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Research Article

# Children's motivation for digital technology use: parents and children's perspective

Vanesa Varga [1] and Marina Kotrla Topić [2]

[1] *Catholic University of Croatia, Zagreb, Croatia*

[2] *Institute of Social Sciences Ivo Pilar, District Center Osijek, Croatia*

ABSTRACT

Since the use of digital technology (DT) has become a significant part of children's everyday life, one of the main questions is why and for what purposes children use DT. This paper aims to explore categories of motivation for DT use among Croatian children aged 9 to 15 years, and their rate of occurrence, from the perspective of children (18 boys; 13 girls; average age = 11) and their parents (3 fathers; 28 mothers). Focus groups with children as well as their parents were conducted online via Zoom, in spring 2021. Results show that both children and their parents state following motives for children's use of DT: fun and entertainment, interaction and communication, relaxation, and rest, learning and seeking information. Furthermore, children, but not their parents, state as their motives time pass and boredom, and Fear of Missing Out. This research contributes to a better understanding of the reasons why children use DT, provides a taxonomy of motives, and shows that children's motives for DT use are universal to different life circumstances.

*Keywords*: children, digital technology, parents, motivation, qualitative research

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✉ Corresponding author email: vanesa.varga@unicath.hr

## Introduction

Digital technology (DT) refers to all types of electronic devices and applications (Sioshansi, 2019) such as tablets, smartphones, and digital activities such as gaming, social media, etc. (Kardefelt-Winther, 2017). Recent research points out that school-aged children spend around 5 or 6 hours a day using DT (e.g., Spina et al. 2021). The research also states that school-aged children and adolescents use DT for communication, playing, schoolwork, etc. (e.g., Ichhpujani et al., 2019; Martin et al., 2018). The effects of DT can be both positive, and negative. For example, DT can be a source of enjoyment, and help develop cognitive skills, knowledge, and social and communication skills (e.g., Bae, 2019). However, overuse of DT is usually associated with negative effects such as depression and anxiety, headaches, neck pain, and sleep problems (e.g., Abendroth et al., 2020).

When it comes to the context of the COVID-19 pandemic research points to a rise in time spent on DT for entertainment (e.g., López-Bueno et. al., 2022; Nagata et al., 2022), and for schoolwork due to home confinement (e.g., Andrew, et al., 2020; Brom et al, 2020). Research also states that children used DT during the pandemic to occupy themselves when they are bored, connect with friends, find school information, and regulate their emotions (e.g., Langmeyer et al., 2022). However, little is known regarding specific changes in motivation for DT use that happened in these circumstances since they have not been explicitly researched. Koran et al. (2022) showed that the main purpose for DT use in children is playing and communication with their friends, both before the pandemic and during the lockdown, indicating that there was no change in motivation. Since the context of the pandemic has led to the rise in time of DT use it would be useful to understand the motivation for its use in order to be able to channel this motivation to other activities besides DT, to minimize its negative effects.

Generally, the motivation for DT use can be separated into positive, and negative. For example, Barker (2009) states that the motivation for school children and adolescents to use DT is a different, fun, and attractive way to communicate, play, and share information with their peers, but it also provides

a way for them to pass time, entertain themselves and learn. Goh et al. (2015) found that for children in the first and second grades of primary school two main motives for computer usage are e-learning and playing games. Hundley & Shyles (2010) investigated teenagers' awareness of the functions DT serve in their lives. They emphasized socializing and entertainment. In addition to the positive aspects of motivation, some researchers emphasize negative motivational aspects. For example, Throuvala et al. (2018) hypothesized that adolescent motivational factors are also driven by dysfunctional mechanisms like FoMO ('Fear of Missing Out') or the need to be online to avoid feelings of apprehension when one is absent from a rewarding experience that others may have. In addition, motivation for DT use can also be related to the overuse of DT. For example, Meng et al. (2020) examined the association between smartphone overuse and smartphone motivation in adolescents and showed that hedonic motivations are associated with problematic use while instrumental motivation is not. Therefore, positive motivation can be associated with some good outcomes such as learning (Goh et al., 2015) but negative motivation could lead to unwanted outcomes in children such as more time spent on DT use (Meng et al., 2020).

Studies on general motives for DT use, as well as comprehensive information about school children's and their parents' perception of motives regarding children's DT use, are scarce. Most research focuses on social media. For adolescents, social media is a tool for communication with friends and family, a source of information, learning and validation, a source of inspiration for one's interests, obtaining a positive mood, self-presentation, and self-expression, and others (Jarman et al., 2021; Throuvala et al., 2018). Other research is focused on smartphones. Young people use them because they are convenient to use, make them feel like adults, help them to relax, express status and identity, etc. (Ahad & Anshari 2017; Wilkinson & Saldaña, 2018).

One possible theoretical framework of the DT motivation research is the Uses and gratification theory which explains how and why people use media in general, stating that people actively choose the media they will use (Katz et al., 1973). Also, the social and psychological needs or gratifications that are met when

people use media (Blumler, 1979). Five basic needs obtained from media are cognitive (acquiring information, knowledge), affective (acquiring pleasurable and emotional experiences), personal (acquiring confidence, status, stability), social (acquiring contact with friends, family), and tension release (escapism and diversion) (Bayer et al., 2016; Katz et al., 1973). Following the theory Whiting & Williams (2013) list the following uses and gratification for social media use in young people: social interaction, information seeking, pass time, entertainment, relaxation, communicatory utility, and convenience utility. To the best of our knowledge, this theoretical framework has not been applied in the exploration of general DT use motivation in children.

## Current study

This paper aims to explore categories of motivation for DT use among Croatian children aged 9 to 15, from the perspective of children and parents, the rate of occurrence of these categories of motives in children's and parent's group discussions, and to provide a preliminary taxonomy of motives. The research questions are - what are the categories of motivation for DT use in children; what are the similarities, and differences in children's and parents' perception and recognition of children's motivation for DT use, and what motives are most dominant in both perspectives. Focus group discussions were chosen because they allow researchers to obtain and increase understanding of the two perspectives on motivation for DT use, the level of consensus within a discussion group, and the possible differences between the two perspectives. The cultural aspect of motivation for DT use is also important because previous research points to cultural differences in the way children use DT (Jackson et al., 2008). To the best of our knowledge, there are no previous studies regarding children's motivation for DT use in Croatia. When it comes to DT use in Croatia, 98% of pupils and students use the Internet daily, and they mostly access it through mobile phones (Croatian Bureau of Statistics, 2019). Finally, studies on various aspects of DT use are not often focused on early adolescence and considering the changes in DT use in life span it is important to monitor and further investigate the motivation for DT use in early adolescence because it might

provide valuable data for the development of practical recommendations for children's DT use before their entering to adolescence.

The data presented here are a part of a qualitative study which is conducted under the research project "Digital technology in the family: patterns of behavior and effects on child development".

## Materials and Methods

### Design

The design of the research was made for a variety of themes that are in the research focus of the project such as general DT use among children, parental mediation, etc. For this paper, we focus only on the questions related to the motivation for DT use in children. The research design included two sets of structured questions, for parents and children., which were designed by the project research team.

Children in group discussion were asked: *What do you do on your digital devices? What is your favorite thing to do? Which digital device do you use most often? There are various reasons to use the devices. Which ones are yours? What is the most useful thing you have learned and how did you use the device?* etc.

The questions for the parents were: *Can you describe to us how it most often looks like when your children use digital devices at home. (Where are they in the apartment house, are they alone or in the company of others, do they choose what they will do on the device or in agreement with you, and what does it look like when they have to stop using the device?),* etc.

### Recruitment

The recruitment process started on February 3rd, 2021, with the first e-mails sent to schools in Croatia and finished on May 4th, 2021. The recruitment package consisted of the following materials: the Permission of the Ministry of Science and Education of the Republic of Croatia to conduct the research, the Permission of the Ethics Committee of the Catholic University of Croatia to conduct the research; An Example of the Participant Consent for parents and

children, and An Invitation to participate in the research for school websites. These documents were sent to a pre-prepared list of elementary schools in Zagreb and Osijek. The invitation was also published on the official website and social media profiles of the Catholic University of Croatia and the project D. E. C. I. D. E.

## Sample and procedure

The parents who contacted the researchers were sent the Participant Consent for parents and children to sign it. Parents were contacted to arrange the date and time when they and their children were available. Before the beginning of the session, participants were informed by the moderator about their rights, that the session will be recorded, that the material will be transcribed and destroyed after transcription, and that their names in the transcript will be changed. In total, nine focus groups with children were conducted via Zoom from March, 30th to May 5th, 2021 (number of participants ranging from 2 to 5), and eight focus groups with parents were conducted via Zoom from March 30th to May 4th, 2021 (number of participants ranging from 3 to 5). All participants, parents, and children received a coupon to visit a local ZOO. The sample consists of 31 children (18 boys; 13 girls; average age = 11) (Appendix A), and 31 parents (3 fathers; 28 mothers) (Appendix B).

