

Barbara Kalebić Maglica*

Petra Anić*

Domagoj Švegar*

Hana Mehonjić*

Do Personality Traits Have Effect on Performance in the Presence of an Audience?

Abstract: The aim of this study was to examine whether there are differences in the performance on simple and complex mathematical tasks depending on the personality traits and the presence of an audience. After completing the personality questionnaire, within the first experimental session, participants ($N=70$) solved one set of simple and one set of complex mathematical tasks. In the second session participants solved another set of simple and another set of complex tasks. In one of the sessions, participants were solving tasks in front of the audience, while in the other session the audience was absent. The results indicate that presence of an audience facilitates performance of those participants low on neuroticism, but only when they are solving simple tasks.

Keywords: *personality traits, social facilitation, presence of an audience, simple and complex mathematical tasks.*

INTRODUCTION

We find ourselves daily in situations in which we are evaluated by other people. Sometimes those people are known, and sometimes unknown. How we react in the above-mentioned social situations depends on various factors (e.g., previous experiences or personality traits).

Although the effects of social facilitation and inhibition are well known in the field of social psychology, there is not many studies that examine the relationship between personality and the mentioned effects. However, some authors (e.g., Ahmad, 2019; Stein, 2009; Uziel, 2007) suggest that considering personality in the context of the social facilitation phenomenon would further enhance the understanding of this area.

Social Facilitation

Triplett's (1898) research findings, according to which cyclists ride faster when they race than when they are alone, stimulated at that time a new research interest in the field of social psychology – the one focused on examining the effects of the presence of other people on an individual's behaviour. In the years that followed, numerous studies were carried out, investigating the impact of the presence of other persons on the performance of different types of tasks. Some studies have shown that

participants achieve better results in the presence of an audience (social facilitation), while the others have indicated a decrease in the effect (social inhibition) (Aiello & Douthitt, 2001; Cacioppo, Rourke, Tassinary, Marshall-Goodall, & Baron, 1990; Dashiell, 1935; Dube & Tatz, 1991; Forgas, Brennan, Howe, Kane, & Sweet, 1980; Guerin, 1986, 1993; Hugnet, Galvaing, Monteil, & Dumas, 1999; Innes & Gordon, 1985; Pessin, 1933; Schmitt, Gilovich, Goore, & Joseph, 1986; Travis, 1925).

Social facilitation and inhibition have traditionally been examined in the context of two categories of social situations: 1) parallel performance of a task, i.e., working in the presence of someone performing the same task, and 2) a passive presence of one or more persons. Nijstad (2009) points out that the main difference between the two paradigms mentioned is that in the parallel performance of tasks, individuals have information on how other people are performing the task, i.e., they can compare their performance with the performance of other participants, which is very important in situations where there are no objective standards for performance. Despite these differences, more contemporary approaches to social facilitation include both paradigms (Nijstad, 2009; Uziel, 2007).

According to Zajonc (1965), the presence of other persons will lead to improvement on the simple, well-learned tasks, but the performance will be slower on more

* University of Rijeka, Faculty of Humanities and Social Sciences, Department of Psychology, Croatia

Corresponding author: Barbara Kalebić Maglica, bararakm@ffri.uniri.hr

difficult and poorly learned tasks. Using Hull-Spence's theory of motivation (Spence, 1956), Zajonc also offered a theoretical explanation of the phenomenon of social facilitation. He believes that the audience is creating tension in the participants, meaning that individuals increase their overall level of incentives and activation. Increased motivation or arousal leads to an increased dominant response which is described as the response that prevails in the repertoire of an individual's responses to a particular situation. Therefore, in simple tasks, the dominant answer is correct, and in the complex tasks it is incorrect. Zajonc's contribution to the domain is manifested in introduction of the complexity of the task as a moderator variable that could explain the inconsistent results of previous research. In addition, Zajonc provided the foundation for many alternative explanations of social facilitation (Baron & Kerr, 2010; Nijstad, 2013; Uziel, 2007).

Some of the more prominent alternative explanations of social facilitation are: 1) Monitoring Theory (Guerin, 1986; Guerin & Innes, 1982), according to which the effect of social facilitation arises because of the uncertainty experienced by a person in social situations. Social situations are filled with various threats to which an individual must react to and which have to be noticed, which increases the level of arousal in a person. 2) The Evaluation Apprehension Theory (Cotrell, 1968, 1972) emphasizes that the audience creates a kind of fear of evaluation which encourages either motivation or arousal, which is then associated with producing a dominant response. 3) According to the Distraction-Conflict Theory (Baron, 1986; Sanders & Baron, 1975), the presence of other persons may be a disturbing stimulus (due to, for example, noise, verbal, and non-verbal reactions of the audience), which leads to a conflict between focusing attention on the task and the audience. Because of this conflict, there is an increase in an individual's arousal, which results in an increase in dominant responses. 4) Self-Efficacy Theory (Bandura, 1977) distinguishes two types of related expectations; the expectation of efficiency (a belief that a person can perform a particular task) and the consequences (a belief that the behaviour would result in positive or negative consequences). Sanna (1992) applied the hypotheses of Self-Efficacy Theory in the context of social facilitation and inhibition phenomena. The presence of others is associated with certain positive or negative consequences (e.g., approval or disapproval of the audience). Whether a person would expect positive or negative consequences depends on expectations related to an individual's self-efficacy (high or low). 5) A more recent look at the effect of social facilitation is offered by Harkins and associates (Social Engagement, Inhibition and Mere Effort, Harkins, 2006; McFall, Jamieson, & Harkins, 2009), according to which facilitation and inhibition happen because when individuals know that their performance would be evaluated, they put in much more effort. According to these authors, the explanation is in an investment of different levels of effort in solving the set task.

All the theories mentioned have their good and bad sides, however, what is important to point out is that they

are not mutually exclusive (Uziel, 2007). They all point out that individuals, when they become aware that they are being watched by the audience, responds in a manner compatible with their phylogenetic inheritance (e.g., by increasing vigilance to ensure survival), ontogenetic experience (e.g., learned reactions), momentary evaluation of their abilities (e.g., self-reflection processes) or the momentary feeling of anxiety (e.g., reaction to interference). It is not surprising that individuals respond in multiple reactions to the presence of other people, i.e., to the ambiguity that involves the presence of an intruder who is not interacting with the individual but is observing.

