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The Correlation Between Burnout and Personality Types in Software Developers

Bachelor of Science Thesis in Software Engineering and Management

Emanuel Mellblom
Isar Arason

Department of Computer Science and Engineering
UNIVERSITY OF GOTHENBURG
CHALMERS UNIVERSITY OF TECHNOLOGY
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Emanuel Mellblom,
Isar Arason

Supervisor: Lucas Gren
Supervisor: Richard Torkar
Examiner: Jan-Philipp Steghöfer

University of Gothenburg
Chalmers University of Technology
Department of Computer Science and Engineering
SE-412 96 Göteborg
Sweden
Telephone + 46 (0)31-772 1000

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Emanuel Mellblom
Software Engineering and Management
University of Gothenburg
Gothenburg, Sweden
Email: gusmellbem@student.gu.se

Isar Arason
Software Engineering and Management
University of Gothenburg
Gothenburg, Sweden
Email: gusarais@student.gu.se

***Abstract*—This paper examines the correlations between the Five Factor Model personality traits and burnout in software developers. Several studies have measured these correlations in the past, both for general populations and within specific fields, but to the best of our knowledge, this is the first study to do this within the field of software development. This study aims to validate generalizations of findings in other fields while also filling the gap in the literature in relating this correlation to software developers. To do this, an online survey consisting of a miniaturized International Personality Item Pool questionnaire for measuring the Five Factor Model personality traits, and the Shirom-Melamed Burnout Measure for measuring burnout, was distributed to several open source developer mailing lists, netting 47 valid responses. The results from correlating these responses indicate a strong link between neuroticism and burnout, while the correlations between each of the other Five Factor Model traits and burnout are inconclusive.**

***Keywords*-burnout; personality; five factor model; software developers;**

I. Introduction

Stress is a commonplace occurrence in many professions. It is a natural response to averse circumstances, heightening alertness and improving reaction speed, allowing a person to better handle a stressful situation. However, this state takes a toll on the human body, impacting the mental and physical health of a person if sustained for long periods of time [1].

People which experience long-term stress on the job are at greater risk of burnout. Burnout occurs when a person can no longer handle the stresses put upon them effectively, resulting in reduced work efficiency, unhappiness, and health problems. However, some people appear to thrive in high intensity environments for long periods of time without burnout [1]. This may be related to the apparent link between personality types and stress suggested in other studies [2]–[9].

A form of personality measurement is the Five Factor Model (FFM) also called the Big Five. The FFM is a construct composed of five personality types: Openness to experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. We aim to investigate the correlation between the FFM personality types and burnout in software engineers. This may provide some insight into why some people are more resistant to burnout than others, which in turn would give employers and potential employees an additional tool for managing workplace stress and burnout. Furthermore, this paper aims to validate existing findings correlating personality with burnout, but within the narrower field of software engineering.

RQ_1: Are any of the Big Five personality traits correlated with software developer burnout?

To answer this question, we created and distributed an online questionnaire consisting of two parts, one measuring the Big Five personality traits, and the other measuring workplace burnout. From each response, six coefficients were derived: one for each of the Big Five personality traits, and a burnout coefficient. Each of the personality coefficients are then correlated with the burnout coefficient, and the result used to attempt to reject the null hypothesis.

Section II of this paper provides background information, outlining current literature on this topic and describing the models used. Section III describes how the data is collected, compiled, and analyzed, and Section IV describes the results of the analysis. Section V discusses these results, and Section VI describes the conclusions made.

II. Background

A number of different personality traits, derived from a multitude of different methods, have been correlated with burnout in other fields [4], [6], [7], [10]–[12], but this paper appears to be first to investigate this apparent correlation in the context of software developers. Current research suggests that Neuroticism and similarly defined traits are consistently positively correlated with stress and burnout, while Openness and Extraversion are negatively correlated [4], [8], [11].

A. Burnout and occupational stress

The concept of burnout was originally formulated in the mid 70's. Since the concept was first coined, interest in this subject has grown significantly and the amount of research on burnout has increased considerably. The most used definition of burnout was created in 1982 by Dr. Christina Maslach, Professor of Psychology at the University of California at Berkley [13]. This model has been modified over the years as research has found that burnout can occur in all professions. The model

now covers all occupations whereas it was initially focused solely on health-care professionals. The three constructs of Maslach's burnout model are emotional exhaustion, depersonalization, and personal accomplishment. Emotional exhaustion can occur when an employee experiences overextended periods of stress, often caused by work overload or conflicts. The second construct, depersonalization or cynicism, represents a negative response to other people, as well as a feeling of being disconnected from others. The last component, personal accomplishment, is described as a decrease in an individual's feeling of competence and productivity.

