



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



A person-centered approach in studying coronavirus pandemic response: The role of HEXACO-PI-R and PANAS dimensions

Bojan Branovački^{*}, Selka Sadiković, Snežana Smederevac, Dušanka Mitrović, Dejan Pajić

Department of Psychology, Faculty of Philosophy, University of Novi Sad, Serbia, Dr. Zoran Djindjić 2, 21 000 Novi Sad, Serbia

ARTICLE INFO

Keywords:

COVID-19
HEXACO
Person-centered approach
Reactions to pandemic

ABSTRACT

The main aim of this study was to explore reactions to the COVID-19 pandemic and their relationship with personality traits using a person-centered approach. Sample of 471 Serbian citizens was collected during the first 7 weeks of the pandemic. Cluster analysis revealed three clusters based on reactions to the pandemic: Adapted, Antagonized, and Passive. Adaptive type is characterized by stable emotional reactions and adherence to behavioral guidelines. Antagonized cluster is characterized by lowered adherence to behavioral guidelines, while Passive cluster is characterized by increased fear and boredom. Clusters differed significantly on HEXACO and PANAS traits. Similarity of obtained clusters with prototypes that commonly emerge using personality traits for classification, stresses the importance of basic individual differences in pandemic-induced behavior.

1. Introduction

The outbreak of Coronavirus disease 19 (COVID-19) has led to a global health, economic and societal crisis and countries around the globe applied various measures in order to control it. In most of the countries these measures have been aimed at “flattening the curve” (World Health Organization, 2020), meaning: reducing the spread of the infection through social and physical distancing, increasing hygiene and quarantine measures (from self-isolation for persons who are potentially infected, to complete lockdowns of the whole cities, regions etc.).

The first recorded case of COVID-19 in Serbia was on March 6, 2020. After ten days, the state of emergency was declared: public facilities and administration, universities, schools, and kindergartens stopped working. Classes were organized through TV stations (for elementary and high school students), and distance-learning online platforms (for university and graduate students). Many people were working from homes, and various facilities, restaurants, shopping malls were closed. Persons over 65 were not allowed to leave their homes, except early on weekends until 7 a.m. for basic shopping. Starting March 29, the complete lockdown from Friday afternoon till Monday morning was applied in the whole country. The slight loosening of measures began at the end of April, and the state of emergency was cancelled on May 6, two months after the first recorded case of COVID-19.

Previous studies on psychological reactions on COVID-19 focus mostly on two broad topics: emotional reactions to pandemic (e.g.,

Brooks et al., 2020; Liu et al., 2020; Mazza et al., 2020; Wang et al., 2020) and compliance with protective measures (e.g., Abdelrahman, 2020; Bacon & Corr, 2020; Harper et al., 2020; Li et al., 2020; Wang et al., 2020).

Research on emotional reactions to pandemic showed that negative emotions (Li et al., 2020), negative alteration in cognition or mood (Liu et al., 2020) and depression, anxiety and stress symptoms (Wang et al., 2020) tend to generally increase after the outbreak of COVID-19, while satisfaction in life and positive emotions decreased (Li et al., 2020). Previous studies (e.g. Mazza et al., 2020) showed that higher negative affect and detachment were associated with higher levels of depression, anxiety and stress. Furthermore, anger and confusion due to the pandemic were more severe in the presence of stressors such as longer quarantine period, fear of infection and frustration (e.g. Brooks et al., 2020), but negative emotions (e.g., worry, fear, anger and boredom) generally declined over time (Sadiković et al., 2020). On the other hand, previous studies on compliance with protective measures focus mostly on predictors of positive behavior change since in the absence of a vaccine, protective measures are of great importance to reduce the spread of COVID-19 and prevent health care systems of collapsing (World Health Organization, 2020). However, researchers showed that fear of getting disease (Harper et al., 2020) and lower distress (Wang et al., 2020) are both associated with higher compliance to precautionary measures. Moreover, women (Abdelrahman, 2020; Gaygisiz et al., 2012), those who are married (Gaygisiz et al., 2012) and older

^{*} Corresponding author.

E-mail address: bojan.branovacki@ff.uns.ac.rs (B. Branovački).

people (Bacon & Corr, 2020; Gaygisiz et al., 2012; Li et al., 2020; Liu et al., 2020) tended to show higher engagement in social distance and compliance to protective measures.

Although personality traits as stable dispositions for certain patterns of behavior and emotional reactions can significantly affect individual differences in responses to circumstances caused by pandemic (Taylor, 2019), yet there are fewest studies (e.g., Bacon & Corr, 2020; Carvalho et al., 2020; Harper et al., 2020; Sadiković et al., 2020) on the role of stable dispositions in the prediction of various behaviors and consequences. Previous studies showed that Extraversion is associated with lower, and Conscientiousness with higher compliance to social distancing measures and hand washing (Carvalho et al., 2020). Also, individuals scoring higher on Reward Reactivity were the most concerned, but motivated to take safety measures (e.g., Bacon & Corr, 2020). Personal safety is of biggest concern for those with higher Fight/Flight/Freeze system and they are also more likely to self-isolate (Bacon & Corr, 2020). Another study (Sadiković et al., 2020) showed that the Behavioral approach system was negatively related to fear and worry and positively to boredom, Fight was associated with boredom and anger, while Behavioral inhibition system was related to anger.

