THE EFFECT OF BREAK TASK ON PERFORMANCE DURING A SECOND SESSION OF BRAINSTORMING

by

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ABSTRACT

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Almost since the beginning of group brainstorming research, studies have looked for ways to increase its effectiveness. One method involves the use of brief breaks from idea generation during the brainstorming session. This study examined the impact of various types of tasks performed during the breaks. Participants brainstormed for two ten-minute sessions with a two-minute break between sessions. Four break conditions were tested. In one condition participants were reinstructed on the brainstorming task and rules. In a second condition participants named an object for each letter of the alphabet. Participants were asked to rest in the third condition. In the fourth condition participants wrote down their ideas during the break. In a control condition there was no break. The number of ideas spoken aloud was used as a measure of productivity. The strongest effect was the superior performance of reinstruction participants in comparison to the control condition participants.

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CHAPTER I

INTRODUCTION

Brainstorming has been used as an effective tool for generating novel ideas about a problem (Parnes & Meadow, 1959). However, research has shown that group productivity has almost never been equal to the combined performance of the same number of individuals brainstorming alone. Various reasons have been cited as to why individuals brainstorm better alone than in groups, such as social loafing, when individuals rely on the other members to produce ideas; production blocking, the physical inability for more than one member to talk at a time; and matching of low performance, when individuals match their performance to the rest of the members of the group so no one does better or worse than any other member in the group (Diehl and Stroebe, 1987, 1991, Paulus and Dzindolet, 1993). This productivity gap has caused interest in increasing brainstorming productivity for groups and individuals.

One possibility for improving group brainstorming performance is the inclusion of a break during the brainstorming session. It seems intuitive that taking a break, getting away from the object of focus, helps improve our focus when we return. We note in our personal lives that getting a good night's rest or taking a walk feels useful in solving more complex problems. Getting away from a problem seems to help bring us to the answer, sometimes faster than actually sitting down and puzzling it out.

Osborn (1963) and Csikszentmihalyi and Sawyer (1995) wrote about the power of getting away from a problem. Evidence suggested if one sat down with a problem too long, the person might get stuck in a rut, thinking of the same thing over and over. In Osborn's (1963) book, he offers several anecdotes about successful "idea" people, and that they all did something completely unrelated to their work when trying to solve a problem. It was during this time that they developed some of their novel ideas. Csikszentmihalyi and Sawyer (1995) suggested an alternative look at the nature of insight and incubation. Insight, a solution or new way of looking at a problem, arose from long periods of intense involvement with a problem followed by incubation, a rest period during which active work on the problem was not done. From interviews they completed with nine people with various careers, they found a common feature in these people's work habits and idea generating process. Many would immerse themselves in a problem, working intensely for long periods of time with others, asking for help and ideas. Then almost all would find some sort of mindless physical task, like gardening or hiking. They are usually alone during this experience. During or after this type of activity new ideas or a new way of looking at the problem may arise. These types of incubation effects have also been shown in some empirical studies.

Several studies have been done to offer support that breaks or incubation periods increase success in problem solving in various types of tasks. Browne and Cruse (1988) had participants individually solve a problem in which they had to divide an 'L' shaped piece of land into four equal parts. There were five conditions in the experiment; three with five minute breaks between the first and second ten minutes of the solution time, and two conditions that had no break during their solution times. One condition had twenty minutes

of solution time and another had twenty-five minutes of solution time. Of the first three, one condition had participants trace a graph picture that offered a hint to the problem they were solving. The second had participants relax during the five minutes, and the third had them memorize a difficult map, ostensibly to recall this later. The other two conditions were to check to see if having twenty-five minutes of problem solving time would be significantly better than having twenty minutes of problem solving time. Results from Browne and Cruse's (1988) experiment showed that getting a hint, relaxing during the break, and having twenty-five minutes to solve the problem led to better performance than doing excessive mental work like reading a map or only having twenty minutes. Relaxing was significantly better than the twenty minutes and the map memorization conditions. The other conditions were not significantly different from each other. This study supports Woodworth and Schlosberg's (1954) fatigue hypothesis that not doing anything would be the best "activity" during an incubation period. They believe that doing nothing helps the brain rejuvenate after long periods of idea generating.

In an experiment by Kirkwood (1984) incubation was found to be effective in idea generation. He had participants form groups of four and brainstorm for thirty minutes. There were three conditions in the experiment. In one condition, the group had to discuss one problem for the entire thirty minutes. Groups in the second condition discussed two problems similar in nature. In a third condition participants discussed two problems that were not similar in nature. For the last two conditions, the groups would discuss the first problem for ten minutes, the second problem for ten minutes, and then resume discussing the first one for the remaining ten minutes. For all conditions, they began and ended discussing

the same problem. Kirkwood (1984) also examined group dynamics to be certain that the nature of the problems did not alter the rate of discussion. He found no differences due to the type of problem but found that those who had discussed a problem not like the original one did significantly better than either of the other two conditions. Those who had discussed two problems that were similar in nature did not do any better than those who had discussed one problem for thirty minutes.

Goldman, Wolters, and Winograd (1992) looked at the length of incubation periods and their efficacy on problem solving. They had the participants work on solving anagrams. Then after a varying amount of time they would show participants more anagrams. Some had been presented before and some were new anagrams. The three conditions varied in the amount of time between first and second presentation. It was either 0-seconds from the first presentation, twenty minutes or 24 hours. Goldman et al. (1992) found 24 hours to be significantly better than the no delay condition, but no other pair-wise comparisons were significantly different. Goldman et al. (1992) also examined whether incubation was task-specific or item specific. They compared new and old items from the twenty-minute and 24 hour conditions. They found that more old items than new items were solved during the second presentation for both conditions. This suggests that participants were solving previously presented anagrams and had not improved their ability to solve anagrams.

Yet not all evidence has been in support of incubation periods' positive effects for incubation periods. Offner, Kramer, and Winter (1996) had participants brainstorm for fifteen minutes about different topics. During that time, some groups of participants had four one minute breaks and another group received four fifteen second breaks. They also stressed

the need to allow thoughts to be free flowing and to keep things moving at a rapid pace. Results did not support the idea that breaks increase productivity. The reason for the lack of effect found in this study is not clear. Several factors may have contributed to the finding of results different from the previous studies. The experimental task of solving many different problems in fifteen minutes may not have been conducive to incubation effects. The variance in the length and number of breaks in each study could have had an effect on the results. The task done during the break might also have contributed to the difference in results. Since the various incubation studies are rather dissimilar it is difficult to understand why some support the incubation hypothesis and others do not.

Dzindolet (1993) encountered what appear to be incubation effects in her dissertation on blocking and social influence processes on brainstorming. She manipulated the level of experience her participants had on the brainstorming task and whether or not they could share their ideas during the interactive brainstorming session in two of her studies. Half of them worked on the brainstorming problem alone for five minutes, writing out their ideas. They were "experienced" participants. The other half read an article for the same amount of time. They were "inexperienced" participants. Then they came together to brainstorm. Half of the participants who had brainstormed shared their ideas with others, the "experienced-share" condition; the other half did not, the "experienced-withhold" condition. She expected a difference between the "experienced-share" and "experienced-withhold" conditions. With a limited pool of ideas, participants in the withhold condition should have fewer ideas available than the share condition. However, the withhold participants did just as well as the share participants, who could state all of their ideas during the session. There are a number of

possible reasons for this finding. Possibly the break between the sessions helped increase productivity during the second session. It may be that the change in modality from writing to speaking allows different regions of the brain to work on the task. Rereading the instructions may have increased motivation in the participants during the second session.

Horn (1993) conducted a study to determine whether the modality change was important in the break effect. Half of the participants changed modes of brainstorming, some changing from writing to speaking, the others from speaking to writing. Half of them did not change modes. Participants in a "break" condition were stopped and given brainstorming instructions again, whether or not they changed modes of brainstorming. Participants in a "no-break" condition were given no break, were not reinstructed, and did not change modes of brainstorming. Horn found a significant difference between the break and no-break conditions in the number of ideas generated during the second session of brainstorming. People in the break condition performed significantly better than those in the no-break condition for the last ten minutes.

Research by Smith and colleagues (Smith, 1995; Smith & Blankenship, 1991; Smith & Vela, 1991) on fixation and incubation may provide clues about the break phenomenon in brainstorming. Fixation, or functional fixedness, is a "block to successful problem solving." Exactly what it is depends on the problem being solved, although the problems tend to be ones of insight rather than procedural. Problems of insight don't have "steps" per se but mostly "hit-or-miss" solutions. Incubation helps when the solution is not forthcoming, when someone steps away from the problem, seemingly to stop thinking about it. When one returns to the problem, or even in the middle of this break, a solution is reached.

Smith and Blankenship (1991) manipulated fixation and incubation. In their set of studies, they had participants do Remote Association Tests. In the RAT, participants were given a list of words. Three words are listed together and a fourth word must be found that will make a compound word or phrase with each of the other three. For example, the words ARM, COAL, and PEACH are listed; the correct solution is PIT. For their experiments, Smith and Blankenship (1991) manipulated fixation by "priming information inappropriate to the correct solution of the problems." That is done by pairing each word with a distracter for example: ARM-leg, COAL-furnace, PEACH-pear. These additional words are meant to misdirect the person's thinking. They were given a specific amount of time to solve each RAT problem. After that, for the incubation treatment, experimenters gave some participants a separate task as an incubation treatment. They read a science fiction story, and they were told that they would be quizzed on it. After reading the story, they were tested again. In experiments 1 and 2, they found that fixedness did decrease performance. Those who had been in the "fixed" condition performed significantly worse than those who were in the "nonfixed" condition. They also found that incubation increased performance for those in the fixed condition during retesting. Those who had an incubation period did better than those who did not. Those in the nonfixed condition did not show any difference between the incubation and no incubation conditions.

Experiment 3 by Smith and Blankenship (1991) showed that there were possible "levels" of fixedness. In experiments 1 and 2, the investigators had used "related" distracters. In Experiment 3, they also had "unrelated" distracters; for example: ARM-boy, COAL-picture, PEACH-stereo. The results showed that the related condition did the worst, the no-

distracter condition, the best, and the unrelated was in between. These results suggest that the more related the distracters, the more fixated your thoughts become. This seems to have a parallel in brainstorming. In brainstorming, participants try to think of novel ideas to questions about various topics. Results show participants will sometimes get "tunnel vision" when thinking about solutions for the open-ended question put to them. They may focus on certain categories for their ideas and may not focus on many others (Larey, 1994).

However, the experiments by Smith and Blankenship (1991) are rather restricted in their application. Most often we cannot control functional fixedness of a problem. A second set of studies done by Smith and Vela (1991) show a more applicable approach to fixedness and incubation. Smith and Vela (1991) did not manipulate fixedness in this study and only looked at reminiscence, the number of newly recalled words during a second test. They used a different set of problems: 50 line drawings of simple objects, five per page, had to be memorized. Participants were given thirty seconds to memorize each page, and then a free recall test was given after the last page was read. Participants had to write what they had seen, and drew a line every 60 seconds to show the number of recalled items per minute. Then participants received another free recall test, some after an incubation period. Smith and Vela (1991) used reminiscence, the number of new words recalled on the second test, as a dependent measure. They found similar results to those of Smith and Blankenship (1991). Those participants who had an incubation period had more reminiscence than those who did not have an incubation period.

In another study Smith and Vela (1991) tested what type of incubation would best increase reminiscence. Tacit recall theory suggests that "unfilled" will do better than "filled"

because the mind needs time to think, albeit unconsciously. A second theory suggests that fluctuations in environmental context would increase reminiscence effects. The more the situation changes the new stimuli in the environment activate more memory. As in previous experiments, Smith and Vela (1991) used no-incubation and unfilled-incubation conditions. They also used a filled-incubation condition. In the unfilled-incubation treatment participants were asked to do nothing, just experience quiet time. For the filled-incubation condition, participants were given difficult maze problems to work on during the incubation period. Results showed that the filled-incubation condition did significantly better than the no-incubation condition. The unfilled-incubation condition was in between the two and not significantly different from either the filled-incubation or no-incubation conditions. Yet, the trend does suggest that occupying the participant's mind with other matters will help increase reminiscence and lends support to the fluctuations theory. This result also agrees with the contextual fluctuation model of Mensink and Raaijmakers (1989). Their model suggests that context plays a large role in forgetting and proactive and retroactive inhibition.