This is however not the only commonly used model of burnout. An alternative model is the Job-Person Fit Model which suggests that burnout can occur when there is a mismatch between the job and the employee. Examples of such a mismatch are when an employee does not have the necessary resources to complete a given task, or when he or she has to little control of the tasks they are assigned to complete. Some individuals also require more meaningful rewards than others for completed work. If a job does not meet this requirement for a given employee, it can lead to burnout according to this model [13]. Another model of note is the Job-Demand-Resources Model, which proposes that burnout can develop when demands are higher than the available resources can fulfill. The strain caused by this can in turn lead to burnout.

Current burnout research has not found an efficient treatment for burnout once it has set in. It should therefore be of high importance for employees and employers to take a preventive approach to burnout. On the personal plain an employee or individual can engage in some person-centered approaches that have been showed to help prevent burnout. Some of these prevention methods includes engaging in relaxing activities such as yoga, meditation and mindfulness training. Another proven method is to take a vacation which allows the employee to take a break from the stressors at work. It has also been demonstrated that social support is one of the most efficient ways of preventing burnout [1], [3], [12], [13].

Past studies have found that burnout decreases the efficiency and quality of work of employees [13]. There appears to be a relationship between personality and how an individual appraises a stressor, which can be viewed as a challenge, a threat, or a natural event, which will influence its impact on the individual [9].

B. Big Five Model

After many studies involving trait-descriptive terms, five main factors were found to be consistent among them. This later led to the development of the Big Five, also known as the Five Factor Model (FFM) [14]. Although there exist many other personality models, such as the Mary-Briggs Type Indicator (MBTI), the five factor model has grown in popularity in recent decades, partly due to its wide support in research and it being consistent over different cultures and measurement instruments [15], [16]. The five factor model consists of five main personality types, often abbreviated OCEAN, each with different associated facets [7], [11], [15]–[17] and are as follows:

1) Openness to Experience (O): People with high scores in Openness to Experience are often related to creativity both in artistic ways as well as in a scientific way. They are described as having divergent thinking and low religiosity, as well as liberal in politics [18]. A high score in this category implies one likes to learn new things, is imaginative, has a variety of interests, and finds enjoyment in new experiences.

2) Conscientiousness (C): Conscientious individuals are often career oriented. They also tend to have a high job satisfaction [18]. Individuals scoring high in this category are described as organized, thorough, and methodical.

3) Extraversion (E): Extraverts enjoy engaging in social interactions and have more friends. An extraverted person often feels energetic and talkative. People in this category often get their energy and drive from other people [18].

4) Agreeableness (A): People high on Agreeableness often experience happiness and high life satisfaction due to a high motivation. They also find it easier to engage in relationships with others [18]. People with a high score in this trait are generally warm, friendly, and compassionate.

5) Neuroticism (N): Neurotic individuals are characterized as being more susceptible to negative emotions. Individuals scoring high in neuroticism are more likely to describe any given event as a negative experience. This in turn can lead to decreased job satisfaction [18]. Neurotic individuals are classified as being susceptible to negative emotions, emotional instability, and tension.

C. Personality stability

Should personality be found to be stable and unchanging, a causal link could potentially be made from the correlation analysis made in this paper, but this is not the case. There has been a substantial amount of research done during the past decades on how and if personality is stable or susceptible to change over time. These studies show that not only can personalities change over time, but is possible for people to change their personality in a desired direction. It is further noted that people will generally become more agreeable, conscientious and emotionally stable as they get older [19]. Another study describes a decline in Openness to Experience, Extraversion, Neuroticism and an increase in Conscientiousness and Agreeableness with age [19]. Neuroticism has also been shown to increase again in the latter part of a person's life [20].

D. SMBQ/SMBM

As burnout measurement, we used the Shirom Melamed Burnout Measure (SMBM), which is a burnout measure derived from Shirom-Melamed Burnout Questionnaire (SMBQ) and is more tailored to assessments of work-related populations [21]. Burnout in this context is a construct that consists of emotional exhaustion, physical fatigue, and cognitive weariness. These components together represents burnout. This measure is a proven and widely used method for measuring burnout [22].

