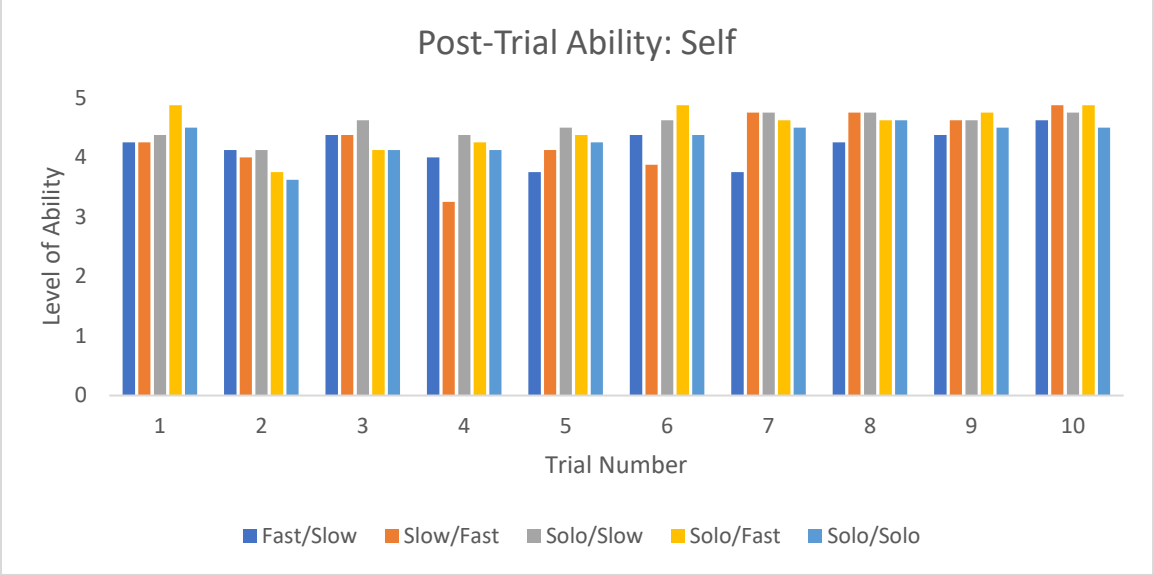
Participant	Fast/Slow	Slow/Fast	Solo/Slow	Solo/Fast
Fast	-5	-13	n/a	-3
Slow	-2	-3	-8	n/a

Following every trial, whether individual or cooperative, participants rated their ability on the prior trial on a scale of one to five, with one being low ability, and five being high ability. As seen in Figure 34, ratings hovered mostly between four and five

(high ability), with an increasing trend ending at ratings ranging from 4.5 - 4.9 for the five groups by the tenth trial. Indeed, ability ratings only dropped below an average score of four in six out of 50 trials. Visual inspection indicates several identifiable differences between groups, for example, Fast/Slow drops below a rating of four in trials five and seven, Slow/Fast is rated below four for trials four and six, and Solo/Fast and Solo/Solo fell below a rating of four on Trials 2 and 3. However, there is no clear pattern connecting these low performances; they present in fast and slow trials, partner and solo plus goal trials, and one even occurs in a return to baseline trial.

Figure 34

Post-Trial Ability: Self

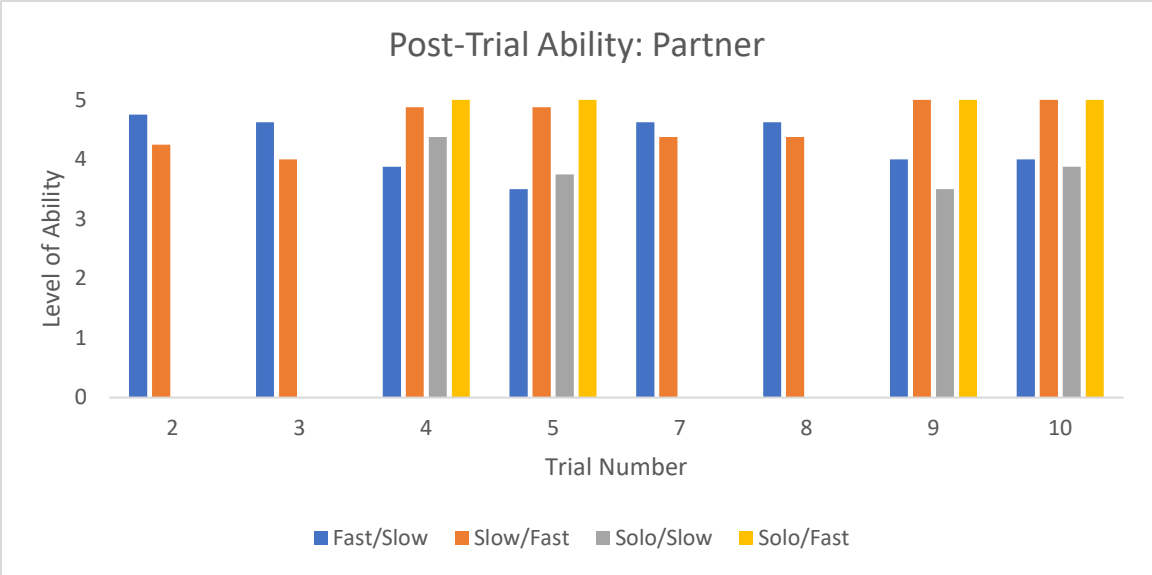


Following every cooperative trial, participants rated their partner's ability on the prior trial on a scale of one to five, with one being low ability, and five being high ability. As seen in Figure 35, ratings were variable between groups and trials, with the lowest overall ratings found for Fast/Slow and Solo/Slow, with Slow/Fast and Solo/Fast 4 at

ratings at or close to five for all trials. This is consistent with programmed partner performance, with the fast partner trials showing higher partner ability ratings and the slow partner trials showing lower ability ratings.

Figure 35

Post-Trial Ability: Partner



Post-Trial Ratings: Stress, Control, Demand

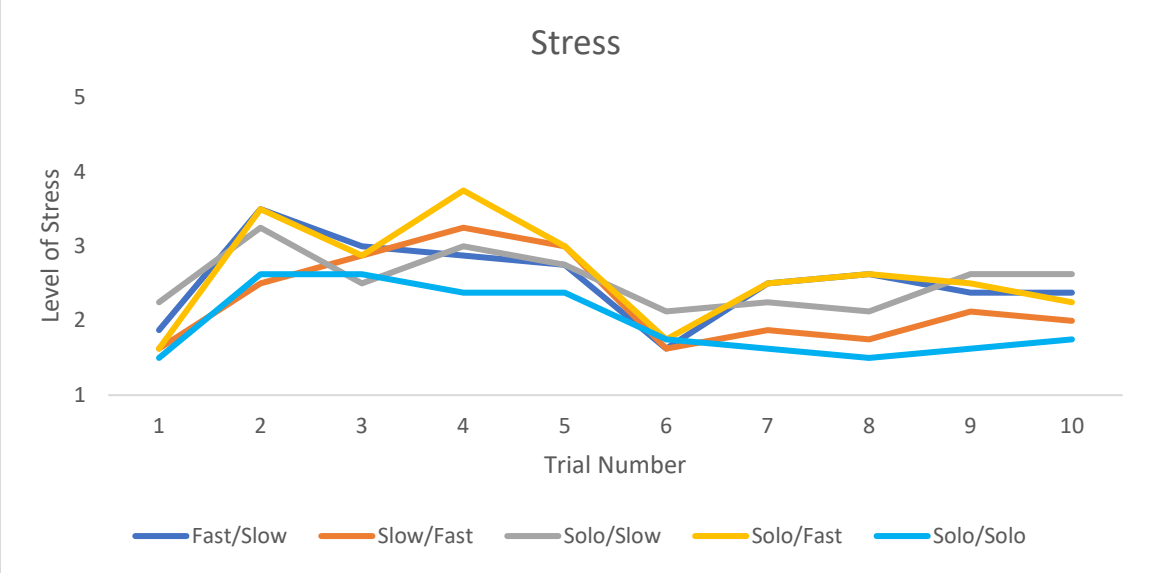
Following every trial, whether individual or cooperative, participants rated the amount of stress they experienced as a result of the trial. The levels of stress as seen in Figure 36 are as follows:

1. Not stressful at all
2. Somewhat stressful
3. Stressful
4. Very stressful
5. Extremely stressful

Ratings were similar between the five groups, peaking under a rating of four (very stressful), and exhibiting a general downward trend across trials. Notably, it appears that Solo/Solo experienced the lowest amount of stress; Solo/Solo was the control group, working alone throughout the entire experiment.