The purpose of the present research is to replicate previous findings on the effects of breaks and to discover the possible mediating mechanisms. The theories of contextual fluctuation, fatigue, and memory retrieval block suggest that for improved performance, the mind should be cleared so that no idea is more "active" than another one. Getting away from the problem allows the mind to calm the "excited" regions of the brain working on the problem. Moreover, exposure to new contexts may allow new areas of the brain to become involved and allow for more diverse ideas to come to light.

In the proposed experiment, several conditions were examined for effectiveness in refocusing the mind to think of new ideas during a second session. Four break conditions were used and one control condition. Two of the conditions, the control and the reinstruction conditions were replications from a previous experiment (Horn, 1993). Participants in the control condition brainstormed the entire session without interruption. In the reinstruction condition participants were reinstructed on the brainstorming task and rules during the break. In a second break condition participants had to name objects beginning with each letter of the alphabet. In a third break condition participants were asked to sit quietly during the break and do nothing. Participants in the fourth condition were asked to continue brainstorming but to write down their ideas instead of speaking aloud.

Woodworth and Schlosberg's fatigue hypothesis (1954) suggests that breaks simply help the brain to rest from the activity. The brain needs time to recuperate after having exhausted its energy to think, and the break allows this process to occur. According to this hypothesis the condition when there is no task during the break should increase performance during the second session of brainstorming more than any other condition. All the other conditions do not provide as much of a rest and should do as poorly in productivity as the control condition.

Other evidence from experiments by Smith and Vela (1991) suggest certain activities can help increase reminiscence effects. The contextual fluctuation model of Mensink and Raaijmakers (1989) suggests that accessing other areas of the mind will increase variation of thoughts and memories and increase reminiscence effects. This hypothesis suggests the greater the fluctuation in context, the less active the previous memories will be. Greater

contextual fluctuations during the break could lead to greater performance during the second session of brainstorming. From this hypothesis, all breaks should increase productivity more than the control condition, but some break conditions could be better than other breaks. The more diverse the break task is from the brainstorming task, the more productive participants should be during the second session. The break written brainstorming task should be the worst of the break conditions, since it continues brainstorming on the same problem. The next worst should be the reinstruction condition, since the task is still within the confines of the brainstorming problem and rules. The break conditions of no task and different task should be the best since they do not involve the original brainstorming problem.

However, another hypothesis is that the break and/or rereading the task and rules for brainstorming provide an increase in motivation. Participants who have a break and have the rules and task instructions read to them again may perform better than those who do not have this experience because they are remotivated. The experimenter interrupts the participants, reads the problem and rules again and then expects them to continue brainstorming. The mere recitation of the rules and task information could increase the participant's motivation. Alternatively, the implicit expectation of the experimenter that the participants have more ideas during the second session can be a motivator. After the break is over the experimenter acts as though the individual will continue brainstorming through their actions, like preparing the recording device again and their words, such as "You may resume brainstorming." Those who don't have the break or the rules and task read to them may not have the same increase of motivation. According to the motivation hypothesis, either all break conditions should be the same, or the reinstruction break should do better than any other break condition.

CHAPTER II

METHOD

Participants

One hundred and eighteen students from the Introduction to Psychology course at U.T. Arlington participated as part of a course requirement. Because the participant pool was small during the semester when the experiment was run, students who had participated in brainstorming experiments before were used, including those who had done the task used in this study. Due to problems with equipment, only 106 participants provided viable data for the experiment, 21 in the Break Reinstruction condition, twenty-two in the Break Written Brainstorming condition, twenty in the Break No Task condition, twenty in the Break Different Task condition, and 23 in the No Break Oral condition.

Procedure

Participants were shown to a small room with a tape recorder, desk and chair. Each participant brainstormed alone. Consent forms were passed out before the experiment commenced. The rules for brainstorming were also handed out and explained in detail to the students. The four rules were: Rule 1: Criticism is ruled out. Rule 2: Freewheeling is welcome. Rule 3: Quantity and quality are wanted. Rule 4: Combination and improvement are sought. Participants were given the set of rules and the experimenter read them with the

participant and asked if they had any questions. They were asked to brainstorm about the Thumbs problem. The task was stated as follows:

> The problem we want you to work on is called the Thumbs problem. We do not think this is likely to happen, but imagine for a moment what would happen if everyone after 1997 had an extra thumb on each hand. This extra thumb will be built just as the present one but located on the other side of the hand. It faces inward, so that it can press against the fingers just as the regular thumb does now. Here is the question: What practical benefits or difficulties will arise when people start having this extra thumb?

Participants were told how much time was allotted for brainstorming, twenty-two minutes for the control condition and two ten minute sessions, with a break of two minutes between each session, for each of the other conditions. The entire brainstorming session was recorded, including breaks, using audio tape recorders for each brainstorming participant.

The experiment had five conditions: a No Break Oral condition, a Break Written Brainstorming condition, a Reinstruction Break condition, a No Task Break condition, and a Different Task Break condition. The No Break Oral condition is a control condition. In the Reinstruction Break condition the experimenter read the brainstorming problem and rules to the participants again. For the No Task Break condition, the experimenter explained to the participants they would have a brief break and that the break was a rest period. Participants were asked to refrain from thinking about the brainstorming problem during the break. Instructions for the Different Task Break condition were to think of an object that began with each letter of the alphabet, beginning with the letter A, and so forth. The participants stated these objects aloud and were recorded on tape. If they completed the task before the two minutes were up, they were requested to repeat the task, each time thinking of new objects, until the time allotted had passed. This task was chosen because it was easily repeatable by the participants and could be done orally. Instructions for the Break Written Brainstorming

condition were to continue brainstorming during the two-minute break but to record the ideas on a sheet of paper provided by the experimenter. Participants were encouraged to think of new ideas during the break and not to repeat ideas from the prior brainstorming session. After the break the experimenter returned and asked them to stop doing the break task. They were asked to resume brainstorming for another ten minutes.

After the brainstorming session was over, the students filled out a questionnaire (see appendix D) and were allowed to leave. The audiotapes were coded to provide information about the condition in which the participant participated. The tapes were transcribed and coded for each idea generated.

Assessing the Data

There are a number of ways of assessing the effect of breaks. Previous studies have examined the productivity in the period after the break. However, this method did not take into account the depletion effects in the no-break conditions. Participants in the No-Break Oral and Break Written Brainstorming conditions will have been brainstorming for two more minutes and may have a smaller pool of ideas available in the second session. For that reason the last twelve minutes were used as a measure of break effectiveness as well as the traditional measure of the last ten minutes. The number of ideas during the first five and second five minutes of each ten-minute session was also recorded. Two coders were used, one coding 25% of the data to check reliability of the other coder.

CHAPTER III

RESULTS

Performance was measured by counting the number of unrepeated ideas on the tape recording of the participants. An analysis of variance was done on the data followed by Duncan's Multiple Range tests to determine significant differences among conditions (see appendix D). Questionnaire data was coded and entered with the number of ideas generated for the thumbs task for each participant. No significant results were found for the data on the questionnaire.

Experience Factor

Due to the limited size of the research participant pool, participants who had prior experience in brainstorming experiments were not excluded from participating in the study. Only four participants said they had experience with the thumbs problem. They were excluded from the study. Yet, the experience factor had a significant impact on performance, with the experienced participants doing better than those participants who had no experience. This phenomenon occurred for the first five minutes after the break, F (9, 96) = 5.28, p = 0.02, the second ten minutes, F (9, 96) = 4.54, p = 0.04, the last twelve minutes, F (9, 96) = 3.95, p = 0.05 and the overall totals, F (9, 96) = 4.19, p = 0.04 (see table 1).

Table 1

Mean Number of Unique Ideas for Experienced and Inexperienced Participants For All Break Conditions

Time		Experience Factor: Experienced n=45	Experience Factor: Inexperienced n=61
First 5 Minutes After the Break	M	21.13	15.16
	SD	14.38	12.92
Last 10 Minutes After the Break	M	34.71	24.87
	SD	25.86	22.25
Last 12 Minutes After the Break	M	36.44	26.95
	SD	27.2	22.19
Overall Total 22 Minutes	M	88.33	69.92
	SD	50.74	41.86

Since prior research usually used participants who had never brainstormed before, the data was partitioned into three groups. The inexperienced participant group consisted of those who had never done a brainstorming experiment (see appendix H). The experienced participants group consisted of only participants who had done a brainstorming experiment before (see appendix F), and an all participant group, which included all participants from the experiment (see appendix E). When the data were analyzed for the experienced participants group, there were no significant differences among break conditions. The rest of the results presented are only for the inexperienced participants.

The First Ten Minutes

During the first five minutes of brainstorming, the break conditions were significantly different from each other, $F(4, 56) = 2.84$, $p = 0.0324$. Participants in the Break No Task

condition (M=34.462, SD=14.140) had significantly more ideas than those in the No Break Oral condition (M=21.250, SD=10.661) or the Break Different Task condition (M=21.444, SD=9.989), but not significantly more ideas than participants of the other conditions. No significant effects were found during the second five-minute segment. Although the F-test was not significant, F (4, 56) = 1.82, p = 0.1375, according to Duncan's Multiple Range test for the overall first ten minutes, the participants in the Break No Task condition (M=55.769, SD=25.959) performed better than participants in the No Break Oral condition (M=35.938, SD=20.809) and Break Different Task condition (M=35.111, SD=21.923).

The Last Ten Minutes

During the first five minutes after the break, the break conditions were significantly different, F (4, 56) = 3.77, p = 0.0087. Break Reinstruction Task participants (M=23.50, SD=15.67) did better than No Break Oral participants (M=7.13, SD=8.33) and the Break Different Task participants (M=11.22, SD=9.65). For the last five minutes, the F-test was not significant, F (4, 56) = 2.22, p = 0.0779 but the Break No Task condition (M=14.62, SD=14.53) did significantly better than No Break Oral condition (M=4.25, SD=5.35) by Duncan's test. The overall last ten minutes of the brainstorming session revealed significant differences between break conditions, F (4, 56) = 2.96, p = 0.0273. Participants in the Break Reinstruction Task (M=33.60, SD=26.87), Break No Task (M=32.39, SD=25.65) and Break Written Brainstorming conditions (M=31.08, SD=20.57) all performed better than the No Break Oral condition participants(M=11.38, SD=12.05) (see table 2).

Table 2
Mean Number of Unique Ideas for Inexperienced Participants After the Break

Condition		n	T53	T54	T210	T12	TOT
Break Reinstruction	M	10	23.50	10.10	33.60	33.60	75.90
	SD		16.54	10.77	26.87	26.87	39.35
Break Written Brainstorming	M	13	18.77	12.31	31.08	33.85	78.62
	SD		12.72	8.50	20.56	20.37	41.14
Break No Task	M	13	17.77	14.62	32.38	32.38	88.15
	SD		11.89	14.53	25.65	25.65	49.76
Break Different Task	M	9	11.22	8.11	19.33	19.33	54.44
	SD		9.65	10.02	18.97	18.97	38.39
No Break Oral	M	16	7.13	4.25	11.38	17.06	53.00
	SD		8.33	5.35	12.05	15.83	33.67

T53 = The first 5 minutes after the break * T54 = The last 5 minutes after the break
T210 = The last 10 minutes after the break * T12 = The last 12 minutes (including the break)
TOT = Total Number of Unique Ideas

Last 12 and Overall 22 Minutes

The break conditions were not significantly different from each other for the last twelve minutes of brainstorming, F (4, 56) = 1.90, p = 0.1231. For the overall totals, there were no significant differences among the break conditions, F (4, 56) = 1.87, p = 0.1282.

