Aggressiveness in the HEXACO personality model

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The aim of this research was to examine the relations between the HEXACO facets and aggressiveness components (anger, vengefulness, domination, hostility, reactive aggression, proactive aggression, and indirect aggression). On a sample of 654 participants from general population, HEXACO–60, Aggressiveness Questionnaire AVDH, Reactive–Proactive Aggression Questionnaire (RPQ), and Indirect Aggression Scale (IAS) were applied. The results of the community structure network analysis provided the most informative insight into these relations and showed that all aggressiveness components formed a single community with the Agreeableness facets. Thereby, facet Patience was the strongest correlate of anger, and hostility had the highest clustering coefficient, which brings together the Agreeableness facets and aggressiveness components. Although Honesty–Humility formed a separate community, some of its facets had strong isolated connections with indirect aggression and dominance. The results revealed that Agreeableness is a dominant correlate of aggressiveness and captures all aggressiveness components, while Honesty–Humility is related to specific components, referring to a manifestation of aggressiveness in a more subtle and indirect way.

Key words: aggressiveness, aggression, HEXACO, network analysis

Highlights:

• The Agreeableness facets and all aggressiveness components formed a joined community.
• Agreeableness had the clear affective aggressiveness component facet – Patience.
• Agreeableness did not have a clear cognitive aggressiveness component facet.
• Honesty–Humility is related to a specific aggressive behavior – indirect aggression.

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Trait aggressiveness is a multidimensional construct which captures specific behavioral (aggression), affective (anger), and cognitive (hostility) components. Aggressiveness was not the basic trait in dominant personality models, at least not as a separate and unique dimension. In lexical Big Five (BF) model (Goldberg, 1992) or in the Five Factor Model – FFM (Costa & McCrae, 1992), aggressiveness is commonly associated with the negative pole of Agreeableness, which refers to interpersonal antagonism. However, different components of aggressiveness are associated with different basic traits. Agreeableness is negatively related to general tendency towards aggressive behavior, e.g., physical and verbal aggression (Gallo & Smith, 1998; Tremblay & Ewart, 2005), aggression under provoking and nonprovoking conditions (Bettencourt, Talley, Benjamin, & Valentine, 2006), tendency towards reactive and proactive aggression (Seibert, Miller, Pryor, Reidy, & Zeichner, 2010), and it influences whether there will be an affiliative or confrontational position in interpersonal conflicts (Caprara, Barbaranelli, & Zimbardo, 1996; Graziano, Jensen-Campbell, & Hair, 1996; Jensen-Campbell & Graziano, 2001). Other components of aggressiveness, such as anger and hostility, are more associated with Neuroticism (Gallo & Smith, 1998; Tremblay & Ewart, 2005). Neuroticism has an important role both in aggression under provoking condition (Bettencourt et al., 2006), and in reactive aggression (Miller & Lynam, 2006; Miller, Zeichner, & Wilson, 2012; Seibert et al., 2010), mostly because these kinds of aggressive behavior are related to anger (Ramirez, 2009). However, for some specific aggressive behaviors, such as relational or indirect aggression, the main predictors are both Neuroticism and Agreeableness (Miller et al., 2012; Seibert et al., 2010).

In the lexical six-factor HEXACO model (Lee & Ashton, 2004) certain reconceptualizations were made, which has implications for determining aggressiveness. The sixth factor, Honesty–Humility, includes a part of variability attributed to Agreeableness from BF, but it also contains new indicators of morality (Lee & Ashton, 2004). Apart from the sixth factor, the HEXACO model also differs by the way it defines Neuroticism and Agreeableness. Specifically, the indicators of anger and hostility that were part of Neuroticism from BF are part of Agreeableness in the HEXACO model, while the indicators of sentimentality and empathy that are part of the Agreeableness in the BF model are in the HEXACO model part of Emotionality, which is a trait closely related to Neuroticism. Because of this reconceptualization, Agreeableness from the HEXACO model had a higher correlation with reactive than with proactive aggression, while Honesty–Humility is highly correlated with both (Book, Volk, & Hosker, 2012). Accordingly, Agreeableness still presents a general tendency towards aggression, but now it includes the tendency towards reactive i.e., immediate aggression followed by anger, which is not the case with Agreeableness from BF. However, Honesty–Humility is to a higher extent related to the selective, deliberate aggression, which corresponds more to proactive aggression (Book et al., 2012; Lee & Ashton, 2012). Relations between the HEXACO and different components of aggressiveness confirmed this distinction: while Agreeableness is
more associated with anger and hostility, Honesty–Humility is more associated with vengefulness, and both traits are almost equally associated with dominance (Dinić, Mitrović, & Smederevac, 2014).

The present study

The aim of this study is to examine the relations between the HEXACO facets and components of the aggressiveness. Several components of aggressiveness which are relevant from the standpoint of personality psychology are included: anger, vengefulness, dominance, hostility, reactive aggression, proactive aggression, and indirect aggression. The first four are components which were extracted by examining the latent structure of items from agreeableness/aggressiveness scales from different personality inventories (Dinić et al., 2014). Namely, these personality scales do not measure the same content of aggressiveness and favor different aggressiveness components, so the purpose of including the four mentioned components is to make sure to capture all the main aggressiveness components present in agreeableness/aggressiveness scales. The rest of the components refer to the behavioral aspect of aggressiveness. Given that different functions of aggression are related to different personality traits and types (Book et al., 2012; Miller & Lynam, 2006; Miller et al., 2012; Seibert et al., 2010), reactive and proactive function of aggression was included. Indirect aggression is also included since it is close to proactive aggression (Miller et al., 2012).