Figure 36

Stress Ratings



Following every trial, whether individual or cooperative, participants rated the amount of control they felt over successful meeting their goal. The levels of stress as seen in Figure 37 are as follows:

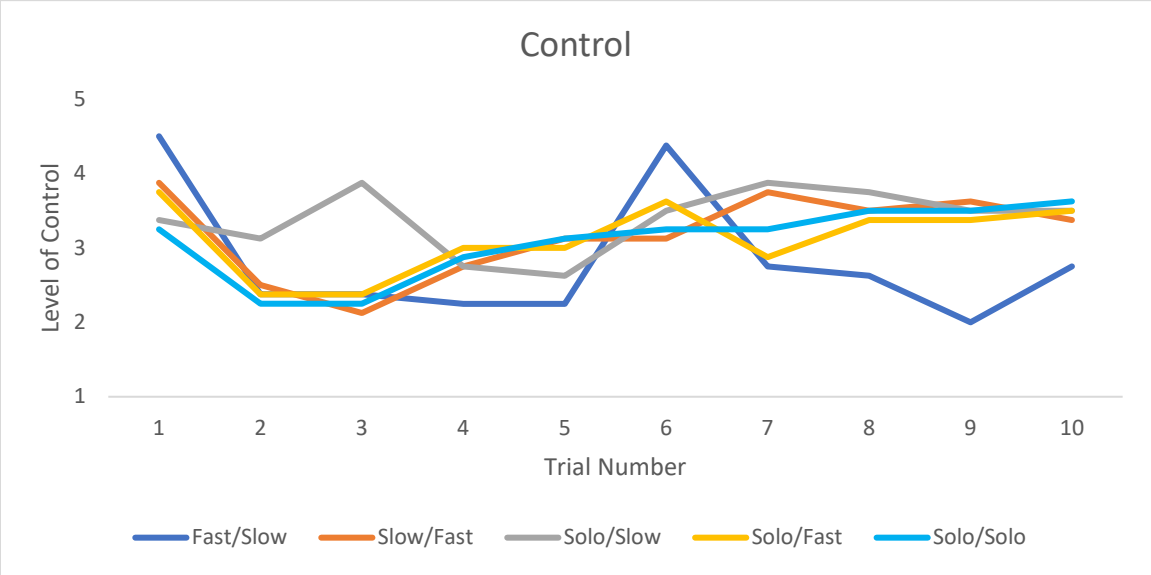
1. No control at all
2. Some control
3. Enough control
4. More than enough control
5. Extreme control

Ratings were similar between the five groups, starting off at fairly high levels of

control, decreasing over the first few experimental conditions, and increasing in the sixth trial in which all participants experienced a return to baseline (no partner, no goal). Notably, Solo/Slow experienced a spike in control in Trials 2 and 3 while the rest of the groups decreased. Additionally, Fast/Slow experienced a spike in control during Trial 6 (return to baseline), but decreased below the rest of the groups in the remaining trials.

Figure 37

Control Ratings



Following every trial, whether individual or cooperative, participants rated the amount of demand they experienced while completing the previous trial. The levels of stress as seen in Figure 38 are as follows:

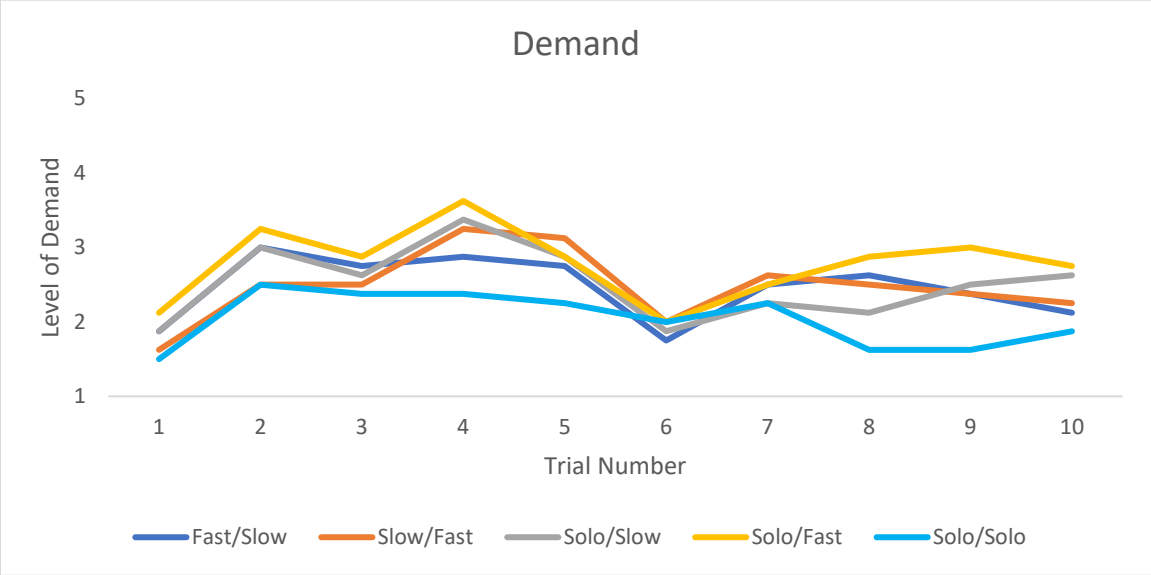
1. Not demanding at all
2. Somewhat demanding
3. Demanding
4. Very demanding

5. Extremely demanding

Ratings were similar between the five groups, starting off at fairly low levels of demand, increasing over the first few experimental conditions, and decreasing in the sixth trial in which all participants experienced a return to baseline (no partner, no goal). Notably, it appears that Solo/Solo experienced the lowest amount of demand; Solo/Solo was the control group, working alone throughout the entire experiment.

Figure 38

Demand Ratings



Post-Experiment Ratings

In addition to the post-trial ratings above, at the end of the experiment, there were several post-experiment ratings to complete. First, all participants except those in Solo/Solo were asked "What did you think about your partner" to assess for the believability of the computer simulation. There was one comment that indicated that the deception was not effective: "I think similar to me my partner improved throughout the

experiment as they became more accustomed to the procedure and got used to the ranges for HR. Thought it was a simulation" (note: HR stands for heart rate, one of the measures in the experiment). Otherwise, there were many simple responses (e.g., "Pretty good," "hard worker," "Great effort"), some responses focused on effort (e.g., "I thought they did great, just didn't exert enough effort as I knew they could in the later trials" from the Fast/Slow group), and some focused on the cooperative nature of the task (e.g., "I think my partner tried his best, and he did really well toward accomplishing his goal considering how much the data changed after each entry. I didn't mind picking up the few extra entries in order to accomplish the group objective" from the Solo/Slow group). See Appendix B for all participant answers.

All participants except those in the Solo/Solo group were asked, "Would you prefer to work alone or with your partner on the next trial?" The results may be found in Table 66. Of the 32 participants, 22 indicated a preference to work alone in the next trial. Seven out of eight participants in Fast/Slow and Solo/Slow indicated a preference to work alone. Five of eight participants in Slow/Fast indicated a preference to work alone, and three of eight participants in Solo/Fast indicated a preference to work alone.

Table 66

Participant Preference

Group	Participant							
	1	2	3	4	5	6	7	8
Fast/Slow	Partner	Alone	Alone	Alone	Alone	Alone	Alone	Alone
Slow/Fast	Alone	Partner	Alone	Alone	Partner	Partner	Alone	Alone
Solo/Slow	Alone	Alone	Alone	Alone	Alone	Alone	Partner	Alone
Solo/Fast	Alone	Partner	Alone	Partner	Alone	Partner	Partner	Partner

Note. Preference for "Alone" is highlighted to aid in discrimination

A Chi-square Test of Independence was conducted to examine whether Group and preference for working alone or working with a partner were independent. There were 5 levels in Group. There were 2 levels in Next_Trial: 1 and 2. A value of 1 in Next_Trial indicates preference for working alone, and a value of 2 in Next_Trial indicates preference for working with a partner.