Lexical research of personality might be the most influential approach in exploring the structure of personality traits and HEXACO model of personality (M.C. Ashton & Lee, 2007) is the most popular conceptualization of six-factor structure of personality (e.g., Mededović et al., 2019; Zettler et al., 2020), consisting of five dimensions related to the Big Five traits, and Honesty/Humility trait (Detailed information about HEXACO traits is supplied in the Supplementary materials (Appendix A). Several personality traits from the HEXACO model were associated with different psychological outcomes due to COVID-19 pandemic. Emotionality and Extraversion were predictors of seeking socioemotional support and avoidance coping strategies (Volk et al., 2021), negative appraisal due to crisis and perception of restrictive protective measures (Modersitzki et al., 2020). Openness to experience is found to be connected to lower negative appraisal (Modersitzki et al., 2020; Volk et al., 2021), while Conscientiousness and Honesty/Humility predicts avoidance strategies (Volk et al., 2021).

1.1. The present study

The pandemic of COVID-19 created novel circumstances which changed people's every-day routine, resulting in emotional and behavioral changes for everyone. In a situation of a pandemic, behavioral choices affect not only personal, but also the welfare of others. Thus individual differences related to solidarity, caring for others, cooperativity, and other prosocial aspects of personality can play a significant role in these choices. Since the HEXACO model, in addition to the dimensions mostly corresponding to the Big Five traits, encompasses more of these aspects of personality particularly in the Honesty/Humility dimension, this makes this model an appropriate framework for examining individual differences in a pandemic situation. Based on previous findings (e.g. Mazza et al., 2020), it can also be assumed that emotional dispositions such as positive and negative affectivity, which are not fully encompassed by the HEXACO model, are important for the affective response to the crisis, but also for some other aspects of behavior.

In order to better understand the complexity of consequences that pandemic had for individuals, it is important to explore individual differences in a wide spectrum of possible reactions. There is a possibility that among the population, there are several types of emotional and behavioral adjustment to the pandemic. It is of great importance to identify these types as it could help us understand and possibly prevent maladaptive reactions during the pandemic. The person-centered approach encompasses the set of methods and techniques that are helpful for researchers who seek to identify subgroups (i.e., types) within heterogeneous populations (Vermunt & Magidson, 2002) who share particular attributes or relations among attributes (Kam & Zhou, 2016). The application of person-centered approach is found to be useful

in applied settings (Gerlach et al., 2018).

Therefore, the main objective of this study was to explore different aspects of reactions related to the COVID-19 pandemic and their relationship with personality traits. The responses to the pandemic will be studied using a person-centered approach (e.g. J.B. Asendorpf et al., 2002; Bergman & Magnusson, 1997). To the best of our knowledge, there is one recent study (Chen et al., 2020) that considers several well-being measures in the context of a person-centered approach, showing that mental status due to pandemic can be explained by three types: high, medium and low risk type.

Since emotional reactions to a number of circumstances may be relevant to a pandemic situation, ratings of experiencing emotions such as fear and worry for oneself, close people, and the economy are included as possible reactions to the risk of infection and economic consequences. Measures of anger and boredom levels are included as potential reactions to many changes in everyday life that stem from social distancing and quarantine measures. Cognitive reactions included responses such as trust in institutions and the accuracy of official information, whereas behavioral responses referred to the adherence to recommended measures, structuring time, and communication with friends and family members. We assumed that based on the latent dimensions underlying these responses, it will be possible to identify clusters of respondents with distinctive behavioral tendencies.

2. Method

2.1. Sample

Sample consisted of 471 participants who provided measures for at least 5 weeks of the data collection period. There were 318 (67.5%) female participants, and the mean age of the sample was 30.13 (SD = 14.35) years. Detailed information about sample and power analysis are available in the supplementary materials (Appendix A) Section 2.

2.2. Procedure

A custom web application was developed for participants to join the study. For each participant, random code was generated which they used to access different surveys and questionnaires. The code was a 13–17-character long string containing randomly ordered letters and digits. The web application was optimized to save anonymized personalized code for each participant using cookies in order to minimize the possibility of error by participants. The anonymity of participants was protected and it allowed students to receive adequate curriculum points. All questionnaires were administered using the Google Forms platform. Four types of forms were administered during the research. After providing informed consent each participant completed the first battery, containing questions about various sociodemographic information and different trait questionnaires including the HEXACO-PI-R and PANAS. Second form was the survey administered daily, from Monday to Saturday each week, while weekly form (third form) was administered each Sunday. Fourth type was a monthly survey administered on the last day of the month (March 31 and April 30). Data was collected during the state of emergency in Serbia starting from March 21 up to May 6.

