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## PESSIMISM AND OPTIMISM AT DUAL TASK PERFORMANCE

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### ÇOKLU GÖREV PERFORMANSINDA KARAMSARLIK VE İYİMSERLİK

#### Abstract

The aim of the present study was to investigate dual task performance in pessimist and optimist participants. To test for this, two hundred fifty participants were screened via life orientation test. Twenty participants were selected from top quartiles of pessimism and optimism. In addition, participants with higher depression and with history of past or current psychiatric and neurologic disorders were eliminated based on Beck depression inventory and psychiatric and neurologic screening test. In the final case, 20 participants from each group were performed three tasks which are single tasks, dual tasks with 1000 ms. and dual task with 0 SOA manipulations. The results showed that individuals who scored higher on pessimism scale were considerably slowing down as compared to individuals who scored higher on optimism scale as task demand increase from single task to dual task with 0 SOA. It has been concluded that pessimism may impair central executive functions during dual task processing.

**Keywords:** Optimism and Pessimism, Dual Task, Multitasking, Executive Functions.

#### Öz

Bu çalışmanın amacı karamsarlığın çoklu görevler sırasında ana yürütücü işlevler üzerindeki etkisini araştırmaktır. Bunu test etmek için, ikiyüz elli (250) katılımcı 'Yasama Uyum Testiyle' incelendi. Ayrıca, Beck depresyon testi, nörolojik ve psikiyatrik hastalık geçmişi testleri gibi ölçekler kullanılarak katılımcılardan geçmişte veya bugün her hangi bir psikolojik ve nörolojik hastalığı olanlar elendi. Bu katılımcılar içerisinde karamsarlık ve iyimserlik testlerinin üst çeyreğinde yer alan katılımcılar seçildi. Böylece, yirmiser kişiden oluşan karamsar ve iyimser iki grup oluşturuldu. Katılımcılar, tekli görev, kolaylaştırılmış ikili görev (iki görev arasında 1000 ms var) zorlaştırılmış ikili görev (iki görev arasında zaman yok (0 ms)) olmak üzere üç ana test uygulamasına katıldı. Bulgular karamsar katılımcıların, iyimser olanlara göre testlerin zorluğu arttıkça daha düşük performans ortaya koyduğunu gösterdi. Kolay testler sırasında iki grup benzer performans sergilerken, zor test

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uygulanmasında iyimser katılımcılar, karamsar olanlara göre daha başarılı olmuştur. Tartışmada, karamsarlığın beyindeki ana yürütücü sistemi etkileyebileceği sonucuna varıldı.

**Anahtar kelimeler:** İyimserlik ve Karamsarlık, İkili Görev, Çoklu Görev, İşlemsel Bellek, Merkezi Yürütme İşlevleri.

## **1. Introduction**

Pessimism refers to interpretation of events toward permanent and pervasive expectations because it is related to lower psychological adjustments that leads usually poorer outcomes. Conversely, optimism refers evaluating the events toward positive and hopeful consequences thus it is associated with better psychological adjustments. Pessimistic and optimistic interpretations of events influence feelings and behaviours which may lead differences in cognitive processing (Helton, Dember, Warm and Matthews 1999; Levens and Gotlib 2012; Maruta, Colligan, Malinchoc and Offord; Szalma, Hancock, Dember and Warm 2006). Previous studies have found that pessimistic interpretations were associated with psychological disorders such as depression (Sweeney, Anderson and Bailey 1986), lower academic achievements (Peterson and Barrett 1987; Seligman, Nolen-Hoeksema, Thornton and Thornton 1990), attentional biases toward negative emotional stimuli (Segerstrom 2001) and impairment in cognitive functioning (Levens and Gotlib 2012). However, the research about influence of pessimism on multitasking which is associated with central executive system is sparse. The aim of the current study is to explore dual task performance in pessimist and optimist individuals. Therefore, we tested participants along easy (single tasks), moderate (dual task 1000 ms) and difficult cognitive tasks (dual task 0 ms) which demands executive functions. Employing such tasks are important because it will allow to understand differences regarding cognitive abilities across tasks from easy to difficult. Investigation potential detrimental effect of pessimism as compared to optimism will contribute the research related to mechanisms underlie psychologic disorders which precipitated by pessimism.