E. IPIP

The International Personality Item Pool (IPIP) is a collection of items used to measure a variety of personality related constructs, including the Five Factor Model [16]. Compared to other measures, IPIP has been found to be more consistent in describing FFM personality traits. The measure can be conducted in the form of a questionnaire consisting of factors and sub-factors which provide numerical values, enabling detailed statistical analysis [16]. IPIP is public and free to copy, edit, and use without explicit permission or fees [23]. IPIP is a widely used inventory for measuring personality and has been proven to be useful in many different fields of study. An additional advantage to IPIP is that the instrument can be relatively short, which can help mitigate the high dropout rates often experienced in online surveys [24].

F. Related Work

Previous research has found indications of personality being an influencing factor in the development of burnout. High perceived job strain is primarily associated with people scoring high in Neuroticism, whereas people scoring high in Extraversion, Openness, Conscientiousness, and Agreeableness perceived their work to be less stressful, and generally experienced lower job strain [12]. Studies have found that introverts often gets stressed more easily than their counterparts, mainly due to the anxious and pessimistic nature of their personality. Furthermore, Neuroticism and Conscientiousness scores may be used as predictors of success in the workplace [7]. People with high scores in Extraversion and Conscientiousness appear to be less likely to experience burnout, while people scoring high in Agreeableness are more so [11]. The personality type most often found to be associated with stress, burnout, and strain is Neuroticism [3], [4], [6], [7], [12], [15].

A study on Volunteer counselors presented similar findings where Neuroticism was found to be a consistent predictor of burnout. People high in Neuroticism often have a hard time coping with stressful situations and are typically more vulnerable to the symptoms leading up to burnout [4]. Neurotic people also tend to create a stressful working environment with a negative atmosphere. This may in turn lead to reduced social support from coworkers, which has been demonstrated to have the possibility to act as a buffer against the symptoms of burnout [3]. One study suggests all five of the big five personality types are related to preceded job strain, where Neuroticism is associated with high job strain and Openness, Conscientiousness, Extraversion, and Agreeableness are all associated with lower job strain [3].

A study conducted on HR professionals showed that conscientious individuals are seldom anxious or nervous and are therefore less likely to experience the symptoms of burnout. The same was found for emotional stability, which is the inverse of Neuroticism [11].

Agreeableness is negatively correlated with stress. This has been attributed to agreeable persons being friendly, cooperative, and flexible, which can allow these individuals to easier gain trust and support from others, which can help mitigate the effects of stress [8]. Conscientiousness was also found to be negatively correlated with stress, likely caused by their careful and meticulous approach to problems. This allows them to avoid or resolve stressful situations before they arise. Extraversion and Openness was also found to be negatively correlated with stress. [8].

III. Method

For personality sampling, we used a minified IPIP questionnaire [25]. This minified version has been validated as closely matching the original 50 item IPIP FFM questionnaire, which has been found to better describe personality than other available personality tests, such as MBTI. Its smaller size also makes it better suited for use in an online format where respondents may have limited time or patience for answering a survey. IPIP is also freely available and does not require a trained professional to interpret the results [16]. This questionnaire outputs five variables, one for each personality trait, with values ranging from 1 to 5, with 1 meaning very inaccurate, and 5 meaning very accurate.

For measuring burnout levels, SMBM was used. SMBM is very short, consisting of only 14 questions, making it ideal for use in a voluntary survey. SMBM is also specifically tailored to measure burnout in working populations, meeting our requirements exactly [22]. Each question in SMBM has answers ranging from 1 to 7, 1 representing never/almost never, and 7 representing always/almost always. The burnout coefficient is derived by adding up the numbers of each answer in the questionnaire. The range of this value is 14 to 98.

The questionnaire consisted of three parts: an introduction and validation section, the IPIP section, and the SMBM section. The introduction contained a message describing the survey and the goal of the study. The validation section consisted of a yes or no question asking whether the participant was currently employed as a software engineer, followed by a question about years of experience. The former question is required as SMBM assumes ongoing employment. We had intended to take years of experience into account during the correlation, but this question was left unused post-collection as the experience groups were largely in the 10+ year range, leaving the remaining experience ranges too small for meaningful statistical analysis.

The data was collected through an online survey with 51 responses in total. This was done by distributing it through a number of open source mailing list[1], as well as advertisement through Twitter from a Swedish software developer podcast[2]. 4 out of the 51 responses were invalidated due to responding negatively to being employed at the time of taking the questionnaire, which is required by the SMBM portion of the survey.