Although Agreeableness from the HEXACO model is supposed to be the main correlate of aggressiveness and captures a wider range of aggressiveness components (Lee & Ashton, 2004), previous studies showed that Honesty–Humility is also closely associated with aggressiveness (Book et al., 2012; Dinić et al., 2014; Lee & Ashton, 2012). However, there are specific relationships between these basic traits and certain components of aggressiveness. Namely, Agreeableness includes facets of patience and gentleness, and thus it should be more (negatively) related to anger, hostility, and immediate or reactive aggression, while Honesty–Humility includes facets of sincerity and fairness, and thus it should be more (negatively) related to calculated or proactive aggression, including vengefulness (Book et al., 2012; Dinić et al., 2014; Lee & Ashton, 2012). Having in mind the intentional nature of indirect aggression, it could be expected that it is mostly related to Honesty–Humility.

However, the other traits should be also considered in their relations with aggressiveness although their associations with aggressiveness are not as strong. For example, Emotionality was moderately correlated with displaced aggression (Lee & Ashton, 2012) and had small negative correlation with instrumental (proactive) aggression (Book et al., 2012). Moreover, Conscientiousness from FFM was negatively related to both reactive and proactive aggression (Jones, Miller, & Lynam, 2011; Miller et al., 2012), and to indirect aggression (Gleason, Jensen–Campbell, & Richardson, 2004).
Considering the relations of almost all HEXACO traits with certain components of aggressiveness, the main question is what is the location of aggressiveness components in HEXACO model: are some HEXACO traits, such as Agreeableness, central to the aggressiveness components, or are aggressiveness components connected to several different HEXACO traits in a way which indicates that there is no grouping around one trait, or do aggressiveness components form a separate group. To answer this question, confirmatory and exploratory approaches are applied. In order to ensure the same hierarchical level of variables, analyses were done on facet level of both HEXACO traits and aggressiveness. Firstly, several proposed models were tested with the location of aggressiveness components: 1) only in Agreeableness, 2) only in Honesty–Humility, 3) in both mentioned dimensions, according to theoretical expectations and previous research, 4) in a separate factor. We also tested a model based on structural equation modeling (SEM) approach in which the bifactor model of aggressiveness was built (with general factor of aggressiveness and aggressiveness components as specific factors) and settled regression paths from Agreeableness and Honesty–Humility factors to specific aggressiveness factors in order to get significance of these relations. The version without other HEXACO traits except Agreeableness and Honesty–Humility was also tested. In addition, a bifactor model was tested with Agreeableness facets, Honesty–Humility facets, and aggressiveness components in a general factor and three additional specific factors which constitute these traits. The main idea of this model is to get insight into factor loadings of aggressiveness components and explained variance of specific and general factors. Secondly, exploratory factor analysis (EFA) along with network community analysis was used. Compared to EFA, which should show the common latent structure of the HEXACO facets and aggressiveness components, the network community analysis should reveal the patterns of clustering of these variables without invoking latent factors. Network analysis enables us to identify both weak and central, cohesive elements of clusters, which could provide us with more informative insight into specific relations between HEXACO facets and aggressiveness components.

Method

Participants and procedure

The sample included 654 participants (49.6% of males) from the general population, aged between 18 and 73 (M = 30.49, SD = 12.37, Mode = 20). Most of the participants were highly educated: 41.5% were college students and 24.7% finished a higher school or faculty, while 32.4% finished only primary or secondary school (9 respondents or 1.5% did not fill in the question about education). There were no significant gender differences in age (t(641) = -0.66, p > .05), nor in the education level (χ²(2) = 0.52, p > .05), but there was significant difference in age regarding the education level (F(2, 632) = 156.93, p < .001), with students being the youngest. All procedures performed in the study were in accordance with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Before participating in the study, the participants were provided with the information about the purpose of the study and they signed informed consent. The testing was performed by
trained MA students as a part of their pre–exam activities. Each student collected the data from a specific number of participants, based on given age and sex quotas. The same sample was used in Dinić and Wertag (2018).

Measures

HEXACO–60 (Ashton & Lee, 2009). HEXACO–60 is a shorter form of the HEXACO–PI–R, which measures six dimensions of the lexical HEXACO model, each consists of four facets. Each dimension was operationalized with 10 items (2 or 3 items per facet) with 5-point Likert type scale for answering (α’s were in the range from .67 for Emotionality to .79 for Openness to experience).

Reactive–Proactive Aggression Questionnaire (RPQ; Raine et al., 2006). RPQ contains 23 items measuring reactive aggression (n = 11, α = .81, e.g., “Yelled at others when they have annoyed you.”) and proactive aggression (n = 12, α = .87, e.g., “Yelled at others so they would do things for you.”). The participants indicate how frequently they have expressed each of the aggressive behaviors on the scale from 0 = never to 2 = often.

Indirect Aggression Scale – Aggressor version (IAS–A; Forrest et al., 2005). IAS–A measures three forms of adult indirect aggression – social exclusion (n = 10, α = .89, e.g., “Purposefully left them out of activities.”), use of malicious humor (n = 9, α = .87, e.g., “Used sarcasm to insult them.”), and guilt induction (n = 6, α = .82, e.g., “Used emotional blackmail on them.”). Instructions for the IAS–A require the participants to think about the situations when they have exhibited such behavior towards another person in the past 12 months. A 5-point Likert scale for answering was provided, from 1 = never to 5 = regularly. Since these three forms are highly correlated (from .76 to .85), and they form an isolated, dense cluster in network analysis, the total score for IAS–A was computed (α = .94).