Difference Results

Subtracting the number of ideas for the first five minutes after the break from the number of ideas for the last five minutes before the break yields a difference measure. A negative score means that the participant performed better after the break than before. Significant differences were found between the break conditions, F (4, 56) = 4.62, p = 0.0027. The scores of Break Reinstruction Task (M= -8.300, SD=16.371) and Break Written

Brainstorming conditions (M= -3.538, SD=10.485) demonstrate that they do significantly better than No Break Oral condition (M=7.563, SD=9.245) (see figure 1). This difference can also be seen for number of ideas per five-minute segments. Only the lines for the Break Reinstruction Task and Break Written Brainstorming conditions have a positive slope from the last five minutes before the break to the first five minutes after the break. All the rest have a negative slope (see figure 2). The breaks in the Break Reinstruction Task and Break Written Brainstorming conditions helped productivity increase significantly during the second session, especially for the first five minutes after the break.

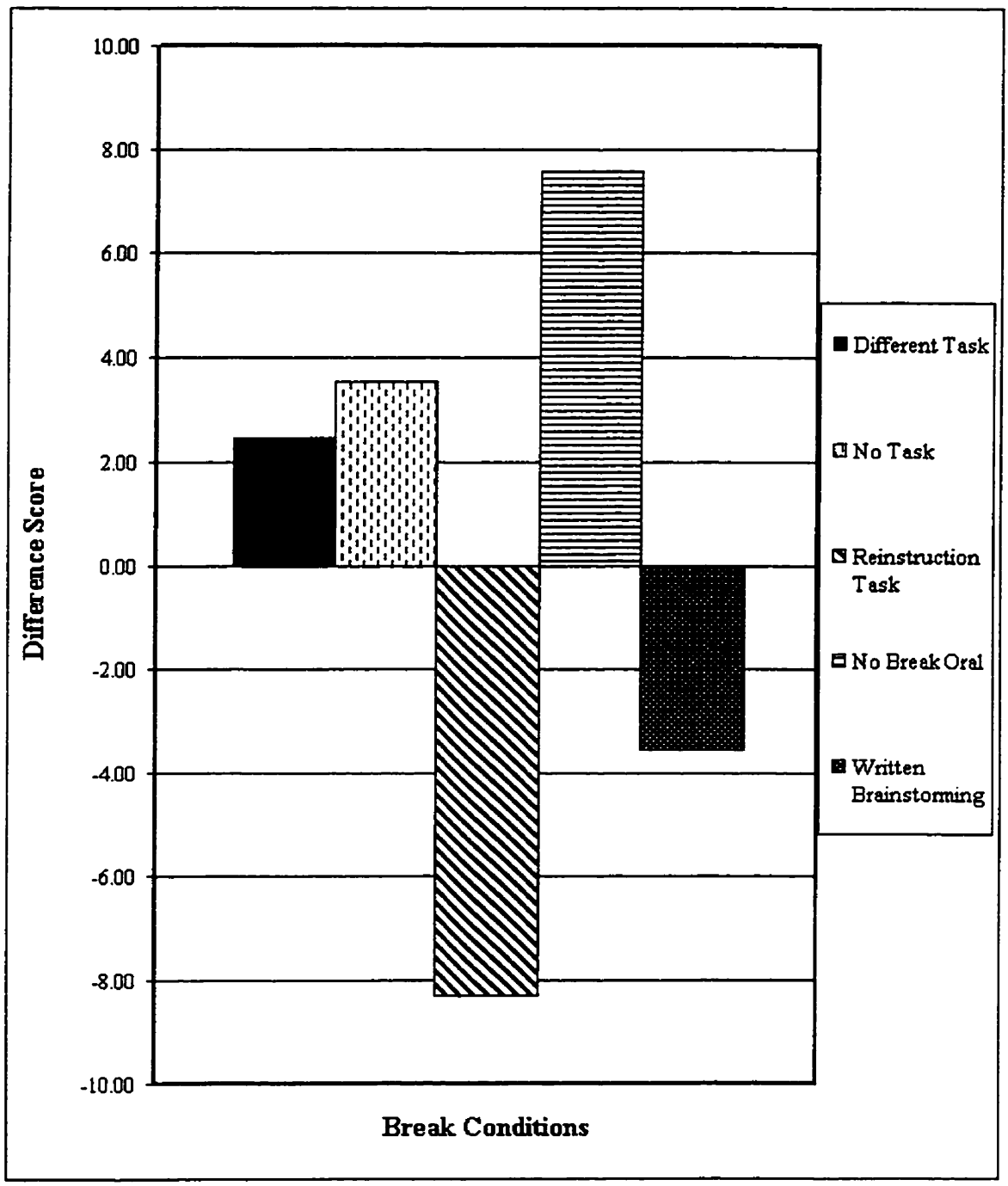

Figure 1. The number of ideas difference from the last five minutes before the break to the first five minutes after the break.

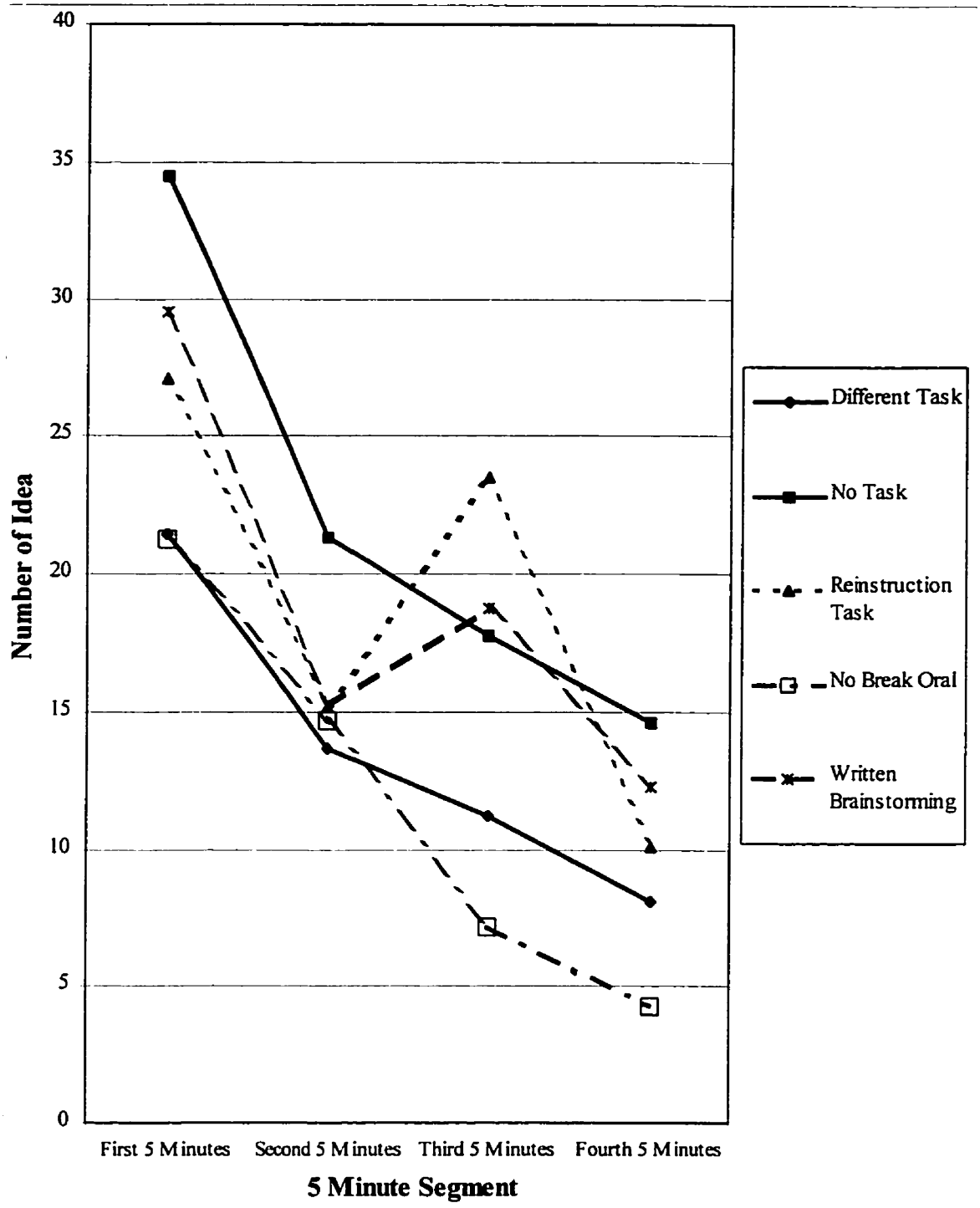

Figure 2. The number of ideas for first and second five minute segments before the break and third and fourth five minute segments after the break.

CHAPTER IV

DISCUSSION

The results of this study demonstrate that some types of breaks during brainstorming can have positive effects for individuals who do not have prior brainstorming experience. Consistent with prior research is the finding that the Break Reinstruction Task condition performed significantly better during the second session of brainstorming than the No Break Oral condition. The Break Written Brainstorming and the Break No Task conditions also helped increase performance during the second session in comparison to the No Break Oral condition. Only the Break Different Task condition did not perform significantly better than the No Break Oral condition after the break. The results of this study can be related to various theoretical hypotheses

According to the fatigue hypothesis, which states that inactivity helps the mind recover from idea generation, the Break No Task condition should have done significantly better than the No Break Oral condition. The Break Reinstruction condition should have done better than the No Break Oral condition, but it should not have done as well as the Break No Task condition. The rest of the conditions should not have been significantly different from the No Break Oral condition. The results provide partial support for this hypothesis. The Break No Task condition and the Break Reinstruction condition led to better performance than the No Break Oral condition, and the Break Different Task condition was not significantly different from the No Break Oral condition. However, the performance

of the Break Written Brainstorming condition should not have been better than the No Break Oral condition. The difference score between the last five minutes before the break and the first five minutes after the break also did not support the fatigue hypothesis. The Break No Task condition had more ideas during the last five minutes of the first session than in the first five minutes of the second session, the number of ideas decreasing after the break. But the participants in the Break Reinstruction and Break Written Brainstorming conditions increased the number of ideas generated after the break. So the fatigue hypothesis gains only partial support.

According to the hypothesis that the experimenter's expectation for participants to continue to brainstorm after the break would motivate participants to produce more ideas during the second session, all of the break conditions should have done better than the no-break condition. Although the Break Reinstruction, Break Written Brainstorming and the Break No Task conditions did perform better than the No Break Oral condition, the Break Different Task condition was not significantly different from the No Break Oral condition. Thus, the hypothesis that simply having a break motivates participants to do better is not completely supported in this study.

The notion of increased motivation caused by rereading of the brainstorming rules and problem also has some support. By rereading the brainstorming rules and problem, participants' motivation is increased and thus, their ability to produce more ideas. The participants who reread the problem and rules should do better than those who do not. The Break Reinstruction condition doing significantly better than the No Break Oral condition supports this hypothesis. However, the Break Written Brainstorming and Break No Task

conditions did as well as the Break Reinstruction Task condition. These results suggest that the hypothesis may have been too simple. It was not just the rereading of the brainstorming rules and problem that helped increase productivity. The results shown here suggest that doing a task relevant to the brainstorming task might help increase productivity, provided the task is not brainstorming orally.

The contextual change hypothesis suggests that the greater the contextual change during the break, the better the performance of the participants. Participants who do a task during the break that appears contextually very different from the brainstorming problem should do better during the second session of brainstorming than participants who do a task that is more similar to the brainstorming task. This would suggest that the more different a break task is from the brainstorming task (e.g., the Break Different Task condition), the better participants would do. The Break Reinstruction Task and the Break No Task conditions were more productive than the No Break Oral condition. The participants in these conditions were doing something different from the brainstorming problem during the break. However, the most contextually different task, the Break Different Task condition, was not significantly better than the No Break Oral condition. Moreover the condition with the least contextually different task, the Break Written Brainstorming condition, was better than the No Break Oral condition.