In the last five years, the social facilitation effect has been most often examined in context of sports (e.g., Edwards, Dutton-Challis, Cottrell, Guy, & Hettinga, 2018; Wann & Hackathorn, 2019), problem solving (e.g., Laird, Bailey, & Hester, 2018), eating (e.g., Herman, 2015; Higgs & Ruddock, 2020; Ruddock, Brunstrom, Vartanian, & Higgs, 2019), Stroop task (e.g., Seitchik, Brown, & Harkins, 2017), and judgment (e.g., Rothweiler, Goodwin, & Kukucka, 2020). Some replications of Zajonc et al.'s (1969) experiment were done (e.g., Halfmann, Bredehöft, & Häusser, 2020; Neider, Fuse, & Suri, 2019). Recently, the effect has been examined in human-computer context (e.g., Emmerich & Masuch, 2018; Strojny, Dużmańska-Misiarczyk, Lipp, & Strojny, 2020).

Traits of the Performers

In the thirties of the last century, many researchers have been talking about the differences in sensitivity to the presence of other people (e.g., Allport, 1924; Dashiell, 1935; Hollingsworth, 1935; Triplett, 1898). Zajonc himself (1965), but also researchers whose theories are based on his paradigm, ignored individual differences, and emphasized the complexity of the task as the central moderator variable. The division into situationalism and dispositionism (Baumeister, 1999; Jones, 1998) also contributed to ignoring individual differences in the effect of social facilitation. It seems that a mixture of historical, methodological, and theoretical causes has contributed to the relatively rare involvement of personality in the examination of the effect of social facilitation. According to some data twenty-five years ago, only some 5-7% of the research of social facilitation includes some personality traits, and only two scientific review research papers deal with this issue at the qualitative level (Geen, 1980; Paivio, 1965). The first quantitative analysis of individual differences in the effect of social facilitation was made by Uziel (2007).

In the research of the effects of social facilitation, three personality traits dominate: self-esteem, neuroticism (anxiety) and extraversion (e.g., Carver, Sutton, & Scheier, 2000; Eysenck & Eysenck, 1985) and are interrelated (Cheng & Furnham, 2003; Pelham & Swarm, 1989; Wood, Heimpel, & Michela, 2003). Therefore, some authors (e.g., Uziel, 2007) speak of positively- (high self-esteem and high extraversion) and negatively-oriented individuals (low self-esteem and high neuroticism). The meta-analysis carried out by Uziel (2007) shows that the presence of

other people leads to decreasing of performance in negative-oriented individuals and increases in positively oriented. In addition, the results of this analysis show that personality is a stronger moderator of the effects of social facilitation than the complexity of tasks is.

The recent research indicates that there are some personality traits that have been moderators of social facilitation effect (e.g., neuroticism, orientation, self-esteem, and self-sufficiency; see Ahmad, 2019). Recently for example, Ahmad (2019) has found that the time taken to reach a decision increases and the accuracy of the decision decreases in the mere presence of others when the decision-making task is difficult, but the reverse effect is observed when the task is simple. The self-sufficiency plays a moderating role in this phenomenon. People who score high in this trait are less anxious about the social presence and thus less aroused.

In the context of the Big Five personality traits, some research (e.g., Oyibo & Vassileva, 2019) showed that individuals who are high in neuroticism, low in openness, and low in conscientiousness are more likely to be susceptible to social influence.

The Aim of the Study

As noted above, the situations in which other people are present are vague and important. They are unclear because individuals do not know the outcomes of the presence of other people, and both positive and negative consequences of such situations are possible. In addition, they are also important because both positive and negative outcomes influence our future. Personality traits predispose individuals to behave in a certain way in such situations. It is known that the individuals who score high on extraversion are prone to positive interpretations, and those who are higher in neuroticism to negative interpretations (Gomez, Gomez, & Cooper, 2002; Grant & Dajee, 2003; Rusting, 1999; Zelenski & Larsen, 2002). People who are high in neuroticism have impaired performance in social presence compared to performance in alone condition. Extraverts are predisposed to experience higher levels of positive affect in general, so they are more likely to perceive the social presence as a positive factor rather than negative (Uziel, 2007). According to our knowledge, other personality traits of the Five-Factor Model (openness to experience, conscientiousness, and agreeableness), which is also one of the currently most studied models, have not been reviewed in the context of the effect of social facilitation and inhibition. While the effect of neuroticism and extraversion in the context of social facilitation has been previously examined, the effects of other personality traits of the Five-Factor Model are not known. Considering the research on the dimensions of the Five-Factor Model and social influence, we can assume that people who are low in openness and conscientiousness will be more sensitive to the presence of other people. The Big Five is an extensive and widely accepted model of personality, with wide application in different domains (e.g., education, health, prejudice) and

across cultures due to its empirical validity so it would be interesting to apply it in the context of social facilitation.

Therefore, the aim of this study is to examine whether there is a difference in success in simple and complex mathematical task, depending on the different personality traits of the Five-Factor Model and the presence or absence of the audience.

METHOD

Participants

Fifty-two students participated in the pilot experiment, while 70 students from University of Rijeka, Croatia participated in the main experiment. The sample of participants in the main experiment consisted of 5 men (7.1%) and 65 women (92.9%). Age of participants ranged between 19 and 26 years ($M = 21.13$, $SD = 1.72$). None of the subjects from the pilot experiment participated in the main experiment.

Measures

Big Five Inventory (BFI). BFI (John, Donahue, & Kentle, 1991) consists of 44 items written in the form of claims (e.g. "... is full of energy") and is used to estimate five personality dimensions: extraversion, neuroticism, openness to experience, agreeableness and conscientiousness. BFI shows good internal validity on all dimensions in different studies (John & Srivastava, 1999; Komarraju, Karau, Schmeck, & Avdić, 2011; Schmukle, Back, & Egloff, 2008). The structure of BFI was verified on Croatian sample, and the results of confirmatory factor analysis indicate a satisfactory structure and high internal consistency coefficients ranging from .72 to .83 (Kardum, Gračanin, & Hudek-Knežević, 2006). In the present study, the reliability coefficients (Cronbach Alpha) ranged from .79 for extraversion to .87 for neuroticism.