## Data Analysis

The organization of codes for the data analyses was inspired by the Uses and gratification theory. The research team adapted the above-mentioned Whiting & Williams (2013) list of motives. Motives for interaction and communication were perceived as similar by children and parents and were merged into one category. The same was with learning and searching for information. Children's and parents' focus groups were analyzed separately, according to the same categories. The unit of the analysis was one broad statement. They were determined by a keyword approach (e.g., fun, rest, relax). Two coders separately coded 159 statements. They agreed on a total of 126 statements (93 statements by children, and 33 by parents). The inter-rater

reliability for children's groups is 87.74%, and for parents' it is 62.62%. The final inter-rater reliability is 79.25%. The final step was calculating the rate of occurrence for each motive. This provided the researchers with a basis for a short taxonomy that depicts each category of motives.

## Results

The statements on children's motives for DT use from children and parents' discussions were organized into the six categories as followed: C1 (entertainment and fun), C2 (interaction and communication), C3 (time pass and/or boredom), C4 (relaxing and rest), C5 (learning and searching for information) and C6 (Fear of Missing Out - FoMO). For each category, we first present findings from group discussions.

### Entertainment and fun

One of the most often stated motives for DT use in children is fun and entertainment. It was stated by children in 26 (27.96%) statements. Here are examples from focus groups.

F19 (girl, 14): *Mostly for fun and communicating with the world, actually.*

Sometimes, children gave examples of specific devices to better explain what is used for fun:

F15 (boy, 10): *I use PlayStation because it entertains me. I'm happy when I play.*

For parents, entertainment and fun were present in 8 (24.24%) statements. The parental statements are more elaborate and reflect a disagreement with their children's use of DT for entertainment because they feel other types of entertainment, are being neglected.

MF21 (mother of girl, 15): *Even fun, for them it is the only form of entertainment. They don't know how to have fun at all anymore, like we used to.*

## Interaction and communication

The most often stated motive for DT use by children is interaction and communication (32 statements, 34.41%). They frequently mention smartphones which they use for texting with friends or for calling them.

F36 (boy, 10): *My favorite is my smartphone, (...) because I can use my smartphone to communicate with my friends with calls and text messages.*

They also mention apps they use in order to interact and communicate, like WhatsApp and Viber.

F32 (boy, 10): *I use WhatsApp the most because, I don't know, that's where people send me the most messages. Friends, mom, dad.*

Another aspect of communication that emerges from children's discussions is communication with the purpose of arranging a face-to-face meeting.

F09 (boy, 15): *To have fun, or to arrange with someone to meet somewhere, see each other, at basketball.*

Parent's answers confirm this motive (16 statements, 48.48%). They emphasized that children's motivation to use apps for communication is noticeable in chat groups. They also make audio recording of the messages on the apps:

MF06 (mother of boy, 10): *I figured out that on WhatsApp he has his own school group, they often record themselves, they don't feel like typing, then they send those recordings.*

Also, children use apps for communication with friends. They emphasize chat groups can be useful, as a source of information and even for socialization.

MF25 (mother of boy, 10): (...) *class groups which he uses as a good source of information, so not everything they have on those smartphones is bad, some groups they have are related to their sports* (...)

Parents state the benefits of the DT use due to certain circumstances, like living far away, and the COVID-19 pandemic.

MF14 (mother of girl, 9): *We are now in the circumstances that we are not in the part of town where she goes to school. Well, she can't go out on her own when she wants to, so she spends a lot of time communicating with her friends, mostly on smartphone.*

## Time pass and boredom

Children state boredom as one of the motives for DT use quite often. This motive is present in 20 statements (21.51%). The parents did not mention these motives. One specific context mentioned when children use DT out of boredom is morning.

F01 (boy, 14): *Instagram, when I wake up in the morning, or when I'm bored.*

Furthermore, children state that they pick up a certain device because they perceive there is nothing else to do. Therefore, the context of the situation causes boredom.

F02 (boy, 11): *Well, I play more because I'm in the countryside, there's no one here, and the weather isn't nice. And my brother doesn't really like being outside.*

## Relaxing and resting

To a lesser extent, children state relaxing and resting as one of the motives. This is mentioned in four statements (4.30%). Their parents did not mention those motives as much as children. There was only one reference to it (6.25%).

MF19 (mother of girl, 14): *For me, the first association is rest and relaxation, and a smartphone.*

Children state they use DT in order to relax and have a break from schoolwork.

F16 (girl, 10): *After school I go on my smartphone for a while, to take a break and then I write homework.*

## Learning and searching for information

Children's motive to use the DT is also to obtain information and to learn. This motive is present in nine statements (9.68%).

F01 (boy, 14): *If I need to research something for school, I primarily work on my smartphone because it's easier for me.*

Parents state that children's motive to use the DT is online schooling. They refer to this motive in eight statements (24.24%), they use it for school and to find information that interests them.

MF26 (mother of boy, 9): *(...) he uses it for research through Google, let's say he follows it very well - astronomy.*

## Fear of Missing Out (FoMO)

Finally, Fear of Missing Out was not mentioned as a motive in parents' discussions, but it was mentioned two times in children's discussions (2.15%). This is a very low occurrence rate, but it is important to consider that even children in this age range do mention this motive for DT use. Children perceive it as a need to be included in communication because of their high interest in what is being said.

F14 (girl, 9): *Sometimes my friends send me messages, then I get so interested that I can't contain myself.*

## Rate of occurrence of different motives for DT use in children

For both children and parents, the most often mentioned motive for DT use in children is interaction and communication (25.39%), and also in parents (48.48%). The second most-often mentioned motive in children is fun and entertainment (20.63%), and also in parents (24.24%). For parents, the same number of statements refer to learning as well (8, 24.24%). This is not the case for children themselves (9.68%).

For children, the third most often mentioned motive is boredom (20, 21.51%), which is not mentioned by parents. Finally, relaxing and resting were mentioned only four times by children (4.30%) and one time by parents (6.25%),

while FoMO was only mentioned two times by children (2.15%), and not at all by parents. This provided the researchers with a basis for a short taxonomy of phrasings that depict each category of motives. The results are presented in Table 1.

**Table 1**
**Taxonomy of children's motives for DT use based on study data**

| Motivation category | Paraphrased statements from children and/or parents reporting why children use DT |
|---|---|
| Entertainment and fun | To have fun. |
| | For entertaining. |
| | Because it makes them happy. |
| Interaction and communication | To communicate with others (friends and family) with texts, messages, calls, or video calls. |
| | To arrange with someone to meet somewhere. |
| | Chat rooms with friends and/or teachers. |
| Time pass and boredom | Because of boredom. |
| Relaxing and resting | To rest after school. |
| | To take a break. |
| | To relax. |
| Learning and searching for information | To research something for school. |
| | To make presentations. |
| | For school. |
| | For homework. |
| FoMO | The interest is so high that the person cannot contain themselves. |
| | Have to be reachable. |

## Discussion

The results show that interaction and communication are the most often mentioned motives in children's and parents' statements. Children mentioned devices such as smartphone, and applications like WhatsApp for texting with friends. Other research also shows that teens use DT to communicate and socialize (e.g., Barker, 2009; Ichhpujani et al., 2019). Both parents and children in this study consider this to be a good and valuable motive for DT use. Children communicate with friends through game apps or consoles, but this type of communication is left unnoticed by parents, who report children using chat rooms to communicate. This is a valuable observation because when parents report other motives for their children's DT use, such as fun, they talk about it with a level of disapproval, while their children are enthusiastic about it. It might be that if they had a better understanding that these motives are interrelated, they would exhibit less disapproval regarding children's use of gaming apps. Such disapproval, resulting from differences in understanding motivation, might result in more parent-child conflict, and a better understanding might help eliminate that. The motive to use DT for interaction and communication in children at this age is not surprising. Peer communication is vital during adolescence for their mental well-being (Bianchi et al., 2020). Relations with peers in adolescents are positively related to their life satisfaction (Proctor et al., 2009), and difficulties in peer communication mediate the relationship between self-esteem and life satisfaction in adolescence (Szcześniak et al., 2022).

The study was conducted in the COVID-19 pandemic context and although the research questions did not refer directly to the pandemic the participants did mention it on their own. The motive for communication is especially important in the context of the pandemic. Parents mention how due to quarantines, children were unable to socialize with their friends in person, so they regard DT as a kind of savior and form a positive perception of DT in the context of communication and socializing. Children, but not parents, mentioned the use of DT for communication with friends in order to arrange a face-to-face meeting, which again points to discrepancies in understanding the full range of motivation for children's DT use between children and parents. One similar study

also shows that the main purpose for children to use DT during the lockdown is communication, and playing (Koran et al., 2022). In a study on adolescents' psychological well-being after the second prolonged lockdown due to the COVID-19 pandemic, Jusiene et al. (2020) found that the lack of face-to-face communication with peers was very important for predicting depression risk in adolescents.