All of the hypotheses had some support yet at least one condition performed in a contradictory manner. Since none of these hypotheses completely fit the results obtained, a new model was developed. It is called the Modified Contextual Theory. The results of this study may suggest that what is needed to refocus participants is not a large contextual change

but a small one. For the Break Reinstruction Task the participants focus again on the brainstorming task and the rules but refrain from brainstorming. The Break Written Brainstorming condition changes the mode of brainstorming but helps the participants stay focused on the same task. The Break No Task condition doesn't prevent the participants from thinking about the brainstorming problem. Although the participants are not thinking about the problem consciously during the break, it is still active in their memory. The "modified" contextual change hypothesis suggests that too much change in context, as produced by the Break Different Task condition, or too little change as in the No Break Oral condition, may slow productivity in brainstorming. According to this new hypothesis, the change during the break must be slight and participants must still be able to focus on the problem or have recently been exposed to the problem without interruption. For novel problems, it might be necessary to simply refocus on the problem and not get distracted by heavy mental activity.

The results of the Dzindolet (1993) experiment are consistent with the contextual change hypothesis. Half of the participants brainstormed alone before they brainstormed with a group and the other half read an article not pertaining to the experiment. She had all the participants move from one room to another when they went from the "break" to the brainstorming task. Those who had brainstormed on the same task before joining the group did just as well as those who had not brainstormed before they joined the group. Of those who had brainstormed before, half could share their ideas from the previous brainstorming session and the other half could not share their ideas. There was no significant difference in the number of ideas generated in the withhold and sharing conditions. The change from one

room to another may have provided a contextual change that facilitated the continued brainstorming.

The present study did not try to replicate the contextual change of moving from one room to another. This potential difference of "physical" versus "psychological" change is one that needs to be evaluated in future research. Also the break of this experiment was shorter than those breaks during other experiments. Breaks in the studies by Dzindolet (1993) and Horn (1993) were approximately five minutes. The effects of the length of breaks and the number of breaks should be investigated.

The effect of the previous experience of the participants on their performance of subsequent brainstorming tasks could be an interesting study for the future. Correlation between a participant's performance during the first and second sessions could be measured to determine how the prior brainstorming session affects the participant's performance during the next brainstorming session. If there were two or more brainstorming problems, would sequence be a factor in productivity levels? Another direction for research would be to study more break tasks. We should look at ways to increase motivational levels of participants and examine if this has an effect on productivity. We should explore the similarities of those tasks that increase productivity levels. Evidence from this study and previous ones suggest that refocusing on the brainstorming task during the break helps increase productivity. What tasks would be beneficial to keeping a group in focus on the brainstorming problem? Would breaks be necessary if a group constantly refocuses on the brainstorming problem?

APPENDIX A

STATEMENT OF CONSENT FOR PARTICIPATION IN THE EXPERIMENT

Statement of Consent for Participation in Botticelli

This experiment involves doing a brainstorming task and filling out a questionnaire. I understand that after the experimental session is concluded, I will be given a more detailed explanation of the procedures and specific purposes of the experiment, and I will have an opportunity to ask questions regarding it.

I recognize that no discomfort of any sort is anticipated during or as a result of this experiment. The benefits of participating in research (both to myself and the psychology department) have been outlined during my psychology class. The data in this study will be used for scientific purposes only. Furthermore, I understand that records of my participation will be held strictly confidential.

My signature below indicates my consent to participate in this experiment.

_____ _____

Name Date

_____ _____

Instructor's name, Time of Class Student ID #

APPENDIX B

RULES FOR BRAINSTORMING AND THE THUMBS PROBLEM

RULES FOR BRAINSTORMING

Rule 1: Criticism is ruled out. Adverse judgment of ideas must be withheld. Don't criticize any ideas that come to mind.

Rule 2: Freewheeling is welcome. The wilder the idea, the better. It is easier to tame down than to think up. Don't be afraid to say anything that comes to mind, the farther out the idea, the better.

Rule 3: Quantity and quality are wanted. Come up with as many good, creative ideas as you can.

Rule 4: Combination and improvement are sought. You should be willing to join or change suggestions you have made into still better ideas. Don't be afraid to combine and improve on them.

THE THUMBS PROBLEM

The problem we want you to work on is called the Thumbs problem. We do not think this is likely to happen, but imagine for a moment what would happen if everyone after 1997 had an extra thumb on each hand. This extra thumb will be built just as the present one but located on the other side of the hand. It faces inward, so that it can press against the fingers just as the regular thumb does now. Here is the question: What practical benefits or difficulties will arise when people start having this extra thumb?

APPENDIX C

QUESTIONNAIRES

QUESTIONNAIRES FOR BOTTICELLI

Questionnaire - No Break-Oral Condition

We would like you to rate various aspects of your experience while you were doing the brainstorming task. Take a few minutes to reflect and answer the following questions. For most of these questions, we have provided nine point scales for you to indicate your feelings. The more extreme your feelings in one direction or the other, the more you should mark a number in that direction.

(1) Have you ever participated in an experiment like this before? Yes No

If you answered Yes: Was the task the same as the present one? Yes No

(2) How would you rate the number of ideas you were able to generate during the entire brainstorming session? I was able to generate:

very few ideas some ideas very many ideas

1 2 3 4 5 6 7 8 9

(3) How do you feel after finishing the brainstorming session? I feel:

very tired same as before more energetic

1 2 3 4 5 6 7 8 9

(4) How did you like the task of brainstorming orally?

disliked strongly neutral strongly liked

1 2 3 4 5 6 7 8 9

(5) How do you think a break would affect your productivity? With a break, I think my productivity would:

increase			stay the same					decrease
1	2	3	4	5	6	7	8	9

Questionnaire – Break Written Brainstorming Condition

We would like you to rate various aspects of your experience while you were doing the brainstorming task. Take a few minutes to reflect and answer the following questions. For most of these questions, we have provided nine point scales for you to indicate your feelings. The more extreme your feelings in one direction or the other, the more you should mark a number in that direction.

(1) Have you ever participated in an experiment like this before? Yes No

If you answered Yes: Was the task the same as the present one? Yes No

(2) How would you rate the number of ideas you were able to generate during the entire brainstorming session? I was able to generate:

very few ideas some ideas very many ideas

1 2 3 4 5 6 7 8 9

(3) How would you rate the number of ideas you were able to generate during the first session? I was able to generate:

very few ideas some ideas very many ideas

1 2 3 4 5 6 7 8 9

(4) How would you rate the number of ideas you were able to generate during the second session? I was able to generate:

very few ideas some ideas very many ideas

1 2 3 4 5 6 7 8 9

(5) Rate your performance during the second session of brainstorming. Comparing it to the first session, during the second session I did:

worse				same				better
1	2	3	4	5	6	7	8	9

(6) Rate how well you liked the task of writing your ideas for 3 minutes:

disliked				neutral				liked
1	2	3	4	5	6	7	8	9

(7) Rate how the task of writing your ideas may have affected your productivity during the second session. Because of the task, during the second session I was able to produce:

more ideas				same amount				fewer ideas
1	2	3	4	5	6	7	8	9

(8) Rate your performance during the second session of brainstorming. Comparing it to the first session, during the second session I did:

worse				same				better
1	2	3	4	5	6	7	8	9

(9) How do you feel after finishing the brainstorming session? I feel:

very tired				same as before				more energetic
1	2	3	4	5	6	7	8	9

Questionnaire - Break Reinstruction Condition

We would like you to rate various aspects of your experience while you were doing the brainstorming task. Take a few minutes to reflect and answer the following questions. For most of these questions, we have provided nine point scales for you to indicate your feelings. The more extreme your feelings in one direction or the other, the more you should mark a number in that direction.

(1) Have you ever participated in an experiment like this before? Yes No

If you answered Yes: Was the task the same as the present one? Yes No

(2) How would you rate the number of ideas you were able to generate during the entire brainstorming session? I was able to generate:

very few ideas some ideas very many ideas

1 2 3 4 5 6 7 8 9

(3) How would you rate the number of ideas you were able to generate during the first session? I was able to generate:

very few ideas some ideas very many ideas

1 2 3 4 5 6 7 8 9

(4) How would you rate the number of ideas you were able to generate during the second session? I was able to generate:

very few ideas some ideas very many ideas

1 2 3 4 5 6 7 8 9

(5) Rate your performance during the second session of brainstorming. Comparing it to the first session, during the second session I did:

worse				same				better
1	2	3	4	5	6	7	8	9

(6) Rate how well you liked the task of rereading the instructions and the task:

disliked				neutral				liked
1	2	3	4	5	6	7	8	9

(7) Rate how the task of rereading the instructions may have affected your productivity during the second session. Because of the task, during the second session I was able to produce:

more ideas				same amount				fewer ideas
1	2	3	4	5	6	7	8	9

(8) To what extent were you thinking of the Thumbs problem while rereading the instructions? I was thinking of the Thumbs problem:

not at all				sometimes				often
1	2	3	4	5	6	7	8	9

(9) How do you feel after finishing the brainstorming session? I feel:

very tired				same as before				more energetic
1	2	3	4	5	6	7	8	9

Questionnaire – Break Different Task Condition

We would like you to rate various aspects of your experience while you were doing the brainstorming task. Take a few minutes to reflect and answer the following questions. For most of these questions, we have provided nine point scales for you to indicate your feelings. The more extreme your feelings in one direction or the other, the more you should mark a number in that direction.

(1) Have you ever participated in an experiment like this before? Yes No

If you answered Yes: Was the task the same as the present one? Yes No

(2) How would you rate the number of ideas you were able to generate during the entire brainstorming session? I was able to generate:

very few ideas some ideas very many ideas

1 2 3 4 5 6 7 8 9

(3) How would you rate the number of ideas you were able to generate during the first session? I was able to generate:

very few ideas some ideas very many ideas

1 2 3 4 5 6 7 8 9

(4) How would you rate the number of ideas you were able to generate during the second session? I was able to generate:

very few ideas some ideas very many ideas

1 2 3 4 5 6 7 8 9

(5) Rate your performance during the second session of brainstorming. Comparing it to the first session, during the second session I did:

worse				same				better
1	2	3	4	5	6	7	8	9

(6) Rate how well you liked the task of reciting an object for each letter of the alphabet:

disliked				neutral				liked
1	2	3	4	5	6	7	8	9

(7) Rate how the task of reciting an object for each letter of the alphabet may have affected your productivity during the second session. Because of the task, during the second session I was able to produce:

more ideas				same amount				fewer ideas
1	2	3	4	5	6	7	8	9

(8) To what extent were you thinking of the Thumbs problem while reciting an object for each letter of the alphabet? I was thinking of the Thumbs problem:

not at all				sometimes				often
1	2	3	4	5	6	7	8	9

(9) How do you feel after finishing the brainstorming session? I feel:

very tired				same as before				more energetic
1	2	3	4	5	6	7	8	9

Questionnaire - Break No Task Condition

We would like you to rate various aspects of your experience while you were doing the brainstorming task. Take a few minutes to reflect and answer the following questions. For most of these questions, we have provided nine point scales for you to indicate your feelings. The more extreme your feelings in one direction or the other, the more you should mark a number in that direction.