Mathematical tasks. Two sets of simple and two sets of complex mathematical tasks were designed specifically for the purpose of this experiment. Simple tasks included summing and subtracting three-digit numbers, while complex tasks included summing, subtracting, dividing, and multiplying operations. Each set was comprised of 30 tasks. In order to inspect if the difficulty of all four sets is appropriate, pilot experiment was conducted. Results of the pilot experiment showed that participants were significantly more accurate ($t_{51} = 26.65$, $p < .01$) when solving simple ($M = 20.94$, $SD = 4.96$) than complex ($M = 3.79$, $SD = 1.47$) tasks. Furthermore, no significant differences in the number of correct answers were found neither between the two sets of simple tasks ($t_{50} = 1.21$, $p > .05$; $M_1 = 20.08$, $SD_1 = 5.07$; $M_2 = 21.77$, $SD_2 = 4.83$) nor between the two sets of complex tasks ($t_{50} = 1.04$, $p > .05$; $M_1 = 4.12$, $SD_1 = 1.42$; $M_2 = 3.38$, $SD_2 = 1.55$). Therefore, all four sets were found to be appropriate for the study. However, since 5.77% of participants managed to solve all 30 simple tasks within a set in a pilot study, five more tasks were added to each set, in order to reduce the potential ceiling effect problem. Thus, in the main experiment, four sets of 35 tasks were used.

Procedure and Design

Repeated measures 2 x 2 design with counterbalancing was used in the main experiment, which was conducted individually in two experimental sessions. Both independent factors were manipulated within participants: audience (present/absent) and mathematical tasks difficulty (simple/complex). After answering to several demographic questions and completing the BFI, within the first experimental session participants solved one set of simple and one set of complex mathematical tasks. In the second session, that took place 7 to 14 days afterwards, participants solved another set of simple and another set of complex mathematical tasks. In one of the sessions, participants were solving mathematical tasks in front of the audience comprised of two people, one experimenter and a student, while in the other session audience was absent. Serial order of task difficulty (simple/complex), task form (A/B) and audience (present/absent) was counterbalanced across participants. In all conditions, participants were given 3 minutes for solving each set of mathematical tasks.

RESULTS

Means, standard deviations, ranges of observed results, indices of skewness and kurtosis and Cronbach alpha coefficients are presented in Table 1. Values of Cronbach alpha coefficients indicate that all measures of personality dimensions are suitable for further statistical analyses (Table 1). Furthermore, skewness and kurtosis indices of all continuous variables are within acceptable limits of ± 2 , which indicates that distributions of these variables do not differ significantly from normal distribution. Therefore, parametric statistical procedures were used in all subsequent analyses.

In order to determine if social facilitation or inhibition occurred in the present study, two-way repeated measures ANOVA was conducted with task difficulty and presence of audience as independent variables. The main effect of task difficulty was significant ($F_{1,69} = 927.02, p < .01$,

part. $\eta^2 = .93$): number of correct answers was higher for simple ($M = 22.24, SD = 6.11$) than complex ($M = 3.65, SD = 1.91$) tasks. The main effect of audience was not significant ($F_{1,69} = .60, p > .05$, part. $\eta^2 = .01$): number of correct answers in conditions with audience ($M = 26.16, SD = 7.97$) and without audience ($M = 25.63, SD = 8.04$) did not differ significantly. The interaction was not significant: $F_{1,69} = 1.10, p > .05$, part. $\eta^2 = .02$ (descriptives for the interaction are presented in Table 1).

In order to inspect if personality dimensions moderate the effects of audience on participants' performance or the effects of interaction between audience task difficulty on participants' performance, each of the Big five dimensions was first divided into two categories, with regard to their median. Each of the obtained dichotomized variables was then set as third factor into separate three-way ANOVAs. Thus, five 2x2x2 mixed design ANOVAs were conducted, with task difficulty and presence of audience as within-subjects factor and one of the following dichotomized variables as a between-subjects factor: extraversion, neuroticism, openness, agreeableness, and conscientiousness (Table 2). Significant two-way interaction between audience and dichotomized between-subjects factor would indicate that given between-subjects factor moderates the effect of audience on task performance, while significant three-way interaction would indicate that particular between-subjects factor moderates the interaction between audience and task difficulty on task performance. The main effects as well as the two-way interactions between task difficulty and audience are not relevant for these analyses of moderator effects and therefore are not presented in Table 2.

Analyses of moderator effects revealed that only one of the five dimensions (neuroticism) yielded significant results. Neuroticism moderates the effect of audience on performance: two-way interaction between neuroticism and audience was significant ($F_{1,68} = 5.54, p < .05$, part. $\eta^2 = .08$). Furthermore, it was found that neuroticism moderates the interaction between audience and task

Table 1 Means, Standard Deviations, Ranges, Indices of Skewness and Kurtosis for all Continuous Variables and Cronbach Alphas for Personality Dimensions

	Mean	SD	Range	Skewness	Kurtosis	Alpha
Extraversion	20.00	5.10	6-29	-.55	.01	.79
Neuroticism	14.36	6.13	3-30	.33	-.25	.87
Openness	26.01	6.70	5-38	-.66	.29	.84
Agreeableness	23.37	6.25	2-33	-.87	.93	.84
Conscientiousness	22.54	6.04	5-33	-.51	.37	.86
Simple/alone¹	21.94	6.84	5-35	.33	-.58	-
Complex/alone²	3.69	2.14	0-11	.66	1.18	-
Simple/audience³	22.54	6.44	10-35	.19	-.97	-
Complex/audience⁴	3.61	2.11	0-10	.60	.20	-

¹Number of correct answers in condition with no audience and simple mathematical tasks