As mentioned, parents expressed concerns regarding children using too much DT, especially for entertainment and fun, which is the second most often mentioned motive in both perspectives. Other studies also show that children use DT for entertainment or non-school work-related activities (e.g., Anthony, et al., 2021). Parents in this study also indicate that they are unhappy with the amount of time children spend using DT for fun and entertainment because they fear their children choose devices as a sole way of having fun. Some believe that DT has replaced other ways of having fun, such as playing outdoors. Children do not share their point of view. They use gaming consoles and apps to arrange to meet in person with their friends which again shows that some motives for their use of specific DT might be misinterpreted by their parents. While parents believe that children prefer activities on DT over other types of entertainment it seems the children resort to DT when other types of entertainment are unavailable.

The occurrence of references to learning and informational motivation is similar in both perspectives. Children use DT for school purposes which are in accordance with previous research (e.g., Drouin, et al 2020). Parents also state that children's motive to use the DT is online schooling and to find information that interests them. Considering the occurrence of online classes for at least some of the children, it was expected that motivation for learning is mentioned more often and elaborated in more detail. A possible explanation is that when considering motivation for DT use, both children and their parents considered primarily intrinsic motivation. Online classes are not the choice of children themselves, but rather a result of specific circumstances.

Regarding other categories of motivation, the results show more discrepancies between children's and parents' perspectives. For example, Fear of

Missing Out was not mentioned by parents but was stated, although rarely, by children. In adolescents increased need to belong and to be popular is associated with increased use of social media (Beyens, et al., 2016). Parents in this study seem to not recognize this need. It might be that for children some motives are important and valid, and for parents, they seem less meaningful.

Time-pass and boredom are other motives for DT use mentioned by children, but not by parents. While fun and entertainment seem to be related to actively choosing to do something that entertains them, time-pass and boredom are passively driven motivations. The time-pass motive to use DT in the morning, at a wake-up time is mentioned several times. The context of not having anything else to do, friends not being available, holidays, etc. usually leads to children picking up a device (e.g., Iwanicka & Iwanicka, 2020). This type of use, which is not motivated by a specific wish to use DT but rather by the need to fill out time, might offer space for the creation of intervention regarding minimizing DT use in children. By offering children activities to fill out shorter periods when they feel bored, it would be possible to lower their DT use. Finally, children and parents state relaxing and resting as one of the motives for DT use (e.g., Hidding et al., 2017). It seems that children usually rest from schoolwork by using the DT.

Code frequency supplies researchers with an objective measure of the prevalence of an attitude between and within groups (Breen, 2006). In this case, the level of occurrence of specific motives can be regarded as a level of importance showing that interaction and communication, and fun and entertainment are considered by both perspectives as the most important motives for DT use. It is also possible that the motivation for DT use varies across different countries, but to investigate these hypotheses further cross-cultural research is needed. Some motives may be important for a particular person or group, or even be related to a certain context, however, the code frequency gives good insight into what comes to mind first, and it shows a level of salience within the discussion. Range of motives that both perspectives report points to a conclusion that the motives for children's use of DT are universal across different life situations. The short taxonomy of phrasings that children and parents used to describe children's motivation for DT use provides researchers

with the foundation for further research, specifically for the development of scales aiming to further investigate this topic.

### Limitations and suggestion for future research

Although this research contributes to a better understanding of the motives for DT use in children, certain limitations are present. The sample in this study prevents the conclusions to be generalized. Furthermore, focus groups are a great way to gain insight opinions, but certain motives are possibly not stated. This is also due to the design of the research, which covered several topics, and the motivation for using DT is only one part. Future research on the motivation to use DT should be examined with more complex survey questionnaires for parents and children.

## Conclusion

Regarding the motives for the DT use in children aged 9 to 15 years in Croatia, this research identified several categories. Both children and parents most often mention interaction and communication, followed by fun and entertainment, learning, and seeking information, and finally relaxation and rest. Two categories of motives were mentioned only by children, and these are time pass and boredom, and FoMO. The Uses and gratification theory provided us with a good framework for DT motives analyses in children. This research gives an overview of the motivation for DT use among Croatian children thus filling in the gap in the existing literature on DT use in the regional context. Providing different perspectives allowed researchers to detect differences that might be considered a source of child-parent conflict regarding children's DT use. Research that uses a focus group approach and a parent-child perspective is particularly lacking. Furthermore, this research has pointed out a certain fear of parents because children sometimes choose the DT devices for entertainment purposes over other ways of having fun that they might see as better. Children recognize a practical side of the DT since it helps them interact with friends and family, but also more superficial ways of using DT due as time pass and boredom. These results offer a starting point for the development of guidelines aiming to help

parents to better understand the children's motivation for DT use and to help children to choose different activities when they are bored, besides using DT.

*Note*

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*Data availability statement*

For further details on data, contact the corresponding author of the manuscript.

*Conflict of interest*

We have no conflicts of interest to disclose.

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# Appendix A

## Children's group discussions data

| Session | Participant | Gender | Age |
|---|---|---|---|
| Session 1 | F01 | boy | 14 |
| | F03 | boy | 13 |
| | F19 | girl | 14 |
| | F24 | boy | 13 |
| Session 2 | F10 | girl | 11 |
| | F11 | boy | 11 |
| Session 3 | F06 | boy | 10 |
| | F15 | boy | 10 |
| Session 4 | F09 | boy | 15 |
| | F21 | girl | 15 |
| | F25 | boy | 10 |
| | F07 | girl | 12 |
| | F12 | boy | 12 |
| Session 6 | F14 | girl | 9 |
| | F17 | girl | 10 |
| | F26 | boy | 9 |
| | F28 | girl | 12 |
| Session 7 | F08 | boy | 14 |
| | F18 | girl | 11 |
| | F20 | boy | 14 |
| | F30 | boy | 11 |
| Session 8 | F16 | girl | 10 |
| | F23 | girl | 12 |
| | F32 | girl | 10 |
| Session 9 | F29 | boy | 9 |
| | F31 | girl | 10 |
| | F34 | boy | 9 |
| | F35 | boy | 10 |
| | F36 | boy | 10 |

# Appendix B

## Parents' group discussions data

| Session | Participant |
|---|---|
| Session 1 | MF01 |
| | DF03 |
| | MF19 |
| | MF21 |
| | MF27 |
| Session 2 | MF02 |
| | MF10 |
| | MF11 |
| | MF18 |
| Session 3 | MF06 |
| | MF14 |
| | DF15 |
| Session 4 | MF04 |
| | MF09 |
| | MF24 |
| | MF25 |
| Session 5 | MF15 |
| | DF17 |
| | MF26 |
| Session 6 | MF07 |
| | MF20 |
| | MF23 |
| | MF28 |
| Session 7 | MF08 |
| | MF16 |
| | MF32 |
| Session 8 | MF29 |
| | MF31 |
| | MF34 |
| | MF35 |
| | MF26 |

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Research Article

# "The Devil in Disguise": A Test of Machiavellianism Instruments (the Mach-IV, the Machiavellian Personality Scale, and the Five Factor Machiavellianism Inventory)

Beata Grabovac[1] and Bojana M. Dinić ✉[2]

*1 Department of Social Sciences and Humanities, Hungarian Language Teacher Training Faculty, University of Novi Sad, Serbia*

*2 Department of Psychology, Faculty of Philosophy, University of Novi Sad, Serbia*

ABSTRACT

The main aim of this study was to test the convergent, discriminant, and criterion validity of the Serbian adaptations of three Machiavellianism instruments (the Mach-IV, the short version of the Machiavellian Personality Scale – MPS-short, and the Five Factor Machiavellianism Inventory – FFMI) based on their relations with HEXACO traits, distress aspects (anxiety, depression, and stress), and emotion regulation strategies (suppression and reappraisal). The sample included 195 participants (80% were women) from Serbia, aged between 18 and 60 years, and the most of them were students. The results showed that the Mach-IV and the MPS-short are mutually more similar to each other and their main negative correlate is Honesty-Humility, while the FFMI appears to be distant from the other instruments and its main positive correlates are Extraversion and Conscientiousness and a negative one is Emotionality. Furthermore, the Mach-IV and MPS-short showed positive relations with distress aspects and non-adaptive emotion regulation (suppression), while the FFMI showed opposite patterns of relations. Since the FFMI captures the most items and facets, it explained the most variance of distress and regulation strategies, but the Mach-IV and the MPS-short, especially its amorality facet, showed significant incremental contribution in the explanation of anxiety, stress, and suppression. We discuss implications of the use of each of the three instruments.

*Keywords*: Machiavellianism, validity, personality assessment, distress, emotional regulation

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✉ Corresponding author e-mail: bojana.dinic@ff.uns.ac.rs

# Introduction

## The Measures of Machiavellianism

We can define Machiavellianism as a tendency to manipulate and exploit others in order to achieve personal goals related to cynical beliefs and pragmatic morality (Christie & Geis, 1970). Christie and Geis (1970) stated that the four fundamental characteristics of Machiavellianism are: lack of empathy enabling objectifying others, instrumental view of others aiding insincerity, seeing others rationally, and quick and efficient problem solving. Bereczkei (2016) underlines five key characteristics: manipulation, amorality, cynicism, emotional coldness, and lack of empathy. Although it refers to antisocial traits as callousness and the use of duplicitous tactics, the use of strategic approach (Jones & Paulhus, 2009) is also a characteristic of Machiavellianism.