(1) Have you ever participated in an experiment like this before? Yes No

If you answered Yes: Was the task the same as the present one? Yes No

(2) How would you rate the number of ideas you were able to generate during the entire brainstorming session? I was able to generate:

very few ideas some ideas very many ideas

1 2 3 4 5 6 7 8 9

(3) How would you rate the number of ideas you were able to generate during the first session? I was able to generate:

very few ideas some ideas very many ideas

1 2 3 4 5 6 7 8 9

(4) How would you rate the number of ideas you were able to generate during the second session? I was able to generate:

very few ideas some ideas very many ideas

1 2 3 4 5 6 7 8 9

(5) Rate your performance during the second session of brainstorming. Comparing it to the first session, during the second session I did:

worse				same				better
1	2	3	4	5	6	7	8	9

(6) Rate how well you liked doing nothing during the break:

disliked				neutral				liked
1	2	3	4	5	6	7	8	9

(7) Rate how the break may have affected your productivity during the second session. Because of the break, during the second session I was able to produce:

more ideas				same amount				fewer ideas
1	2	3	4	5	6	7	8	9

(8) To what extent were you thinking of the Thumbs problem while taking a break? I was thinking of the Thumbs problem:

not at all				sometimes				often
1	2	3	4	5	6	7	8	9

(9) How do you feel after finishing the brainstorming session? I feel:

very tired				same as before				more energetic
1	2	3	4	5	6	7	8	9

APPENDIX D

ABBREVIATIONS

ABBREVIATIONS

BDT	Break Different Task, participants had to come up with as many objects for each letter of the alphabet
BNT	Break No Task, participants were told to do and think about nothing
BRI	Break Reinstruction Task, participants were read the rules and the task for brainstorming again
BWB	Break Written Brainstorming, participants had a break but were asked to continue brainstorming about the problem in written form rather than oral
DIF5	The difference between the last 5 minutes before the break (T52) and the first 5 minutes after (T53)
NBO	No Break Oral, participants brainstormed for the entire session
RELTOT	Twenty-five percent of the total number of ideas (without repeats) for the reliability test
T51	The number of ideas during the first five minutes of brainstorming session (without repeats)
T52	The number of ideas during the second five minutes of brainstorming session (without repeats)
T53	The number of ideas during the third five minutes of brainstorming session after the two-minute break (without repeats)
T54	The number of ideas during the fourth five minutes of brainstorming session after the two-minute break (without repeats)
T110	The number of ideas during the first ten minutes of brainstorming session (without repeats)
T210	The number of ideas during the second ten minutes of brainstorming session after the two-minute break (without repeats)
T12	The number of ideas during the second ten minutes of brainstorming session including the two-minute break (without repeats)
TOT	The number of ideas for the 22 minutes of brainstorming without repeats.

APPENDIX E

ANOVA ON ALL PARTICIPANTS WITH THE EXPERIENCE FACTOR

ALL PARTICIPANTS WITH THE EXPERIENCE FACTOR

General Linear Models Procedure
Class Level Information

Class	Levels	Values
XP	2	0 1
CON	5	BDT BNT BRI NBO BWB

Number of observations in data set = 106

Dependent Variable: TOT

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	25997.77725566	2888.64191730	1.38	0.2087
Error	96	201196.82651793	2095.80027623		
Corrected Total	105	227194.60377359			

R-Square	C.V.	Root MSE	TOT Mean
0.114430	58.89163	45.77991127	77.73584906

Source	DF	Type I SS	Mean Square	F Value	Pr > F
XP	1	8782.01360965	8782.01360965	4.19	0.0434
CON	4	5495.39364509	1373.84841127	0.66	0.6244
XP*CON	4	11720.37000092	2930.09250023	1.40	0.2405

Source	DF	Type III SS	Mean Square	F Value	Pr > F
XP	1	9183.87474158	9183.87474158	4.38	0.0390
CON	4	3844.44660141	961.11165035	0.46	0.7659
XP*CON	4	11720.37000092	2930.09250023	1.40	0.2405

ALL PARTICIPANTS WITH THE EXPERIENCE FACTOR

Dependent Variable: T51

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	2389.94432339	265.54936927	1.50	0.1586
Error	96	16984.54624265	176.92235669		
Corrected Total	105	19374.49056604			

R-Square	C.V.	Root MSE	T51 Mean
0.123355	46.65549	13.30121636	28.50943396

Source	DF	Type I SS	Mean Square	F Value	Pr > F
XP	1	410.27417260	410.27417260	2.32	0.1311
CON	4	867.13937349	216.78484337	1.23	0.3052
XP*CON	4	1112.53077731	278.13269433	1.57	0.1880

Source	DF	Type III SS	Mean Square	F Value	Pr > F
XP	1	472.04872699	472.04872699	2.67	0.1057
CON	4	556.41264251	139.10316063	0.79	0.5369
XP*CON	4	1112.53077731	278.13269433	1.57	0.1880

Dependent Variable: T52

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	1398.46348539	155.38483171	0.89	0.5405
Error	96	16831.15915612	175.32457454		
Corrected Total	105	18229.62264151			

R-Square	C.V.	Root MSE	T52 Mean
0.076714	72.57228	13.24101864	18.24528302

Source	DF	Type I SS	Mean Square	F Value	Pr > F
XP	1	632.30606592	632.30606592	3.61	0.0606
CON	4	339.47008323	84.86752081	0.48	0.7474
XP*CON	4	426.68733624	106.67183406	0.61	0.6575

Source	DF	Type III SS	Mean Square	F Value	Pr > F
XP	1	701.97358394	701.97358394	4.00	0.0482
CON	4	320.88978068	80.22244517	0.46	0.7667
XP*CON	4	426.68733624	106.67183406	0.61	0.6575

ALL PARTICIPANTS WITH THE EXPERIENCE FACTOR

Dependent Variable: T53

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	3253.20295375	361.46699486	2.07	0.0399
Error	96	16781.13666889	174.80350697		
Corrected Total	105	20034.33962264			

R-Square	C.V.	Root MSE	T53 Mean
0.162381	74.70473	13.22132773	17.69811321

Source	DF	Type I SS	Mean Square	F Value	Pr > F
XP	1	922.77896690	922.77896690	5.28	0.0238
CON	4	1738.50712990	434.62678248	2.49	0.0485
XP*CON	4	591.91685695	147.97921424	0.85	0.4991

Source	DF	Type III SS	Mean Square	F Value	Pr > F
XP	1	701.43339476	701.43339476	4.01	0.0480
CON	4	1300.23479640	325.05869910	1.86	0.1238
XP*CON	4	591.91685695	147.97921424	0.85	0.4991

Dependent Variable: T54

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	1685.73557721	187.30395302	1.40	0.1989
Error	96	12842.34932845	133.77447217		
Corrected Total	105	14528.08490566			

R-Square	C.V.	Root MSE	T54 Mean
0.116033	101.9124	11.56609148	11.34905660

Source	DF	Type I SS	Mean Square	F Value	Pr > F
XP	1	388.41860329	388.41860329	2.90	0.0916
CON	4	335.68177407	83.92044352	0.63	0.6442
XP*CON	4	961.63519985	240.40879996	1.80	0.1357

Source	DF	Type III SS	Mean Square	F Value	Pr > F
XP	1	367.73632147	367.73632147	2.75	0.1006
CON	4	139.97336176	34.99334044	0.26	0.9019
XP*CON	4	961.63519985	240.40879996	1.80	0.1357

ALL PARTICIPANTS WITH THE EXPERIENCE FACTOR

Dependent Variable: T110

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	6895.23671216	766.13741246	1.28	0.2561
Error	96	57328.38592935	597.17068676		
Corrected Total	105	64223.62264151			

R-Square	C.V.	Root MSE	T110 Mean
0.107363	52.26655	24.43707607	46.75471698

Source	DF	Type I SS	Mean Square	F Value	Pr > F
XP	1	2061.24377084	2061.24377084	3.45	0.0663
CON	4	2012.18038996	503.04509749	0.84	0.5017
XP*CON	4	2821.81255137	705.45313784	1.18	0.3240

Source	DF	Type III SS	Mean Square	F Value	Pr > F
XP	1	2325.30982791	2325.30982791	3.89	0.0513
CON	4	1496.07339113	374.01834778	0.63	0.6449
XP*CON	4	2821.81255137	705.45313784	1.18	0.3240

Dependent Variable: T210

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	8609.13651747	956.57072416	1.73	0.0922
Error	96	53037.62763348	552.47528785		
Corrected Total	105	61646.76415094			

R-Square	C.V.	Root MSE	T210 Mean
0.139653	80.91939	23.50479287	29.04716981

Source	DF	Type I SS	Mean Square	F Value	Pr > F
XP	1	2508.56888683	2508.56888683	4.54	0.0357
CON	4	3318.95659124	829.73914781	1.50	0.2077
XP*CON	4	2781.61103940	695.40275985	1.26	0.2916

Source	DF	Type III SS	Mean Square	F Value	Pr > F
XP	1	2084.93058639	2084.93058639	3.77	0.0550
CON	4	2004.52923015	501.13230754	0.91	0.4631
XP*CON	4	2781.61103940	695.40275985	1.26	0.2916

ALL PARTICIPANTS WITH THE EXPERIENCE FACTOR

Dependent Variable: T12

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	7734.79059832	859.42117759	1.46	0.1758
Error	96	56685.17166583	590.47053819		
Corrected Total	105	64419.96226415			

R-Square	C.V.	Root MSE	T12 Mean
0.120068	78.43354	24.29959955	30.98113208

Source	DF	Type I SS	Mean Square	F Value	Pr > F
XP	1	2333.99869402	2333.99869402	3.95	0.0496
CON	4	2173.12825447	543.28206362	0.92	0.4556
XP*CON	4	3227.66364982	806.91591246	1.37	0.2513

Source	DF	Type III SS	Mean Square	F Value	Pr > F
XP	1	2266.81383577	2266.81383577	3.84	0.0530
CON	4	1809.76073902	452.44018476	0.77	0.5498
XP*CON	4	3227.66364982	806.91591246	1.37	0.2513

Dependent Variable: DIF10

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	3637.67512804	404.18612534	1.47	0.1704
Error	96	26410.25883422	275.10686286		
Corrected Total	105	30047.93396226			

R-Square	C.V.	Root MSE	DIF10 Mean
0.121062	93.66823	16.58634568	17.70754717

Source	DF	Type I SS	Mean Square	F Value	Pr > F
XP	1	21.94634842	21.94634842	0.08	0.7782
CON	4	3304.79907651	826.19976913	3.00	0.0221
XP*CON	4	310.92970311	77.73242578	0.28	0.8886

Source	DF	Type III SS	Mean Square	F Value	Pr > F
XP	1	6.55578297	6.55578297	0.02	0.8776
CON	4	3090.85538139	772.71384535	2.81	0.0297
XP*CON	4	310.92970311	77.73242578	0.28	0.8886

ALL PARTICIPANTS WITH THE EXPERIENCE FACTOR

Dependent Variable: DIF5

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	2431.52846025	270.16982892	2.42	0.0161
Error	96	10724.73569070	111.71599678		
Corrected Total	105	13156.26415094			

R-Square	C.V.	Root MSE	DIF5 Mean
0.184819	1931.682	10.56957884	0.54716981

Source	DF	Type I SS	Mean Square	F Value	Pr > F
XP	1	27.36943327	27.36943327	0.24	0.6218
CON	4	2222.78664063	555.69666016	4.97	0.0011
XP*CON	4	181.37238634	45.34309658	0.41	0.8040

Source	DF	Type III SS	Mean Square	F Value	Pr > F
XP	1	0.00010396	0.00010396	0.00	0.9992
CON	4	1983.13421793	495.78355448	4.44	0.0025
XP*CON	4	181.37238634	45.34309658	0.41	0.8040

ALL PARTICIPANTS WITH THE EXPERIENCE FACTOR

General Linear Models Procedure
Duncan's Multiple Range Test for variable: TOT
NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha = 0.05 df = 96 MSE= 2095.8
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes = 51.79245

Number of Means 2
Critical Range 17.86
Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	XP
A	88.333	45	1
B	69.918	61	0

Duncan's Multiple Range Test for variable: T53
NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha = 0.05 df = 96 MSE= 174.8035
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes = 51.79245

Number of Means 2
Critical Range 5.157
Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	XP
A	21.133	45	1
B	15.164	61	0

ALL PARTICIPANTS WITH THE EXPERIENCE FACTOR

Duncan's Multiple Range Test for variable: T210
NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha = 0.05 df = 96 MSE= 552.4753
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes = 51.79245

Number of Means 2
Critical Range 9.168
Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	XP
A	34.711	45	1
B	24.869	61	0

Duncan's Multiple Range Test for variable: T12
NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha = 0.05 df = 96 MSE= 590.4705
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes = 51.79245

Number of Means 2
Critical Range 9.478
Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	XP
A	36.444	45	1
B	26.951	61	0

ALL PARTICIPANTS WITH THE EXPERIENCE FACTOR

Duncan's Multiple Range Test for variable: T53
NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha = 0.05 df = 96 MSE = 174.8035
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes = 21.13701

Number of Means 2 3 4 5
Critical Range 8.073 8.495 8.776 8.981
Means with the same letter are not significantly different.