2.3. Measures

HEXACO-PI-R (K. Lee & Ashton, 2018; Serbian adaptation: Mededović et al., 2019) is a questionnaire intended to measure six domain-level traits through 96 items with five-point Likert scales. Traits measured were Honesty-Humility (HH), Emotionality, Extraversion, Agreeableness, Conscientiousness, and Openness to experience.

Positive and Negative Affect Schedule – PANAS (Watson et al., 1988; Serbian adaptation: Mihaljčić et al., 2014) is a 20-item questionnaire intended to measure Positive (PA) and Negative Affect (NA) with 10

items tapping each. Respondents were asked to answer how they felt generally in order to assess trait aspects of Positive and negative affect. All items were measured on a five-point Likert scale ranging from very little or not at all, to extremely (felt certain affect).

Responses to coronavirus and isolation survey. These surveys, administered daily, weekly or monthly, assessed how participants are handling the COVID-19 pandemic and the state of emergency in Serbia through assessment of their affective, behavioral and cognitive responses to the situation. The content of the items referred to emotional responses of fear (related to people and economy), worry and boredom during the pandemic, as well as behaviors and attitudes towards government issued guidelines and safety measures and level of organization participants attained during the isolation. In this research questions from daily and monthly surveys were used. All questions were measured using a five-point Likert scale and item content is presented in Table 1. In total, 15 items were used, 10 from the daily and 5 from the monthly survey.

Sociodemographic data. Different socio demographic data was collected during the data collection period. In this research information about gender, age, education status, partner status, and place of living was used.

2.4. Data analysis

Items measured daily were averaged across weeks which resulted in 7 variables for each item: from March 21 to 27, from March 28 to April 3, from April 4 to 10, from April 11 to 17, from April 18 to 24, from April 25 to May 1, and from May 2 to May 6 when the state of emergency ended. ICCs (two-way mixed, absolute agreement, average measurement) of these variables for all questions ranged from 0.92 up to 0.97

Table 1
Pattern matrix of the “Responses to coronavirus and isolation” items.

Item	F&W	AGG	B	QC
(D) How afraid are you that you will be infected with the coronavirus today?	0.91			
(D) Are you occupied with thoughts of the coronavirus today?”	0.89			
(D) How afraid are you that someone close will be infected with the coronavirus today?	0.85			
(D) How afraid are you that the current situation will lead to an economic crisis?	0.74			
(M) I have acted in accordance with the recommendations of the government.		0.86		
(M) I have acted responsibly towards myself and others (wore protective gloves, masks, avoided close contact etc.)		0.82		
(M) I have advised others (family, friends, partner etc.) to act in accordance with the recommendations from the government.		0.75		
(M) I have acted in accordance with the recommendations and have not spread unverified information and misinformation on social networks.		0.72		
(M) I had confidence in the accuracy of the information published by the competent institutions.		0.62		
(D) To what extent do you miss active socializing with peers today?			0.92	
(D) To what extent do you miss going to school / college / work today?			0.83	
(D) How bored were you today?			0.60	-0.44
(D) How would you rate the quality of your communication with your family today?				0.91
(D) How would you rate the quality of your communication with friends via social media today?				0.87
(D) To what extent are you angry, annoyed or aggressive today?				-0.48

Note. (D) – item from the daily survey; (M) – item from the monthly survey; F&W – Fear and worry; AGG – Adherence to the Government guidelines; B- Boredom; QC – Quality of communication.

indicating excellent test-retest stability/reliability. Average measures were created from these 7 measurements and one variable was created for each participant who had measurements for 5 or more weeks (at least 1 measure per week). Monthly surveys (March and April) had ICCs ranging from 0.59 up to 0.77 indicating satisfactory reliability, and for each of 5 items from monthly surveys one averaged measure was created. In order to explore latent space of these items and reduce them to a smaller number of components, principal component analysis using Promax rotation was applied. Parallel analysis and Velicer’s MAP test were used to determine the optimal number of components. In order to identify different clusters of persons on identified components related to reactions to pandemic, two-step clustering procedure with cross-validation was performed (see Supplementary materials (Appendix A), Section 3 for details). Analyses were performed in SPSS 21 statistical software (IBM Corp, 2012) and R project for statistical computing (R Core Team, 2016).

3. Results

3.1. Principal component analysis

Principal component analysis resulted in four components named Fear and worry, Adherence to the government guidelines (AGG), Boredom, and Communication. The pattern matrix of the four components is presented in Table 1, additional information about the factor retention procedure and analysis are presented in Supplementary materials (Section 4).

3.2. Descriptive statistics

Basic descriptive indicators and correlations for research variables are presented in Supplementary materials, Section 5. Values of skewness and kurtosis for all variables were inside the recommended range (± 1.5 ; Tabachnick & Fidell, 2013) indicating that there were no significant deviations from normal distributions. Reliability coefficients for all scales and factor scores indicate at least satisfactory, up to excellent reliability.