²Number of correct answers in condition with no audience and complex mathematical tasks

³Number of correct answers in condition with audience and simple mathematical tasks

⁴Number of correct answers in condition with audience and complex mathematical tasks

Table 2 Three-Way Interactions and Two-Way Interactions between Audience and One of the Dichotomized Between-Subject Variables (Self-Esteem, Extraversion, Conscientiousness, Openness, Agreeableness and Neuroticism) on Participants' Performance

Interaction	$F_{1,68}$	p	part. η^2
Extraversion x Audience	.07	.79	.00
Extraversion x Audience x Task complexity	.11	.74	.00
Conscientiousness x Audience	1.13	.29	.02
Conscientiousness x Audience x Task complexity	.52	.48	.01
Openness x Audience	.00	.96	.00
Openness x Audience x Task complexity	.36	.55	.01
Agreeableness x Audience	.32	.57	.01
Agreeableness x Audience x Task complexity	.05	.83	.00
Neuroticism x Audience	5.54	.02*	.08
Neuroticism x Audience x Task complexity	4.66	.03*	.06

* $p < .05$

difficulty on performance: three-way interaction between neuroticism, audience and task complexity was significant ($F_{1,68} = 4.66$, $p < .05$, part. $\eta^2 = .06$). Partial eta squared coefficients indicate medium effect size (Cohen, 1988) for both of these significant effects. No other moderator effects were found. In order to obtain more detailed insight into the moderator effects, Fisher's LSD post hoc analysis was conducted.

Post-hoc analysis of the two-way interaction between neuroticism and audience revealed only one significant difference among four conditions (Figure 1). Participants with lower neuroticism performed significantly better in condition with audience ($M = 13.35$, $SD = 4.35$) compared to condition without audience ($M = 12.35$, $SD = 4.56$), while participants with higher neuroticism performed equally well in conditions with ($M = 12.77$, $SD = 3.58$) and without audience ($M = 13.33$, $SD = 3.31$).

Post-hoc analysis of the three-way interaction (neuroticism x audience x task complexity) was conducted separately for complex and for simple tasks.

None of the Fisher's LSD tests was significant when performance on complex tasks was analyzed (Figure 2). Number of correct answers did not differ significantly between the following four conditions: low neuroticism

with audience ($M = 3.57$, $SD = 2.46$), low neuroticism without audience ($M = 3.54$, $SD = 2.40$), high neuroticism with audience ($M = 3.67$, $SD = 1.67$) and high neuroticism without audience ($M = 3.85$, $SD = 1.84$).

Within post-hoc analysis of performance on simple tasks, one Fisher's LSD test was significant (Figure 3): in the group of participants with low neuroticism, number of correct answers was higher in condition with audience ($M = 23.14$, $SD = 6.85$) than in condition without audience ($M = 21.16$, $SD = 7.55$), while in the group of participants with high neuroticism performance did not differ significantly between conditions with audience present ($M = 21.88$, $SD = 5.98$) or absent ($M = 22.82$, $SD = 5.96$).

When all the results are considered together, it can be concluded that the two-way (neuroticism x audience) interaction revealed that presence of audience affects performance of participants through interaction with neuroticism. Specifically, according to the post-hoc analysis of that interaction, presence of audience significantly facilitates overall performance on mathematical tasks, but only of those participants low on neuroticism, while participants with high neuroticism were not significantly affected by the presence of audience.

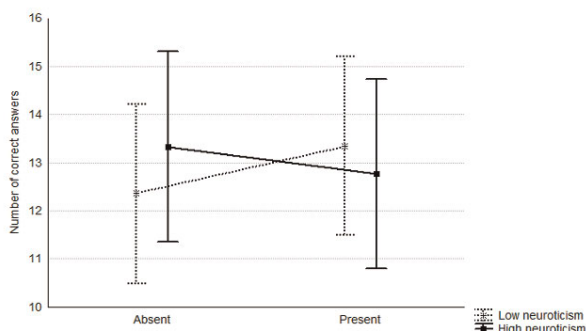


Figure 1. Two-way interaction between neuroticism and audience on task performance

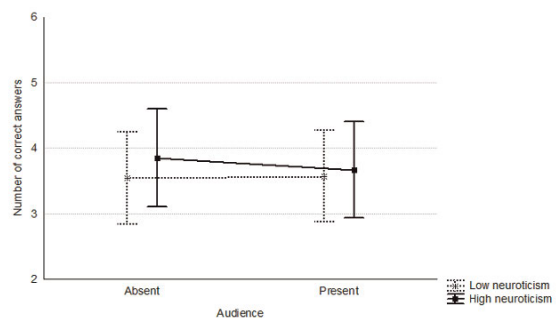


Figure 2. Performance on complex mathematical tasks with regard to presence of audience (present/absent) and neuroticism of participants (high/low)

When post-hoc analysis of significant three-way (neuroticism x audience x task complexity) interaction was conducted on simple tasks, the same pattern of results, as the pattern obtained from the two-way (neuroticism x audience) interaction was found: presence of audience facilitates performance on simple mathematical tasks, but only of those participants with lower neuroticism. However, when the same post-hoc analysis was conducted on complex tasks, presence of audience did not affect neither participants with low nor subjects with high neuroticism.

Thus, it can be concluded that presence of audience facilitates performance of those participants low on neuroticism, but not when they are solving complex tasks, while participants with higher neuroticism are unaffected by the presence of audience, irrespective of task complexity. No evidence of social inhibition was found in the present study.

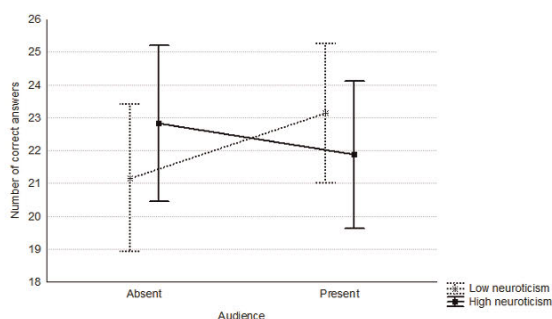


Figure 3. Performance on simple mathematical tasks with regard to presence of audience ((present/absent) and neuroticism of participants (high/low)

DISCUSSION

The aim of the study was to examine whether there is a difference in the success of solving simple and complex mathematical tasks depending on the presence or absence of the audience and on the different personality traits of the Five-Factor Model.