Duncan Grouping		Mean	N	CON
	A	24.000	21	BRI
B	A	19.864	22	BWB
B	A	18.250	20	BNT
B	A	15.450	20	BDT
B		11.348	23	NBO

ALL PARTICIPANTS WITH THE EXPERIENCE FACTOR

Duncan's Multiple Range Test for variable: T210
NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha = 0.05 df = 96 MSE = 552.4753
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes = 21.13701

Number of Means	2	3	4	5
Critical Range	14.35	15.10	15.60	15.97

Means with the same letter are not significantly different.

Duncan Grouping		Mean	N	CON
	A	36.667	21	BRI
B	A	32.591	22	BWB
B	A	31.300	20	BNT
B	A	25.150	20	BDT
B		20.130	23	NBO

ALL PARTICIPANTS WITH THE EXPERIENCE FACTOR

Duncan's Multiple Range Test for variable: DIF10
NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha = 0.05 df = 96 MSE = 275.1069
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes = 21.13701

Number of Means 2 3 4 5
Critical Range 10.13 10.66 11.01 11.27
Means with the same letter are not significantly different.

Duncan Grouping		Mean	N	CON
	A	23.870	23	NBO
	A	23.450	20	BNT
B	A	18.600	20	BDT
B		12.000	22	BWB
B		10.619	21	BRI

ALL PARTICIPANTS WITH THE EXPERIENCE FACTOR

Duncan's Multiple Range Test for variable: DIF5
NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha = 0.05 df = 96 MSE = 111.716
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes = 21.13701

Number of Means 2 3 4 5
Critical Range 6.454 6.791 7.016 7.180
Means with the same letter are not significantly different.

Duncan Grouping		Mean	N	CON
	A	6.957	23	NBO
B	A	2.800	20	BNT
B	A	1.900	20	BDT
B	C	-3.545	22	BWB
	C	-5.619	21	BRI

ALL PARTICIPANTS WITH THE EXPERIENCE FACTOR

General Linear Models Procedure

Level of XP	Level of CON	N	TOT Mean	TOT SD	T51 Mean	T51 SD
0	BDT	9	54.444444	38.3930694	21.4444444	9.9888827
0	BNT	13	88.153846	49.7625129	34.4615385	14.1398691
0	BRI	10	75.900000	39.3459019	27.1000000	10.9691487
0	NBO	16	53.000000	33.6729367	21.2500000	10.6614571
0	BWB	13	78.615385	41.1350185	29.5384615	12.7842050
1	BDT	11	80.727273	47.9522490	30.4545455	13.2692399
1	BNT	7	82.142857	38.3076519	32.2857143	16.9481000
1	BRI	11	91.272727	49.7897397	30.5454545	14.3412945
1	NBO	7	110.428571	50.8030745	35.8571429	15.8264396
1	BWB	9	81.666667	67.4240313	26.4444444	15.7885331

Level of XP	Level of CON	N	T52 Mean	T52 SD	T53 Mean	T53 SD
0	BDT	9	13.6666667	12.7964839	11.2222222	9.6537270
0	BNT	13	21.3076923	13.5301183	17.7692308	11.8894480
0	BRI	10	15.2000000	7.6710133	23.5000000	16.5411944
0	NBO	16	14.6875000	11.6431310	7.1250000	8.3336667
0	BWB	13	15.2307692	11.5625390	18.7692308	12.7223808
1	BDT	11	20.3636364	14.6100837	18.9090909	12.7707051
1	BNT	7	20.5714286	11.5737799	19.1428571	14.5192811
1	BRI	11	21.2727273	14.8532213	24.4545455	15.6356237
1	NBO	7	26.5714286	9.8802352	21.0000000	15.2861593
1	BWB	9	17.8888889	20.6968865	21.4444444	16.3944435

Level of XP	Level of CON	N	T54 Mean	T54 SD	T110 Mean	T110 SD
0	BDT	9	8.1111111	10.0180393	35.1111111	21.9228445
0	BNT	13	4.6153846	14.5289278	55.7692308	25.9587938
0	BRI	10	10.1000000	10.7749710	42.3000000	15.6634749
0	NBO	16	4.2500000	5.3478968	35.9375000	20.8085519
0	BWB	13	12.3076923	8.4988687	44.7692308	23.1774094
1	BDT	11	11.0000000	12.9151074	50.8181818	26.1985426
1	BNT	7	10.1428571	7.2210011	52.8571429	24.2585282
1	BRI	11	15.0000000	13.0766968	51.8181818	26.0876146
1	NBO	7	19.1428571	13.4465432	62.4285714	22.9627027
1	BWB	9	13.3333333	17.2843860	44.3333333	35.1496799

ALL PARTICIPANTS WITH THE EXPERIENCE FACTOR

Level of XP	Level of CON	N	----------T210---------- Mean	SD	----------T12---------- Mean	SD
0	BDT	9	19.3333333	18.9670767	19.3333333	18.9670767
0	BNT	13	32.3846154	25.6500112	32.3846154	25.6500112
0	BRI	10	33.6000000	26.8667494	33.6000000	26.8667494
0	NBO	16	11.3750000	12.0492047	17.0625000	15.8302190
0	BWB	13	31.0769231	20.5647819	33.8461538	20.3668282
1	BDT	11	29.9090909	24.8574116	29.9090909	24.8574116
1	BNT	7	29.2857143	20.7421815	29.2857143	20.7421815
1	BRI	11	39.4545455	26.7968791	39.4545455	26.7968791
1	NBO	7	40.1428571	27.1626494	48.0000000	32.2386931
1	BWB	9	34.7777778	31.9130764	37.3333333	32.5998466

Level of XP	Level of CON	N	----------DIF10---------- Mean	SD	----------DIF5---------- Mean	SD
0	BDT	9	15.7777778	14.3768719	2.44444444	5.7903176
0	BNT	13	23.3846154	13.6841664	3.53846154	6.7776026
0	BRI	10	8.7000000	19.6528200	-8.30000000	16.3710449
0	NBO	16	24.5625000	16.1945207	7.56250000	9.2445930
0	BWB	13	13.6923077	14.7839136	-3.53846154	10.4850321
1	BDT	11	20.9090909	17.5809815	1.45454545	10.4915550
1	BNT	7	23.5714286	23.8736755	1.42857143	6.5791880
1	BRI	11	12.3636364	17.8396902	-3.18181818	13.7099831
1	NBO	7	22.2857143	20.1056732	5.57142857	12.0810753
1	BWB	9	9.5555556	6.6916200	-3.55555556	9.8502679

ALL PARTICIPANTS WITH THE EXPERIENCE FACTOR

Level of		----------TOT----------		----------T51----------		----------T52---------	
XP	N	Mean	SD	Mean	SD	Mean	SD
0	61	69.9180328	41.8633870	26.8196721	12.6220814	16.1475410	11.6402120
1	45	88.3333333	50.7354995	30.8000000	14.6203470	21.0888889	14.6688015

Level of		----------T53----------		----------T54----------		----------T110---------	
XP	N	Mean	SD	Mean	SD	Mean	SD
0	61	15.1639344	12.9192109	9.7049180	10.4711417	42.9672131	22.5846314
1	45	21.1333333	14.3789619	13.5777778	13.1087911	51.8888889	26.7812878

LEVEL OF		----------T210---------		----------T12----------		----------DIF10-------	
XP	N	Mean	SD	Mean	SD	Mean	SD
0	61	24.8688525	22.2519478	26.9508197	22.1874035	18.0983607	16.4059998
1	45	34.7111111	25.8620661	36.4444444	27.1983920	17.1777778	17.7588504

Level of		----------DIF5----------	
XP	N	Mean	SD
0	61	0.98360656	11.3702709
1	45	-0.04444444	11.0493841

ALL PARTICIPANTS WITH THE EXPERIENCE FACTOR

Level of		----------TOT----------		----------T51----------		----------T52----------	
CON	N	Mean	SD	Mean	SD	Mean	SD
BDT	20	68.9000000	44.8422968	26.4000000	12.4832519	17.3500000	13.8915915
BNT	20	86.0500000	45.1226107	33.7000000	14.7687437	21.0500000	12.5717938
BRI	21	83.9523810	44.6995259	28.9047619	12.6526865	18.3809524	12.1015544
NBO	23	70.4782609	46.9785924	25.6956522	13.8938665	18.3043478	12.2601898
BWB	22	79.8636364	51.9718747	28.2727273	13.8122851	16.3181818	15.5360912

Level of		----------T53----------		----------T54----------		----------T110---------	
CON	N	Mean	SD	Mean	SD	Mean	SD
BDT	20	15.4500000	11.8520485	9.7000000	11.4987413	43.7500000	25.0575653
BNT	20	18.2500000	12.5021051	13.0500000	12.4328724	54.7500000	24.7681353
BRI	21	24.0000000	15.6716304	12.6666667	12.0013888	47.2857143	21.7810534
NBO	23	11.3478261	12.3972456	8.7826087	10.8584133	44.0000000	24.3795742
BWB	22	19.8636364	14.0247925	12.7272727	12.4639741	44.5909091	27.8869471

Level of		----------T210---------		----------T12----------		---------DIF10---------	
CON	N	Mean	SD	Mean	SD	Mean	SD
BDT	20	25.1500000	22.4904073	25.1500000	22.4904073	18.6000000	16.0177533
BNT	20	31.3000000	23.5307190	31.3000000	23.5307190	23.4500000	17.2702208
BRI	21	36.6666667	26.3217274	36.6666667	26.3217274	10.6190476	18.3425085
NBO	23	20.1304348	21.9861617	26.4782609	25.8102685	23.8695652	17.0355360
BWB	22	32.5909091	25.1616850	35.2727273	25.3962536	12.0000000	12.0948631

Level of		----------DIF5----------	
CON	N	Mean	SD
BDT	20	1.90000000	8.5032502
BNT	20	2.80000000	6.6141793
BRI	21	-5.61904762	14.8811162
NBO	23	6.95652174	9.9474906
BWB	22	-3.54545455	9.9891716

APPENDIX F

ANOVA ON EXPERIENCED PARTICIPANTS ONLY

EXPERIENCED PARTICIPANTS ONLY

General Linear Models Procedure
Class Level Information

Class	Levels	Values
CON	5	BDT BNT BRI NBO BWB

Number of observations in data set = 45

Dependent Variable: TOT

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	4817.06493506	1204.26623377	0.44	0.7759
Error	40	108442.93506494	2711.07337662		
Corrected Total	44	113260.00000000			

R-Square	C.V.	Root MSE	TOT Mean
0.042531	58.94487	52.06796882	88.33333333

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	4817.06493506	1204.26623377	0.44	0.7759

Dependent Variable: T51

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	367.23751804	91.80937951	0.41	0.8030
Error	40	9037.96248196	225.94906205		
Corrected Total	44	9405.20000000			

R-Square	C.V.	Root MSE	T51 Mean
0.039046	48.80390	15.03160211	30.80000000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	367.23751804	91.80937951	0.41	0.8030

Dependent Variable: T52

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	310.59971140	77.64992785	0.34	0.8499
Error	40	9157.04473304	228.92611833		
Corrected Total	44	9467.64444444			

R-Square	C.V.	Root MSE	T52 Mean
0.032806	71.74539	15.13030463	21.08888889

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	310.59971140	77.64992785	0.34	0.8499

EXPERIENCED PARTICIPANTS ONLY

Dependent Variable: T53

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	204.48427128	51.12106782	0.23	0.9200
Error	40	8892.71572872	222.31789322		
Corrected Total	44	9097.20000000			