Dual tasks (DT) or multitasking that refers to performing two tasks concurrently is widely used to explore executive functions that controls, regulates, manipulates, and integrates information during cognitive processing (Baddeley 1996; Baddeley 2012). In DT procedures, there are one auditory and one visual single tasks which aren't required much executive functions when performing individually because they are often simple and basic (Szameitat, Saylik and Parton 2016). Therefore, regarding individual differences usually there is no difference between

groups in single task performance. However, when performing these single tasks concurrently as dual tasks, the task become more difficult and requires extensive use of executive functions for control of attention during processing of the task processing (Baddeley 1996; Baddeley 2012). For instance, inhibition function is assumed to be used to avoid processing of the second task until the first task is processed in the mental space and switching is supposed to be used to shift the focus of the attention from the first task to the second task (Luria and Meiran 2003; Szameitat, Schubert and Torsten 2011; Luria and Meiran 2003; Jiang 2004). Also, updating is used to maintain the first and second task related context and rules until both tasks are processed (De Jong 1995; Logan and Gordon 2001). In this context, when comparing performance on single tasks and dual task, potential individual differences due to pessimism or optimism regarding executive functions will revealed.

Seligman's Model suggest that individual with higher pessimistic level prone to higher stress level, anxiety and depression (Shurman and Seligman, 1994; Gillham, Reivich and Seligman 2001). Interpreting this in the context of cognitive psychology pessimist individual more likely to have cognitive impairments on demanding cognitive tasks. The reason for that is that such features (i.e. stress, anxiety) are known to be a potential cause which limit investment of cognitive resources during task processing (Eysenck, 1967; Eysenck and Eysenck, 1986).

Previous studies about cognitive processing in pessimism as compared to optimism are sparse and somehow inconsistent. While some studies found out that pessimism impairs cognitive processing in working memory tasks (Ashby, Valentin and Turken 2002; Levens and Gotlib 2012), the others were failed show such cognitive impairments in pessimist as compared to optimist individuals (Szalma 2002; Szalma 2006). For instance, Levens and Gotlib (2012) found that pessimist individuals were slower during processing of emotion n back task as compared optimist participants. According to the authors, the reason for that is that pessimist people may unable to employ efficient effort into the task because emotional stimuli bring stress-related mental representations from long-term memory which interferes with cognitive processing (Levens and Gotlib 2012). On the other hand, Szalma, (2009) failed to show such cognitive impairments in pessimist as compared to optimist participants on a vigilance task performance.

One potential reason for such inconsistency among the empirical findings might be that the detrimental effects of pessimism might be revealed on specific tasks (Szalma 2009). This means that while pessimist and optimist participants could differ regarding cognitive processing on

certain tasks, they may perform similarly on another one. Therefore, to investigate effect of pessimism as compared to optimism, the task should be well controlled and task demand should be manipulated along several conditions from easy to difficult conditions.

To understand the effect of pessimism on the executive function in dual-task performance, it would be beneficial to use an experimental design that allows for perfect control of the temporal concurrency of the tasks. One paradigm fulfilling this purpose is the psychological refractory period (PRP) dual task paradigm. In this paradigm, performing two tasks simultaneously or with an interval between two tasks (stimulus onset asynchrony [SOA]) cause delay in processing of the second tasks (Pashler 1994a; Logan and Gordon 2001). Accordingly, the processing of the second task will be delayed until the processing of the first task has been completed because two tasks cannot be processed at the same time at the mental workspace (Pashler 1994a; Logan and Gordon 2001). The previous literature shows that by using this paradigm, task processing in a single task (do not requires much executive functions) and a dual task (requires extensive use of executive functions) can be compared (De Jong 1995; Logan and Gordon 2001; Luria and Meiran 2003; Meyer and Kieras 1997b). Moreover, in addition to comparison between single and dual tasks, task demand could be increased by SOA manipulation (SOA 0 and 1000ms). Increasing task demand by the SOA manipulation places a pure demand on the central executive system because no additional stimuli are inserted (Szameitat, Schubert, Müller and Von Cramon 2002). Thus, the demand increase is undertaken completely by SOA manipulation on the central executive system. When the SOA is short, higher stimuli competition in the mental workspace causes a delay in the processing of the second stimulus (Luria and Meiran 2005; Jiang 2004). However, when the SOA is long there is more time for using the executive functions (Monsell 2003) so the demand on central executive system is lowered in this condition (Luria and Meiran 2003).