The results obtained show that there is a main effect of the difficulty of the task on the performance, where participants can solve the easier tasks with more success than complex mathematical tasks, which confirms that manipulation of task difficulty has succeeded. The main effect of the presence of the audience was not gained, nor the significant interaction between the task's difficulty and the presence of the audience. It was obtained that audience presence affects performance on mathematical tasks through neuroticism. More precisely, the presence of an audience facilitates performance on simple mathematical tasks, and only in those participants who achieve a low score on neuroticism. The effects of the social facilitation referred to by Zajonc (1965) were obtained only in the context of neuroticism, which points to the need to include personality traits in the examination of this social phenomenon.

Even some earlier research (e.g., Uziel, 2007; Stein, 2009) shows that personality traits, such as extraversion,

self-esteem, neuroticism, and anxiety, are significant moderators in relation to the presence of the audience and performance. It was noticed that not all individuals approach social situations with the same level of skill and ability. Some individuals are self-assured, resourceful, and socially competent, while others are anxious and apprehensive. The results of this research are only partly consistent with findings in the literature related to neuroticism.

Neuroticism is a dimension of personality characterized by the tendency to attract stressful life events (Bolger & Schilling, 1991; Fergusson & Horwood, 1987), experiencing negative affects such as frustration, anxiety, losing control easily, etc. The tendency to experience such emotions increases our sensitivity to stress and additionally weakens a physiologically based lower capacity to deal with stress. This may hinder adaptation, which is why people with high neuroticism tend to prefer negative estimates, as well as difficulties in establishing relationships with other people, and poor control over their behaviour and emotions (e.g., Costa & McCrae, 1992; Martin, Ward, & Clark, 1983; Stone & Costa, 1990). They also apply less adaptable strategies when faced with problems (Cimbalic Gunther, Cohen, & Armeli, 1999). In addition, people with high neuroticism are more depressed and have lower self-esteem (Costa & McCrae, 1990).

During evaluative social situations, individuals high in neuroticism report high levels of anxiety (Geen, 1985; Mikulincer & Shaver, 2007), demonstrate anxiety-related behaviours (Geen, 1985), experience elevated physiological responses (Beidel, Turner, & Dancu, 1985), and experience performance impairments (Uziel, 2007).

Although, some research shows that when working alone or when feeling supported (i.e., in low threat situations), individuals high in neuroticism often demonstrate superior performance to that of low neuroticism individuals, especially on simple challenges (e.g., Geen, 1985; Horwitz & McCaffrey, 2008; Hutchinson & Ruiz, 2011), such findings were not obtained in this research. Namely, the results obtained, as well as a part of those mentioned in the literature, show that in people who achieve high scores on neuroticism as well as on anxiety (which is in high correlation with neuroticism, Matthews, Deary, & Whiteman, 2009) the presence of the audience does not interfere with performance when it comes to tests of attention and set-shifting, tests of motor function, etc. (e.g. Constantinou, Bauer, Ashendorf, Fisher, & McCaffrey, 2005; Kehrner, Sanchez, Habif, Rosenbaum, & Townes, 2000; Lynch, 2005). Obviously, due to inconsistent findings in the interpretation of the results, it is necessary to consider the type of task that is used in particular research but also to examine the contribution of characteristics of an individual who is in evaluative situations with the audience, which is partly done in this research.

It is possible that the participants who achieve high scores on the neuroticism have experienced this research as an evaluative social situation since it used the number of correctly solved tasks at a predetermined time as a measure

of performance, as was said to the participants. Given the aforementioned characteristics of neuroticism, it is possible that the situation was experienced as stressful, disturbing, frustrating and uncontrollable (Uziel & Baumeister, 2012) which hindered them in performance no matter what task they were working on. Any manipulation which increases the subjects' feeling of evaluation tends to accentuate performance decrement in high neurotic subjects (e.g., Cox-Fuenzalida, Swickert, & Hittner, 2004; Eysenck, 1982). Neurotic/anxious individuals also have difficulty in suppressing a dominant but inappropriate response, and they are more easily distracted by irrelevant stimuli than those low in neuroticism/anxiety in a variety of task paradigm (Eysenck, Derakshan, Santos, & Calvo, 2007).

The situation in people who score a low score on neuroticism is somewhat different. In simple mathematical tasks, such persons achieve a significantly better result in the presence of the audience than when they are alone. Thus, the audience facilitates their performance on a simple, well-learned task, which confirms the existence of social facilitation whose effects are well known in the field of social psychology. On simple tasks, automatic performance requires less attention, and any attention directed to an observer does not exhaust attentional capacity. Individuals low in neuroticism do not interpret ordinary situations as threatening and minor frustrations as hopelessly difficult. According to Matthews (2004, 2008), emotional stability relates to success in the stressful environment via resilience to threat and tolerance of social and evaluative threat.

No effects of other personality traits of the Five-factor model (extraversion, openness to experience, agreeableness, and conscientiousness) on the performance on a simple or complex task were obtained in the presence of audience. The obtained results should be taken with caution and checked in future studies on larger and representative samples of respondents since such research has not been done so far.