3.3. Cluster analysis

Cross-validation of two-step clustering procedure indicates that three cluster solutions was the optimal solution. Average Cohen’s kappa of 1000 cross-validation repetitions for three cluster solution is 0.95 (SD = 0.09), while for four (M = 0.68, SD = 0.16) and five (M = 0.66, SD = 0.12) it was lower, indicating that three cluster solution is the most stable. Three cluster solution (Fig. 1) consists of: The Adaptive type (n = 217, 46.1%) which is characterized by moderately low scores on Fear and worry, and Boredom, and moderately high scores on AGG and Quality of communication. Second type was named the Antagonized type (n = 121, 25.7%) characterized primarily by significantly lowered scores on AGG and moderately low scores on Quality of communication. Third type was named the Passive type (n = 133, 28.2%). Members of this cluster had high scores on Fear and worry, and Boredom, close to average scores on AGG, and somewhat lowered scores on Quality of communication.

3.4. Analysis of variance

Univariate ANOVAs (Table 2) indicate that there are significant differences between clusters on both Positive and Negative affect scales, and on all HEXACO-PI-R dimensions except Openness. Detailed post hoc tests are shown in Supplementary materials (Section 6).

Pearson Chi-square test and ANOVA were used in order to determine whether there are significant differences on several socio demographic indicators between clusters. For all tested variables, including gender ($\chi^2 (2, N = 471) = 1.037, p = .596$), whether they live in the

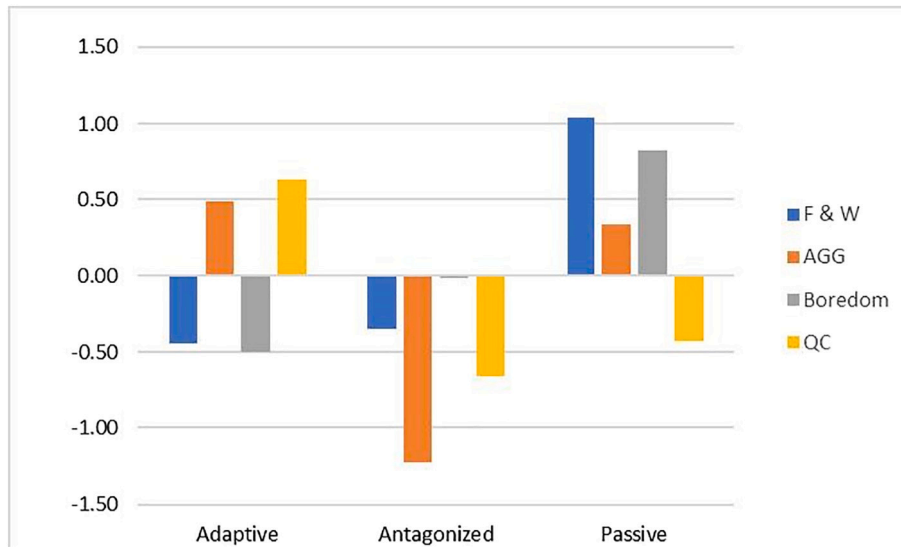


Fig. 1. Cluster profiles. F & W - Fear and worry; AGG - Adherence to the government guidelines; QC - Quality of communication.

Table 2

Differences between clusters on PANAS and HEXACO-PI-R.

Variable	ANOVA		Post Hoc test (Scheffé)
	F (2, 468)	η^2	
PANAS PA	14.25**	0.057	AD > AN**, AD > PA**
PANAS NA	28.95**	0.110	AD < AN**, AD < PA**, AN < PA**
HH	6.86**	0.029	AD > AN**, AD > PA*
Emotionality	13.24**	0.054	AD < PA**, AN < PA**
Extraversion	9.43**	0.039	AD > AN**, AD > PA ⁺
Agreeableness	7.80**	0.032	AD > AN**, AD > PA**
Conscientiousness	12.76**	0.052	AD > AN**, AD > PA*
Openness	2.28	0.009	No differences

Note. AD – adaptive; AN – Antagonized; PA – Passive; η^2 – eta squared; * - $p < .05$; ** - $p < .01$; + - $p = .051$; F(2, 468) – F test value (df_b, df_w).

countryside, town or city (χ^2 (4, N = 471) = 3.54, $p = .471$), education level (χ^2 (8, N = 471) = 6.46, $p = .597$), and whether they have romantic partner or not (χ^2 (2, N = 471) = 3.70, $p = .157$) there were no significant differences. There were no significant differences in age between clusters (F(2, 468) = 0.516, $p = .597$).

4. Discussion

Explaining and understanding people’s reactions to various risk situations and crises is extremely important, both from the aspect of maintaining mental health, and minimizing the negative effects of such threats, e.g. further spread of an infectious disease (Taylor, 2019; WHO, 1992). In this context, the aim of this study was to explain typical adaptive and maladaptive behavioral and emotional responses to COVID-19 pandemic among Serbian citizens. Our intention was to analyze both the cognitive aspects of (rational) reactions to uncertainty of the pandemic, as well as the role of affect experienced at the moment of decision making, which may be considered to be the risk-as-feelings facet of the emotional response to threats and risk situation (Loewenstein et al., 2001).