Results

The results of the Chi-square test were not significant based on an alpha value of 0.05, $\chi^2(3) = 6.40$, $p = .094$, suggesting that Group and Next_Trial could be independent of one another. This implies that the observed frequencies were not significantly different than the expected frequencies. Table 67presents the results of the Chi-square test.

Table 67

Observed and Expected Frequencies

	Next_Trial				
Group	1	2	χ^2	*df*	*p*
1	7[5.50]	1[2.50]	6.40	3	.094
2	5[5.50]	3[2.50]			
3	7[5.50]	1[2.50]			
4	3[5.50]	5[2.50]			

Note. Values formatted as Observed[Expected].

At the end of the experiment, all participants were asked to indicate their cumulative grade point average (GPA) while in college or university. The results may be found in Table 68.

Table 68

Participant GPA

Group	Participant							
	1	2	3	4	5	6	7	8
Fast/Slow	3.3	3.8	3.9	3.4		4	4	3.9
Slow/Fast	2.9		3.5	3.9	3.8	3	3.9	3
Solo/Slow	3	3.7	4	3.8	3.8	3	3	4
Solo/Fast	4	3	3	3	4	3.2	4	3.2
Solo/Solo	3.5	3	3.9	3	4	3.5	3.7	3

To analyze the relationship between GPA and performance, a Pearson correlation analysis was conducted between GPA and three components of participants performance: average performance, the trial with the maximum performance, and the increase between baseline performance and the trial with the maximum performance. Cohen's standard was used to evaluate the strength of the relationship, where coefficients between .10 and .29 represent a small effect size, coefficients between .30 and .49 represent a moderate effect size, and coefficients above .50 indicate a large effect size (Cohen, 1988).

Results

The result of the correlation was examined based on an alpha value of 0.05. There were no significant correlations between any pairs of variables. Table 69 presents the results of the correlation.

Table 69

Pearson Correlation Results Between GPA and Increase_from_BL

Combination	r_p	95% CI	p
GPA-Average	0.32	[-0.00, 0.58]	.053
GPA-Max	0.26	[-0.06, 0.54]	.110
GPA-Increase_from_BL	0.06	[-0.26, 0.38]	.706

Note. $n = 38$.

Study 3 Discussion

Study 3 was designed to assess the impact of inconsistent coworker performance on individual performance and social loafing on an online data entry task. Specifically, Study 3 assessed the impact of coworkers that established a high level of productivity, then started performing poorly, and coworkers that established a low level of productivity, then improved their performance, and control conditions to account for each combination. Study 3 is more closely aligned to real-world work environments in which workers are likely to categorize coworkers as high and low performers, and to notice aberrations in performance. Based on previous research, including Study 1, one may hypothesize that participants will be more likely to engage in social loafing when paired with partners who appear to have the ability to perform at high levels of productivity, but who fail to do so, and may take a free ride when formerly slow coworkers speed up.

Of the forty participants in five groups, not one participant improved across all ten trials. This is inconsistent with Study 1 and 2 in which ten of 21 participants and eight of 32 participants, respectively, improved across all trials. Additionally, rates of improvement across trials was relatively low when compared to previous research (Roose & Williams, 2017) and Study 1 and Study 2. This increased evidence of social loafing may be related to the switch from five 10-minute conditions (as used in Study 1 and Study 2) to ten five-minute conditions. While the amount of work is the same (50 minutes), engaging in twice as many sessions may result in a perception of more work, and therefore more fatigue or social loafing. Future research may further explore this phenomenon, for example, comparing shorter and longer sessions, and having participants rate levels of fatigue and effort.

In the group comparisons, the increases across trials were similar, with comparable average scores starting in the baseline trial throughout the final trial. Increases from the previous trial were slightly higher in trials completed alone when compared to trials completed cooperatively. Although the difference is relatively small, this result is consistent with social loafing theory, as participants appeared to exert more effort on trials in which they worked alone. Participants showed the highest overall increase in scores from baseline to the final trial in Slow/Fast and Solo/Fast. This may be explained by participants matching their effort to their partner's apparent effort in Slow/Fast, which was also aligned with what would be expected from practice effects (e.g., improvements in performance across trials).

A comparison of Fast/Slow and Slow/Fast is consistent with the comparisons made in Study 1 and Study 2, as Fast/Slow and Slow/Fast both experience fast and slow coworkers. A mixed model ANOVA comparing Fast/Slow and Slow/Fast was consistent with mixed model ANOVAs completed in Study 1 and Study 2, with significant interaction effects between the within-subjects factor and group level, indicating that the order in which participants experience fast and slow conditions was significant.

To further explore this result, comparisons between Fast/Slow and Solo/Slow and Slow/Fast and Solo/Fast were designed. Of interest in Study 3 is the interplay of perceived effort and ability. When participants are paired with a partner who performs well at first, then poorly, participants may perceive that their partner has sufficient ability to meet the goal, but fails to exert sufficient effort. Alternatively, when participants are paired with a partner who performs poorly at first, then improves, participants may perceive that their partners are improving in ability, effort, or both. The question then

becomes whether participants are likely to engage in social loafing based on the behavioral patterns of their partner and their perceptions of their partners' ability and effort. Statistical analyses comparing Fast/Slow and Solo/Slow and Slow/Fast and Solo/Fast found no significant difference based on group assignment, suggesting that the change in partner speed from fast to slow or slow to fast did not significantly impact participant performance.

Additionally, focused analyses were completed on cooperative versus alone conditions, specifically when comparing Fast/Slow and Solo/Slow and Slow/Fast and Solo/Fast. Mixed model ANOVAs indicated no significant differences between the alone and cooperative conditions of the two groups. Again, this is contrary to social loafing research, which would predict better performance in the alone conditions when compared to the cooperative conditions.

In paired samples t-tests comparing the average performances of each group the Solo/Solo group performed significantly worse than the rest of the groups and the Fast/Slow group performed significantly better than the rest of the groups. The poor performance of the Solo/Solo group is inconsistent with social loafing research which would predict poorer performance in cooperative conditions when compared to alone conditions. Additionally, the superior performance of the Fast/Slow group is of interest one would expect this to be an aversive condition in that participants are paired with partners who work fast for two trials, then they slow down for two trials. Previous research would predict that participants would be unwilling to pick up the slack for coworkers who appear to have the ability to perform, but fail to exert the necessary effort to perform. However, upon analyses of trial-by-trial results, participants performed well

during fast trials, then poorly during the slow trials.

To account for the assumptions about perceived and expected effort in Study 1 and Study 2, Study 3 included a variety of additional pre-trial, post-trial, and post-experiment feedback. In the pre-trial feedback, Slow/Fast, Solo/Slow, and Solo/Fast indicated ratings at or just below five on every trial for the question "How much effort will you exert on the next trial?" Fast/Slow overall indicated the lowest levels of predicted effort for their own performance (although barely dropping below a four on a scale of one to five). Moving from fast partners to slow partners is likely to be the most aversive as partners appear to have the ability to perform well, but fail to exert the effort. The lowest effort for the Fast/Slow group was measured in the last two trials, possibly indicating social loafing following so many trials of inconsistent partner performance. On the other hand, the Slow/Fast group also experienced inconsistent partner performance, and the average ratings for pre-trial effort was a five on every trial, except for Trials 9 and 10 which had an average rating of 4.9. In fact, Fast/Slow was the only group to record average effort ratings of less than 4.9, indicating that the conditions experienced by Fast/Slow had a significantly negative impact on the effort participants reported being prepared to exert on the task.

When comparing pre-trial effort ratings and post-trial effort ratings, all groups dropped from their predicted effort to their actual effort, essentially an admission of social loafing. The majority of this discrepancy was in fast trials. It is possible that in these fast trials, upon witnessing the ability of their partner to contribute more than half of the team goal, participants engaged in social loafing, taking a free ride. Slow/Fast had the highest drop between predicted and actual effort for the self-ratings, twice as many

points lost as the rest of the groups. The majority of the drop was in fast trials, indicating social loafing in the form of taking a free ride on the efforts of their fast partner. The Fast/Slow group had a smaller discrepancy between predicted and actual effort, and the majority of their drop was also in fast trials, also indicating taking a free ride. The Solo/Slow group showed a similar discrepancy between predicted and actual effort compared to the Fast/Slow group. The Solo/Slow group only worked with slow partners; the drop from predicted to actual effort for the Solo/Slow group may be interpreted as social loafing due to either matching of effort with their slow partners, or based on a perception that no matter what amount of effort they exerted, their partner's level of performance would not be sufficient to meet the goal.