In this study, no evidence of social inhibition was found. The participants have performed equally successfully on complex tasks regardless of whether the audience is present or not and which personality traits they have. The obtained results should certainly be further examined through some future research. Namely, this research has certain shortcomings which need to be considered when making conclusions. First, the sample is small and consists of students of psychology, mostly female so results of the study cannot be generalized to other people. It is known from the literature that there are gender differences in personality traits, where women tend to have higher mean levels of agreeableness and neuroticism than men (Chapman, Duberstein, Sörensen, & Lyness, 2007; Costa, Terracciano, & McCrae, 2001; Feingold, 1994). Future research should include a larger number of male participants because some findings suggest that gender moderates the effects of social facilitation (Ruddock et al., 2019). Small number of participants is a major limitation of this study in general and considering the sheer number

of exploratory analyses that were conducted. In addition, the audience was represented by students approximately the same age as the participants. Due to the students' workload, the audience was not always comprised of the same two people. In future research, it would certainly be necessary to include an audience to which participants are not familiar with and to involve a larger number of individuals in the audience (not just two as in this research). It would be interesting to check whether similar results are obtained in the co-acting paradigm. In future research, selected mathematical tasks should be replaced by some other tasks that are more important for social situations and interaction among individuals. If mathematical tasks are used in future research, it is necessary to better determine their difficulty. In this study very difficult tasks were used which can create a floor effect that might have affected the results. Besides, it is possible that some of the participants have learned in advance what would be expected from them in the research (although participants were asked not to reveal the steps and tasks) so they have somehow been prepared for what they were expected to do. Lastly, future research should use continuous personality variables because the dichotomous coding (in the ANOVA) limits the conclusions that can be drawn from the effects.

Despite these shortcomings, this research is one of the few which links the personality traits of the Five-Factor Model and social facilitation and inhibition. It was carried out individually in two situations (in the presence of audiences and without the audience) in which participants solved both simple and difficult mathematical tasks. Although the future studies should further examine the effects of the personality traits of the Five-Factor Model in the context of social facilitation and inhibition, the results of this study direct to the importance of emotional stability in solving simple tasks in the presence of the audience, having both theoretical and practical implications in detecting those persons which fail in solving different tasks in the presence of the audience, and attempts to act upon them by informing them about the effects of social facilitation and more efficient ways of dealing with stressful evaluative situations.

REFERENCES

- Ahmad, S. N. (2019). The role of social facilitation theory on consumer decision making: A conceptual framework. *American Journal of Management*, 16(2), 80-89.
- Aiello, J. R., & Douthitt, E. A. (2001). Social facilitation from Triplett to electronic performance monitoring. *Group Dynamics: Theory, Research and Practice*, 5(3), 163-180.
- Allport, F. H. (1924). *Social psychology*. Boston: Houghton-Mifflin.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84, 191-215.
- Baron R. S. (1986). Distraction - conflict theory: Progress and problems. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (pp. 1-40). New York: Academic Press.
- Baron, R. S., & Kerr, N. L. (2010). *Group process, group decision, group action*. New York: Open University Press.
- Baumeister, R. F. (1999). On the interface between personality and social psychology. In O. P. Oliver & L. A. Pervin (Eds.), *Handbook of*