In general, our research has demonstrated the importance of individual differences in explaining the coping responses to COVID-19 pandemics and further supported the use of HEXACO in an ecological model of behavioral and emotional responses to risk situations (Modersitzki et al., 2020; Volk et al., 2021). Our findings show that people’s reactions to the pandemic may be differentiated along the four main dimensions: the level of fear and worry they feel, the level of adherence

to the rules and recommendations set by the government, the capability to structure free time in order to avoid feeling bored, and the capacity to maintain the high quality of communication with their friends and family. Unlike the fear and worry that have shown to be the common reactions to the pandemic and may not necessarily be characterized as maladaptive reactions, failing or even refusing to adhere to the government guidelines may be considered as a form of risky behavior in the situations such as the global pandemic. Nevertheless, this type of reaction to the pandemic was registered among more than a quarter of participants, forming the so-called Antagonized cluster. Members of this cluster were also characterized by the lower score on the Fear and worry and the extremely low score on the Quality of communication. This may indicate that these participants did not make the informed decision to disobey authorities’ guidelines in order to engage in more social interactions and daily activities, but are rather manifesting some form of maladaptive behavior that may be qualified as introverted and alienated. On the other hand, members of the Passive cluster are also experiencing deterioration in the quality of communication but mostly due to the extremely high level of fear and worry they feel. Consequently, they are experiencing the highest level of boredom as an effect of isolation.

Unlike the members of the Antagonized and Passive clusters, the majority of people are in fact able to cope well with the pandemic by effectively structuring their free time and maintaining the satisfying level of communication with their friends and family members. This result confirms some previous research findings indicating the positive correlation between the strong presumptions on orderliness with fewer panic thoughts and fear emotions (Trzebiński et al., 2020). Furthermore, members of this Adapted cluster were capable of effectively managing the negative effects of isolation despite the fact they were also most consistent in complying with the government health directives. Nevertheless, both the Antagonist and Passive clusters are characterized by the evident deterioration in the quality of communication which may indicate that the government directives were focused exclusively on controlling the further spread of infections while neglecting the possible negative psychological factors of emotional distress. Previous research has shown that this is not an uncommon approach of health authorities (Taylor, 2019) and the results of this study may also be considered as an appeal to the authorities to devote more attention to improving the risk communication and put more effort in making the intervention strategies more trustworthy, supportive, and informative.

Members of the Adapted, Antagonized and Passive clusters do not differ from each other in any of the examined sociodemographic variables. Namely, gender and age are controlled, while education level,

place of residence, and partnership status are not relevant for the cluster discrimination. Therefore, factors that contribute to different patterns of response to a coronavirus pandemic include stable individual differences, manifested in new and threatening external circumstances. In our study, the PANAS PA and NA dimensions and HEXACO personality traits were compared across clusters. The results show that the dimensions of affectivity contribute to coping with an emergency situation. Members of the Adapted cluster show higher PANAS PA and lower PANAS NA scores than members of the Antagonized and Passive clusters. Emotional stability allows them to focus resources on compliance with the recommendations, actively structuring time and adequate communication with close people. Although members of the Antagonized cluster had significantly lower scores on the PANAS NA compared to Passive cluster, they do not differ significantly from members of the Passive cluster in relation to the PANAS PA. Their emotional resources are being depleted by confronting the government rules and deteriorated quality of communication with close people, which indicates a possible high aggressive potential. Previous research has shown that Hostility is one of the facets of PANAS NA (Mihic et al., 2014), which indicates that Negative Affectivity includes emotions that are commonly attributed to aggression. Unlike them, preoccupation with negative emotions in the Passive cluster contributes to lethargy, poorer social contacts and boredom. Although members of the Passive cluster adhere to preventive measures, which are imposed by the authorities, they themselves do not have the initiative for more active behavior in a crisis situation.

A more detailed insight into the differences between the clusters was provided by their comparison in relation to HEXACO-PI-R personality traits. Members of the Adapted cluster show higher Honesty/Humility, Extraversion, Agreeableness and Conscientiousness scores than members of the other clusters. Previous results showed that increase in PANAS PA and decrease in PANAS NA indirectly indicated the Extraversion score, due to the high correlations between these constructs (Rusting & Larsen, 1997). However, HEXACO-PI-R Extraversion includes social courage, social self-esteem, sociability, and liveliness (Zettler et al., 2020), which certainly contribute to a more optimistic attitude of adapted people. Agreeableness contributes to the quality of communication, while Conscientiousness enables the experience of control over responsibilities, which creates conditions for positive reinforcement from the environment (Fiddick et al., 2016). Moreover, high Honesty promotes justness, frankness, modesty and avoidance of greed, creating conditions for postponing current personal goals, without frustration and feelings of deprivation. Lower scores on the Emotionality certainly contribute to such emotional stability during a pandemic.