The Fast/Slow group showed the largest discrepancy between predicted partner effort and actual partner effort in that post-trial ratings of partner effort were lower than pre-trial ratings of predicted partner effort. This is in line with the conditions in Fast/Slow, with partners that start fast, and switch to slow, indicating that participants attended to their partner's drop in speed. Solo/Slow only had slow partners, and the actual effort ratings were overall lower than predicted effort ratings. Slow/Fast had partners that started slow and ended fast, consistent with the slightly higher actual effort than predicted effort, and Solo/Fast only had fast partners, consistent with slightly higher actual effort than predicted effort. The increase from predicted to actual may be low for Slow/Fast and Solo/Fast because most participants rated predicted efforts high (mostly 5) on most trials. It is possible that the number of trials was not sufficient to build a predictable pattern of responding for participants to perceive.

The stress, demand, and control reported by participants did not vary significantly

between groups. Stress and demand were the lowest for Solo/Solo (the control group), however not by a substantial margin. Other than the control group, stress and demand ratings were generally similar across all trials for all participants. Ratings for level of control were generally similar as well, with one peak of higher than average levels of control on trials 2 and 3 for Solo/Slow. This corresponds to two solo plus goal conditions with a goal of 24, the lowest goal given to any group in any trial. The other notable result in the control ratings is Fast/Slow in which the ratings deviate from the rest of the groups. Fast/Slow control ratings are lower than the pack in trials 4 and 5 in which their fast partner has switched to slow performance, their control peaks at trial six when they return to baseline after two trials with a slow partner, and another drop occurs in trials 8 through ten when they are again paired with a fast partner that switches to slow. This outcome is consistent with the results of Study 1 in which participant performance was significantly worse in the Fast/Slow condition.

In the post-experiment feedback, participants were asked if they would like to work alone or with a partner in the next trial. Most participants (69%) indicated a preference to work alone. All but one participant in each the Fast/Slow and Solo/Slow groups indicated this preference, suggesting that working with partners who exhibit a decrement in performance, or only working with slow partners are similarly undesirable working conditions for cooperative tasks. In the Slow/Fast group, five of eight participants preferred to work alone, indicating that the improvement in performance by their partner was not sufficient to exhibit preference to continue working with that partner. In the Solo/Fast group, five of eight indicated a preference to work with a partner in the next trial, which is the highest preference for partner work among all groups. As

the Solo/Fast group was the only group to only be paired with fast partners, this is evidence that cooperative work with fast partners is most preferred. These preferences appear consistent with the conditions experienced by each group.

It is also important to point out the discrepancies between the pre-experiment ratings on the importance of individual contribution versus group achievement, and the post-experiment preference for working alone or with a partner. While the majority of participants indicated higher importance of group outcomes when compared to individual contribution within the group goal in the pre-experiment rating, the majority of participants indicated a preference to work alone in the post-experiment rating. While these outcomes may appear contradictory, there may be an explanation for the discrepancy. For example, a participant may highly value cooperative work, while still preferring individual work. Alternatively, the preference for working alone provided in the post-experiment feedback may have been a direct result of the experimental conditions, and being paired with inconsistently performing partners may have resulted in the overall preference to work alone in subsequent trials. While participants may enter an experiment or workers may enter a new job with a particular preference for individual or group work, their preference may change based on their actual experience working alone or with coworkers.

An analysis was completed comparing GPA to average performance across all trials, the maximum performance on any trial (the most records completed in any trial), and the increase from baseline to the maximum performance on any trial. While the comparison of GPA to average performance was near the $p = .05$ significance standard, none of the relationships were statistically significant, suggesting that academic

performance was not a significant predictor of performance in these studies.

General Discussion

Social loafing has been studied in a variety of fields since the early 1900s when Ringelmann (1913) observed a negative relationship between group size and effort per participant in physical tasks. Since then, researchers have examined social loafing with a variety of tasks, settings, and participants, finding that social loafing is pervasive, resulting in substantial decreases in productivity. This is problematic due to the fact that group work is unavoidable in many areas of our lives. The empirical and theoretical research base for social loafing in other fields is robust, however, a behavior analytic approach to social loafing research may uncover valuable information regarding variables that mediate or moderate social loafing.

The three studies described in this manuscript represent the first known social loafing studies to use computer simulated partners to vary partner productivity within participant to study the impact of coworker performance on participant social loafing. Study 1 analyzed these variables in the context of cooperative and competitive contingencies; Study 2 used groups of two and four in cooperative trials; Study 3 examined inconsistent coworker performance in cooperative trials. The results of these studies provide a foundation for continued research on social loafing and productivity in group settings, and the contingencies that support optimal performance.

Study 1 found competitive trials produced better performance than cooperative trials, which is inconsistent with previous research (e.g., Johnson et al., 1981). The impact of fast and slow partners depended on the order in which participants experienced each condition. The Slow/Fast participants were highly productive, improving

performance and hitting goals in most trials. The Fast/Slow participants improved in less trials and hit less goals, possibly exhibiting social loafing consistent with previous research that has shown individuals are unwilling to pick up the slack for coworkers who have the ability to perform, but fail to exert the effort. In this case, fast partners set the standard for coworker performance, and when followed by a different slow partner, participants may have interpreted this difference as a lack of effort rather than a lack of ability to be successful at the task.

In Study 2, the four-person cooperative trials produced slightly better results than the two person cooperative trails, inconsistent with social loafing research which would suggest increased social loafing as group size increases. The impact of the fast and slow coworkers again depended on the order in which participants experienced each condition. Slow/Fast participants engaged in more social loafing than the Fast/Slow participants. This is the opposite effect than was found in Study 1. However, a direct comparison of Study 1 and Study 2 may not be appropriate due to the different conditions. Study 1 and Study 2 both included a two-person cooperative condition, but Study 1 switched from cooperative to competitive conditions, and Study 2 switched from cooperative to four-person cooperative conditions. Therefore, the opposing results should be analyzed within that context. In Study 2, Slow/Fast participants exhibited social loafing in the final team trial (fast team), potentially indicating social loafing based on the perception that their team could carry them (free riding).

Study 3 maintained a focus on fast and slow conditions, and paid closer attention to inconsistent partner performance and the comparison of cooperative and alone conditions. Similar to Study 2, the Fast/Slow participants in Study 3 exhibited higher

productivity than the Slow/Fast participants in all but one trial. Notably, the main increases in performance responsible for the higher overall performance were in the fast conditions, followed by minimal increases or even flat or downward performances with the slow coworkers. In the comparison between Fast/Slow and Solo/Slow, and Slow/Fast and Solo/Fast, solo plus goal conditions were used to control for the change in partner performance. Statistical analyses did not indicate significant differences between the groups, indicating that the change from fast to slow or slow to fast partner performance did not have a significant impact when compared to groups who only had fast or slow partners. Statistical analyses were also performed on the same two pairs of groups comparing cooperative conditions and solo plus goal conditions to directly compare alone conditions verses cooperative conditions. Again, no significant differences were found between the two groups.

Overall, while targeted comparisons between groups may indicate a higher prevalence of social loafing in certain conditions as described in the preceding paragraphs, there were many outcomes in each study that were inconsistent with each other and with social loafing research. Based on the results of Study 3 specifically, which included sharper focus on alone versus cooperative conditions, pairing participants with coworkers resulted in higher productivity, higher reports of job control, and lower reports of stress and demand. Instead, these results would appear to be more consistent with social facilitation, in which performance is enhanced in the presence of others. However, social facilitation is distinguished from social loafing by the role of the "others" present. In social loafing, "others" are working collectively (cooperating), resulting in decrements in effort. In social facilitation, "others" are present, but not working collectively, resulting

in enhanced effort. Therefore, the experimental design for the present studies do not align with the social facilitation paradigm.

These studies addressed several variables described in traditional social loafing research. Instrumentality and dispensability were manipulated by the varying fast and slow partners. When paired with fast partners, participants are likely to perceive their contribution as dispensable, which should result in a higher likelihood of social loafing. The opposite would be true when paired with slow partners. This was not found to be universally true, indicating that other variables impacted social loafing.

Social loafing has been shown to be impacted by features of the task itself (e.g., difficulty, relevance, value, interest). While specific feedback about these variables was not solicited from the participants, the task was selected for this research as it may appear to be generally neutral in value as a mundane, repetitive task, and not generally difficult. However, these are assumptions, and future research using this experimental task may solicit specific feedback on the qualities of the task from participants, or vary features of the task, for example, making the data entry task more or less complex.