To extract data points from the survey results, each of the two sections of the questionnaire were processed following instructions outlined by their respective authors. In the IPIP

[1]See Appendix A

[2]https://twitter.com/kodsnack

portion of the questionnaire, each item is accompanied by answers ranging from 1 to 5, where 1 means the subject strongly disagrees with the statement, and 5 means the subject strongly agrees. Each question is associated with a specific personality trait, either positively or negatively, and the value of the answer determines its weight when calculating the final score for each trait. Adding up the question values for each trait gives the final trait score. Similarly, the SMBM portion's numerical answers are simply added together for the final coefficient.

The hypotheses being tested in this paper are as follows:

$$H_0 : \rho_{b,o} = \rho_{b,c} = \rho_{b,e} = \rho_{b,a} = \rho_{b,n} = 0$$
$$H_1 : \rho_{b,o} \neq 0$$
$$H_2 : \rho_{b,c} \neq 0$$
$$H_3 : \rho_{b,e} \neq 0$$
$$H_4 : \rho_{b,a} \neq 0$$
$$H_5 : \rho_{b,n} \neq 0$$

$_b$ = Burnout Coefficient

$_{o,c,e,a,n}$ = FFM Trait Coefficients

The null hypothesis (H_0) states that there is no correlation between a person's personality trait ($_{o,c,e,a,n}$ representing Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism) and their susceptibility to burnout ($_b$). Conversely, five alternative hypotheses were posed ($H_{1\sim5}$), each stating that a given personality trait is correlated with burnout.

Before deciding on a correlation method, we used the Shapiro-Wilks normality test to check for normality. After concluding the FFM coefficients were unlikely to be normal, and as two quantitative, continuous, possibly non-normal variables will be tested for correlation for each combination of burnout and personality trait, the Spearman rank-order correlation will be used. Considering the small number of respondents (~ 50) and the correlation method used, we would reject the null hypothesis if $\phi \geq 0.40$ with $a = 0.10$ for any of the pairs, as suggested by Cohen [26], where ϕ is the slope, or strength of correlation, and a is the p-value threshold, or statistical confidence.

A. Validity Threats

Some threats present in the study were not mitigable considering the limited time and resources of the authors. One such threat, and arguably the most serious one, is selection bias. The sampled population is self-selected through voluntary participation in an online survey, which may have biased the data by common method variance [27]. This surveying method was chosen over other methods, such as in-person surveys, as it would allow the collection of more data points. An added drawback to online surveys is the lack of response rate measurement due to the distribution method of the survey. No information regarding the of number of people subscribed to each mailing list was available.

People participating in self-assessment surveys on personality have the tendency to not be fully honest with their answers, but studies have demonstrated that the IPIP framework is resistant to these effects [16]. No such studies have been made regarding SMBM, which remains an uncertainty. However, as this survey is done anonymously online, we believe this will not be a significant factor.

TABLE I
MEANS, STANDARD DEVIATIONS, AND CORRELATIONS OF BURNOUT WITH THE FFM VARIABLES

Measure	r	p	mean	sd
1. Openness	−0.1002	0.5027	3.95	0.72
2. Conscientiousness	−0.1449	0.3312	3.40	0.70
3. Extraversion	−0.2303	0.1193	2.43	0.77
4. Agreeableness	−0.0633	0.6726	3.34	0.86
5. Neuroticism	0.5699	0.000 03	2.90	0.81
6. Burnout	—	—	48.23	17.39

IV. RESULTS

The results of the analysis (Table I & Fig 1) show that Neuroticism is strongly positively correlated with Burnout in software engineers, confirming the findings of similar studies, while the correlations between the other four FFM coefficients are inconclusive. With this, H_0 can be rejected, but only H_5 is accepted.

V. DISCUSSION

A. Key Findings

The result of our analysis shows that Neuroticism is strongly positively correlated with Burnout in software developers. This is in line with what has been found by similar studies in other fields [2]–[4], [4]–[9], but no statistically significant results were found for correlation with the remaining personality traits.

Contrary to the findings of similar papers on this topic [3], [5]–[7], the result of our study did not find Conscientiousness to have a strong negative correlation with burnout. This is possibly caused by the small sample size of this study, considering the consistent results in other studies and low significance. An alternative hypothesis is that software development may be different in some significant way to other fields taken as a whole. While Conscientiousness has been shown to be a net positive in resistance to burnout, it has also been shown to be positively correlated with emotional exhaustion [7], which contributes to the development of burnout. This factor may be more pronounced in the field of software development where large ongoing projects and close collaboration are emphasized.

As no causal analysis was conducted, we cannot speculate on the presence or direction of a causal link. Job related burnout is certainly something which takes time to develop, while personalities have been shown not to be a stable construct over time [19], [20].