Unlike the Adapted, the members of the Antagonized and Passive clusters achieve lower scores in the dimensions of Honesty, Extraversion, Agreeableness and Conscientiousness. The only HEXACO-PI-R dimension that significantly distinguishes the members of these two clusters is Emotionality. Namely, the members of the Antagonized cluster are more similar to the Adapted, while the members of the Passive cluster are emotionally unstable, achieving the highest scores on Emotionality. This is an important result, since it indicates the importance of emotionality for the perception of danger and behavior related to the threat. Antagonized are emotionally stable, do not show fear of coronavirus infection and avoid measures taken by the government. Ignoring measures and poorer communication with close people may reflect their general rebellion against the rules, which the pandemic provoked and emphasized. While higher Honesty is mainly associated with a pro environmentalism and willingness to contribute to the improvement of the environment, even despite the personal cost (Zettler et al., 2020), lower Honesty is often based on extremely positive self-evaluation (Mededović et al., 2019), which can make it difficult to adapt to the constraints imposed by circumstances and the environment. This tendency is also reflected in the low scores on Agreeableness and Conscientiousness. In other words, it is possible that the Antagonized have a high aggressive potential, accompanied by a lack of control, which shapes their work environment and close relationships, while

pandemic and imposed rules only reinforced these tendencies.

On the other hand, members of the Passive cluster show a tendency towards high anxiety and fear, sentimentality and dependence on others. Preoccupation with worries engages their resources, which reduces the possibility of a proactive attitude towards life circumstances (Modersitzki et al., 2020; Volk et al., 2021). Introversiveness probably contributes to a lack of social skills, which can be an additional source of dissatisfaction during periods of isolation. Interestingly, their score on Honesty is similar to the Antagonized, although they respect the established rules regarding the pandemic. It is possible that the Passive have a similar experience of injustice as the Antagonized, without manifest reactions, due to internalizing coping strategies. Therefore, the Passive adhere to the preventive measures, but have poor social contacts, get bored and preoccupied with the fear of coronavirus infection.

Overall, the results show that human behavior during a pandemic can be classified into three possible clusters: Adapted, Antagonistic, and Passive. These clusters explain individual differences in pandemic coping strategies, which are predominantly shaped by emotional reactions and stable personality traits. The great similarity of these clusters with prototypes that commonly emerge using personality traits for classification supports the significance of basic individual differences in pandemic-induced behavior. Namely, the three common personality prototypes in previous studies based on Big Five model are Resilient, Overcontrolled and Undercontrolled (J.B. Asendorpf et al., 2001; J.B. Asendorpf et al., 2002; J.B. Asendorpf & van Aken, 1999). The structure of our clusters, which were based on the reactions to ongoing pandemic, shows important similarities to these prototypes. The Adapted cluster in our study matches up with the Resilient prototype, described by low neuroticism and the average level of the other Big Five dimensions. The Antagonized cluster is similar to Undercontrolled prototype, described by low Conscientiousness and Agreeableness, while Passive cluster resembles Overcontrolled prototype, described with high Neuroticism and low Extraversion. It is possible that these three strategies: Resilience/Adaptability, Undercontrol/Antagonism, and Overcontrol/Passivity reflect general classes that can be recognized on each sufficiently representative set of behaviors. Namely, similar prototypes were obtained using the rRST model (Mitrović et al., 2014), so our results can be considered as a replication of previous findings, on another sample and with different measures. Therefore, it is possible that human reactions to a pandemic include previously developed patterns of coping with the environment, which significantly contribute to the manifestation of specific functional or dysfunctional reactions. This is supported by the result that sociodemographic variables are not important for shaping patterns of emotional and behavioral reactions to a threatening environment, such as a pandemic.

These results should be considered with caution, taking into account the limitations of the study. The first of them refers to the applied measures of response to the pandemic. Since the onset of the pandemic was sudden, most researchers were forced to design their own questionnaires to assess possible reactions. Over the course of the restrictive measures, a wider range of reactions could be identified, which did not become part of the study. Nevertheless, we believe that these reactions are partially encompassed by latent factors, which are broad enough to cover a variety of emotional, cognitive, and behavioral responses. Moreover, three patterns of coping with a pandemic confirm the existence of previously identified clusters of Resilient, Overcontrolled and Undercontrolled (J.B. Asendorpf et al., 2002), which is an indirect indicator of the representativeness of the applied measures. Second, a large part of the respondents who were recruited through social networks did not fill the HEXACO-PI-R. Therefore, out of the initial 1526 citizen science participants, only 471 were included in this study, who provided data for this questionnaire. However, descriptive indicators for our sample show that it is sufficiently representative when it comes to gender, age, and educational status.

Overall, our view is that combining a person-centered approach and a variable-centered approach (J.B. Asendorpf et al., 2002) could contribute to shedding light on patterns of coping with the current

pandemic. Therefore, future research needs to focus on further validation of this cluster solution and the search for potentially new patterns of classifying responses to global pandemics.

Data availability statement

The data that support the findings of this study are openly available on OSF platform at DOI [10.17605/OSF.IO/PQ8ZN](https://doi.org/10.17605/OSF.IO/PQ8ZN) (<https://osf.io/pq8zn/>).