Aggressiveness Questionnaire (AVDH; Dinić et al., 2014). AVDH is based on examining the common structure of the items from agreeableness/aggressiveness scales from various personality inventories from psycho–lexical (Big Five Inventory – BFI, IPIP–HEXACO–PI–R, and Big Five Plus Two – BF+2), as well as from psycho–biological models (Zuckerman–Kulhman Personality Questionnaire–III–Revised – ZKPQ–III–R, Reinforcement Sensitivity Questionnaire – RSQ, and Multidimensional Personality Questionnaire – MPQ). Based on parallel analyses, four factors were extracted, which was followed by constructing new items referring to the factors content. AVDH contains 23 items with joint 5-point Likert type scale, and measures four aggression traits: 1. Anger, which refers to the affective aspect of the trait aggression, e.g., frequent and easy experiencing of anger and rage, hot temper, and overreacting in experiencing anger (n = 5, α = .79, e.g., “I get angry easily.”), 2. Vengefulness, referring to the tendency to retaliate and to the cognitive aspect of aggression, such as planning and imagining revenge attempts that include the desire for harming or humiliating another person (n = 6, α = .90, e.g. “I simply must make mischief to people who annoy me.”), 3. Dominance, which includes the tendency towards more subtle expressions of aggressive impulses through intrusion, argumentativeness, and initiating verbal disputes, with the need to assume social dominance and demonstrate superiority (n = 7, α = .85, e.g., “Nobody dares to contradict me.”), and 4. Hostility, which includes bigotry and unfriendly attitude towards others, which could be manifested as more covert or passive aggression, and also as reduced tolerance for other people’s mistakes, and concentration mostly on other people’s imperfections (n = 5, α = .73, e.g., “Some people annoy me so much that I cannot stand their presence.”).

Data analysis

Firstly, confirmatory factor analysis (CFA) was used to test seven models: 1) model in which all aggressiveness components were located in the same factor as Agreeableness facets; 2) model in which all aggressiveness components were located in the same factor as Honesty–Humility facets; 3) model in which certain components were located in Agreeableness factor.
(anger, hostility, reactive aggression), and certain in Honesty–Humility factor (vengefulness, proactive and indirect aggression). Because dominance could be located in both Honesty–Humility and Agreeableness factors, we checked solutions in which dominance is only in Honesty–Humility, only in Agreeableness, and in both factors, and then we compared its loadings in order to set the location of dominance; 4) model with a separate aggressiveness factor which includes all aggressiveness components; 5) SEM model in which there is a bifactor model of aggressiveness (with general factor of aggressiveness and specific factors as aggressiveness components) and settled regression paths from Agreeableness and Honesty–Humility to each of specific aggressiveness factors; 5a) variant of Model 5 but with regression paths in line with relations in Model 3; 6) variant of Model 5a without other HEXACO traits, except for Agreeableness and Honesty–Humility; 7) bifactor model with Agreeableness, Honesty–Humility, and aggressiveness as specific factors and one general factor. In all models, correlations between factors were included. Because multivariate normality was violated, robust maximum likelihood estimator (MLR) was applied. Several fit indices were calculated: comparative fit index (CFI) and Tucker–Lewis index (TLI) which should be ≥ .95, root mean square error of approximation (RMSEA) and standardized root mean square residual (SRMS) which should be < .08 for acceptable model fit (Hooper, Coughlan, & Mullen, 2008). AIC and BIC were calculated for comparing the non-nested models. CFA was conducted in R package “lavaan” (Rosseel, 2012).

Secondly, principal axis factor analysis was applied, and number of factors was obtained based on parallel analysis, Wayne Velicer’s minimum average partial (MAP) and very simple structure (VSS) criteria. The analysis was conducted in R package “psych” (Revelle, 2017).

Thirdly, network analysis was applied. The approach in the network analysis was the “network of personality components” approach (Cramer et al., 2012), which was used as a comprehensive, data-driven tool for investigating the underlying structural organization of the component interactions. The main goal of the network analysis in our study is discovering the partitioning of the network into distinguishable groups (communities) of variables whose intra-group relations are more frequent than extra-group ones. This kind of partitioning, or community structure, reveals dense localized patterns of interactions, which are essential for explaining the differences in the relations of the aggressiveness components with the facets from different HEXACO domains.

Although network models (or Ising models) are statistically equivalent to latent variable models, in the former all connections between observables are represented by two-way connections of the same type, while in the latter the direction of the effect from the indicator to the latent variable cannot change (Kruis & Maris, 2016; Marsman, Maris, Bechger, & Glas, 2015). This is a unique benefit of the network approach, as the analysis is focused on the localized, complex pattern of interaction between observable variables, with each effect being interpreted not only numerically, but in a relational manner. Therefore, this approach is a suitable addition to the factor analysis as it provides an alternative exploratory framework where the observed associations between manifest variables are not being explained as a result of an underlying factor structure, but as a consequence of mutualistic relations between these variables (Kruis & Maris, 2016).