B. Practical Implications

Our study has found that software developers scoring high in Neuroticism have a higher risk of experiencing burnout. Companies could, as an example, make use of this information by testing employee's personalities, both new and current, and using that information to regulate the frequency of the application of a burnout measure, such as SMBM. By testing people with a higher risk of burnout more frequently, less time can be spent on lower risk employees, allowing the discovery of latent burnout faster and at a lower cost. In such cases, stress intervention, a form of social support, may be applied. It has been demonstrated to be a strong buffer against the effect of burnout [1], [12], and has previously been shown to have a positive effect on burnout mitigation in software developers. Other methods which have proven effective include yoga and meditation [1]. We urge careful consideration when using Neuroticism in the employment process as susceptibility to burnout is not exclusively decided by Neuroticism and may be mitigated by other factors, such as the other four FFM coefficients [1], [12].

C. Limitations and future research

The use of a self-report questionnaire in this study may have lead to relationships between variables being inflated due to social desirability effects, meaning that respondents might answer the questionnaire in a dishonest way in order to inflate their own and others' view of themselves. However, as the survey was entirely anonymous, this effect is minimized.

As no significant results were derived for the remaining four FFM variables, possibly caused by the small sample size, further study is required to validate Extraversion, Openness, and Agreeableness having an inverse relationship with burnout as found in similar studies.

Lastly, the absence of a strong correlation with Conscientiousness, despite the consistent results in similar studies, is an interesting find. While this may be a statistical fluke, we speculate that there may be factors specific to the field of software development behind this finding, and we believe a more detailed investigation into this would give some interesting insight into the specific psychological factors which may be at work within software development.

VI. Conclusion

To our knowledge, this is the first study that has researched the correlation between the FFM personality types and burnout in the field of software development. The goal of this study is to analyze the correlations between the five different personality types (namely Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism) and burnout. This was investigated by using questionnaires which have been validated and proven reliable in measuring personality types (IPIP) and burnout (SMBM). This study suggests that that Neuroticism is a very strong indicator of workplace burnout, which implies people scoring high in Neuroticism may wish to seek less stressful and demanding jobs, and employers may wish to put more effort in monitoring and helping employees scoring high in Neuroticism, such as by applying stress intervention measures. This is in line with similar studies in other fields [4], [6], [7], [12], [15]. This study did not have the sample size to conclusively accept or reject correlation between Burnout and Openness, Conscientiousness, Extraversion, and Agreeableness.

We suggest further research is needed in line with this paper, but with larger sample sizes and better sampling methods, in order to confirm or reject the findings of similar papers on the remaining factors, and to investigate the potential divergence of the influence of Conscientiousness on Burnout in the field of software development compared to other fields.

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References

[1] P. Singh and D. Suar, "Health consequences and buffers of job burnout among indian software developers," *Psychological Studies*, vol. 58, no. 1, pp. 20–32, Mar 2013. [Online]. Available: https://doi.org/10.1007/s12646-012-0171-9

[2] D. McAdams, "The five-factor model in personality: A critical appraisal," *Journal of personality*, vol. 60, no. 2, pp. 329–361, 2006.

[3] M. Törnroos, M. Hintsanen, T. Hintsa, M. Jokela, L. Pulkki-Råback, and N. Hutri-Kähönen, "Associations between five-factor model traits and perceived job strain: A population-based study," *Journal of Occupational Health Psychology*, vol. 18, No. 4, p. 492–500, 2013.

[4] A. B. Bakker, K. I. Van Der Zee, K. A. Lewig, and M. F. Dollard, "The relationship between the big five personality factors and burnout: A study among volunteer counselors," *The Journal of Social Psychology*, vol. 146(1), p. 31–50, 2006.

[5] A. Pietrantoni, *Intersect of the 5 Factor Model of Personality and Gender Relative to Perceived Levels of Stress for Law Enforcement Officers*. Alliant International University, California School of Professional Psychology, San Diego, 2013.

[6] S. Grant and J. Langan-Fox, "Personality and the occupational stressor–strain relationship: The role of the big five," *Journal of Occupational Health Psychology*, vol. Vol. 12, No. 1, p. 20–33, 2007.

[7] G. Armon, A. Shirom, and S. Melamed, "The big five personality factors as predictors of changes across time in burnout and its facets," *Journal of Personality*, vol. 80:2, pp. 403–427, 2012.

[8] F. M. Chan, "The effects of optimism and the five-factor model of personality on stress and performance in the workplace," *University of Tennessee, Knoxville*, pp. 43–65, 2004.