CRedit authorship contribution statement

Bojan Branovački: Conceptualization, Investigation, Methodology, Formal analysis, Writing - original draft, Writing - review & editing. **Selka Sadiković:** Conceptualization, Investigation, Methodology, Writing - original draft, Writing - review & editing. **Snežana Smederevac:** Conceptualization, Investigation, Supervision, Writing - original draft, Writing - review & editing. **Dužanka Mitrović:** Investigation, Supervision, Writing - original draft, Writing - review & editing. **Dejan Pajić:** Investigation, Methodology, Formal analysis, Supervision, Writing - original draft, Writing - review & editing.

Declaration of competing interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.paid.2020.110536>.

References

- Abdelrahman, M. (2020). Personality Traits, Risk Perception, and Protective Behaviors of Arab Residents of Qatar During the COVID-19 Pandemic. *International Journal of Mental Health and Addiction*, 1-12. doi:<https://doi.org/10.1007/s11469-020-00352-7>.
- Asendorpf, J. B., Borkenau, P., Ostendorf, F., & van Aken, M. A. G. (2001). Carving personality description at its joints: Confirmation of three replicable personality prototypes for both children and adults. *European Journal of Personality*, 15, 169–198.
- Asendorpf, J. B., Caspi, A., & Hofstee, W. K. B. (2002). The puzzle of personality types. *European Journal of Personality*, 16, S1–S5.
- Asendorpf, J. B., & van Aken, M. A. G. (1999). Resilient, overcontrolled, and undercontrolled personality prototypes in childhood: Replicability, predictive power, and the trait-type issue. *Journal of Personality and Social Psychology*, 77, 815–832.
- Ashton, M. C., & Lee, K. (2007). Empirical, theoretical, and practical advantages of the HEXACO model of personality structure. *Personality and Social Psychology Review*, 11(2), 150–166. doi:<https://doi.org/10.1177/1088868306294907>.
- Bacon, A. M., & Corr, P. J. (2020). Coronavirus (COVID-19) in the United Kingdom: A personality-based perspective on concerns and intention to self-isolate. *British Journal of Health Psychology*. doi:<https://doi.org/10.1111/bjhp.12423>.
- Bergman, L. R., & Magnusson, D. (1997). A person-centered approach in research on developmental psychopathology. *Development and Psychopathology*, 9, 291–319. doi:<https://doi.org/10.1017/s095457949700206x>.
- Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., & Rubin, G. J. (2020). The psychological impact of quarantine and how to reduce it: Rapid review of the evidence. *The Lancet*, 395(10227), 912–920. doi:[https://doi.org/10.1016/S0140-6736\(20\)30460-8](https://doi.org/10.1016/S0140-6736(20)30460-8).
- Carvalho, L. D. F., Pianowski, G., & Gonçalves, A. P. (2020). Personality differences and COVID-19: Are extraversion and conscientiousness personality traits associated with engagement with containment measures? *Trends in Psychiatry and Psychotherapy*, 42(2). doi:<https://doi.org/10.1590/2237-6089-2020-0029>.
- Chen, B., Sun, J., & Feng, Y. (2020). How Have COVID-19 Isolation Policies Affected Young People's Mental Health?—Evidence From Chinese College Students. *Frontiers in Psychology*, 11. doi:<https://doi.org/10.3389/fpsyg.2020.01529>.
- Fiddick, L., Brase, G. L., Ho, A. T., Hiraishi, K., Honma, A., & Smith, A. (2016). Major personality traits and regulations of social behavior: Cheaters are not the same as the reckless, and you need to know who you're dealing with. *Journal of Research in Personality*, 62, 6–18. doi:<https://doi.org/10.1016/j.jrp.2016.02.007>.
- Gaygisiz, U., Gaygisiz, E., Ozkan, T., & Lajunen, T. (2012). Individual differences in behavioral reactions to H1N1 during a later stage of the epidemic. *Journal of Infection and Public Health*, 5, 9–21. doi:<https://doi.org/10.1016/j.jiph.2011.09.008>.
- Gerlach, M., Farb, B., Revelle, W., & Nunes Amaral, L. A. (2018). A robust data-driven approach identifies four personality types across four large data sets. *Nature Human Behaviour*, 2(10), 735–742. doi:<https://doi.org/10.1038/s41562-018-0419-z>.
- Harper, C. A., Satchell, L. P., Fido, D., & Litzman, R. D. (2020). Functional fear predicts public health compliance in the COVID-19 pandemic. *International journal of mental health and addiction*. doi:<https://doi.org/10.1007/s11469-020-00281-5>.
- IBM Corp. Released 2012. IBM SPSS statistics for windows, version 21.0. Armonk, NY: IBM Corp.
- Kam, C. C. S., & Zhou, M. (2016). Is the Dark Triad better studied using a variable-or a person-centered approach? An exploratory investigation. *PLoS One*, 11, Article e0161628. doi:<https://doi.org/10.1371/journal.pone.0161628>.
- Lee, K., & Ashton, M. C. (2018). Psychometric properties of the HEXACO-100. *Assessment*, 25(5), 543–556. doi:<https://doi.org/10.1177/1073191116659134>.