The basic element of a network is a node, which represents one variable, and an edge, which indicates the association between variables. More specifically, the edge weight is the strength of association between two variables, while the form of associativity is determined by the type of the computed network. The algorithm used for visual representation of each network was the Fruchterman–Reingold algorithm (Fruchterman & Reingold, 1991), which positions nodes with the highest number of connection nodes in the middle of the graph, while the nodes that are less connected to others are on the periphery. Also, this layout places the group of nodes which are densely connected with each other in proximity, which enables
visual identification of potential communities. In this study, the concentration network of given variables was computed, based on their partial correlations, using the adaptive LASSO method (Zou, 2006) as the most recommended (Constantini et al., 2015). This method is based on the use of LASSO penalty (Friedman, Hastie, & Tibshirani, 2008) on partial correlations of different intensity (the lower the coefficient, the proportionately higher the penalty is), leading to small coefficients being reduced to zero. R package “qgraph” (Epskamp, Craner, Waldorp, Schmittmann, & Borsboom, 2012) was used for network computation. In order to describe the structure of node groupings, the community detection method was used. Communities are locally densely connected parts of the network. There is a difference between strong communities, where nodes are more likely to have edges located inside the community than outside of it, and weak communities, where only some nodes have this property. In weak communities, some nodes are more open towards the rest of the network and their relation to their neighbors can be described with lower clustering coefficient (Girvan & Newman, 2002). Community structure of the LASSO concentration network was detected by using a “walktrap” detection algorithm (Pons & Latapy, 2006) from the R package “igraph” (Csárdi & Nepusz, 2006). This algorithm showed the accuracy in the networks of the same size and density, as the one in this study, and it results in reliable community structure (Yang, Algesheimer, & Tessone, 2016). Most community detection algorithms calculate many different community partitions of the network and choose the one which has the highest modularity score. Modularity of a given network partition into communities is higher when there are many more edges between the nodes of the same community than it could be expected by chance, i.e. in a random network (Newman, 2010). Once detected, the community structure shows which variables have strong local interactions with other variables of their own type. Local clustering coefficient was also used, and it represents a ratio of the number of the pairs of neighbors that one node is connected to the number of pairs of neighbors the same node has. While modularity is based on the total number of edges within one group, the clustering coefficient is concerned with triads (or triangles) of nodes, which means that a node with high clustering coefficient is connected to neighboring nodes which are themselves connected with each other, which leads to triadic closure and formation of node cliques or strong communities (Newman, 2010). Signed Zhang clustering coefficient (Zhang & Horvath, 2005) was used and computed using the R package “qgraph” (Epskamp et al., 2012).

**Results**

**Descriptives and correlations**

Honesty–Humility and Agreeableness show stronger correlations with aggressiveness components, with Honesty–Humility having slightly higher negative correlations with indirect aggression and vengefulness, while Agreeableness has a higher correlation with reactive aggression and anger (Table 1). Their facets also show different pattern of relations. The strongest negative correlation was found between the facet Patience from Agreeableness and anger, while Forgiveness, for example, has strong negative edges with vengefulness and hostility. Also, Fairness from the Honesty–Humility domain shows stronger negative correlations with aggressive behaviors, while Modesty has stronger negative correlations with dominance. However, the other traits and their facets have higher correlations with aggressiveness components, e.g., Social Boldness from Extraversion with dominance, and Prudence from Conscientiousness with anger and vengefulness.
Table 1  
Descriptives and correlations between HEXACO traits and aggressiveness components