R-Square	C.V.	Root MSE	T53 Mean
0.022478	70.55360	14.91032841	21.13333333

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	204.48427128	51.12106782	0.23	0.9200

Dependent Variable: T54

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	395.26349206	98.81587302	0.55	0.6989
Error	40	7165.71428571	179.14285714		
Corrected Total	44	7560.97777778			

R-Square	C.V.	Root MSE	T54 Mean
0.052277	98.57597	13.38442592	13.57777778

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	395.26349206	98.81587302	0.55	0.6989

Dependent Variable: T110

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	1310.60028860	327.65007215	0.43	0.7837
Error	40	30247.84415584	756.19610390		
Corrected Total	44	31558.44444444			

R-Square	C.V.	Root MSE	T110 Mean
0.041529	52.99597	27.49902005	51.88888889

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	1310.60028860	327.65007215	0.43	0.7837

EXPERIENCED PARTICIPANTS ONLY

Dependent Variable: T210

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	913.76681097	228.44170274	0.32	0.8626
Error	40	28515.47763348	712.88694084		
Corrected Total	44	29429.24444444			

R-Square	C.V.	Root MSE	T210 Mean
0.031050	76.92045	26.69994271	34.71111111

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	913.76681097	228.44170274	0.32	0.8626

Dependent Variable: T12

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	1870.04617605	467.51154401	0.61	0.6581
Error	40	30679.06493506	766.97662338		
Corrected Total	44	32549.11111111			

R-Square	C.V.	Root MSE	T12 Mean
0.057453	75.99057	27.69434280	36.44444444

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	1870.04617605	467.51154401	0.61	0.6581

Dependent Variable: DIF10

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	1399.75815296	349.93953824	1.12	0.3598
Error	40	12476.81962482	311.92049062		
Corrected Total	44	13876.57777778			

R-Square	C.V.	Root MSE	DIF10 Mean
0.100872	102.8146	17.66127092	17.17777778

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	1399.75815296	349.93953824	1.12	0.3598

EXPERIENCED PARTICIPANTS ONLY

Dependent Variable: DIF5

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	479.89668110	119.97417027	0.98	0.4288
Error	40	4892.01443001	122.30036075		
Corrected Total	44	5371.91111111			

R-Square	C.V.	Root MSE	DIF5 Mean
0.089334	-9999.99	11.05894935	-0.04444444

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	479.89668110	119.97417027	0.98	0.4288

General Linear Models Procedure

Level of		--------TOT--------		--------T51----------		--------T52--------	
CON	N	Mean	SD	Mean	SD	Mean	SD
BDT	11	80.727273	47.9522490	30.4545455	13.2692399	20.3636364	14.6100837
BNT	7	82.142857	38.3076519	32.2857143	16.9481000	20.5714286	11.5737799
BRI	11	91.272727	49.7897397	30.5454545	14.3412945	21.2727273	14.8532213
NBO	7	110.428571	50.8030745	35.8571429	15.8264396	26.5714286	9.8802352
BWB	9	81.666667	67.4240313	26.4444444	15.7885331	17.8888889	20.6968865

Level of		--------T53--------		--------T54--------		--------T110--------	
CON	N	Mean	SD	Mean	SD	Mean	SD
BDT	11	18.9090909	12.7707051	11.0000000	12.9151074	50.8181818	26.1985426
BNT	7	19.1428571	14.5192811	10.1428571	7.2210011	52.8571429	24.2585282
BRI	11	24.4545455	15.6356237	15.0000000	13.0766968	51.8181818	26.0876146
NBO	7	21.0000000	15.2861593	19.1428571	13.4465432	62.4285714	22.9627027
BWB	9	21.4444444	16.3944435	13.3333333	17.2843860	44.3333333	35.1496799

Level of		--------T210-------		--------T12--------		-------DIF10--------	
CON	N	Mean	SD	Mean	SD	Mean	SD
BDT	11	29.9090909	24.8574116	29.9090909	24.8574116	20.9090909	17.5809815
BNT	7	29.2857143	20.7421815	29.2857143	20.7421815	23.5714286	23.8736755
BRI	11	39.4545455	26.7968791	39.4545455	26.7968791	12.3636364	17.8396902
NBO	7	40.1428571	27.1626494	48.0000000	32.2386931	22.2857143	20.1056732
BWB	9	34.7777778	31.9130764	37.3333333	32.5998466	9.5555556	6.6916200

EXPERIENCED PARTICIPANTS ONLY

Level of		----------DIF5---------	
CON	N	Mean	SD
BDT	11	1.45454545	10.4915550
BNT	7	1.42857143	6.5791880
BRI	11	-3.18181818	13.7099831
NBO	7	5.57142857	12.0810753
BWB	9	-3.55555556	9.8502679

APPENDIX G

ANOVA ON ALL PARTICIPANTS WITHOUT THE EXPERIENCE FACTOR

ALL PARTICIPANTS WITHOUT THE EXPERIENCE FACTOR

General Linear Models Procedure
Class Level Information

Class	Levels	Values
CON	5	BDT BNT BRI NBO BWB

Number of observations in data set = 106

Dependent Variable: TOT

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	5066.57135311	1266.64283828	0.58	0.6807
Error	101	222128.03242048	2199.28744971		
Corrected Total	105	227194.60377359			

R-Square	C.V.	Root MSE	TOT Mean
0.022301	60.32810	46.89656117	77.73584906

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	5066.57135311	1266.64283828	0.58	0.6807

Dependent Variable: T51

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	814.44784065	203.61196016	1.11	0.3570
Error	101	18560.04272539	183.76279926		
Corrected Total	105	19374.49056604			

R-Square	C.V.	Root MSE	T51 Mean
0.042037	47.54887	13.55591381	28.50943396

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	814.44784065	203.61196016	1.11	0.3570

Dependent Variable: T52

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	255.52796807	63.88199202	0.36	0.8373
Error	101	17974.09467344	177.96133340		
Corrected Total	105	18229.62264151			

R-Square	C.V.	Root MSE	T52 Mean
0.014017	73.11597	13.34021489	18.24528302

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	255.52796807	63.88199202	0.36	0.8373

ALL PARTICIPANTS WITHOUT THE EXPERIENCE FACTOR

Dependent Variable: T53

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	1971.83132225	492.95783056	2.76	0.0319
Error	101	18062.50830040	178.83671585		
Corrected Total	105	20034.33962264			

R-Square	C.V.	Root MSE	T53 Mean
0.098423	75.56164	13.37298455	17.69811321

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	1971.83132225	492.95783056	2.76	0.0319

Dependent Variable: T54

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	341.99155915	85.49788979	0.61	0.6573
Error	101	14186.09334651	140.45636977		
Corrected Total	105	14528.08490566			

R-Square	C.V.	Root MSE	T54 Mean
0.023540	104.4266	11.85142902	11.34905660

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	341.99155915	85.49788979	0.61	0.6573

Dependent Variable: T110

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	1742.51874541	435.62968635	0.70	0.5909
Error	101	62481.10389610	618.62479105		
Corrected Total	105	64223.62264151			

R-Square	C.V.	Root MSE	T110 Mean
0.027132	53.19713	24.87216901	46.75471698

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	1742.51874541	435.62968635	0.70	0.5909

ALL PARTICIPANTS WITHOUT THE EXPERIENCE FACTOR

Dependent Variable: T210

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	3729.42060681	932.35515170	1.63	0.1735
Error	101	57917.34354414	573.43904499		
Corrected Total	105	61646.76415094			

R-Square	C.V.	Root MSE	T210 Mean
0.060497	82.44035	23.94658733	29.04716981

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	3729.42060681	932.35515170	1.63	0.1735

Dependent Variable: T12

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	2232.44283069	558.11070767	0.91	0.4633
Error	101	62187.51943347	615.71801419		
Corrected Total	105	64419.96226415			

R-Square	C.V.	Root MSE	T12 Mean
0.034655	80.09283	24.81366588	30.98113208

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	2232.44283069	558.11070767	0.91	0.4633

Dependent Variable: DIF10

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	3320.62288566	830.15572141	3.14	0.0178
Error	101	26727.31107660	264.62684234		
Corrected Total	105	30047.93396226			

R-Square	C.V.	Root MSE	DIF10 Mean
0.110511	91.86679	16.26735511	17.70754717

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	3320.62288566	830.15572141	3.14	0.0178

ALL PARTICIPANTS WITHOUT THE EXPERIENCE FACTOR

Dependent Variable: DIF5

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	2249.90070280	562.47517570	5.21	0.0007
Error	101	10906.36344815	107.98379652		
Corrected Total	105	13156.26415094			

R-Square	C.V.	Root MSE	DIF5 Mean
0.171014	1899.141	10.39152523	0.54716981

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	2249.90070280	562.47517570	5.21	0.0007

ALL PARTICIPANTS WITHOUT THE EXPERIENCE FACTOR

General Linear Models Procedure

Duncan's Multiple Range Test for variable: T53

NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha = 0.05 df = 101 MSE = 178.8367

WARNING: Cell sizes are not equal.

Harmonic Mean of cell sizes = 21.13701

Number of Means	2	3	4	5
Critical Range	8.160	8.588	8.871	9.079

Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	CON
A	24.000	21	BRI
B A	19.864	22	BWB
B A	18.250	20	BNT
B A	15.450	20	BDT
B	11.348	23	NBO

ALL PARTICIPANTS WITHOUT THE EXPERIENCE FACTOR

Duncan's Multiple Range Test for variable: T210
NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha = 0.05 df = 101 MSE = 573.439
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes = 21.13701

Number of Means 2 3 4 5
Critical Range 14.61 15.38 15.89 16.26
Means with the same letter are not significantly different.

Duncan Grouping		Mean	N	CON
	A	36.667	21	BRI
B	A	32.591	22	BWB
B	A	31.300	20	BNT
B	A	25.150	20	BDT
B		20.130	23	NBO

ALL PARTICIPANTS WITHOUT THE EXPERIENCE FACTOR

Duncan's Multiple Range Test for variable: DIF10
NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha = 0.05 df = 101 MSE = 264.6268
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes = 21.13701

Number of Means	2	3	4	5
Critical Range	9.93	10.45	10.79	11.04

Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	CON
A	23.870	23	NBO
A	23.450	20	BNT
B A	18.600	20	BDT
B	12.000	22	BWB
B	10.619	21	BRI

ALL PARTICIPANTS WITHOUT THE EXPERIENCE FACTOR

Duncan's Multiple Range Test for variable: DIF5
NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha = 0.05 df = 101 MSE = 107.9838
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes = 21.13701

Number of Means 2 3 4 5
Critical Range 6.341 6.673 6.894 7.055
Means with the same letter are not significantly different.