[9] R. A.B, M. J. van der Wal, J. C. Bucx, G.-J. S. Hendriks, and J. B. Prins, "Work stress and satisfaction in relation to personality profiles in a sample of dutch anaesthesiologists," *European Journal of Anaesthesiology (EJA)*, vol. 33 issue 11, pp. 800–806, 2016.

[10] V. M. Dumitru and D. Cozman, "The relationship between stress and personality factors," *HVM Bio ux*, vol. 4(1), pp. 34–39, 2012.

[11] A. Santos, M. Mustafa, and G. T. Chern, "The big five personality traits and burnout among malaysian hr professionals," *Asia-Pacific Journal of Business Administration*, vol. Vol. 8 No. 1, pp. 2–20, 2016.

[12] M. Törnroos, M. Hintsanen, T. Hintsa, M. Jokela, L. Pulkki-Råback, and N. Hutri-Kähönen, "Associations between five-factor model traits and perceived job strain: A population-based study," *Journal of Occupational Health Psychology*, vol. Vol. 18, No. 4, p. 492–500, 2013.

[13] C. A. McGeary and D. D. McGeary, "Occupational burnout," in *Handbook of Occupational Health and Wellness*, R. J. Gatchel and I. Z. Schultz, Eds. New York: Springer, 2012, ch. 9, pp. 181–201.

[14] L. R. Goldberg, "The development of markers for the big-five factor structure," *Psychological Assessment*, vol. 4, pp. 26–42, 1992.

[15] Z. Q. guo an Bob O'Shea, W. Mike, and Z. Yu-Bo, "The influence of big five personality traits on subjective well-being: Mediation of job satisfaction," *International Conference on Management Science & Engineering*, vol. 18, pp. 717–725, 2011.
[16] F. Robert, A. Lefteris, T. Richard, and S. Maria, "Links between the personalities, views and attitudes of software engineers," *Information and Software Technology*, vol. 52, Issue 6, pp. 611–624, 2010.
[17] J. E. Hannay, E. Arisholm, H. Engvik, and D. I. Sjøberg, "Effects of personality on pair programming," *IEEE TRANSACTIONS ON SOFTWARE ENGINEERING*, vol. VOL. 36, NO. 1, pp. 61–80, 2010.
[18] T. A. Judge, D. Heller, and M. K. Mount, "Five-factor model of personality and job satisfaction: A meta-analysis," *Journal of Applied Psychology*, vol. 87, no. 3, p. 530–541, 2002.
[19] N. W. Hudson and R. C. Fraley, "Volitional personality trait change: Can people choose to change their personality traits?" *Journal of Personality and Social Psychology*, 2015.
[20] A. Terracciano, R. R. McCrae, L. Brant, and C. Paul, "Hierarchical linear modeling analyses of the neo-pi-r scales in the baltimore longitudinal study of aging," *Psychol Aging*, vol. 20, no. 3, p. 493–506, 2005.
[21] A. Shirom. (2018, 03) Burnout and vigor scales (smbm & smvm). [Online]. Available: http://www.shirom.org/arie/index.html
[22] Lundgren-Nilsson, I. Jonsdottir, J. H. Pallant, and G. Ahlborg Jr, "Internal construct validity of the shirom-melamed burnout questionnaire (smbq)," *BMC Public Health*, vol. 12:1, pp. 1–8, 2012.
[23] A scientific collaboratory for the development of advanced measures of personality and other individual differences. [Online]. Available: https://ipip.ori.org
[24] T. Buchanan, J. A. Johnson, and L. R. Goldberg, "Implementing a five-factor personality inventory for use on the internet," *European Journal of Psychological Assessment*, vol. 21 Issue 2, p. 116–128, 2005.
[25] M. B. Donnellan, F. L. Oswald, B. M. Baird, and R. E. Lucas, "The mini-ipip scales: Tiny-yet-effective measures of the big five factors of personality," *Psychological Assessment*, pp. 192–203, 2006.
[26] J. Cohen, "Quantitative methods in psychology, a power primer." *Psychological Bulleting [PsycARTICLES]*, pp. 155–159, 1992.
[27] P. M. Podsakoff, S. B. MacKenzie, and J.-Y. Lee, *Journal of Applied Psychology*, vol. 88, no. 5, pp. 879–903, 2003.