- personality: *Theory and research* (pp. 367-377). New York, NY, US: Guilford Press.
- Beidel, D. C., Turner, S. M., & Dancu, C. V. (1985). Physiological, cognitive and behavioral aspects of social anxiety. *Behaviour Research and Therapy*, 23(2), 109-117.
- Bolger, N., & Schilling, E. A. (1991). Personality and the problems of everyday life: The role of neuroticism in exposure and reactivity to daily stressors. *Journal of Personality*, 59, 355-386.
- Cacioppo, J. T., Rourke, T., Tassinari, L., Marshall-Goodall, B., & Baron, R. S. (1990). Rudimentary physiological effects of mere observation. *Psychophysiology*, 27, 177-186.
- Carver, C. S., Sutton, S. K., & Scheier, M. F. (2000). Action, emotion, and personality: Emerging conceptual integration. *Personality and Social Psychology Bulletin*, 26(6), 741-751.
- Chapman, B. P., Duberstein, P. R., Sörensen, S., & Lyness, J. M. (2007). Gender differences in Five Factor Model personality traits in an elderly cohort. *Personality and Individual Differences*, 43(6), 1594-1603.
- Cheng, H., & Furnham, A. (2003). Personality, self-esteem, and demographic predictions of happiness and depression. *Personality and Individual Differences*, 34, 921-942.
- Cimolic Gunther, K., Cohen, L. H., & Armeli, S. (1999). The role of neuroticism in daily stress and coping. *Journal of Personality and Social Psychology*, 77, 1087-1100.
- Cohen J. (1988). *Statistical power analysis for the behavioral sciences*. New York: Routledge Academic.
- Constantinou, M., Bauer, L., Ashendorf, L., Fisher, J. M., & McCaffrey, R. J. (2005). Is poor performance on recognition memory effort measures indicative of generalized poor performance on neuropsychological tests?. *Archives of Clinical Neuropsychology*, 20(2), 191-198.
- Costa Jr, P. T., & McCrae, R. R. (1990). Personality disorders and the five-factor model of personality. *Journal of Personality Disorders*, 4(4), 362-371.
- Costa Jr, P. T., & McCrae, R. R. (1992). The five-factor model of personality and its relevance to personality disorders. *Journal of Personality Disorders*, 6(4), 343-359.
- Costa Jr, P. T., Terracciano, A., & McCrae, R. R. (2001). Gender differences in personality traits across cultures: Robust and surprising findings. *Journal of Personality and Social Psychology*, 81(2), 322.
- Cotrell, N. B. (1968). Performance in the presence of other human beings: Mere presence and affiliation effects. In E. C. Simmel, R. A. Hoppe, & G. A. Milton (Eds.), *Social facilitation and imitative behavior* (pp. 91-110). Boston: Allyn and Bacon.
- Cotrell, N. B. (1972). Social facilitation. In C. G. McClintock (Ed.), *Experimental social psychology* (pp. 185-236). New York: Holt.
- Cox-Fuenzalida, L. E., Swickert, R., & Hittner, J. B. (2004). Effects of neuroticism and workload history on performance. *Personality and Individual Differences*, 36(2), 447-456.
- Dashiell, J. F. (1935). Experimental studies of the influence of social situations on the behavior of individual human adults. In C. Murchison (Ed.), *A handbook of social psychology* (pp. 1097-1158). Worcester, MA: Clark University Press.
- Dube, S. K., & Tatz, S. J. (1991). Audience effects in tennis performance. *Perceptual and Motor Skills*, 73, 844-846.
- Edwards, A. M., Dutton-Challis, L., Cottrell, D., Guy, J. H., & Hettinga, F. J. (2018). Impact of active and passive social facilitation on self-paced endurance and sprint exercise: Encouragement augments performance and motivation to exercise. *BMJ Open Sport & Exercise Medicine*, 4(1), 1-7.
- Emmerich, K., & Masuch, M. (2018, April). Watch me play: Does social facilitation apply to digital games?. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (pp. 1-12).
- Eysenck, H. J. (1982). The biological basis of cross-cultural differences in personality: Blood group antigens. *Psychological Reports*, 51(2), 531-540.
- Eysenck, M. W., Derakshan, N., Santos, R., & Calvo, M. G. (2007). Anxiety and cognitive performance: Attentional control theory. *Emotion*, 7(2), 336.
- Eysenck, H. J., & Eysenck, M. W. (1985). *Personality and individual differences*. New York: Plenum Press.
- Feingold, A. (1994). Gender differences in personality: A meta-analysis. *Psychological Bulletin*, 116(3), 429.
- Fergusson, D. M., & Horwood, L. J. (1987). Vulnerability to life events exposure. *Psychological Medicine*, 17(3), 739-749.
- Forgas, J. P., Brennan, G., Howe, S., Kane, F. J., & Sweet, S. (1980). Audience effects on squash players' performance. *Journal of Social Psychology*, 111, 41-47.
- Geen, R. G. (1980). The effects of being observed on performance. In P.B. Paulus (Ed.), *Psychology of group influence* (pp. 15-51). Hillsdale, NJ: Erlbaum.
- Geen, R. G. (1985) Test anxiety and visual vigilance. *Journal of Personality and Social Psychology*, 49, 963-70.
- Gomez, R., Gomez, A., & Cooper, A. (2002). Extraversion and neuroticism as predictors of negative and positive informational processing: Comparing Eysenck's, Gray's and Newman's theories. *European Journal of Personality*, 16(5), 54-58.
- Grant, T., & Dajee, K. (2003). Types of task, types of audience, types of actor: Interactions between mere presence and personality type in a simple mathematical task. *Personality and Individual Differences*, 35, 633-639.
- Guerin, B. (1986). Mere presence effects in humans: A review. *Journal of Experimental Social Psychology*, 22, 38-77.
- Guerin, B. (1993). *Social facilitation*. Cambridge: University Press.
- Guerin, B., & Innes, J. M. (1982). Social facilitation and social monitoring: A new look at Zajonc's mere presence hypothesis. *British Journal of Social Psychology*, 21, 7-18.
- Harkins, S. G. (2006). Mere effort as the mediator of the evaluation-performance relationship. *Journal of Personality and Social Psychology*, 91, 436-455.
- Halfmann, E., Bredehöft, J., & Häusser, J. A. (2020). Replicating roaches: A preregistered direct replication of Zajonc, Heingartner, and Herman's (1969) social-facilitation study. *Psychological Science*, 31(3), 332-337.
- Herman, C. P. (2015). The social facilitation of eating. A review. *Appetite*, 86, 61-73.
- Higgs, S., & Ruddock, H. (2020) Social Influences on eating. In H. Meiselman, (Eds.), *Handbook of eating and drinking* (pp. 277-291). Springer, Cham.
- Hollingsworth, H. L. (1935). *The psychology of the audience*. New York: American Book Company.
- Horwitz, J. E., & McCaffrey, R. J. (2008). Effects of a third party observer and anxiety on tests of executive function. *Archives of Clinical Neuropsychology*, 23(4), 409-417.
- Hugnet, P., Galvaing, M. P., Monteil, J. M., & Dumas, F. (1999) Social presence effects in the Stroop task: Further evidence for an attentional view of social facilitation. *Journal of Personality and Social Psychology*, 77, 1011-1025.
- Hutchinson, J. G., & Ruiz, J. M. (2011). Neuroticism and cardiovascular response in women: Evidence of effects on blood pressure recovery. *Journal of Personality*, 79(2), 277-302.
- Innes, J. M., & Gordon, M. I. (1985). The effect of mere presence and a mirror on performance motor task. *Journal of Social Psychology*, 125, 479-484.
- John, O. P., Donahue, E. M., & Kentle, R. L. (1991). *The Big Five Inventory—Versions 4a and 54*. Berkeley, CA: University of California, Berkeley, Institute of personality and social research.
- John, O. P., & Srivastava, S. (1999). The Big five trait taxonomy: History, measurement and theoretical perspectives. In L. A. Pervin & O. P. John (Eds.), *Handbook of personality, second edition: Theory and research* (pp. 102-139). New York: The Guilford Press.
- Jones, E. E. (1998). Major developments in five decades of social psychology. In D.T. Gilbert, T. Fiske, & G. Lindzey (Eds.), *The handbook of social psychology* (pp. 3-57). Boston, MA: McGraw-Hill Companies.
- Kardum, I., Gračanin, A., & Hudek-Knežević, J. (2006). Odnos crta ličnosti i stilova privrženosti s različitim aspektima seksualnosti kod žena i muškaraca. *Psihologijske teme*, 15(1), 101-128
- Kehrer, C. A., Sanchez, P. N., Habif, U., Rosenbaum, G. J., & Townes, B. D. (2000). Effects of a significant-other observer on neuropsych-