<table>
<thead>
<tr>
<th></th>
<th>Anger</th>
<th>Vengefulness</th>
<th>Dominance</th>
<th>Hostility</th>
<th>Reactive agg.</th>
<th>Proactive agg.</th>
<th>Indirect agg.</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honesty–Humility</td>
<td>-0.26</td>
<td>-0.41</td>
<td>-0.35</td>
<td>-0.23</td>
<td>-0.26</td>
<td>-0.33</td>
<td>-0.41</td>
<td>3.52</td>
<td>0.62</td>
</tr>
<tr>
<td>Sincerity</td>
<td>-0.12</td>
<td>-0.29</td>
<td>-0.21</td>
<td>-0.05</td>
<td>-0.06</td>
<td>-0.19</td>
<td>-0.29</td>
<td>3.82</td>
<td>0.78</td>
</tr>
<tr>
<td>Fairness</td>
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<td>-0.21</td>
<td>-0.17</td>
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<td>-0.27</td>
<td>-0.33</td>
<td>3.60</td>
<td>1.01</td>
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<td>Greed Avoidance</td>
<td>-0.18</td>
<td>-0.22</td>
<td>-0.24</td>
<td>-0.16</td>
<td>-0.16</td>
<td>-0.12</td>
<td>-0.18</td>
<td>3.10</td>
<td>0.95</td>
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<tr>
<td>Modesty</td>
<td>-0.26</td>
<td>-0.28</td>
<td>-0.36</td>
<td>-0.23</td>
<td>-0.08</td>
<td>-0.10</td>
<td>-0.18</td>
<td>3.45</td>
<td>0.81</td>
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<td>Emotionality</td>
<td>0.14</td>
<td>-0.05</td>
<td>-0.02</td>
<td>-0.23</td>
<td>-0.01</td>
<td>-0.15</td>
<td>-0.41</td>
<td>3.10</td>
<td>0.56</td>
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<td>0.08</td>
<td>0.06</td>
<td>-0.09</td>
<td>-0.01</td>
<td>-0.06</td>
<td>0.06</td>
<td>2.62</td>
<td>0.77</td>
</tr>
<tr>
<td>Anxiety</td>
<td>0.14</td>
<td>-0.13</td>
<td>-0.05</td>
<td>0.14</td>
<td>0.08</td>
<td>-0.09</td>
<td>-0.07</td>
<td>3.67</td>
<td>0.82</td>
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<td>Dependence</td>
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<td>0.02</td>
<td>0.02</td>
<td>0.04</td>
<td>0.04</td>
<td>-0.03</td>
<td>0.07</td>
<td>3.05</td>
<td>0.94</td>
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<td>Sentimentality</td>
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<td>-0.01</td>
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<td>-0.12</td>
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<td>0.07</td>
<td>0.04</td>
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<td>Social Self-Esteem</td>
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<td>-0.02</td>
<td>-0.01</td>
<td>-0.02</td>
<td>3.39</td>
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<td>-0.41</td>
<td>-0.40</td>
<td>-0.27</td>
<td>-0.30</td>
<td>2.94</td>
<td>0.57</td>
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<td>-0.22</td>
<td>-0.27</td>
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<td>-0.13</td>
<td>-0.15</td>
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<td>0.97</td>
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<td>-0.29</td>
<td>-0.20</td>
<td>-0.16</td>
<td>-0.28</td>
<td>3.01</td>
<td>0.77</td>
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<tr>
<td>Flexibility</td>
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<td>-0.31</td>
<td>-0.30</td>
<td>-0.13</td>
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<td>-0.08</td>
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<td>-0.09</td>
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<td>-0.15</td>
<td>-0.21</td>
<td>3.78</td>
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<td>Perfectionism</td>
<td>-0.01</td>
<td>-0.16</td>
<td>0.01</td>
<td>0.04</td>
<td>0.01</td>
<td>-0.09</td>
<td>-0.10</td>
<td>3.56</td>
<td>0.78</td>
</tr>
<tr>
<td>Prudence</td>
<td>-0.34</td>
<td>-0.30</td>
<td>-0.26</td>
<td>-0.21</td>
<td>-0.22</td>
<td>-0.19</td>
<td>-0.23</td>
<td>3.32</td>
<td>0.82</td>
</tr>
<tr>
<td>Openness to Experience</td>
<td>-0.12</td>
<td>-0.16</td>
<td>-0.05</td>
<td>-0.01</td>
<td>-0.04</td>
<td>-0.11</td>
<td>-0.10</td>
<td>3.46</td>
<td>0.71</td>
</tr>
<tr>
<td>Aesthetic Appreciation</td>
<td>-0.15</td>
<td>-0.23</td>
<td>-0.10</td>
<td>-0.05</td>
<td>-0.11</td>
<td>-0.14</td>
<td>-0.16</td>
<td>3.45</td>
<td>1.08</td>
</tr>
<tr>
<td>Inquisitiveness</td>
<td>-0.19</td>
<td>-0.16</td>
<td>-0.09</td>
<td>-0.10</td>
<td>-0.04</td>
<td>-0.11</td>
<td>-0.11</td>
<td>3.45</td>
<td>0.99</td>
</tr>
<tr>
<td>Creativity</td>
<td>-0.06</td>
<td>-0.10</td>
<td>0.01</td>
<td>-0.01</td>
<td>0.03</td>
<td>-0.05</td>
<td>-0.03</td>
<td>3.48</td>
<td>0.93</td>
</tr>
<tr>
<td>Unconventionality</td>
<td>0.01</td>
<td>-0.07</td>
<td>0.04</td>
<td>0.06</td>
<td>0.10</td>
<td>0.01</td>
<td>0.04</td>
<td>3.45</td>
<td>0.82</td>
</tr>
<tr>
<td>M</td>
<td>2.45</td>
<td>2.11</td>
<td>2.37</td>
<td>3.16</td>
<td>0.74</td>
<td>0.18</td>
<td>1.56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>0.92</td>
<td>0.90</td>
<td>0.81</td>
<td>0.81</td>
<td>0.39</td>
<td>0.29</td>
<td>0.58</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Theoretical ranges are between 1 and 5, except for RA and PA which are between 0 and 2. Correlations ≥ ± .13 are significant at p < .001.

Confirmatory factor analysis

Firstly, we explored the difference in dominance loadings on both Honesty–Humility and Agreeableness factor in order to configure Model 3. The difference between these loadings is negligible (in Honesty–Humility it was...
In Model 5 it could be noted that only vengefulness (-.28) and indirect aggression (-.26) significantly regressed to Honesty–Humility, and that only vengefulness (-.20) regressed to Agreeableness. However, the contribution of vengefulness in relation to Agreeableness is positive, which clearly indicates that the general factor of aggressiveness captures common variance, and the residual variance of specific factors, so the interpretation of this model is biased. Therefore, only relations proposed in Model 3 were kept but as regression paths (Model 5a). All regression paths were significant, except between Honesty–Humility and proactive aggression, and contributions are in expected negative direction. However, this model also does not have satisfactory fit indices. There is no improvement in Model 6 either.