APPENDIX

A. Mailing Lists

- Apache Open Office, Development Mailing List: https://openoffice.apache.org/mailing-lists.html#development-mailing-list-public
- KDE Development: https://www.kde.org/support/mailinglists/
- KDE Core Development: https://www.kde.org/support/mailinglists/
- Scilab Developers mailing list: https://www.scilab.org/development/ml
- Redhatm software factory-dev: https://www.redhat.com/mailman/listinfo/softwarefactory-dev
- R-devel: https://www.r-project.org/mail.html
- GCC mailing lists: https://gcc.gnu.org/lists.html
- XMPP for developers: https://xmpp.org/community/mailing-lists.html
- Wireshark-dev: https://www.wireshark.org/lists/
- Django-developers: https://docs.djangoproject.com/en/dev/internals/mailing-lists/
- Python.dev: https://www.python.org/community/lists/
- GNOME, deval-announce-list: https://mail.gnome.org/mailman/listinfo/devel-announce-list
- TIZEN dev: https://www.tizen.org/community/mailing-lists
- VirtualBox developers list: https://www.virtualbox.org/wiki/Mailing_lists
- Eclipse Mailing Lists: https://accounts.eclipse.org/mailing-list
- Mozilla Web development, General development and Extension development lists: https://www.mozilla.org/en-US/about/forums/#web-development
- Debian developers mailing lists: https://lists.debian.org/devel.html

B. Survey

Note: The data from the survey is provided only in aggregate, as per the introductory text in the survey.

Validation Section.

1) Are you currently employed as a software engineer? (Yes / No)
2) How many years of professional software development experience do you have? (None, 1 year, 2-4 years, 5-9 years, 10+ years)

IPIP Section. Items have the following answer options: Very Inaccurate — 1, 2, 3, 4, 5 — Very Accurate

1) I am the life of the party
2) I sympathize with others' feelings
3) I get chores done right away
4) I have frequent mood swings
5) I have a vivid imagination
6) I don't talk a lot
7) I am not interested in other people's problems
8) I often forget to put things back in their proper place
9) I am relaxed most of the time
10) I am not interested in abstract ideas
11) I talk to a lot of different people at parties
12) I feel others' emotions
13) I like order
14) I get upset easily
15) I have difficulty understanding abstract ideas
16) I keep in the background
17) I am not really interested in others
18) I make a mess of things
19) I seldom feel blue
20) I do not have a good imagination

SMBM Section. Items have the following answer options: Never/Almost Never — 1, 2, 3, 4, 5, 6, 7 — Always/Almost Always

1) I feel tired
2) I have no energy for going to work in the morning
3) I feel physically drained
4) I feel fed up
5) I feel like my "batteries" are "dead"
6) I feel burned out
7) My thinking process is slow
8) I have difficulty concentrating
9) I feel I'm not thinking clearly
10) I feel I'm not focused in my thinking
11) I have difficulty thinking about complex things
12) I feel I am unable to be sensitive to the needs of coworkers and customers
13) I feel I am not capable of investing emotionally in coworkers and customers
14) I feel I am not capable of being sympathetic to coworkers and customers