The most widely used measure of Machiavellianism is the Mach-IV (Christie & Geis, 1970), which originally has three dimensions: tactics (manipulative tactics and justification of immoral behavior to achieve a goal), views (cynical worldview and the belief that humanity is untrustworthy and selfish), and morality (willingness to embrace immoral behaviors in order to achieve a goal). The Mach-IV is based on statements that are either drawn directly from Niccolò Machiavelli's original writings or are considered tapping the same construct. However, the Mach-IV has shown an unstable factor structure, especially across non-Western samples (see Fehr et al., 1992 for details). In a more recent study by Monaghan et al. (2018), results showed that the two-dimensional structure – comprising tactics and views – best describes the content of this instrument across samples from Korea, Hungary, Canada, USA, and Australia. However, in most research, the total score of Mach-IV is used since its utility has been convincingly demonstrated (see Fehr et al., 1992; Visser & Campbell, 2018).

Dahling et al. (2009) have also underlined the issues with reliability, scale structure, and some poor items of the Mach-IV and they developed a new instrument, the Machiavellian Personality Scale (MPS), based on the theoretical assumptions about the main characteristics of Machiavellianism. The scale has four dimensions: amorality, desire-for-control, desire-for-status, and distrust-of-

others and it has long and short forms. Although in their original study a confirmatory factor analysis supported a four-factor structure (Dahling et al., 2009), the factors showed inconsistent relations with empathy and some of them had low reliability (Miller et al., 2015). Moreover, in Chinese language, the use of a bifactor structure showed the best model fit, with only the desire-for-control subscale being more clearly defined and independent from the general Machiavellianism factor (Gu et al., 2017). The use on a Hungarian sample also revealed some discrepancies in comparison with the original scale: 1) instead of the desire-for-status, a new factor emerged (named: feeling-in-control) and 2) the amoral manipulation factor included only aspects of behaving and thinking non-ethically (Talmácsi et al., 2012). The authors believe that the alternative structure was obtained because of a student sample. However, the short versions in French and Italian languages showed a good model fit and reliability (Bianchi & Mirkovic, 2020).

Furthermore, Rauthmann and Will (2011) stated that what the Mach-IV measures is a very malleable and vague concept, and they believed that Machiavellianism may have a hierarchical structure of specific affects (e.g., interpersonal coldness), behaviors (e.g., exploitation), cognitions (e.g., negative perception of others), and desires (e.g., agentic motivation). Although there is no instrument based on their theoretical conception of Machiavellianism, these authors have highlighted that the focus of existing instruments is on characteristics such as cynical attitudes, immoral views, and manipulation, while neglecting others, like long-term planning and impulse control. There are certain additional measures of Machiavellianism, but they are used infrequently and measure even more specific aspects of Machiavellianism (behaviors or attitudes) or their content overlaps with the Mach-IV (for example, the German Machiavellianism Scale) or they are brief and consider Machiavellianism as unidimensional (e.g., the Machiavellianism scale from the Short Dark Triad and the Dark Triad Dirty Dozen).

A relatively newly introduced instrument is the Five Factor Machiavellianism Inventory (FFMI; Collison et al., 2018), which is based on expert estimations and ratings of the structure of Machiavellianism. The FFMI has three

main factors: antagonism (with the following facets: selfishness, immodesty, manipulativeness, callousness, and cynicism), agency (with the facets of: achievement, activity, assertiveness, competence, invulnerability, and self-confidence), and planfulness (with the facets of: deliberation and order), and it seems to capture all the relevant characteristics of Machiavellianism suggested by Rauthmann and Will (2011). Thus, the FFMI measures not only the antagonistic but also the strategic and goal-oriented aspects of Machiavellianism (captured by the agency and planfulness factors).

One rationale for a new instrument is that, according to theoretical expectations, there should be a positive relation between Machiavellianism and constraint. Collison et al. (2018) pointed out that previous Machiavellianism instruments showed negative relations with Conscientiousness, while the agency and planfulness factors from the FFMI, as well as the total score of the FFMI showed positive correlations with Conscientiousness and the antagonism factor showed negative (Collison et al., 2018; Kückelhaus et al., 2020). However, the planfulness factor showed a positive correlation with Agreeableness and the agency factor showed inconsistent correlations with Agreeableness facets, while only the antagonism factor, as well as the FFMI total score showed expected, strong and negative correlations with Agreeableness (Collison et al., 2018; Kückelhaus et al., 2020). Additionally, the FFMI antagonism factor showed high profile similarity with other Machiavellianism instruments (the Mach-IV, the MPS, the Machiavellianism scale from the Dark Triad Dirty Dozen instrument), but the total FFMI score showed low profile similarity with these traditional Machiavellianism measures when considering correlations with the NEO-PI-R and the HEXACO-PI-R (Kückelhaus et al., 2020). In line with that, the FFMI total score, as well as the agency factor, showed positive correlations with indicators of social competency and career success and negative with counterproductive work behavior, contrary to the antagonism factor, while both the total score and the antagonism factor showed negative correlations with emotion recognition (Kückelhaus et al., 2020). Kückelhaus and Blickle (2021) further confirmed the dissimilarity between the FFMI and traditional Machiavellianism instruments and showed that the FFMI total score positively correlates with interpersonal,

occupational and workplace success, and that the agency factor influences these correlations.

Recently, a Serbian adaptation of the FFMI showed a three-factor solution (Dinić et al., 2021). Although there are some deviations from the expected factor structure (the immodesty facet had a marginally significant loading on the agency factor and not on the antagonism factor, and the achievement facet had a marginally significant loading on both order and antagonism factors, and not on the agency factor), the factor structure was mostly in line with the original solution. Results of this study showed that antagonism had positive and low correlations with alexithymia and psychological distress (anxiety, depression, and stress), while both agency and planfulness showed negative correlations with those variables, with agency getting higher correlations.

## Machiavellianism: Correlates and Outcomes

Machiavellianism is a member of the Dark Triad and Dark Tetrad constellation of socially malevolent traits (e.g., Paulhus, 2014). The central features within this constellation are lack of affective responsiveness and interpersonal manipulation (Dinić et al., 2020) or callousness as a facet of antagonism (Dinić et al., 2021). Therefore, Machiavellianism is related to deficits in emotional and social functioning. In their review, Jones and Paulhus (2009) concluded that Machiavellianism has shown consistent negative correlations with both empathy and emotion recognition. Considering the multidimensionality of empathy, following research showed that there were negative relations with affective empathy, while with cognitive empathy these were negative (Al Aïn et al., 2013) or non-significant (e.g., Dinić et al., 2018). A meta-analysis showed a negative link between Machiavellianism and ability emotional intelligence (Miao et al., 2018), and the most prominent correlate was emotion management (e.g., Vonk et al., 2015). Furthermore, there is a positive relation between Machiavellianism and a non-adaptive emotion regulation strategy, suppression of experienced emotions, but no relation with an adaptive strategy, cognitive reappraisal (Akram & Stevenson, 2021). Moreover, Côté et al.

(2011) showed that Machiavellianism has a small negative relation with emotion-regulation knowledge (awareness of the most effective strategies for modifying and nurturing emotions in particular situations). However, the moderation effect of emotion-regulation knowledge showed that persons with high Machiavellianism and good regulation knowledge pose a greater danger to other people.

Machiavellianism, as other dark traits, shows a negative relation with Honesty-Humility from the HEXACO model and with Agreeableness from the Big Five Model (e.g., Lee & Ashton, 2005). Characteristics such as recklessness and impulsivity, which are contained in Conscientiousness, are not part of the original conceptualization of Machiavellianism (e.g., Jones, 2016). However, in previous research which used the Mach-IV, it was shown that Conscientiousness was a negative correlate of Machiavellianism (e.g., Lee & Ashton, 2005). In the case of the FFMI, the results showed that the agency and planfulness factors were positively related to Conscientiousness and negatively to impulsivity, while the antagonism factor showed an opposite pattern of relations (Collison et al., 2018; Kückelhaus et al., 2020). Besides the characteristics shared with other members of the Dark Tetrad, Machiavellianism also shows unique relations with other traits. In a meta-analysis in which various measures of Machiavellianism were used, it has been shown that it is negatively related to Extraversion, Agreeableness and Honesty-Humility (when shared variance among the Dark Triad traits has been controlled for, see Muris et al., 2017). However, the agency and planfulness factors from the FFMI showed negative correlations with Neuroticism facets and agency also showed positive correlations with Extraversion facets, while antagonism showed positive or non-significant correlations with Neuroticism facets, and inconsistent, but mostly negative correlations with Extraversion facets (Collison et al., 2018; Kückelhaus et al., 2020).