In bifactor Model 7, the explained variance of specific aggressiveness factor was 32.76%, while for Agreeableness factor it was 13.61%, for Honesty–Humility factor 10.70%, and for the general factor it was 42.93%. Anger, dominance, and hostility had higher loadings on specific factor, while proactive, indirect, and reactive aggression had higher loading on the general factor, while vengefulness obtained relatively close loadings on both the specific and the general factor. Although explained variance of the general factor is the highest, aggressiveness components had the main contribution on this factor, especially in the domain of aggression behavior. Factor loadings of aggressiveness components vary, and it could be noticed that some components had higher loadings on the specific factor, and while others had high loadings on the general factor. Also, Fairness from Honesty–Humility and Patience from Agreeableness had relatively the same loadings on both the general and the specific factor. This result indicated that there are distinctions between aggressiveness components. In further analyses we explore whether these distinctions reflect different relations with the HEXACO facets.
Table 2
Model fit indices

<table>
<thead>
<tr>
<th>Model</th>
<th>MLR $\chi^2$(df)</th>
<th>CFI</th>
<th>TLI</th>
<th>RMSEA</th>
<th>SRMR</th>
<th>AIC</th>
<th>BIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>1989.98(419)</td>
<td>.684</td>
<td>.690</td>
<td>.076</td>
<td>.082</td>
<td>44078.37</td>
<td>44219.81</td>
</tr>
<tr>
<td>Model 2</td>
<td>1972.84(419)</td>
<td>.688</td>
<td>.653</td>
<td>.075</td>
<td>.082</td>
<td>44061.18</td>
<td>44202.62</td>
</tr>
<tr>
<td>Model 3</td>
<td>1914.81(418)</td>
<td>.699</td>
<td>.705</td>
<td>.074</td>
<td>.079</td>
<td>43988.62</td>
<td>44131.37</td>
</tr>
<tr>
<td>Model 4</td>
<td>1891.99(413)</td>
<td>.703</td>
<td>.665</td>
<td>.074</td>
<td>.080</td>
<td>43973.87</td>
<td>44123.17</td>
</tr>
<tr>
<td>Model 5</td>
<td>1822.99(399)</td>
<td>.714</td>
<td>.666</td>
<td>.074</td>
<td>.079</td>
<td>43924.66</td>
<td>44092.29</td>
</tr>
<tr>
<td>Model 5a</td>
<td>1831.02(405)</td>
<td>.713</td>
<td>.671</td>
<td>.073</td>
<td>.079</td>
<td>43914.16</td>
<td>44073.94</td>
</tr>
<tr>
<td>Model 6</td>
<td>576.29(739)</td>
<td>.809</td>
<td>.747</td>
<td>.098</td>
<td>.061</td>
<td>18987.98</td>
<td>19091.32</td>
</tr>
<tr>
<td>Model 7</td>
<td>678.99(76)</td>
<td>.769</td>
<td>.681</td>
<td>.110</td>
<td>.118</td>
<td>19057.47</td>
<td>19134.74</td>
</tr>
</tbody>
</table>

Note. Model 1 – all aggressiveness components are on Agreeableness factor, Model 2 – all aggressiveness components are on Honesty–Humility factor, Model 3 – anger, hostility, and reactive aggression are on Agreeableness factor, while vengefulness, proactive, and indirect aggression are on Honesty–Humility factor, and dominance is on both factors, Model 4 – aggressiveness components are in separate factor, Model 5 – SEM hybrid model with general aggressiveness model and specific factors as aggressiveness components (bifactor model of aggressiveness), with regressions from Agreeableness and Honesty–Humility to each specific aggressiveness factors; Model 5a – variant of Model 5 with regressions in line with relations in Model 3; Model 6 – the same model as Model 5a, but only with Agreeableness, Honesty–Humility, and aggressiveness factors. Model 7 – bifactor model with Agreeableness, Honesty–Humility, and aggressiveness as specific factors and one general factor. All $\chi^2$s are significant at $p < .001$.

Exploratory factor analysis

Because CFA did not result in satisfactory fit indices, EFA was applied in order to explore the latent structure of HEXACO facets and aggressiveness components. The results of parallel analysis suggested 8 factors, and 5 factors were suggested by applying MAP and VSS criteria. Because most of the criteria suggested 5 factors, this solution was kept and promax rotation was applied. The results show that the factor which encompasses all aggressiveness components includes all facets from Agreeableness and three facets from Honesty–Humility (Fairness, Greed Avoidance, and Modesty, marginally, see Supplement B), but it is noticeable that Honesty–Humility facets had the weakest loadings. Thus, the nature of relations between Agreeableness and Honesty-Humility domains and the aggressiveness components remains vague.

Network analysis

**LASSO network.** LASSO network (Figure 1) shows the structure of relations between seven groups of variables (facets from the six HEXACO traits and aggressiveness components as the seventh group), each represented with a different color. The density of the network is 0.33, which means that the existing edges represent one third of all possible edges between all 31 nodes.

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11 In addition, six-, seven-, and eight-factor solutions were explored. In the six-factor solution, aggressiveness components and Agreeableness facets formed one factor, and the rest of the factors mainly constitute the rest of the HEXACO traits. In the seven-factor solution, only components from AVDH remain in factor together with Agreeableness facets, while aggressive behaviors (reactive, proactive, and indirect aggression) formed separate factor. In the eight-factor solution, aggressiveness components from AVDH formed separate factor along with Modesty facet from Agreeableness.

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The most striking observation resulting from visual inspection of this network is the structural position of the Patience facet from the Agreeableness domain, which is positioned next to the aggressiveness components, presumably due to its strong negative connection with anger, which outweighs the relations this facet has with its own group. The other results refer to the HEXACO structure, i.e., the displacement of Anxiety facet from the Emotionality domain, which is slotted between the facets of the Conscientiousness domain. Visual topology of the network suggests that the relation between Agreeableness, Honesty–Humility, and aggressiveness groups is not clear at this point. Facets from both HEXACO domains have strong negative edges with the aggressiveness components, with the exception of Greed Avoidance facet from Honesty–Humility. Therefore, community detection algorithm was performed on this network.

**Community detection.** Walktrap algorithm was used to detect communities in a LASSO network. Modularity of the resulting community partition is 0.46,
which can be considered an optimal score for the given network. According to the results, there are five different communities (Figure 2).