In the present research, Life Orientation Test (LOT) was used to explore individual differences regarding pessimism and optimism during processing dual tasks. To test this, PRP dual task paradigm is used with varied manipulations. In more detail, to test whether pessimism leads cognitive impairments as compared to optimism, participants performed single tasks and dual tasks with 1000ms and 0 ms SOA manipulations. The reason for employing these tasks is that it allows to test performance of pessimist and optimist participants across tasks with varied demands (i.e. from easy to difficult conditions). The hypothesis to be tested is that

pessimist participants will differ from optimist participants as the task difficulty increase from easy to difficult conditions.

## **2. Methods**

### **2.1. Participants**

Two hundred fifty participants were screened at Brunel University London campus by using 10 item Life orientation test (LOT) of pessimism and optimism to select participants high in pessimism and optimism. From the screened people 46 participants were selected to take part the experiment. Three participants were excluded due to past or current psychiatric or neurological illness. One participants were excluded due to consumption of higher amount of alcohol in 24 hours. Two participants were excluded due to scoring over 15 on Beck Depression Inventory (BDI) (Seligman, 1984). At the final stage 40 participants took part the study: 20 (10 female) were in the pessimism group (mean pessimism score=16.5, range=15–18), and 20 (10 female) were in the optimism group (mean optimism score= 16.0, range=15–18). The two groups were matched for age (pessimism = 21.21 and optimism=22.86) and gender (pessimism: 50% optimism: = 50%). All of the participants were right-handed as assessed by the Edinburgh Inventory (Oldfield, 1971) and had normal or corrected to normal vision. Before participation each participant gave written informed consent. The participants were paid £10 for participating for one hour. The study was approved by the Department of Life Sciences ethics committee at Brunel University.

### **2.2. Materials**

LOT is developed by Scheier & Carver, (1985) to asses optimism and pessimism level among individuals. The Cronbach's alpha coefficients of reliability were 0.70 (optimism), 0.74 (pessimism). It is consisted of 10 items is used to measure dispositional pessimism and optimism. The scores of for both dimensions (i.e. pessimism and optimism) varied from minimum 0 to maximum 18. Basically, participants were selected from top quartiles of each scales. In this context, participants who scored over 15 from in a scale were classified as either pessimists or optimists. This sample selection method was previously used in the anxiety and personality questionnaires (Szameitat, Saylik and Parton 2016; Chan, Harmer and Goodwin, 2008; Portello, Harmer, Flint, Cowen, and Goodwin, 2005). Also, few questionnaires were used to eliminate potential confounding effects. In more detail, a self-designed survey was

used to eliminate participants with current or past history of psychological and neurological history. Beck Depression Inventory (BDI) were used to eliminate participants with current depressive mood (Beck, Epstein, Brown, and Steer 1988). In this inventory, scoring over 15 is related to depressive mood state. Therefore, participants who scored over 15 were excluded. Alcohol and caffeine consumption survey were used to avoid potential effects on cognitive mechanism. Finally, Ishihara colour blindness test used to eliminate participants with colour blindness (Ishihara 1987). These exclusion criteria were important to be employed because it has been previously found that these feature (current or past psychological or neurological illness, current mood state, alcohol and caffeine consumption may affect cognitive processing.

### **2.3. Tasks**

Experimental tasks consisted of three tasks. These are single tasks which are visual and auditory single tasks and DT 1000 ms SOA and DT 0ms SOA.

#### **2.3.1. Single Tasks**

In the visual single tasks, picture of male and female faces was presented. The participants were required to decide whether the presented face is male or female. The key mappings for the response was 'N' for the male faces and 'M' for the female faces. In auditory tasks, participants hear syllables which are 'ha-ha' and 'ya-ya'. Participants were required to decide whether the syllable was 'ha-ha' or 'ya-ya'. The key mappings for the responses were 'C' for the 'ha-ha' and 'X' for the 'ya-ya'. In each single task, there were 2 blocks and each block were consisted of 30 trials. A single task trial started with a blank gray screen for 300 ms. Following by that a fixation cross were appeared for 300 ms. After fixation cross is disappeared the stimuli were presented for 350 ms. Depending on speed of the participants total duration of a trial is varied. After each trial the participants receive a feedback on the screen. If the response was wrong, they saw an error feedback and if the response is correct, they saw a fixation cross for 300 ms. Therefore, there was always 1300 ms between last response and start of the next stimulus (Response-Stimulus-Interval, RSI).

In the analyses, the average of response times and errors rates across visual and auditory single task were calculated to explore response times in single task in pessimist and optimist participants.