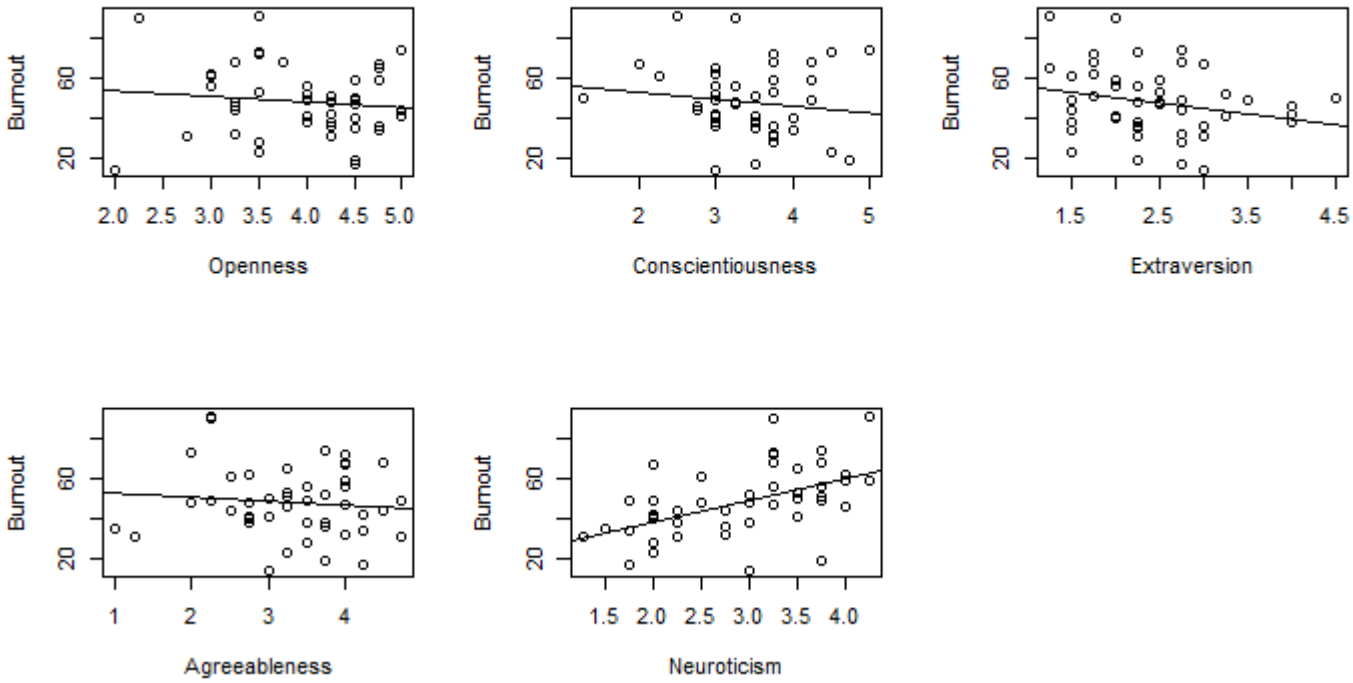

Fig. 1. Plots of each variable pair

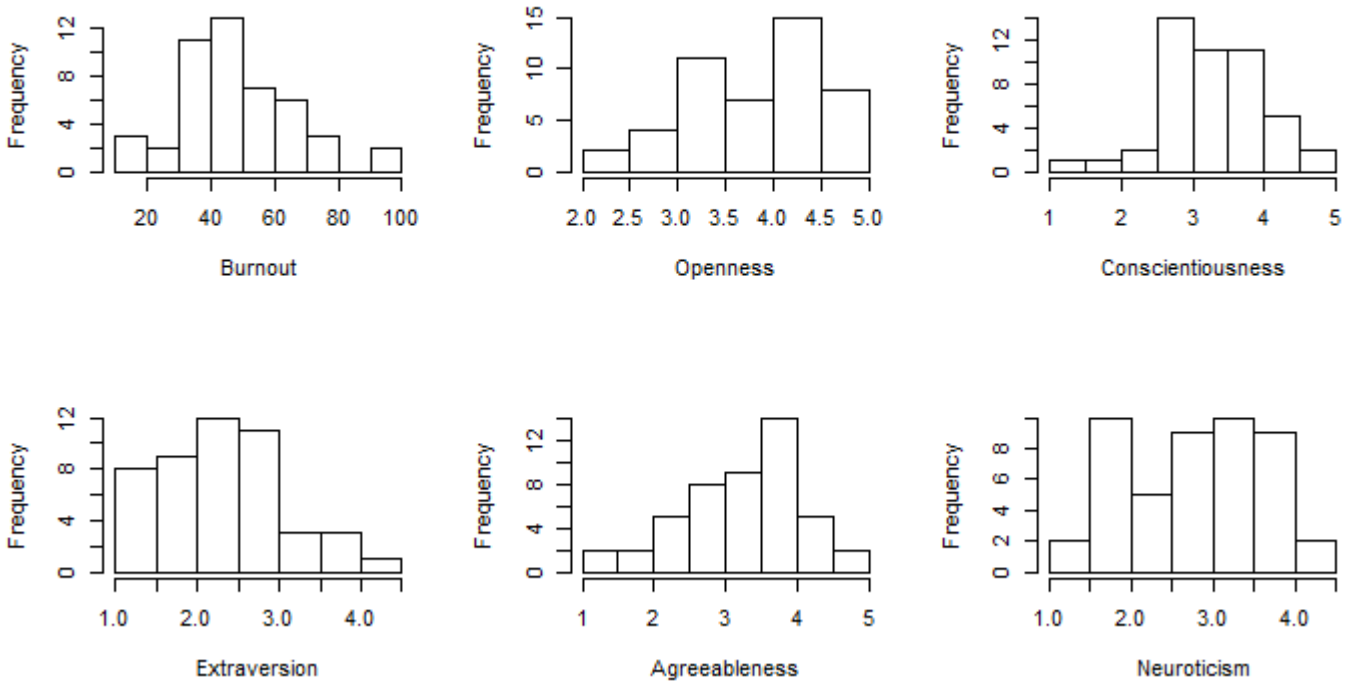

Fig. 2. Histograms of the variables