Participants were also subject to the variables of identifiability, comparison, and evaluation. Participants were able to see their own progress on the screen, indicating that their own contribution was identifiable to the experimenter. During cooperative conditions, they were able to see their coworkers' progress on the screen, providing an opportunity for comparison of their performance to their coworkers' performance. The variable of evaluation potential was also present in these studies in the form of goal-setting. The majority of social loafing research uses vague goals such as "do your best" or "as many as you can" (e.g., Alnuaimi et al., 2010; Hart et al., 2004) although specific

goals have been used in some social loafing research (e.g., George, 1992; Mulvey et al., 1998). The inclusion of goals in this research was due to the fact that most work situations provide goals of some type (e.g., standard performance, required performance). Thus, studying social loafing without the use of goals may lack external validity and may not provide research-based solutions for managers and supervisors to evoke optimal performance from their staff. Additionally, the Solo/Solo group was assigned goals throughout the experiment and still performed significantly worse than the four other groups, suggesting that evaluation alone was insufficient to reduce social loafing.

While expected loafing and perceived loafing may not sound like variables likely to be studied by behavior analysts, self-report and comparison to actual behavior may provide additional information about variables that impact social loafing. In Study 3, 13 of 40 participants reported expending less effort than they planned to exert, indicating that they were influenced by the conditions they experienced, resulting in social loafing. These particular measures of pre-trial predictions, post-trial assessments, and actual behavior (performance on the trial) could provide the foundation for an additional line of research examining the conditions under which participants attend to their own behavior changes, and the extent to which participants accurately assess their own behavior in relation to their coworkers' behavior. These same measures could be extended to the computer simulated partners with participants being provided with their coworkers' self-reported ratings of ability and effort (also computer generated to be controlled as independent variables).

A limitation of these studies is the relatively short period of time participants are engaged in the task. Certainly, over longer periods of times, exposure to the

contingencies of reinforcement and extinction would result in additional variation in participant performance. In addition, as histories become more established and potentially more apparent to participants, other patterns of behavior may emerge. For example, if a team has generally established a history of high performance over a long period of time, it may be more likely that one of the team members would pick up the slack if their partner was having an off day, as the history of mutual reinforcement may support the extra effort with the prediction that the partner will be back to their previous level of performance in the future, or they may return the favor when someone else is having an off day.

Another limitation that threatens external validity is the lack of tangible reinforcement for achieving the goal. The Collective Effort Model (Karau & Williams, 1993) emphasizes the valence or value of the outcome as a crucial component of effort such that increased value of the outcome should result in less social loafing. Participants in these studies received course credit whether they performed well or poorly, whether they met their goal or not, and whether or not they completed the study. This is inconsistent with work situations in which at minimum, workers must achieve a certain level of performance to avoid negative consequences (e.g., discipline, termination), and in some situations, may have access to performance-based rewards (e.g., piece-rate payment, bonuses). While goal attainment may be reinforcing on its own to some participants based on their personal learning histories (e.g., Agnew, 1997; O'Hora & Maglieri, 2006), future research should explore additional reinforcement contingencies including various pay contingencies.

While these studies included a variety of established and novel variables, there are

other variables that could be included in future research to further analyze the impact of coworker behavior on social loafing. The ability to send and receive messages between coworkers (computer simulated messages along with the computer simulated partners) could assess the impact of verbal statements on performance. For example, a computer simulated coworker may be programmed to perform poorly and send messages such as "this experiment is boring," or alternatively, "I'm trying, but this is difficult," to determine differential effects of perceived effort and ability. Additionally, Relational Frame Theory (Hayes et al., 2001) describes how verbal rules may impact behavior, providing another future direction for the present research. Verbal statements may be incorporated into the computer program in the form of motivative augmentals temporarily altering the degree to which goal attainment or cooperation function as reinforcers. For example, a computer-generated banner displayed on the screen with the statement "cooperation is highly valued," may result in increased derived reinforcement from cooperative behavior and the achievement of cooperative goals, reducing or eliminating social loafing in cooperative conditions.

Future research may also include more frequent solo sessions to provide additional opportunities to compare alone and cooperative conditions within participant. Choice conditions could be included such that participants could experience alone and cooperative conditions with fast and slow coworkers, then be given a choice whether to work alone or with their partner, as high levels of performance may not always be an indication of preference for that condition. Variations in goal setting (i.e., evaluation potential) may also be effective in social loafing research. Because evaluation is such a powerful variable in relation to social loafing, goal setting may obscure the impact of

other variables. While goal setting is important for external validity of the results, using a range instead of a singular goal may allow for more variability in performance. For example, some conditions may evoke "just good enough" performance at the bottom of the range, and other conditions may evoke superior performance at the top or above the range. Additionally, component analyses (e.g., Baer, Wolf, & Risley, 1968) may uncover the relative strength of variables alone or in combination.

The studies presented in this document were conducted from February 2020 through November 2020. This time frame is notable due to the COVID-19 pandemic which rose to public awareness and began impacting Americans' way of life around March 2020. This included the closure of the University of Nevada, Reno (UNR) campus, and the start of virtual classrooms for students and telework for workers statewide. At the time of this writing (December 2020), the state of Nevada is still under heavy restrictions including the closure of the UNR campus, hybrid or total virtual schooling for kindergarten through high school students, reduced capacity at restaurants and retail stores, cancellation of large events, prohibitions on social gatherings, and encouragement to work from home when possible.

A known impact of the pandemic on this research included the shift from in-person research for Study 1 to completely online research for Study 2 and Study 3. While Study 1 was completed entirely on a computer, participants met with the research assistant in person and completed the study in the UNR library, which mimics a work environment (e.g., others present and engaged in a variety of tasks). For Study 2 and Study 3, there was a complete absence of physical or even verbal interaction with participants. Participants signed up online, received instructions via email, and completed

the task online. These conditions may have impacted participant performance in a variety of ways. For example, historically, participation in research at UNR is required to be completed in person with interaction between the researcher and/or research assistant and the participant. Even when the participant is not under direct observation or supervision, the physical proximity of the experimenter or research assistant may have a positive impact on performance, and conversely, participating in research online in any number of settings may have had a negative impact on participant performance as the conditions were less similar to a traditional academic or work environment.

Researchers are only beginning to study the impact of the COVID-19 pandemic on the worldwide population. Preliminary reports and research point to myriad negative effects including financial strain due to job loss, impacts to mental health, and the effects of social isolation (e.g., Pfefferbaum & North, 2020). Once the full impact of the pandemic is known, it may be possible to interpret the results of these studies in that context. Perhaps certain students were isolated and lonely, resulting in a preference for working with a partner. On the other hand, workers that unexpectedly shifted from office settings to telework may be experiencing fatigue related to computer work and working with their teams virtually, potentially resulting in a preference for working alone regardless of the other variables in effect. Anecdotally, unexcused absences from research participation escalated drastically during the last two months of data collection (October and November, 2020), potentially as an indicator that students were under a great deal of pressure in the face of ongoing restrictions and the upheaval of their typical lives.

Social loafing has a strong research base, and behavior scientists have much to

offer the research base with a particular focus on environmental variables and reinforcement contingencies, regardless of whether or not they choose to refer to the research as social loafing research. Recall that Skinner (1971) stated, "[t]here may be a natural inclination to be reinforcing to those who reinforce us, as there seems to be to attack those who attack us" (p. 45). This relates to social loafing in work situations, and may predict devastating situations in which poor coworker performance spreads to others who withhold reinforcement (contribution to group work) in response to what they perceive as the withholding of reinforcement from their coworkers.

Research in this area may inform real-world work decisions, possibly in terms of optimal assignment of teams, what type of worker to pair with new employees who are just learning the tasks, or potentially how to handle situations in which workers are having an "off day." For example, further research extending these studies and using the experiment may provide evidence that new employees should be paired with other new employees so they can learn and improve together, or new employees should be paired with highly productive employees to set the example and push them to perform at high levels right away. If productive employees having an "off day" are likely to bring down the productivity of the whole office, managers may encourage taking time off, may assign that worker to a different task, or may have that employee work alone that day, depending on the work available.