- Li, S., Wang, Y., Xue, J., Zhao, N., & Zhu, T. (2020). The impact of COVID-19 epidemic declaration on psychological consequences: A study on active Weibo users. *International Journal of Environmental Research and Public Health*, 17(6), 2032. doi:<https://doi.org/10.3390/ijerph17062032>.
- Liu, N., Zhang, F., Wei, C., Jia, Y., Shang, Z., Sun, L., et al. (2020). Prevalence and predictors of PTSS during COVID-19 outbreak in China hardest hit areas: Gender differences matter. *Psychiatry Research*, 112921. doi:<https://doi.org/10.1016/j.psychres.2020.112921>.
- Loewenstein, G. F., Weber, E. U., Hsee, C. K., & Welch, N. (2001). Risk as feelings. *Psychological Bulletin*, 127(2), 267.
- Mazza, C., Ricci, E., Biondi, S., Colasanti, M., Ferracuti, S., Napoli, C., & Roma, P. (2020). A nationwide survey of psychological distress among Italian people during the COVID-19 pandemic: Immediate psychological responses and associated factors. *International Journal of Environmental Research and Public Health*, 17(9), 3165. doi:<https://doi.org/10.3390/ijerph17093165>.
- Mededović, J., Colović, P., Dinić, B. M., & Smederevac, S. (2019). The HEXACO personality inventory: Validation and psychometric properties in the Serbian language. *Journal of Personality Assessment*, 101(1), 25–31. doi:<https://doi.org/10.1080/00223891.2017.1370426>.
- Mihic, L., Novović, Z., Colović, P., & Smederevac, S. (2014). Serbian adaptation of the positive and negative affect schedule (PANAS): Its facets and second-order structure. *Psihologija*, 47, 393–414. doi:<https://doi.org/10.2298/psi1404393m>.
- Mitrović, D., Smederevac, S., Colović, P., Kodzopeljić, J., & Dinić, B. (2014). Personality prototypes based on dimensions of the revised reinforcement sensitivity theory among prisoners and non-prisoners. *Personality and Individual Differences*, 69, 50–55. doi:<https://doi.org/10.1016/j.paid.2014.05.004>.
- Modersitzki, N., Phan, L. V., Kuper, N., & Rauthmann, J. (2020). Who is impacted? Personality predicts individual differences in psychological consequences of the COVID-19 pandemic in Germany (manuscript accepted for publication). *Social Psychology and Personality Science*. doi:<https://doi.org/10.31234/osf.io/s65ux>.
- R Core Team. (2016). *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. doi:<https://www.R-project.org/>.
- Rusting, C. L., & Larsen, R. J. (1997). Extraversion, neuroticism, and susceptibility to positive and negative affect: A test of two theoretical models. *Personality and Individual Differences*, 22(5), 607–612. doi:[https://doi.org/10.1016/s0191-8869\(96\)00246-2](https://doi.org/10.1016/s0191-8869(96)00246-2).
- Sadiković, S., Branovački, B., Oljača, M., Mitrović, D., Pajić, D., & Smederevac, S. (2020). Daily monitoring of emotional responses to the coronavirus pandemic in Serbia: A citizen science approach. *Frontiers in Psychology*. doi:<https://doi.org/10.3389/fpsyg.2020.02133>.
- Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th ed.). Boston: Pearson.
- Taylor, S. (2019). *The psychology of pandemics: Preparing for the next global outbreak of infectious disease*. Cambridge Scholars Publishing.
- Trzebiński, J., Cabański, M., & Czarniecka, J. Z. (2020). Reaction to the COVID-19 Pandemic: The Influence of Meaning in Life, Life Satisfaction, and Assumptions on World Orderliness and Positivity. *Journal of Loss and Trauma*, 25(6–7), 544–557. doi:<https://doi.org/10.1080/15325024.2020.1765098>.
- Vermunt, J. K., & Magidson, J. (2002). *Latent Class Cluster Analysis*. Applied Latent Class Analysis, 89–106. doi:<https://doi.org/10.1017/cbo9780511499531.004>.
- Volk, A. A., Brazil, K. J., Franklin-Luther, P., Dane, A. V., & Vaillancourt, T. (2021). The influence of demographics and personality on COVID-19 coping in young adults. *Personality and Individual Differences*, 168, 110398. doi:<https://doi.org/10.1016/j.paid.2020.110398>.
- Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C. S., et al. (2020). Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *International Journal of Environmental Research and Public Health*, 17, 1–25. doi:<https://doi.org/10.3390/ijerph17051729>.
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, 54(6), 1063–1070. doi:<https://doi.org/10.1037/0022-3514.54.6.1063>.
- World Health Organization. (1992). *Psychosocial consequences of disasters: Prevention and management*. Geneva: World Health Organization. doi:<https://apps.who.int/iris/handle/10665/58986>.
- World Health Organization (2020). An ad hoc WHO technical consultation managing the COVID-19 infodemic: call for action. doi:<https://www.who.int/publications/i/item/9789240010314%20>.
- Zettler, I., Thielmann, I., Hilbig, B. E., & Moshagen, M. (2020). The nomological net of the HEXACO model of personality: A large-scale meta-analytic investigation. *Perspectives on Psychological Science*, 15(3), 723–760. doi:<https://doi.org/10.1177/1745691619895036>.