### **2.3.2. Dual Tasks (DT)**

In the dual tasks visual and auditory tasks were presented either simultaneously (0 SOA) or in a rapid succession (1000 ms SOA). The task order was as visual and auditory (face=> syllable). Participants were required to decide whether the presented face image is male or female at first as fast as possible. Subsequently, they have to decide whether the syllable is 'ha – ha' or 'ya – ya' as fast as possible. The key mappings were identical as in the single tasks. In DT 0SOA tasks visual and auditory tasks presented simultaneously and participants were required to respond the tasks respectively as fast as possible.

DT 1000 ms SOA was identical to DT 0 SOA except for 1000 ms between presentation of the tasks because the faces were presented at first and after 1000ms SOA the second syllables were presented.

A trial in DT 0 SOA started with 300 ms fixation cross. Following by that, the stimuli were presented for 300 ms. After response execution the feedback were given as in the single tasks. Response registration started from onset of the first task and last maximum for 4000 ms. Time durations were identical for DT 1000 SOA except for 1000 ms between presentation of each tasks. Therefore, at SOA1000, the available time to respond is 4000ms to stimulus1 and 3000ms to stimulus 2 (all durations relative to onset of stimulus). Response registration was terminated either after 4000ms or after the number of required responses had been registered.

### **2.4. Procedure**

Initially, a participant information form and consent form were given to all participants. They read the information form and signed the consent form. Subsequently, they filled screening questionnaires including beck depression inventory, self-designed psychiatric and neurologic survey, alcohol and caffeine consumption survey, Isihara color test and LOT which measures dispositional pessimism and optimism. Participants who scored over 15 on pessimism or optimism scales were selected. Following by that, the participants who passed the exclusion criteria took part the main study. Participants performed a PRP dual task that is consisted of two choice response tasks, one auditory and one visual tasks either concurrently as dual tasks or individually as a single task. In the study there were two sessions practice and main experimental session.

Participants performed all tasks which are single tasks, DT 1000 SOA and DT 0 SOA tasks in the practice session for 15 minutes. Following by completion of the practice session, the main experimental study started.

Participants took part all the tasks separately and single tasks, DT 0 and DT 1000 SOA tasks were counterbalanced along the study. In the visual single tasks, picture of male and female faces was displayed. The participants were required to decide whether the presented face is male by pressing ‘N’ button or female by pressing ‘M’ button. In auditory tasks, participants hear syllables which are ‘ha-ha’ and ‘ya-ya’ and they were required to decide whether the syllable was ‘ha-ha’ by pressing ‘C’ button or ‘ya-ya’ by pressing ‘X’ button. In the DT 0 SOA tasks, both single tasks presented simultaneously, and participants were required to respond visual tasks either by pressing ‘N’ or ‘M’ and then auditory tasks by pressing either ‘C’ or ‘X’ as fast as possible. In DT 1000 SOA, the procedure was identical to DT 0 SOA except for 1000 ms interval. Therefore, the participants must respond the first tasks as fast as possible and when the second stimulus was presented after 1000 ms they must respond as fast as possible.

At the end of the study participants were received a debriefing form. Overall the study took one hour for each participant.

### 3. Results

In the following analyses, if not otherwise stated, an analysis of variance (ANOVA) one way and mixed design were used. The significant effects for the AVOVA tests were reported at  $p < .01$  unless otherwise stated. The between-subject independent variable was LOT (Pessimism vs. Optimism). Single and dual task conditions were used as the within-subject variables. Response times and error rates in the task conditions were dependent variables.