As teamwork becomes more essential and unavoidable for employers and employees alike, managers would benefit from understanding optimal combinations of work groups, and how employee behavior may be impacted by their coworkers' performance. The results of this study will contribute to the social loafing research by

providing the first study known to this researcher to vary coworker performance in real time to assess the impact on participant performance, and to provide the foundation for future research to further explore and identify variables of coworker performance that may impact individual performance.

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Appendix A

Figure A1

Administrative User Interface

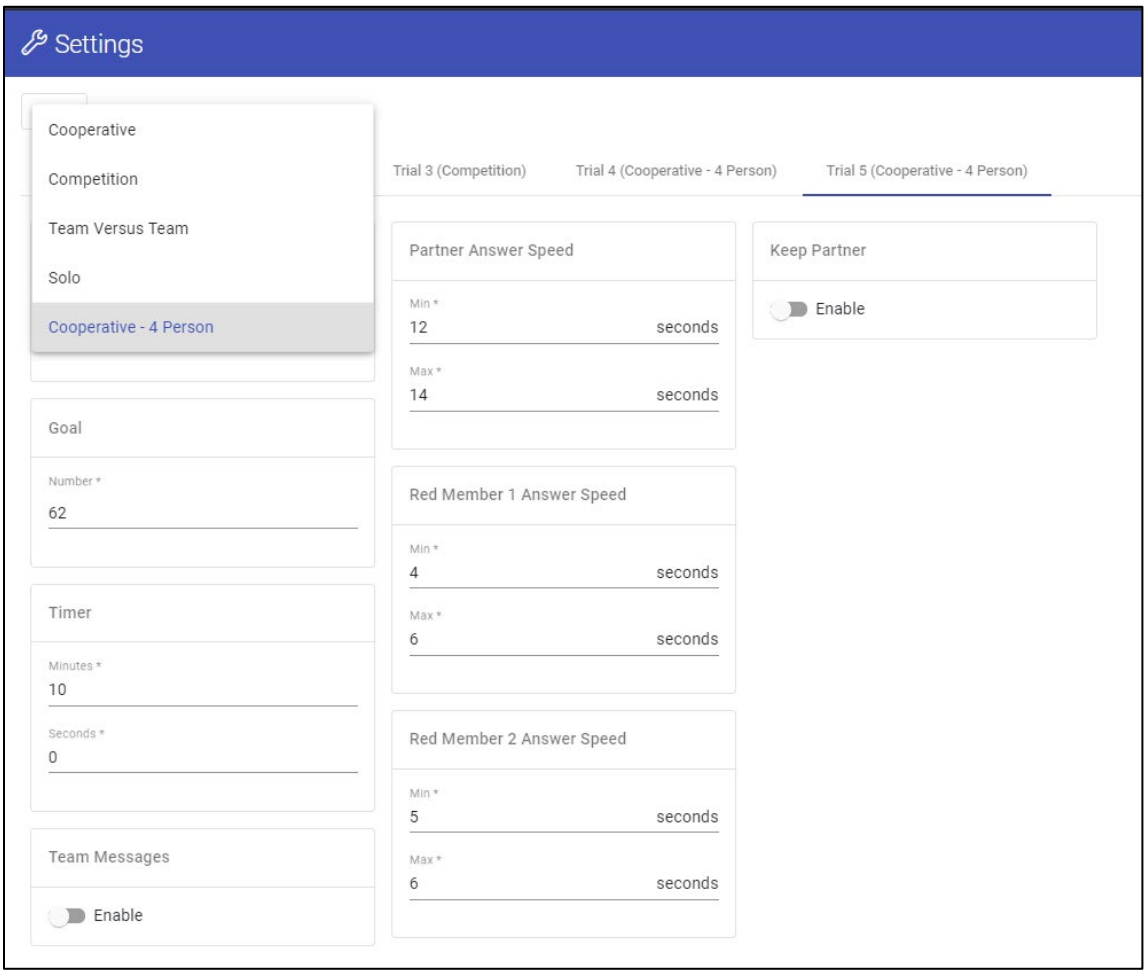


Figure A2

Condition A: Baseline Condition

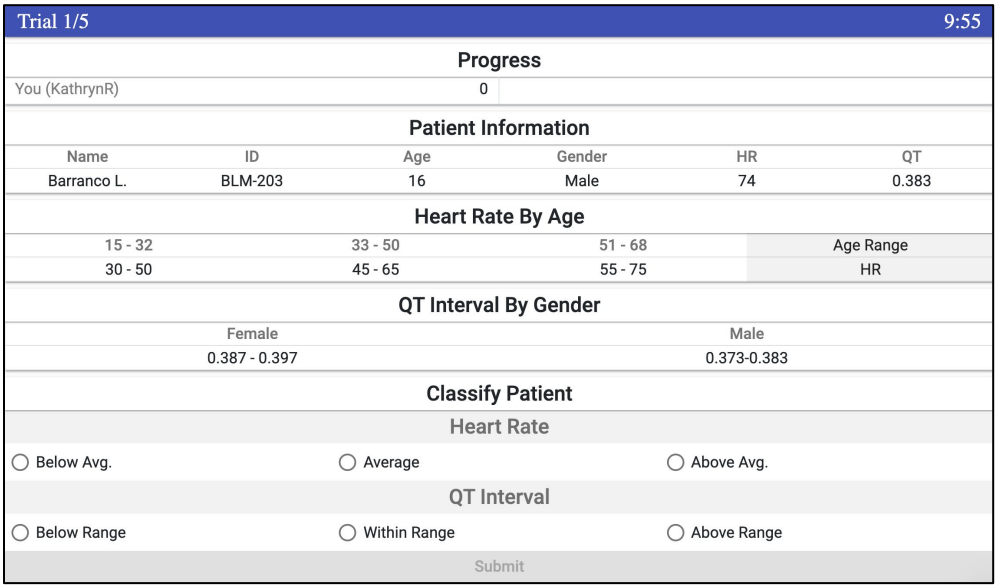


Figure A3

Condition B: Two-person Cooperative Condition

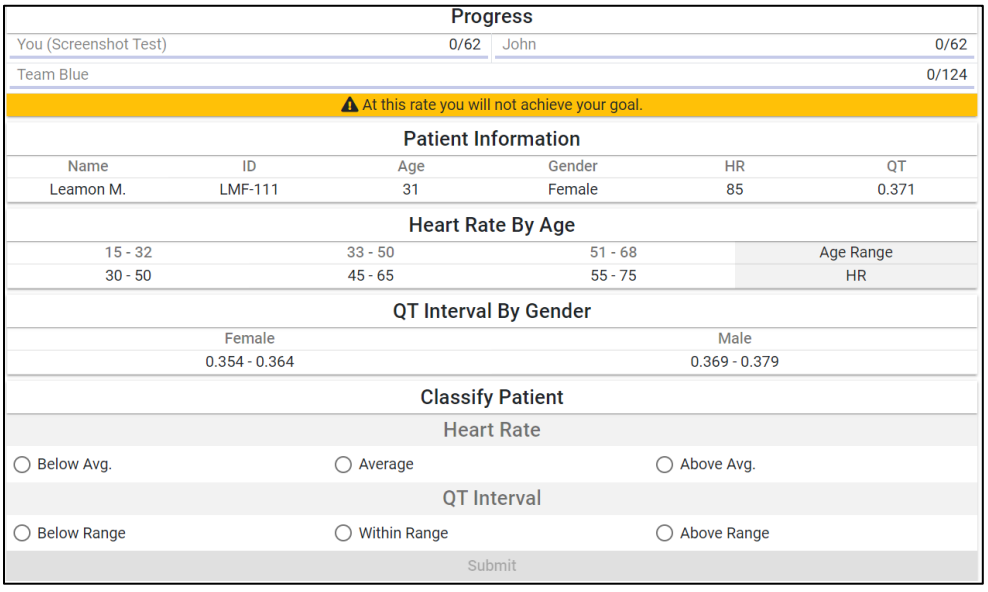


Figure A4

Condition C: Competitive Condition