The most important result regarding the relations between the aggressiveness components and the HEXACO facets is the presence of the community in which components of aggressiveness and Agreeableness facets are joined. This partition can be seen as a consequence of a strong negative edge between anger and Patience, positive edges between the aggressiveness components, and lack of notable strong edges of other Agreeableness facets towards nodes from other communities. Facets of Honesty–Humility domain form a weak community, which has several strong edges with the previous community, notably with dominance and indirect aggression. However, the only

12 Walktrap algorithm produced the optimal modularity scores compared to other algorithms suitable for the size and density of our network. Modularity scores for other algorithms: 0.44 (Infomap), 0.39 (Label propagation), 0.18 (Edge betweenness). Spinglass algorithm reports negative modularity score, which means that there are more edges outside the found communities than in the communities themselves. Louvain algorithm returns exactly the same partitioning as walktrap with the same modularity.
node without any such edges is Greed Avoidance and it represents the main cohesive element of this community. If this node is removed from the network, the Honesty–Humility community falls apart and merges with reactive, proactive and indirect aggression into a new community. The remaining three communities are consisted of combining facets of the Extraversion and the Conscientiousness domain (along with the Anxiety), facets of the Emotionality domain (without Anxiety), and facets from the Openness domain.

In addition to these insights provided by the community analysis, it is useful to take a look at local clustering coefficient of all the nodes, as the nodes with low clustering values have slightly more connections with the rest of the network, outside their communities.

**Clustering coefficients.** In order to compare the clustering of different nodes throughout the network, the relative clustering coefficients are shown, among which the variable with the highest absolute coefficient has the relative coefficient of 1 (Figure 3).

![Figure 3. Relative clustering coefficients.](image)

**Legend.** Hsi = Sincerity, Hfa = Fairness, Hga = Greed Avoidance, Hmo = Modesty, Efe = Fearfulness, Ean = Anxiety, Ede = Dependence, Ese = Sentimentality, Xss = Social Self-Esteem, Xsb = Social Boldness, Xso = Sociability, Xli = Liveliness, Afo = Forgiveness, Age = Gentleness, Afl = Flexibility, Apa = Patience, Cor = Organization, Cdi = Diligence, Cpe = Perfectionism, Cpr = Prudence, Oaa = Aesthetic Appreciation, Oin = Inquisitiveness, Ocr = Creativity, Oun = Unconventionality, A = Anger, V = Vengefulness, D = Dominance, H = Hostility, Iagg = Indirect aggression, Ragg = Reactive aggression, Pagg = Proactive aggression.
Hostility is the node with the highest relative clustering coefficient in the network which means that it forms cohesive triads with the neighboring nodes and therefore brings together the Agreeableness facets and the aggressiveness components. These results shed new light on the cohesiveness of the Agreeableness and aggressiveness community. While the strongest edge in this community is the one between Patience and anger, hostility is the most clustered node. These results pointed out that both Patience and hostility are the key nodes in this community, but their contribution to the cohesiveness of the community is different.

Of all aggressiveness components, anger and proactive aggression have the lowest clustering coefficients, which means that they are not part of many closed triadic structures. For proactive aggression, this is a result of the absence of strong edges with dominance, hostility, and vengefulness. For anger, however, the issue is not lack of edges towards the neighboring nodes, but high centrality and a large number of weak connections towards many edges in the network. Edges with high centrality in networks of medium density can be the weakest parts of any community if their centrality score is determined by important intra–community relations, which means that their pattern of relations is dispersed through the entire network (Gupta et al., 2016).

**Discussion**

Results of confirmatory approach regarding relations between the HEXACO facets and aggressiveness components do not provide satisfactory fit indices for proposed models. Considering that, exploratory approach was applied, which includes both EFA and network analysis. EFA resulted in a factor which includes aggressiveness components along with all Agreeableness facets and most of the Honesty–Humility facets, which had the lowest loadings. Community detection algorithm on LASSO correlation network provides additional exploratory insight into these relations. While community analysis also ties all facets from Agreeableness together with the aggressiveness components, the Honesty–Humility facets remain associated together as a weak, but stable community. Results of both exploratory analyses showed that among the HEXACO traits and its facets, the Agreeableness domain is most closely related to aggressiveness components and, as could be seen in network analysis, together they form a joined community. Namely, affective and cognitive aggressiveness components were mostly related to Neuroticism from BF (e.g., Gallo & Smith, 1998; Tremblay & Ewart, 2005), but in HEXACO model they are located in the negative pole of Agreeableness, together with the behavioral component. This result suggests that Agreeableness captures a wider range of interpersonal outcomes, including all main components of aggressiveness. This is in line with the theoretical assumptions (Lee & Ashton, 2004) and it is not surprising.
However, there are two main implications regarding the position of aggressiveness in the HEXACO model. First, the nodes which bring together the Agreeableness domain and aggressiveness are Patience facet and hostility, but in a different way. Patience assesses a tendency to remain calm rather than to become angry (Lee & Ashton, 2004), thus it is strongly connected to anger as the affective component of aggressiveness. As mentioned before, indicators of the affective component of aggressiveness in BF model belong to Neuroticism (Goldberg, 1992), so the question is if allocation of these indicators makes Agreeableness from HEXACO the key correlate of aggressiveness, or it points out to a stronger connection with aggressiveness. It seems that the latter is the case, given that the other facets of Agreeableness have dense, medium strength, relations with the aggressiveness components.