Duncan Grouping		Mean	N	CON
	A	6.957	23	NBO
B	A	2.800	20	BNT
B	A	1.900	20	BDT
B	C	-3.545	22	BWB
	C	-5.619	21	BRI

ALL PARTICIPANTS WITHOUT THE EXPERIENCE FACTOR

General Linear Models Procedure

Level of		--------TOT--------		--------T51----------		---------T52--------	
CON	N	Mean	SD	Mean	SD	Mean	SD
BDT	20	68.9000000	44.8422968	26.4000000	12.4832519	17.3500000	13.8915915
BNT	20	86.0500000	45.1226107	33.7000000	14.7687437	21.0500000	12.5717938
BRI	21	83.9523810	44.6995259	28.9047619	12.6526865	18.3809524	12.1015544
NBO	23	70.4782609	46.9785924	25.6956522	13.8938665	18.3043478	12.2601898
BWB	22	79.8636364	51.9718747	28.2727273	13.8122851	16.3181818	15.5360912

Level of		---------T53---------		----------T54----------		----------T110----------	
CON	N	Mean	SD	Mean	SD	Mean	SD
BDT	20	15.4500000	11.8520485	9.7000000	11.4987413	43.7500000	25.0575653
BNT	20	18.2500000	12.5021051	13.0500000	12.4328724	54.7500000	24.7681353
BRI	21	24.0000000	15.6716304	12.6666667	12.0013888	47.2857143	21.7810534
NBO	23	11.3478261	12.3972456	8.7826087	10.8584133	44.0000000	24.3795742
BWB	22	19.8636364	14.0247925	12.7272727	12.4639741	44.5909091	27.8869471

Level of		----------T210---------		----------T12----------		---------DIF10---------	
CON	N	Mean	SD	Mean	SD	Mean	SD
BDT	20	25.1500000	22.4904073	25.1500000	22.4904073	18.6000000	16.0177533
BNT	20	31.3000000	23.5307190	31.3000000	23.5307190	23.4500000	17.2702208
BRI	21	36.6666667	26.3217274	36.6666667	26.3217274	10.6190476	18.3425085
NBO	23	20.1304348	21.9861617	26.4782609	25.8102685	23.8695652	17.0355360
BWB	22	32.5909091	25.1616850	35.2727273	25.3962536	12.0000000	12.0948631

Level of		------------DIF5-----------	
CON	N	Mean	SD
BDT	20	1.90000000	8.5032502
BNT	20	2.80000000	6.6141793
BRI	21	-5.61904762	14.8811162
NBO	23	6.95652174	9.9474906
BWB	22	-3.54545455	9.9891716

APPENDIX H

ANOVA ON INEXPERIENCED PARTICIPANTS ONLY

INEXPERIENCED PARTICIPANTS ONLY

General Linear Models Procedure
Class Level Information

Class	Levels	Values
CON	5	BDT BNT BRI NBO BWB

Number of observations in data set = 61

Dependent Variable: TOT

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	12398.69871094	3099.67467774	1.87	0.1282
Error	56	92753.89145299	1656.31949023		
Corrected Total	60	105152.59016393			

R-Square	C.V.	Root MSE	TOT Mean
0.117911	58.20802	40.69790523	69.91803279

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	12398.69871094	3099.67467774	1.87	0.1282

Dependent Variable: T51

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	1612.43263276	403.10815819	2.84	0.0324
Error	56	7946.58376068	141.90328144		
Corrected Total	60	9559.01639344			

R-Square	C.V.	Root MSE	T51 Mean
0.168682	44.41634	11.91231638	26.81967213

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	1612.43263276	403.10815819	2.84	0.0324

Dependent Variable: T52

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	455.55770807	113.88942702	0.83	0.5111
Error	56	7674.11442308	137.03775755		
Corrected Total	60	8129.67213115			

R-Square	C.V.	Root MSE	T52 Mean
0.056036	72.49595	11.70631272	16.14754098

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	455.55770807	113.88942702	0.83	0.5111

INEXPERIENCED PARTICIPANTS ONLY

Dependent Variable: T53

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	2125.93971557	531.48492889	3.77	0.0087
Error	56	7888.42094017	140.86465965		
Corrected Total	60	10014.36065574			

R-Square	C.V.	Root MSE	T53 Mean
0.212289	78.26888	11.86864186	15.16393443

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	2125.93971557	531.48492889	3.77	0.0087

Dependent Variable: T54

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	902.05348186	225.51337046	2.22	0.0779
Error	56	5676.63504274	101.36848291		
Corrected Total	60	6578.68852459			

R-Square	C.V.	Root MSE	T54 Mean
0.137118	103.7432	10.06819164	9.70491803

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	902.05348186	225.51337046	2.22	0.0779

Dependent Variable: T110

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	3523.39265273	880.84816318	1.82	0.1375
Error	56	27080.54177350	483.58110310		
Corrected Total	60	30603.93442623			

R-Square	C.V.	Root MSE	T110 Mean
0.115129	51.17967	21.99047756	42.96721311

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	3523.39265273	880.84816318	1.82	0.1375

INEXPERIENCED PARTICIPANTS ONLY

Dependent Variable: T210

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	5186.80081967	1296.70020492	2.96	0.0273
Error	56	24522.15000000	437.89553571		
Corrected Total	60	29708.95081967			

R-Square	C.V.	Root MSE	T210 Mean
0.174587	84.14523	20.92595364	24.86885246

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	5186.80081967	1296.70020492	2.96	0.0273

Dependent Variable: T12

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	3530.74572825	882.68643206	1.90	0.1231
Error	56	26006.10673077	464.39476305		
Corrected Total	60	29536.85245902			

R-Square	C.V.	Root MSE	T12 Mean
0.119537	79.95980	21.54982049	26.95081967

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	3530.74572825	882.68643206	1.90	0.1231

Dependent Variable: DIF10

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	2215.97062666	553.99265667	2.23	0.0777
Error	56	13933.43920940	248.81141445		
Corrected Total	60	16149.40983607			

R-Square	C.V.	Root MSE	DIF10 Mean
0.137217	87.15572	15.77375714	18.09836066

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	2215.97062666	553.99265667	2.23	0.0777

INEXPERIENCED PARTICIPANTS ONLY

Dependent Variable: DIF5

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	1924.26234587	481.06558647	4.62	0.0027
Error	56	5832.72126068	104.15573680		
Corrected Total	60	7756.98360656			

R-Square	C.V.	Root MSE	DIF5 Mean
0.248068	1037.577	10.20567180	0.98360656

Source	DF	Type I SS	Mean Square	F Value	Pr > F
CON	4	1924.26234587	481.06558647	4.62	0.0027

INEXPERIENCED PARTICIPANTS ONLY

General Linear Models Procedure

Duncan's Multiple Range Test for variable: T51
NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha = 0.05 df = 56 MSE = 141.9033
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes = 11.69708

Number of Means 2 3 4 5
Critical Range 9.87 10.38 10.72 10.96
Means with the same letter are not significantly different.

Duncan Grouping		Mean	N	CON
	A	34.462	13	BNT
B	A	29.538	13	BWB
B	A	27.100	10	BRI
B		21.444	9	BDT
B		21.250	16	NBO

INEXPERIENCED PARTICIPANTS ONLY

Duncan's Multiple Range Test for variable: T53
NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha = 0.05 df = 56 MSE = 140.8647
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes = 11.69708

Number of Means	2	3	4	5
Critical Range	9.83	10.34	10.68	10.92

Means with the same letter are not significantly different.

Duncan Grouping		Mean	N	CON
	A	23.500	10	BRI
B	A	18.769	13	BWB
B	A	17.769	13	BNT
B	C	11.222	9	BDT
	C	7.125	16	NBO

INEXPERIENCED PARTICIPANTS ONLY

Duncan's Multiple Range Test for variable: T54
NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha = 0.05 df = 56 MSE = 101.3685
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes = 11.69708

Number of Means	2	3	4	5
Critical Range	8.340	8.773	9.058	9.265

Means with the same letter are not significantly different.

Duncan Grouping		Mean	N	CON
	A	14.615	13	BNT
B	A	12.308	13	BWB
B	A	10.100	10	BRI
B	A	8.111	9	BDT
B		4.250	16	NBO

INEXPERIENCED PARTICIPANTS ONLY

Duncan's Multiple Range Test for variable: T110
NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha = 0.05 df = 56 MSE = 483.5811
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes = 11.69708

Number of Means	2	3	4	5
Critical Range	18.22	19.16	19.78	20.24

Means with the same letter are not significantly different.

Duncan Grouping		Mean	N	CON
	A	55.769	13	BNT
B	A	44.769	13	BWB
B	A	42.300	10	BRI
B		35.938	16	NBO
B		35.111	9	BDT

INEXPERIENCED PARTICIPANTS ONLY

Duncan's Multiple Range Test for variable: T210
NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha = 0.05 df = 56 MSE = 437.8955
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes = 11.69708

Number of Means	2	3	4	5
Critical Range	17.33	18.23	18.83	19.26

Means with the same letter are not significantly different.

Duncan Grouping		Mean	N	CON
	A	33.600	10	BRI
	A	32.385	13	BNT
	A	31.077	13	BWB
B	A	19.333	9	BDT
B		11.375	16	NBO

INEXPERIENCED PARTICIPANTS ONLY

Duncan's Multiple Range Test for variable: DIF10
NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha = 0.05 df = 56 MSE = 248.8114
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes = 11.69708

Number of Means	2	3	4	5
Critical Range	13.07	13.74	14.19	14.52

Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	CON
A	24.563	16	NBO
A	23.385	13	BNT
B A	15.778	9	BDT
B A	13.692	13	BWB
B	8.700	10	BRI

INEXPERIENCED PARTICIPANTS ONLY

Duncan's Multiple Range Test for variable: DIF5
NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha = 0.05 df = 56 MSE = 104.1557
WARNING: Cell sizes are not equal.
Harmonic Mean of cell sizes = 11.69708

Number of Means	2	3	4	5
Critical Range	8.454	8.893	9.182	9.392

Means with the same letter are not significantly different.

Duncan Grouping		Mean	N	CON
	A	7.563	16	NBO
B	A	3.538	13	BNT
B	A	2.444	9	BDT
B	C	-3.538	13	BWB
	C	-8.300	10	BRI

INEXPERIENCED PARTICIPANTS ONLY

General Linear Models Procedure

Level of		----------TOT----------		----------T51----------		----------T52----------	
CON	N	Mean	SD	Mean	SD	Mean	SD
BDT	9	54.4444444	38.3930694	21.4444444	9.9888827	13.6666667	12.7964839
BNT	13	88.1538462	49.7625129	34.4615385	14.1398691	21.3076923	13.5301183
BRI	10	75.9000000	39.3459019	27.1000000	10.9691487	15.2000000	7.6710133
NBO	16	53.0000000	33.6729367	21.2500000	10.6614571	14.6875000	11.6431310
BWB	13	78.6153846	41.1350185	29.5384615	12.7842050	15.2307692	11.5625390

Level of		----------T53----------		----------T54----------		----------T110----------	
CON	N	Mean	SD	Mean	SD	Mean	SD
BDT	9	11.2222222	9.6537270	8.1111111	10.0180393	35.1111111	21.9228445
BNT	13	17.7692308	11.8894480	14.6153846	14.5289278	55.7692308	25.9587938
BRI	10	23.5000000	16.5411944	10.1000000	10.7749710	42.3000000	15.6634749
NBO	16	7.1250000	8.3336667	4.2500000	5.3478968	35.9375000	20.8085519
BWB	13	18.7692308	12.7223808	12.3076923	8.4988687	44.7692308	23.1774094

Level of		----------T210----------		----------T12----------		----------DIF10----------	
CON	N	Mean	SD	Mean	SD	Mean	SD
BDT	9	19.3333333	18.9670767	19.3333333	18.9670767	15.7777778	14.3768719
BNT	13	32.3846154	25.6500112	32.3846154	25.6500112	23.3846154	13.6841664
BRI	10	33.6000000	26.8667494	33.6000000	26.8667494	8.7000000	19.6528200
NBO	16	11.3750000	12.0492047	17.0625000	15.8302190	24.5625000	16.1945207
BWB	13	31.0769231	20.5647819	33.8461538	20.3668282	13.6923077	14.7839136

Level of		----------DIF5----------	
CON	N	Mean	SD
BDT	9	2.44444444	5.7903176
BNT	13	3.53846154	6.7776026
BRI	10	-8.30000000	16.3710449
NBO	16	7.56250000	9.2445930
BWB	13	-3.53846154	10.4850321

APPENDIX I

RELIABILITY TEST FOR ALL PARTICIPANTS

RELIABILITY TEST FOR ALL PARTICIPANTS

Correlation Analysis
2 'VAR' Variables: RELTOT TOT
Simple Statistics

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
RELTOT	25	39.240000	19.216486	981.000000	8.000000	93.000000
TOT	25	92.920000	55.093799	2323.000000	14.000000	209.000000

Pearson Correlation Coefficients / Prob > |R| under Ho: Rho=0 / N = 25

	RELTOT	TOT
RELTOT	1.00000	0.86707
	0.0	0.0001
TOT	0.86707	1.00000
	0.0001	0.0

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