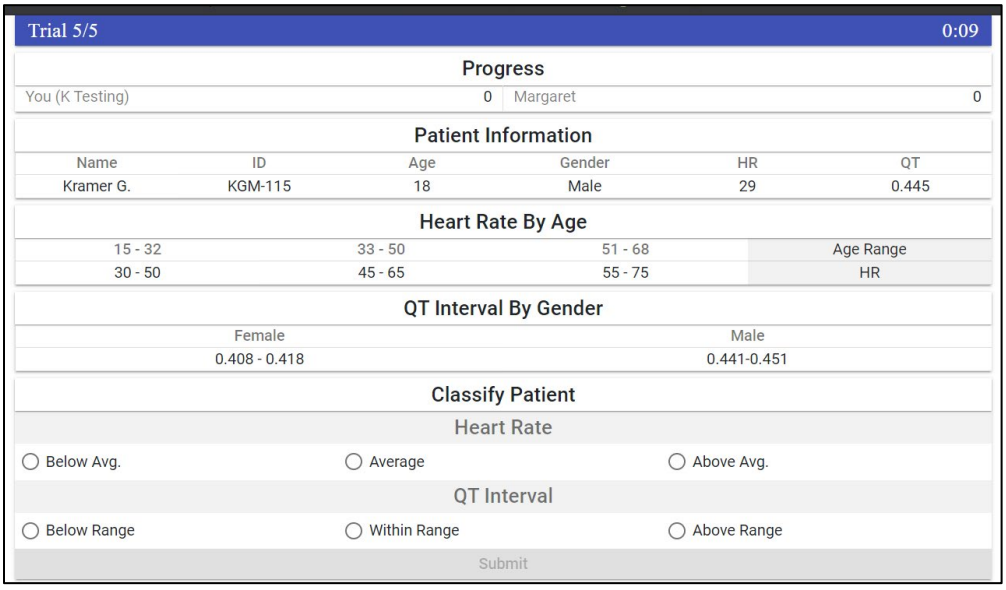
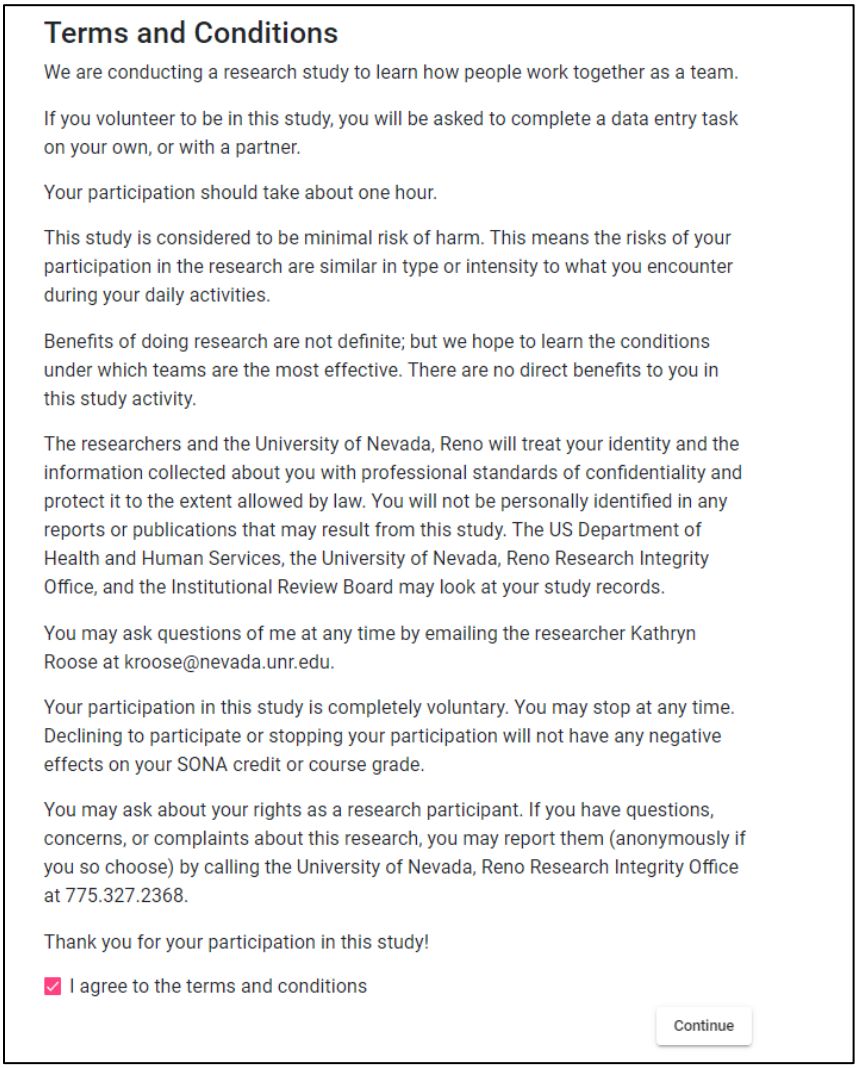


Figure A5

Informed Consent



Terms and Conditions

We are conducting a research study to learn how people work together as a team.

If you volunteer to be in this study, you will be asked to complete a data entry task on your own, or with a partner.

Your participation should take about one hour.

This study is considered to be minimal risk of harm. This means the risks of your participation in the research are similar in type or intensity to what you encounter during your daily activities.

Benefits of doing research are not definite; but we hope to learn the conditions under which teams are the most effective. There are no direct benefits to you in this study activity.

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 me at any time by emailing the researcher Kathryn Roose at kroose@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 SONA credit or course 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!