- chological test performance. *The Clinical Neuropsychologist*, 14(1), 67-71.
- Komarraju, M., Karau, S. J., Schmeck, R. R., & Avdić, A. (2011). The Big Five personality traits, learning styles, and academic achievement. *Personality and Individual Differences*, 51, 472-477.
- Laird, B. K., Bailey, C. D., & Hester, K. (2018). The effects of monitoring environment on problem-solving performance. *The Journal of Social Psychology*, 158(2), 215-219.
- Lynch, J. K. (2005). Effect of a third party observer on neuropsychological test performance following closed head injury. *Journal of Forensic Neuropsychology*, 4(2), 17-25.
- Martin, M., Ward, J. C., & Clark, D. M. (1983). Neuroticism and the recall of positive and negative personality information. *Behaviour Research and Therapy*, 21(5), 495-503.
- Mathews, G. (2004). Neuroticism from the top down: Psychophysiology and negative emotionality. In R. Stelmack (Ed.), *On the psychobiology of personality: Essays in honor of Marvin Zuckerman* (pp. 249-66). Amsterdam: Elsevier Science.
- Mathews, G. (2008). Personality and information processing: A cognitive-adaptive theory. *Handbook of Personality Theory and Assessment*, 1, 56-79.
- Mathews, G., Deary, I. J., & Whiteman, M. C. (2009). Stable traits and transient states. *Personality Traits*, 3, 85-120.
- McFall, S. R., Jamieson, J. P., & Harkins, S. G. (2009). Testing the mere effort account of the evaluation-performance relationship. *Journal of Personality and Social Psychology*, 96, 135-154.
- Mikulincer, M., & Shaver, P. R. (2007). *Attachment in adulthood: Structure, dynamics, and change*. New York: Guilford Press.
- Neider, D. P., Fuse, M., & Suri, G. (2019). Cockroaches, performance, and an audience: Reexamining social facilitation 50 years later. *Journal of Experimental Social Psychology*, 85, Article 103851.
- Nijstad, B. A. (2009). *Group performance*. East Sussex: Psychology Press.
- Nijstad, B. A. (2013). Performance. In J. M. Levine (Ed.), *Group processes* (pp. 193-214). New York: Psychology Press.
- Oyibo, K., & Vassileva, J. (2019). The relationship between personality traits and susceptibility to social influence. *Computers in Human Behavior*, 98, 174-188.
- Paivio, A. (1965). Personality and audience influence. In B. Maher (Ed.), *Progress in experimental personality research* (pp. 127-173). New York: Academic Press.
- Pelham, B. W., & Swarm, W. B. Jr. (1989). From self-conceptions to self-worth: On the sources and structure of global self-esteem. *Journal of Personality and Social Psychology*, 57, 672-680.
- Pessin, J. (1933). The comparative effects of social and mechanical stimulation on memorizing. *American Journal of Psychology*, 45, 263-270.
- Rothweiler, J. N., Goodwin, K. A., & Kukucka, J. (2020). Presence of administrators differentially impacts eyewitness discriminability for same-and other-race identifications. *Applied Cognitive Psychology*, 34(6), 1530-1537.
- Ruddock, H. K., Brunstrom, J. M., Vartanian, L. R., & Higgs, S. (2019). A systematic review and meta-analysis of the social facilitation of eating. *The American Journal of Clinical Nutrition*, 110(4), 842-861.
- Rusting, C. L. (1999). Interactive effects of personality and mood on emotion-congruent memory and judgment. *Journal of Personality and Social Psychology*, 77(5), 1073-1086.
- Sanders, G. S., & Baron, R. S. (1975). The motivating effects of distraction on task performance. *Journal of Personality and Social Psychology*, 32, 956-963.
- Sanna, L. J. (1992). Self-efficacy theory: Implications for social facilitation and social loafing. *Journal of Personality and Social Psychology*, 62(5), 774-786.
- Schmitt, B. H., Gilovich, T., Goore, N., & Joseph, L. (1986). Mere presence and social facilitation: One more time. *Journal of Experimental Social Psychology*, 22, 242-248.
- Schmukle, S. C., Back, M. D., & Egloff, B. (2008). Validity of the Five-Factor Model for the implicit self-concept of personality. *European Journal of Assessment*, 24(4), 263-272.
- Seitchik, A. E., Brown, A. J., & Harkins, S. G. (2017). Social facilitation: Using the molecular to inform the molar. In S. G. Harkins, K. D. Williams, & J. M. Burger (Eds.), *Oxford library of psychology. The Oxford handbook of social influence* (pp. 183-203). Oxford University Press.
- Spence, K. W. (1956). *Behavior theory and conditioning*. New Haven: Yale University Press.
- Stein, L. M. (2009). *Individual differences in social facilitation*. (Master thesis). Graduate School-New Brunswick Rutgers, The State University of New Jersey, New Jersey.
- Stone, S. V., & Costa, P. T. (1990). Disease-prone personality or distress-prone personality? The role of neuroticism in coronary heart disease. In H. S. Friedman (Ed.), *Personality and Disease* (pp. 178-200). New York: Wiley.
- Strojny, P. M., Dużmańska-Misiarczyk, N., Lipp, N., & Strojny, A. (2020). Moderators of social facilitation effect in virtual reality: Copresence and realism of virtual agents. *Frontiers in Psychology*, 11, 1252.
- Travis, L. E. (1925). The effect of small audience upon eye-hand coordination. *Journal of Abnormal and Social Psychology*, 29, 142-146.
- Triplett, N. (1898). The dynamogenic factors in pacemaking and competition. *American Journal of Psychology*, 9, 507-533.
- Uziel, L. (2007). Individual differences in the social facilitation effect: A review and meta-analysis. *Journal of Research in Personality*, 41, 579-601.
- Uziel, L., & Baumeister, R. F. (2012). The effect of public social context on self-control: Depletion for neuroticism and restoration for impression management. *Personality and Social Psychology Bulletin*, 38(3), 384-396.
- Zajonc, R. B. (1965). Social facilitation. *Science*, 149, 269-274.
- Zelenski, J. M., & Larsen, R. J. (2002). Predicting the future: How affect-related personality traits influence likelihood judgments of future events. *Personality and Social Psychology Bulletin*, 28(7), 1000-1010.
- Wann, D. L., & Hackathorn, J. (2019). Audience effects in sport: The reciprocal flow of influence between athletes and spectators. In M. H. Anshel, T. A. Petrie, & J. A. Steinfeldt (Eds.), *APA handbooks in psychology series. APA handbook of sport and exercise psychology, Vol. 1. Sport psychology* (pp. 469-488). American Psychological Association.
- Wood, J. V., Heimpel, S. A., & Michela, J. L. (2003). Savoring versus dampening: Self-esteem differences in regulating positive affect. *Journal of Personality and Social Psychology*, 85(3), 566-580.