**Table 1:** Shows Mean and SD along The Tasks in Pessimist and Optimist Participants

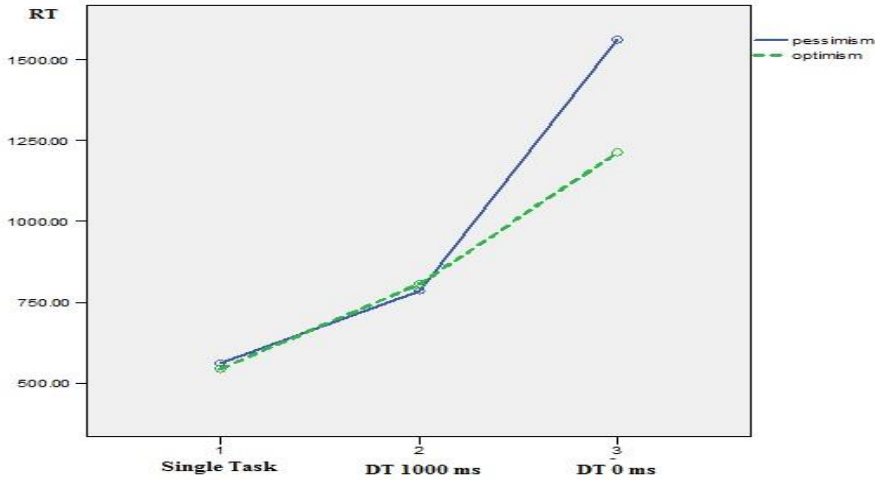
Descriptive Statistics					
Tasks	Group	Mean	SD	No	ANOVA
Single task	Pessimism	561.18	78.60	20	F (1, 39) = .40; p > .05
	Optimism	544.06	90.82	20	
DT 0	Pessimism	784.39	179.94	20	F (1, 39) = .14; p > .05
	Optimism	806.72	191.29	20	
DT 1000	Pessimism	1560.76	352.85	20	F (1, 39) = 12.02; p < .01
	Optimism	1212.27	278.30	20	



The results regarding single tasks shows that pessimists and optimists did not differ on single tasks processing  $F(1, 39) = .40; p > .05$ . This indicates that pessimism and optimism do not influence on single task performance. While pessimist and optimist participants have similar performance on dual task with 1000 ms. SOA  $F(1, 39) = .14; p > .05$ , they significantly differ on dual task with 0 SOA as evident by slower response times in pessimist participants as compared to optimist participants  $F(1, 39) = 12.02; p < .01$ .

To analyze interaction effects along the tasks, 2X2 factorial ANOVA was calculated with the between subject factor groups (pessimism vs optimism) and the within subject factors which are task conditions (Single task vs Dual task 0 SOA). Regarding dual task variables, in the present study the analyses of RT 2 was selected because majority of previous studies in PRP dual tasks indicates that RT 2 is the most sensitive measure (Pashler 1994a; Szameitat et al., 2011). The results show that on average the pessimist participants were slower than the optimist participants [groups main effect;  $F(1, 39) = 9.16; p < .01$ ]. Furthermore, the dual task performance was evident, as illustrated by the on average slower RTs in the short SOA compared to the single task [main effect dual task  $F(1, 39) = 355.38; p < .01$ ]. Finally, the dual task response times was longer for the pessimists than for the optimists compared to the single task, as is evident by the interaction between the group and dual task 0 SOA performance [ $F(1, 39) = 14.02; p < .01$ ]. Similar, analyses were run for effect of SOA manipulation on pessimist and optimists (between subject factor groups (pessimism vs optimism) and the within subject factor dual tasks conditions with SOA variations (SOA 1000 vs SOA 0). The results showed that generally pessimists were faster than optimists [groups main effect;  $F(1, 39) = 5.44; p < .05$ ]. Moreover, dual task SOA manipulation was evident as showed by the on average longer RTs in the DT 0 SOA compared to DT 1000 ms SOA [main effect dual task  $F(1, 39) = 185; p < .01$ ]. Finally, Response times on 0 SOA dual tasks become longer for the pessimists than for the optimists compared to the dual task with 1000 SOA, as is evident by the interaction between the group and dual task 0 SOA performance [ $F(1, 39) = 18.05; p < .001$ ].

**Figure 1:** Shows Performance of Pessimist and Optimist Participants along The Tasks



Taken together, the results indicate that while pessimist and optimist participants had similar performance on single tasks and dual tasks with 1000 SOA, pessimist participants were dramatically slowing down on dual tasks with short SOA. Further, the interaction effects refer that pessimist participants become slower as task difficulty increase from single tasks to dual tasks with 0 SOA, and from dual task 1000 SOA to dual task 0 SOA respectively.

#### 4. Discussion

In the present study performance of pessimist and optimist participants were compared along the single and dual tasks. The aim was to explore detrimental effect of pessimism in dual task performance which is associated with executive functions. The results showed that while pessimist and optimist participants did not differ on single and dual tasks with 1000 ms SOA, pessimist participants were dramatically slowing down in dual task with 0 SOA. The interaction effects between showed that pessimist participants become slower as the demand increase from single to dual tasks (0 SOA) as compared to optimist participants.