☑ I agree to the terms and conditions

Continue

Figure A6

Tutorial

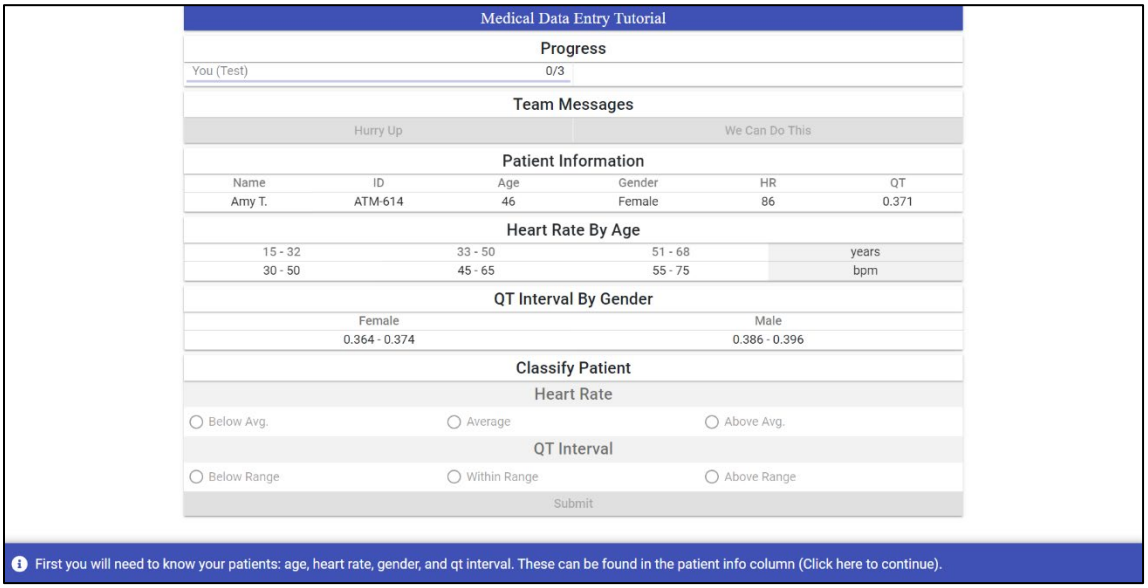


Figure A7

Pre-Experiment Rating

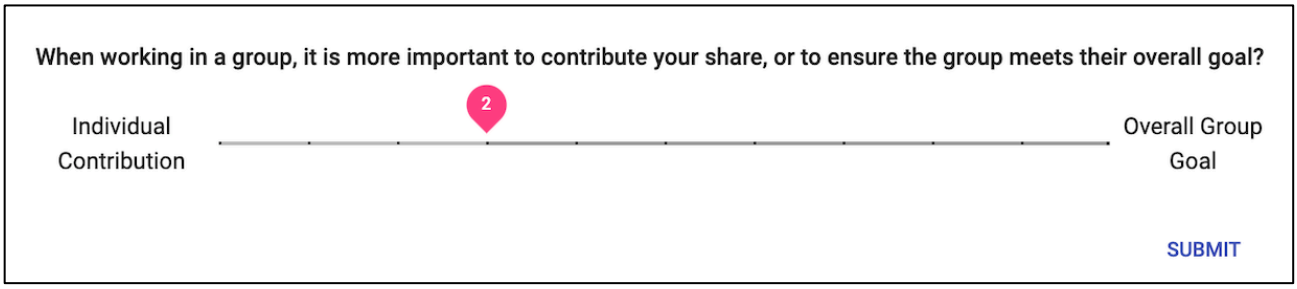


Figure A8

Pre-Trial Ratings

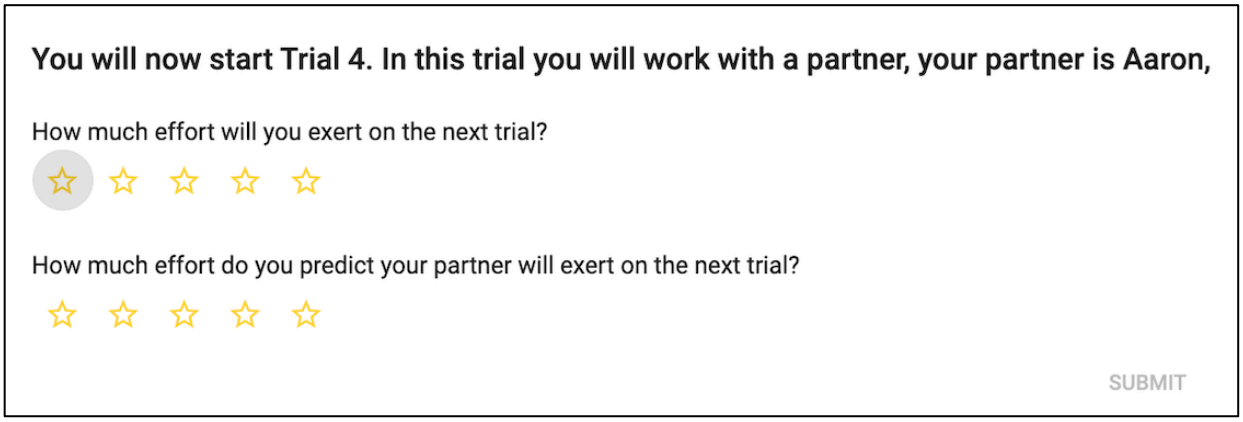


Figure A9

Post-Trial Ratings

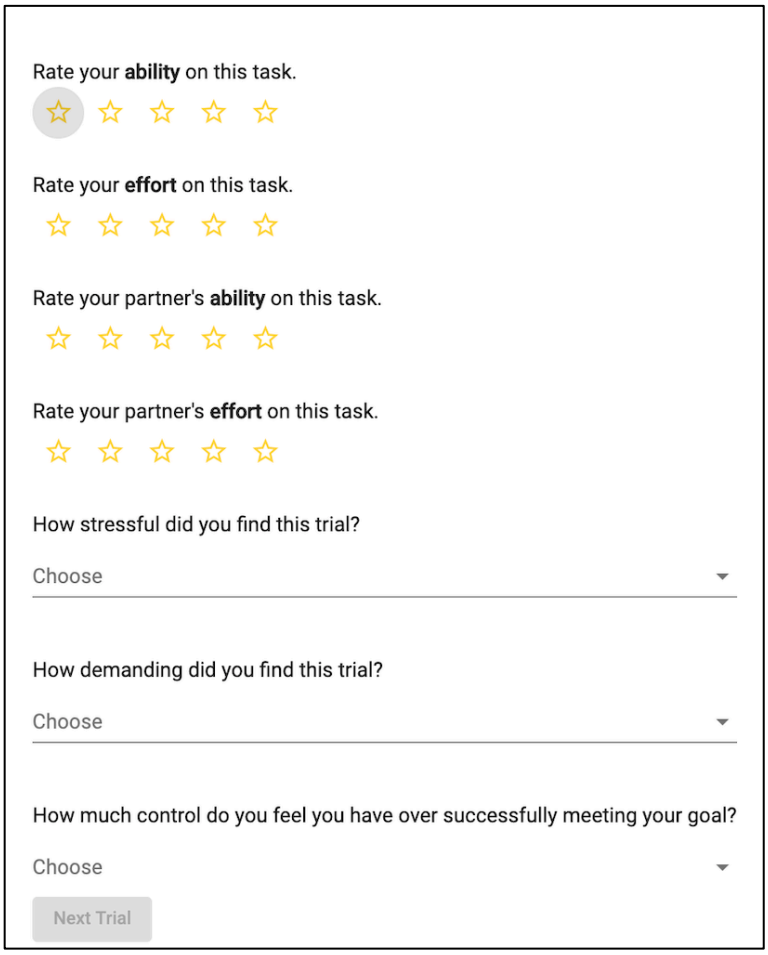
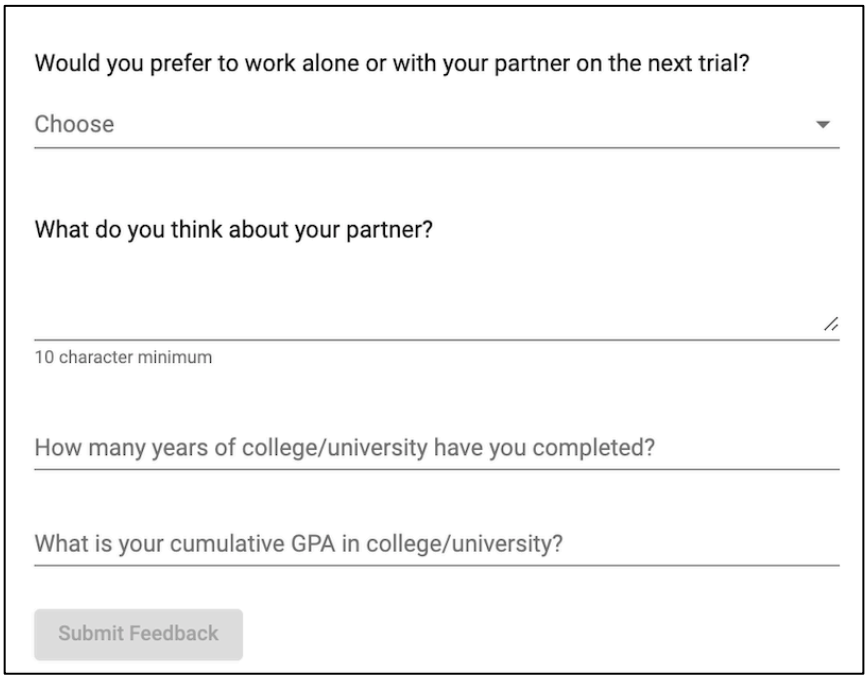


Figure A10

Post-Experiment Feedback



Appendix B

Fast/Slow:

1. Great effort
2. My partner is slow in completing tasks.
3. I'm not sure! They helped out and that's all that matters.
4. I thought they did great, just didn't exert enough effort as I knew they could in the later trials.
5. As time went on he stopped caring because he knew we were never going to complete the task I did the same thing
6. she was great. but towards the end, she kinda gave up.
7. Tended to do worse as we went to the next trial. Lost motivation.
8. He picked up my slack during the first trials while I got the hang of it!

Slow/Fast:

1. He was okay, he got VERY slow a lot of the times, some of them it didn't even feel like he was trying.
2. very efficient and quick
3. They did awesome! We were pretty equal.
4. I think she did great. I actually didn't pay attention or noticed that we could see how many charts we each completed. Im not really sure how welll they did but I tried my best and hope for them to try their best.

5. I think similar to me my partner improved throughout the experiment as they became more accustomed to the procedure and got used to the ranges for HR. Thought it was a simulation
6. She pushes me to do better, almost competition like
7. sometimes he didn't do his work other times he did.
8. I think that my partner did a good job at pushing me to keep up

Solo/Slow

1. They did a great job!
2. I think that they did a great job. They started slow but finished strong.
3. I think my partner tried his best, and he did really well toward accomplishing his goal considering how much the data changed after each entry. I didn't mind picking up the few extra entries in order to accomplish the group objective.
4. She did great
5. They are slow at the data entry, but they still tried
6. Pretty good.
7. hard worker
8. I think they're working hard, but they are just slower than they need to be to meet the goal.

Solo/Fast

1. Michelle is extremely focused and fast.
2. they out in a lot of effort

3. Very fast at working
4. Did well together
5. My partner was good and fast
6. Fast, definitely smart
7. My partner has been doing a great job!
8. She was quick!