Furthermore, Machiavellianism is related to various negative psychosocial outcomes, among which relations with interpersonal difficulties and antisocial behaviors stand out as the most prominent (Muris et al., 2017). However, when exploring relations with various mental health indicators, results were rather mixed (see a review by Jones & Paulhus, 2009). For example, one

group of research showed that Machiavellianism (measured with the Mach-IV or MPS) had small to moderate positive relations with anxiety and depression (Al Aïn et al., 2013; Bianchi & Mirkovic, 2020; Gómez-Leal et al., 2019), although in some studies only the relation with anxiety was significant (using a medical diagnosis of anxiety and a German Machiavellianism scale, see Malesza & Kaczmarek, 2019). Other authors have pointed out that there is no substantial link between Machiavellianism and depression (Bianchi & Mirkovic, 2020), while again others have found a weak negative correlation between depression and Machiavellianism (Bonfá-Araujo et al., 2021). Based on the original conceptualization of Machiavellianism, it should be unrelated to indicators such as anxiety and depression, given its detached functioning in situations of interpersonal conflict (e.g., Jones, 2016). However, in empirical validations, the relations with poor mental health indicators are mostly positive, but weak (for a review, see Jones, 2016). Thus, there is a warranty for further exploration of its relations with mental health indicators considering different measures of Machiavellianism.

## The Present Study

The main aim of this research is to examine the convergent, discriminant, and criterion validity of the Serbian adaptations of three Machiavellianism instruments (the Mach-IV, the MPS, and the FFMI), which were based on different theoretical approaches and methodologies (e.g., items were created using Niccolò Machiavelli's statements or expert estimations and ratings) and to add to the further understanding of mental health correlates of Machiavellianism. More precisely, we examine the convergent and discriminant validity of the Machiavellianism instruments via correlations with HEXACO traits. In line with previous research (e.g., Lee & Ashton, 2005), we expect that the main correlate of all instruments that measure Machiavellianism would be Honesty-Humility (convergent validity), while correlations with other HEXACO traits should be lower (discriminant validity). Besides Honesty-Humility as a main correlate, we assume that Agreeableness will also show significant negative correlations with Machiavellianism instruments, providing further validity

evidence for malevolent and socially aversive characteristics of Machiavellianism. In line with theoretical assumptions (e.g., Jones, 2016), we expect Machiavellianism measures to correlate positively with Conscientiousness, which would indicate a planful and strategic approach present in Machiavellians. For the rest of the personality traits, we do not expect to find substantial correlations, but we could anticipate to find significant correlations depending on the measured aspect of Machiavellianism (e.g., since the FFMI also measures the agency aspect, we could expect a positive correlation with Extraversion, see Collison et al., 2018). Furthermore, criterion validity is being examined via its relations with psychological distress and emotion regulation strategies. We presume to find a positive relation between Machiavellianism instruments and mainly non-adaptive emotion regulation strategies (e.g., expressive suppression, see Akram & Stevenson, 2021) and distress aspects (e.g., Al Aïn et al., 2013; Jones, 2016). In addition to this, since the FFMI is a more comprehensive instrument compared to the Mach-IV and the MPS and it captures not only antagonism, but also the agency and planfulness aspects of Machiavellianism (Collison et al., 2018), we will explore the incremental validity of the Mach-IV and the MPS to find out which are the criterion validity measures over and above the FFMI. We expect that the Mach-IV and the MPS will not show significant incremental validity over and above the FFMI, since the antagonistic aspect that they cover should be already captured by the FFMI. Finally, to get better insight into their similarities and differences, shared and specific content, we will explore a joint factor analysis of these three instruments.

# Method

## Participants and Procedure

The sample included 195 participants (80% women) from Serbia, aged between 18 and 60 years ($M$ = 24.60, $SD$ = 8.52). Most of the participants were students (71.30%) and 21.50% had a college or university degree. A convenience sample was used, and it consisted mainly of students who took part in the study for course credits. The rest of the participants were required via social networks,

by snowball sampling. Data were collected online via the Google Forms platform, anonymously. The instruments had a pre-defined order; we administered the FFMI first, then the MPS, HEXACO-60, Mach-IV, ERQ, DASS-21, followed by questions about socio-demographic characteristics. Study was approved by the Ethical Committee of the Department of Psychology, Faculty of Philosophy, University of Novi Sad, Serbia, which is the Second Instance Commission of the Ethical Committee of the Serbian Psychological Society (code 201810260923_BSQL).

## Instruments

### *Mach-IV*

The Mach-IV (Christie & Geis, 1970, for the Serbian adaptation see Međedović & Petrović, 2015) has 20 items measuring manipulative tactics, a cynical attitude to human nature and pragmatic morality. The response format is a 5-point Likert scale (from 1 = *strongly disagree* to 5 = *strongly agree*).

### *Machiavellian Personality Scale – short form*

The Machiavellian Personality Scale – short form (MPS-short; Dahling et al., 2009) has 16 items distributed into four facets: amorality (5 items), desire-for-control (3 items), desire-for-status (3 items), and distrust-of-others (5 items). This was the first use of the scale in Serbian language and for this purpose the authors of this study translated the English version to Serbian and it was back-translated to English by a professional English language lecturer in order to ensure the original meaning (see translation at https://osf.io/uv93z/). The response format is a 5-point Likert scale (from 1 = *strongly disagree* to 5 = *strongly agree*).

### *Five Factor Machiavellianism Inventory (FFMI)*

The Five Factor Machiavellianism Inventory (FFMI; Collison et al., 2018, for Serbian adaptation see Dinić et al., 2021) contains 52 items, which measure 13 facets (all facets have four items) distributed into three factors: 1) antagonism (20 items), which captures the facets of selfishness (low altruism) (4 items), immodesty (4 items), manipulativeness (4 items), callousness (4 items), and cynicism (4 items); 2) agency (24 items), which captures the facets of

achievement (4 items), activity (4 items), assertiveness (4 items), competence (4 items), self-confidence (4 items), and invulnerability (4 items); and 3) planfulness (8 items), which captures two facets: deliberation (4 items) and order (4 items). The response format is a 5-point Likert scale (from 1 = *disagree strongly* to 5 = *agree strongly*).

*HEXACO-60*

The HEXACO-60 (Ashton & Lee, 2009, for the Serbian adaptation see Sokolovska et al., 2018) measures six basic personality traits (each with 10 items): Honesty-Humility, Emotionality, Extraversion, Agreeableness (versus Anger), Conscientiousness, and Openness to Experience, each containing four facets. The response format is a 5-point Likert scale (from 1 = *strongly disagree* to 5 = *strongly agree*).

*Emotion Regulation Questionnaire (ERQ)*

The Emotion Regulation Questionnaire (ERQ; Gross & John, 2003, for the Serbian adaptation, see Popov et al., 2016) measures two emotional regulation strategies: expressive or emotional suppression (4 items) and cognitive reappraisal (6 items). The response format is a 7-point Likert scale (from 1 = *strongly disagree* to 7 = *strongly agree*).

*Depression Anxiety Stress Scale (DASS-21)*

The Depression Anxiety Stress Scale (DASS-21; Lovibond & Lovibond, 1995, for the Serbian adaptation see the official website http://www2.psy.unsw.edu.au/Groups/Dass/Serbian/Serbian.htm) measures three domains of psychological distress (each with 7 items): depression, anxiety, and stress. The response format is a 4-point Likert scale (from 0 = *did not apply to me at all* to 3 = *applied to me very much, or most of the time*).

In Table 2, there are the descriptive statistics and alphas for all the instruments used.

## Data Analysis

First, we calculated a model fit for all three instruments – the Mach-IV, the MPS, and the FFMI. Because of the violation of multivariate normality, we used a robust diagonally weighted least squares (DWLS) estimator. The evaluation of the model fit was in line with recommendations of Hu and Bentler (1999): for a good fit *RMSEA* and *SRMR* should be < .06, and *TLI* and *CFI* > .95, and for an acceptable fit *RMSEA* and *SRMR* should be < .08 and *TLI* and *CFI* > .90. The model fit was calculated in R package "lavaan" (Rosseel, 2012).

Second, mutual correlations between the various Machiavellianism instruments, as well as between Machiavellianism instruments and other validity measures (HEXACO, emotion regulation, and distress scales) were calculated. For multiple comparisons, Bonferroni *p*-correction was applied (.05/36 = .00143, see Table 2). In order to check profile similarity across correlations with validity measures, the Cronbach and Gleaser's (1953) *D* statistic based on Euclidean distances was used with lower values showing greater profile similarity. *D* can be interpreted as Cohen's *d* (Cohen, 1992), meaning that values of and above .20 can be considered as a small effect indicating similar profiles, values of .50 and above as a medium effect and showing moderately similar profiles, and the value of .80 and above as a large effect and dissimilar profiles.