Hostility also has an important role in forming the Agreeableness + aggressiveness community. It is the most clustered node and it is connected to almost all other nodes from its community. Previous studies showed mixed results regarding the cognitive (not hostility specific) component of the trait. For example, in Zillig, Hemenover, and Dienstbier (2002) study, in personality inventories based on lexical paradigm (Big Five Inventory, Unipolar Adjective Trait Descriptors, and Revised Interpersonal Adjective Scale) the cognitive component is less represented in the Agreeableness domain. However, a recent study showed that lexical based inventories, such as HEXACO–100 and BFI, accentuated the cognitive component in Agreeableness, compared to the inventories based on psycho-biological paradigm (Dinić & Smederevac, 2018). What is certain is that although the affective component of aggressiveness has a clear facet in the HEXACO model, the cognitive component does not.

The second important implication is regarding Honesty–Humility facets. Although in EFA almost all facets of this trait belong to the factor which contains aggressiveness components and Agreeableness facets, they are tied into the Honesty–Humility community and formed a separate community. This means that the Honesty–Humility domain is distinct from the Agreeableness domain, at least when relations with aggressiveness are analyzed, point out that Agreeableness is the dominant correlate of aggressiveness. The divergent validity of Honesty–Humility is well established (Ashton & Lee, 2007; Ashton, Lee, & de Vries, 2014), but previous studies showed that both Agreeableness and Honesty–Humility were related to certain aggressiveness components (Book et al., 2012; Dinić et al., 2014; Lee & Ashton, 2012). Therefore, a separate Honesty–Humility community, without any aggressiveness component, is not expected.

Of all Honesty–Humility facets, Greed Avoidance is the most distant from the aggressiveness components. Greed Avoidance refers to the tendency to be uninterested in possessing lavish wealth, luxury goods, and signs of high social status (Lee & Ashton, 2004). These characteristics are more related to materialism and not necessarily include absence or low aggressiveness markers. What could be also concluded is that Greed Avoidance is distant from all other
nodes in the network and acts as a strongest cohesive element of the Honesty–Humility community (note that in EFA Greed Avoidance is located in the factor with aggressiveness components and Agreeableness).

Although facets from Honesty–Humility form a separate community, there are some strong isolated connections with certain aggressiveness components. For example, the Modesty facet has a strong negative relation with dominance, while Sincerity and Fairness facets have strong negative relations with indirect aggression. Modesty and Greed Avoidance refer to Humility, while Sincerity and Fairness refer to Honesty (Ashton & Lee, 2007). However, the difference between Modesty and Greed Avoidance is in the sense of superiority and entitlement, which is present in Modesty. These characteristics capture the maladaptive aspect of narcissism (Campbell, Bonacci, Shelton, Exline, & Bushman, 2004), which is related to socially undesirable outcomes, including aggression. Results in this study indicated that Modesty is negatively related to certain aspect of aggressiveness that refer to the tendency towards social domination and showing-off in arguments in order to demonstrate superiority. On the other hand, the tendency toward more subtle, indirect aggression is more negatively related to Honesty aspect. Together, the results indicate that Honesty–Humility is related to very specific components of aggressiveness and does not represent the disposition for general aggressiveness. What is more important is that the used form of aggression (more subtle, indirect) is more indicative for Honesty–Humility than the function of aggression (reactive or proactive). This result is not in line with the suggestions based on results from previous studies (Book et al., 2012; Knight, 2016; Lee & Ashton, 2012), but in these studies distinctions between forms and functions of aggression were not made. To conclude, community network analysis enables us to compare the few stronger associations of Honesty–Humility facets with aggressiveness components (indirect aggression and dominance), internal structure of correlations inside this domain, and associations of Honesty–Humility facets with other domains, and as a result we can conclude that all Honesty–Humility facets form a weak, but autonomous community.

Taken together the results confirmed that all aggressiveness components are, to some extent, included in HEXACO model, given that aggressiveness components do not form separate factor or community. Therefore, the percent of the variance in the aggressiveness components accounted for by the HEXACO facets is 31.78%, which indicate that there is a large amount of aggressiveness variance that HEXACO facets do not cover. It could be assumed that the “core” of aggressiveness is captured by the HEXACO model, specifically by the Agreeableness, but that there are some unique manifestations of aggressiveness which depend on another construct beyond basic personality traits. This construct could be a constellation of “dark” or malevolent personality traits, namely Dark Tetrad, as some authors suggested (Paulhus, Curtis, & Jones, 2017).

The limitation of this study is that all used questionnaires are self-reports and the results could be influenced by shared method variance. Although self-
report is a standard tool in personality psychology, behavioral assessments are warranted. In addition, due to the high correlation between the scales of indirect aggression, the set of different aspects of indirect aggression was reduced to a single variable, which limited the information obtained from different aspects of this aggressiveness component. Also, the small percent of shared variance could be the result of using the short form of HEXACO inventory. In line with that, we recommend that future study should use the longer version of HEXACO instrument and test whether proposed CFA models would result in satisfactory fit indices and whether the same latent and community network structure would be obtained. Despite these limitations, the present findings could provide better insight into both the shared and unique features of the aggressiveness and the HEXACO facets, which may indicate different mechanisms underlying the process of variable grouping and clustering in the mutual network. Future studies could include facets from BF and HEXACO model together, along with various components of aggressiveness.

References


Agresivnost u HEXACO modelu ličnosti

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Ključne reči: agresivnost, agresija, HEXACO, analiza mreža

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