The results indicate that pessimism may impair task processing in certain tasks which is demanding in terms of executive functions. Conversely, when the task is rather easy or does not requires much use of executive functions, pessimist and optimist participants perform similarly. The

evidence for this interpretation is that in dual task with short SOA condition, pessimist participants considerably slower as compared to optimist participants. Previously, it has been found that DT with short SOA requires extensive use of executive functions (Luria and Meiran 2005, Luria and Meiran 2003; Jiang, 2004). Particularly, these functions are switching, inhibition and updating which are supposed to be main functions of central executive system (Miyake, Friedman, Emerson, Witzki, Howerter and Wager 2000). On the other hand, single task is basic and virtually it doesn't require executive functions (Saylik 2017). Although, DT with long SOA (1000 ms) is more difficult than single tasks, and it is associated with executive functions as well, the demand regarding executive functions in this task was minimized (Luria and Meiran 2005; Szameitat et al., 2002; Luria and Meiran 2003; Jiang 2004). In this context, the reason why pessimist and optimist participants did not differ in this condition might be because of lower demand on executive functions.

The current results are in line with study of Levens and Gotlib (2012) which shows task impairment in cognitive tasks and in addition provides a new perspective. In more detail, Levens and Gotlib (2012) used an n-back task which consisted of emotional stimuli. The authors showed that pessimist participants were slower than optimist participants during processing n-back task. They concluded that emotional stimuli in the task trigger stress related activities which interferes with cognitive processing. However, in the current study the stimuli were not emotional, and the impairment seems to be occurred due to pure demand on the central executive system. It has been previously shown that stress and anxiety impair executive functions during processing of dual tasks (Eysenck 1967). In this context, stress level in pessimist participants may increase due to task difficulty of DT short SOA tasks as compared to optimist participants. Thus, the current results suggest that pessimist participants may have cognitive impairments due to demand on central executive system without confounding effect of emotional stimuli.

The interpretations made above about pessimism seems well fitted in Seligman's Meodel because in this model it has been assumed that pessimism is associated with elevated stress and anxiety (Shurman and Seligman, 1994). Previously, it has been shown that traits associated with such features often lead impaired cognitive processing (Saylik, 2018). In this context, detrimental effect of pessimism is evident on demanding dual tasks and this might be due to such stress and anxiety associated with pessimism.

Previous dual task studies confirm that dual task performance with short SOA leads increased stress level in normal participants (Saylik 2017). If we accept that pessimist individuals are prone to elevated stress level (Chang 2002), then the cause of the task impairment in pessimists as compared to optimists might be stress because elevated stress level activates limbic system in the brain which suppress employment of cognitive resources in prefrontal regions (Braver, Gray and Burgess 2007).

The current results seem to be valid and reliable for two reasons. First, in the current study participants from both groups were selected from top quartiles of the LOT scales among two hundred fifty people. Therefore, the participants were placed in the category of highly pessimist or optimists sample. Second the exclusion criteria were strictly followed thus people with past or current psychiatric or neurological illness, depressive current mood, consumption of higher amount of alcohol and caffeine in 24 hrs were excluded. These criteria were important because it is known that the indicated features such as caffeine consumption or depression leads cognitive differences. In addition, pessimism is strongly associated with depression and anxiety so a patient with depression is likely to be scored higher on pessimism. In this case one cannot exclude confounding effect of depression (Saylik 2017).

To conclude, this is to our knowledge the first study investigating the performance of pessimist and optimist individuals on single and dual tasks performance. The results showed that individuals with higher scores of pessimism level performed worse than individuals with higher scores of optimism as demand increase on central executive system in dual task processing. The results indicate that pessimism may impair executive functions in dual task performance as compared to optimism. The reason for that might be elevated stress level in pessimist as compared to optimist participants because stress related activities in the brain interfere with cognitive activities (Levens and Gotlib 2012). Thus, the results presented here should be considered as a platform for future studies to build upon. Hopefully, this will then allow for the development of treatments that can help to alleviate the deficits associated with pessimism. In addition, it should be noted that the stress level in pessimist and optimist individuals has not been collected in the current study. So, the future research may focus on stress level by employing either objective or subjective measure during processing cognitive tasks. Moreover, the current results are based on behavioral performance which indicates pessimist and optimist individuals indeed differ on difficult dual task performance. Such behavioral results often indicate different brain

activations as well. However, in this study brain activities haven't been recorded. Therefore, future studies should focus on neural correlates of this behavioral results to find out cortical activities in related regions such as in limbic system and prefrontal regions.

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