Third, a regression analysis was used to test the explained variance of validity measures based on each of the three Machiavellianism instruments. Additionally, we conducted a hierarchical regression analysis in order to test the incremental contribution of the Machiavellianism instruments. In this analysis, in the first step, we entered the instrument that explained the highest percentage of variance in the previous regression analysis, and the rest of the instruments in the second step.

Finally, we conducted a factor analysis (principal axis factoring method) on the Machiavellianism instruments and their subscales in order to test whether they formed a one-factor solution and refer to the same construct. The number of factors was tested based on a parallel analysis (O'Connor, 2000) and promax rotation was used for the interpretation of the factors. As significant loadings

were considered those higher than ± .32 (Tabachnick & Fidell, 2019). All analyses from the second step were calculated in IBM SPSS for Windows v26 (IBM Corp., 2019). Data and the instruments are available at https://osf.io/uv93z/.

## Results

### Factor Structures of the Machiavellianism Instruments

*Mach-IV.*

Since a one-factor solution is usually used for the Mach-IV, we firstly tested this solution. The model fit was unsatisfactory (Table 1). The modification indices have suggested to include residual correlations between two negatively formulated items (item 9 "*Most people are brave*." and item 14 "*Most people are basically good and kind*."), which improved the fit. We also tested the two-factor model solution based on Monaghan et al. (2018), which includes only 10 items, but it showed an overfit, with a correlation between the factors of .52. Given that the total score of the Mach-IV is mostly used in research and considering the overfit of the alternative model and the satisfactory model fit of the modified one-factor solution, we kept the total score in further analyses.

*MPS-short.*

The proposed four-factor model showed a satisfactory model fit. The alphas for facets ranged from .48 (desire-for-status) to .65 (desire-for-control) and the omegas ranged from .49 (amorality) to .64 (desire-for-control), which can be considered as adequate given the small number of items per several facets.

*FFMI.*

Since previous research regarding the exploration of the factor structure of the Serbian adaptation of the FFMI used an exploratory factor approach (Dinić et al., 2021) in line with the original study (Collison et al., 2021), the model fit for the three-factor solution was assessed using an exploratory structural equation modeling (ESEM) approach. The results showed an excellent model fit. However, the latent structure is somewhat different from the original solution, with facets of achievement and immodesty showing high loadings on the planfulness factor,

along with deliberation, while order from the original planfulness factor showed marginal loadings on all factors. Having this in mind, we will use facet scores in the main analyses. Cronbach's alphas for the facets ranged from .52 (selfishness) to .75 (order) and omegas ranged from .47 (selfishness) to .75 (order). These values can be considered as adequate and acceptable given the small number of items per some facets.

**Table 1**
**The model fit of three Machiavellianism instruments**

| Instruments | Models | DWLS $\chi^2(df)$ | *p* | *CFI* | *TLI* | *RMSEA* (90% *CI*) | *SRMR* |
|---|---|---|---|---|---|---|---|
| Mach-IV | one-factor | 299.31 (170) | < .001 | .886 | .873 | .063 (.051 - .074) | .091 |
| | modified one-factor | 279.41 (169) | < .001 | .903 | .891 | .058 (.046 - .070) | .087 |
| | two-factor | 31.45 (34) | .593 | 1.00 | 1.00 | .000 (.000 - .047) | .058 |
| MPS-short | four-factor | 165.25 (98) | < .001 | .925 | .908 | .059 (.043 - .075) | .084 |
| FFMI | three-factor | 42.98 (42) | .429 | .999 | .997 | .011 (.000 - .050) | .054 |

*Note*. For the exploration of the FFMI, ESEM was used in line with the original study (Collison et al., 2021), while for the exploration of the Mach-IV and the MPS, CFA was used.

## Convergent and Discriminant Validity of the Machiavellianism Instruments

Correlations among the three instruments have shown that the Mach-IV and the MPS-short are more similar to each other compared to the FFMI (Table 2). Both the Mach-IV and the MPS-short showed the highest negative correlations with Honesty-Humility among the HEXACO traits, while the FFMI showed this with Extraversion in a positive direction, followed by Conscientiousness (positive) and Emotionality (negative). Furthermore, both the Mach-IV and the MPS-short showed positive correlations with distress aspects and expressive suppression, while the FFMI showed negative correlations with distress aspects and positive with cognitive reappraisal. The results on profile similarity showed that the Mach-IV and the MPS-short are very similar ($D$ = .18),

while the FFMI is very distant from both the Mach-IV ($D$ = 2.23) and the MPS-short ($D$ = 2.08).

Table 2

**Correlations between Machiavellianism scales and personality, distress, and emotional regulation scales**

| Instrument | Scale or subscale | *M*(*SD*) | α | Mach-IV | MPS | FFMI |
|---|---|---|---|---|---|---|
| Mach-IV | | 2.72(0.49) | .79 | 1 | | |
| MPS-short | | 2.53(0.52) | .77 | .70*** | 1 | |
| FFMI | | 3.05(0.33) | .80 | .27*** | .39*** | 1 |
| HEXACO-60 | Honesty-Humility | 3.69(0.70) | .75 | -.53*** | -.65*** | -.25*** |
| | Emotionality | 3.30(0.67) | .73 | -.17* | -.03 | -.40*** |
| | Extraversion | 3.19(0.72) | .80 | -.11 | -.02 | .51*** |
| | Agreeableness | 2.99(0.68) | .75 | -.25*** | -.35*** | -.20** |
| | Conscientiousness | 3.68(0.69) | .82 | -.22** | -.13 | .42*** |
| | Openness | 4.00(0.69) | .78 | -.16* | -.16* | -.05 |
| DASS-21 | Depression | 0.74(0.68) | .87 | .35*** | .26*** | -.30*** |
| | Anxiety | 0.81(0.73) | .86 | .26*** | .26*** | -.22*** |
| | Stress | 1.27(0.76) | .88 | .31*** | .31*** | -.24*** |
| ERQ | Cognitive reappraisal | 4.97(1.14) | .76 | -.08 | -.03 | .21** |
| | Expressive suppression | 3.62(1.31) | .82 | .34*** | .26*** | .11 |

***$p$ < .001, **$p$ < .01, *$p$ < .05.

Regarding the FFMI facets, the highest correlations were found between assertiveness, self-confidence, competence and Extraversion, all in a positive direction; order, competence, activity and Conscientiousness, all in a positive direction; invulnerability and Emotionality in a negative direction; and manipulation, immodesty and Honesty-Humility, in a negative direction (a full correlational matrix can be found at https://osf.io/uv93z/). Since the FFMI captures diverse aspects of Machiavellianism and considering the results of the model fit, further analyses were run on the facet level for both the FFMI and the MPS-short.

## Criterion Validity of the Machiavellianism Instruments

Results of the regression analyses showed that the FFMI facets explained

the highest percent of variance of the criterion variables (Table 3), which could be expected since the FFMI captures the highest number of items and facets. The results of the hierarchical regression analysis showed that the Mach-IV and the MPS-short amorality facet had an incremental contribution over and above the FFMI facets in the explanation of anxiety, stress, and suppression (Table 4).

**Table 3**

**Explained variance ($R^2$) of distress and emotional regulation scales based on Machiavellianism scales**

| Regression analysis | Criterion | | | | |
|---|---|---|---|---|---|
| | Depression | Anxiety | Stress | Cog. reap. | Ex. supp. |
| $R^2$ Mach-IV | .12*** | .07*** | .10*** | .04 | .23*** |
| $R^2$ MPS-short | .12*** | .12*** | .17*** | .03 | .24*** |
| $R^2$ FFMI | .37*** | .40*** | .50*** | .12* | .29*** |
| Hierarchical regression analysis | | | | | |
| $R^2$ FFMI | .40*** | .37*** | .50*** | .12* | .29*** |
| $\Delta R^2$ Mach-IV and MPS-short | .03 | .05** | .06*** | .03 | .11*** |
| $R^2$ Total | .43*** | .43*** | .55*** | .16* | .39*** |

***$p < .001$, **$p < .01$, *$p < .05$.

Among the FFMI facets, the main predictors of anxiety were deliberation and achievement in a positive and invulnerability in a negative direction; the main predictors of stress were achievement in a positive and invulnerability and callousness in a negative direction; and the main predictors of suppression were assertiveness in a negative and invulnerability in a positive direction (Table 4). Depression could be predicted by competence and invulnerability in a negative and immodesty in a positive direction. Although the first step showed a significant explanation of the variance of reappraisal, only cynicism showed a marginally significant and negative effect. The second step showed no significant contribution in the explanation of reappraisal, but among the variables in this step desire-for-control showed a significant negative effect. Taken together, the results showed that the Mach-IV and a specific facet of the MPS-short - amorality - had an incremental contribution over and above the FFMI facets, but this validity was limited to specific aspects of distress and emotion regulation strategies.

Table 4

Hierarchical regression analysis: Contributions (β) of Machiavellianism scales in the prediction of distress and emotional regulation scales

| | DASS-21 | | | ERQ | |
|---|---|---|---|---|---|
| 1st step (FFMI) | Depression | Anxiety | Stress | Cog. reap. | Ex. supp. |
| achievement | .01 | .18* | .18** | .05 | .06 |
| activity | -.15 | .07 | .00 | .08 | -.09 |
| selfishness | -.13 | -.02 | .02 | .05 | -.05 |
| assertiveness | -.07 | -.13 | -.13 | -.01 | -.20* |
| competence | -.27** | -.14 | -.10 | .18 | .10 |
| deliberation | .01 | .24*** | .07 | -.03 | .04 |
| invulnerability | -.19** | -.35** | -.48*** | .07 | .26*** |
| immodesty | .17* | -.08 | .03 | -.05 | -.12 |
| order | -.03 | -.02 | .05 | -.01 | .09 |
| self-confidence | -.09 | -.06 | -.08 | .12 | -.03 |
| manipulation | -.02 | .12 | -.02 | .11 | -.04 |
| callousness | .06 | -.15 | -.14* | -.02 | .11 |
| cynicism | -.03 | -.09 | -.06 | -.16+ | .09 |
| 2nd step (Mach-IV and MPS-short) | | | | | |
| Mach-IV | .17 | .22* | .19* | -.01 | .19* |
| amorality | .13 | .19* | .22** | -.01 | .33*** |
| desire-for-control | -.09 | .02 | .04 | -.21* | -.10 |
| desire-for-status | -.03 | .03 | -.00 | -.03 | .-.02 |
| distrust-of-others | .00 | .08 | -.09 | .15 | .07 |

***$p$ < .001, **$p$ < .01, *$p$ < .05, + $p$ = .059.

## Latent Structure of the Machiavellianism Instruments

The latent structure of the Machiavellianism construct was examined based on principal axis factoring of the Mach-IV and facets from the MPS-short and the FFMI. The results of the parallel analysis suggested four factors. However, the 4th factor comprised only one facet (order from the FFMI), and a few more variables which had significant secondary loadings. Therefore, we kept the three-factor solution. Based on the pattern matrix (Table 5) the first factor was

interpreted as Dominance, which comprises three facets from the MPS-short and several facets from the FFMI among which achievement showed the highest loading. The second factor was named Agency, and it mainly comprises the FFMI agency facets. The third factor was named Antagonism, and it comprises the Mach-IV, amorality from the MPS-short, and antagonism facets from the FFMI. We should note that facets from the MPS-short and the FFMI are mixed in the final factor solution, i.e., the factors were not composed of facets from only one instrument. The first and the third factor showed a moderate correlation of .49, while the first and the second (.19) and the second and the third factor (-.12) showed low correlations.

Table 5

Pattern matrix of a joint factor analysis of Machiavellianism scales

| | Dominance | Agency | Antagonism |
|---|---|---|---|
| FFMI achievement | .78 | | |
| MPS-short desire-for-status | .71 | | |
| MPS-short desire-for-control | .65 | | |
| MPS-short distrust-of-others | .55 | | |
| FFMI immodesty | .53 | | |
| FFMI deliberation | -.47 | | |
| FFMI manipulation | .43 | | .40 |
| FFMI competence | | .92 | |
| FFMI self-confidence | | .72 | |
| FFMI assertiveness | | .69 | |
| FFMI activity | | .58 | |
| FFMI order | | .39 | |
| FFMI invulnerability | | .33 | |
| Mach-IV | | | .72 |
| FFMI cynicism | -.34 | | .71 |
| MPS-short amorality | | | .63 |
| FFMI selfishness | | | .50 |
| FFMI callousness | | | .47 |

*Note:* Loadings lower than .32 were omitted.

## Discussion

The results of this study showed that the three Machiavellianism instruments capture different aspects of Machiavellianism, with the Mach-IV and the MPS-short showing higher mutual similarity compared to the FFMI. This is in line with different theoretical assumptions based on which these three instruments were developed, with the FFMI capturing aspects of low impulsivity and planfulness, besides the major aspects of Machiavellianism, which refer to antagonistic traits (Collison et al., 2018; Kückelhaus et al., 2020; Kückelhaus & Blickle, 2021).

The differences between the instruments were the most obvious in relation to Honesty-Humility, with the Mach-IV and the MPS-short showing higher correlations with this trait compared to the FFMI. Honesty-Humility was considered as a common core of dark traits, including Machiavellianism (e.g., Lee & Ashton, 2005), as it captures the antagonistic aspects of these malevolent traits. Since the FFMI measures other than antagonistic aspects of Machiavellianism, it showed high correlations with other traits, e.g., positive with Extraversion and Conscientiousness and a negative one with Emotionality, which is in line with Collison et al. (2018). These results point out that the dominant aspect of the FFMI is grandiosity and agency followed by callousness, and not antagonism per se. Therefore, the FFMI captures some positive aspects of the human nature, personal capacities, and strengths, along with emotional detachment. In previous studies (e.g., Kückelhaus et al., 2020) it was pointed out that Machiavellianism measured by the FFMI captures the use of aggressive behavior in a strategic and controlled manner; however, in the cited study the positive relations between the total FFMI scores and malevolent behaviors (counterproductive work behaviors) were missed, while the antagonistic factor showed positive and agency and planfulness showed negative small correlations with counterproductive work behaviors.

The difference between the three instruments is further confirmed by their relations with criteria variables. While the Mach-IV and the MPS-short were positively correlated with distress aspects and expressive suppression, which is

in line with previous research (e.g., Akram & Stevenson, 2021; Al Aïn et al., 2013), the FFMI showed negative relations with distress and positive ones with cognitive reappraisal. These results highlight the negative outcomes of the antagonistic aspects of Machiavellianism not only for others but also for the self and one's own mental health. However, it seems that the FFMI also captures adaptive functioning, such as constructive strategies of emotional regulation (cognitive reformulation, according to Gross & John, 2003) and reduced distress.

Considering the comprehensiveness of the FFMI, it is not surprising that it explained most of the criteria variance and that the facets from the FFMI were the strongest predictors of distress measures. More precisely, invulnerability was the consistent negative predictor of all distress aspects, but a positive one of expressive suppression, while competence was a negative predictor of depression. This is in line with a previous study that showed that anxiety and depression from the Five Factor Model showed negative relations with the agency factor, which captures invulnerability and competence (Collison et al., 2018). These results reflect the resiliency of the agentic aspect of Machiavellianism. However, the positive relation of the invulnerability facet and a mainly non-adaptive emotion regulation strategy (expressive suppression) adds to the potential cost of using manipulative strategies in order to cover or block emotions. In contrast, assertiveness was a negative predictor of expressive suppression, confirming the advantage of the tendency to openly and directly show one's own opinions and feelings. Furthermore, deliberation was a positive predictor of anxiety, which is in line with Collison et al. (2018), who showed a positive relation of anxiety from the Five Factor Model and the planfulness factor, which captures deliberation.

Despite the comprehensiveness of the FFMI, results also showed that both the Mach-IV and the amorality facet from the MPS-short showed significant incremental contribution in the explanation of some of the distress aspects and a non-adaptive emotion regulation strategy, over and above the FFMI. This is not in line with our expectation that FFMI will subsume both the Mach-IV and the MPS-short due to its comprehensiveness. However, this result

could indicate that some of the antagonistic aspects of the Mach-IV and the MPS-short are unique and not redundant to the FFMI.

Results of the joint factor analysis further contribute to the distinction of these three Machiavellianism instruments and have shown that three factors could be extracted from them - dominance, agency, and antagonism. The antagonism factor captures the core of Machiavellianism and all three Machiavellianism instruments contribute to this factor: the Mach-IV, the amorality from the MPS-short, and three facets from the original FFMI antagonism factor. This result is in line with Collison et al.'s (2018) notion that Machiavellianism instruments mainly measure the antagonistic aspect of this construct. This factor mainly covers egoistic and cold-hearted behavioral tactics, which can include amoral behaviors such as lying and being dishonest.

The factor named dominance captures three facets from the MPS-short, two from the FFMI antagonism factor (immodesty and manipulation), one from the FFMI agency factor (achievement), and one from the FFMI planfulness factor (deliberation). The main content of this factor is related to agentic traits, and it captures social potency and desire for control and status, but in combination with antagonistic and manipulative tactics. Achievement and desire-for-status had the main loading on this factor. We must note that in the original study (Collison et al., 2018), achievement had a secondary loading on the antagonism factor. Thus, it cannot be seen as solely an aspect of agency, and this was also confirmed by our results. Furthermore, in a previous study about the Serbian adaptation of the FFMI, immodesty had also had a significant loading only on the agency factor (Dinić et al., 2021), suggesting the complex meaning of this facet.

Finally, the agency factor captures only the FFMI facets and the majority of them are from the original FFMI agency factor with competence showing the highest loading, which is in line with the previous study dealing with the Serbian adaptation of the FFMI (Dinić et al., 2021). This factor has low correlations with the rest of the factors, and it is a sole characteristic of the FFMI.

The factor that refers to long-term planning and a need for order was not extracted in our study, but we have found two factors of agency - one with and one without antagonistic aspects. It should be mentioned that in Collison et

al. (2018), two factors of the FFMI were suggested by a parallel analysis and a minimum average partial (MAP) test, but the authors kept three factors as most interpretable, although the agency and planfulness factors achieved relatively high-profile similarity. Future studies should address the status of planfulness, as well as the unique aspects of agency in Machiavellianism and its relations with malevolent outcomes.

Based on all results, we can conclude that the content of the FFMI is not referring to malevolence in the same way as other traditional Machiavellianism scales. Miller et al. (2017) have pointed out that it is difficult to write items that assess low Agreeableness and high Conscientiousness, which represent the agency factor of Machiavellianism, a distinctive feature in comparison to psychopathy. Thus, it is a challenge to develop a measure of the agentic aspects of Machiavellianism without capturing adaptive aspects of interpersonal and emotional functioning. Although the FFMI captures inhibition, constraint, and good impulse control, as the authors originally proposed, it showed rather low and modest correlations with indicators of antagonism within the basic personality traits. Therefore, we could conclude that the FFMI captures some aspects of antagonism as the main characteristics of Machiavellianism, but not in the expected amount. The key characteristics that the FFMI captures when we consider the total score are the strategic, dominant, and agentic aspects of Machiavellianism. As the factors of the FFMI showed the expected relations with validity variables, we suggest that scores on the proposed factors should be used in future studies instead of the total score. The factor structure of the FFMI should be also further explored.

There are several limitations of this study. First, all correlates and outcomes were measured by self-report instruments. Future studies should include behavioral indicators of mental health and other validity constructs, such as cheating, or indicators of social deviance that need to include strategic planning. Second, the majority of participants were students and women, which limits the generalizability of the results. Third, some facets had low reliability coefficients (e.g., selfishness from the FFMI), thus conclusions based on them should be taken with caution. Fourth, we used MPS-short instead of the full MPS

and future studies could explore whether the same results would be obtained through the usage of the full MPS version.

Despite these limitations, the contribution of this study is that it offers a better insight into the validity of three Machiavellianism instruments, considering their relations with personality traits and emotional and mental health functioning. In the case when there is a need for in-depth assessment of Machiavellianism, which includes not only the antagonistic aspects of this trait, but also the agency aspect, the FFMI could serve as an instrument of choice using a factor level analysis and not the total score. However, in the situations of screening or when only a global measure of Machiavellianism is enough, the Mach-IV and the MPS, especially its amorality facet, could be used.

*Conflict of interest*

We have no conflicts of interest to disclose.

*Data availability statement*

Data used in this paper is available at: https://osf.io/uv93z/.

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Research Article

# Perceptual richness of words and its role in free and cued recall

Milica Popović Stijačić [1,2] and Dušica Filipović Đurđević [3,4]

*1 Laboratory of experimental psychology, Faculty of Philosophy, University of Novi Sad*

*2 Department of psychology, Faculty of Media and Communications, Singidunum University*

*3 Laboratory for experimental psychology, Faculty of Philosophy, University of Belgrade*

*4 Department of psychology, Faculty of Philosophy, University of Belgrade*

ABSTRACT

This research aimed to clarify the role of the perceptual richness of words (PR) in the recall tasks. PR was operationalized as the number of sensory modalities through which an object can be perceived. Previously, we found that concepts experienced with many modalities (*dog*) were recalled more accurately in cued recall than those perceived with few modalities (*rainbow*) and abstract words. This finding fitted the Perceptual symbol system theory (PSST) and the Dual coding theory (DCT) predictions. We tested the PR effect in both cued (experiment 1- E1) and free recall tasks (experiment 2 – E2) in the present study. With careful stimuli manipulation of context availability and emotional valence and statistical control of arousal and relatedness, made to exclude their influence on recall, we tested alternative explanations of the concreteness effect offered by the relational-distinctiveness hypothesis. The additional perceptual codes improved recall accuracy in the cued recall task (E1), which was in line with the PSST and the DCT. This conclusion is straightforward: two critical groups of concrete words were matched for concreteness and visual perceptual strength. Thus, more accurate recall of concepts experienced with many modalities can be attributed to richer perceptual experience. However, the relational information was essential for recall accuracy in

the free recall task (E2), as hypothesized by the relational-distinctiveness hypothesis.

*Keywords*: free recall, cued recall, dual coding theory, perceptual richness, perceptual symbol systems theory

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✉ Corresponding author email: milica.p.stijacic@gmail.com

## Introduction

In this paper, we shed light on the debate concerning the origin of the concreteness effect in memory tasks (Marschark & Hunt, 1989; Marschark & Surian, 1992; Paivio et al., 1988; 1994; Paivio, 1991; Schwanenflugel et al., 1992). To test this effect, we chose the Paired-Associate Learning paradigm (Begg, 1973; Begg & Robertson, 1973), where participants can perform free or cued recall tasks after learning pairs of words. Out of many proposed explanations, we focus on the most prominent ones: the Dual coding approach (Paivio 1991; Paivio et al., 1988; Paivio et al., 1994), the Context availability theory (Schwanenflugel et al., 1992) and the relational-distinctiveness hypothesis (Marschark & Hunt, 1989; Marschark & Surian, 1992).

### Word concreteness

The word concreteness is defined as the degree to which the word's meaning could be perceptually experienced (Brysbaert et al., 2014; Brysbaert et al., 2014; Clark & Paivio, 2004; Paivio et al., 1968; Reilly et al., 2017). Based on concreteness ratings, the word could be predominantly abstract (truth) or concrete (apple), in which case it could be easily perceived. Higher concreteness has often been linked to more accurate recall (Begg & Robertson, 1973; Marschark & Surian, 1992; Nelson & Schreiber, 1992; Paivio, 1965; Paivio, 1969; Paivio et al., 1988; Paivio et al., 1994).

The Dual coding theory (DCT) offered the first account of the concreteness effect (Paivio, 2013; Paivio & Sadoski, 2011; Paivio, 2008; Paivio, 1991; Paivio, 1969; Paivio, 1965). In line with the DCT, abstract words are mainly represented symbolically, whereas concrete words are double coded: symbolically via verbal codes (system of logogens; Morton, 1969) and perceptually via analogue codes (system of imagens). To explain the additive effect of the two independent systems, Paivio proposed the conceptual peg hypothesis (Paivio, 1991). Based on this hypothesis, one can use different mnemonic techniques to remember words, such as using rhymes or associative relations (*gun-fun* or *blood-wound*). With regards to abstract words, remembering is based on the associative level. However, remembering concrete words is enhanced with the analogue code, representing an additional peg for connecting two words. For example, in the example of *blood* and

*wound*, there are associative and perceptual relations between the words, so one can create a mental image of a bloody wound, which increases the probability of its correct recall.

However, Context availability theory challenged the idea of using imagery as an automated process (Schwanenflugel et al., 1992; Schwanenflugel et al., 1988; Schfanenfluel & Shoben, 1983). For example, Schwanenflugel and her colleagues (1992) observed concreteness effects only with individuals reporting the use of mental imagery and only when participants were explicitly instructed to evoke mental images (in imageability rating task administered during implicit learning phase), but not when they were instructed to evoke the context in which the word is encountered (context availability rating). Based on this they concluded that imagery is not initiated automatically.

Recently, both the DCT and the context availability theory were confronted with the affective embodiment perspective, oriented toward investigating the role of emotions in conceptual representations (Kousta et al., 2011; Kousta et al., 2009). This approach attributes differences in word processing to differences in emotional experience, operationalized as the emotional valence (e.g., whether words provoke positive, negative, or neutral feelings). Their experiments recorded differences in lexical processing of concrete and abstract words that were matched for imageability and context availability but not for emotional valence. In other words, they did not exclude the relevance of the DCT; instead, they added the emotional experience as a factor in the abstract knowledge representation.

## Paired-Associate Learning - PAL

The concreteness effect was thoroughly tested in the Paired-Associate Learning paradigm, in which participants read the pairs of words, and subsequently engage in either free or cued recall task (Begg, 1973; Begg & Robertson, 1973; Marschark & Hunt, 1989; Marschark & Surian, 1992; Paivio, 1969; Paivio, 1965; Paivio et al. 1994). In the free recall task, the cue-target are fully recalled by the participant, whereas in the cued recall task, they are given the first word from the previously presented pair (i.e., cue), and recall the second word (i.e., target). The concreteness effect in PAL is predicted by several models. However, the description of the precise conditions in which the concreteness effect is expected has been the ground of the

debate between the DCT (Pavio et al., 1994; Paivio, 1991) and the relational-distinctiveness hypothesis (Marschark & Surian, 1992; Marschark & Hunt, 1989).

According to the DCT and peg hypothesis, the advantage of the concrete words in PAL is a consequence of the additional memory code (supplementary analogue representation), which serves as an extra mnemonic peg later in the recall phase (Paivio, 1965; Paivio et al., 1994). For example, when learning the pair *swing-tree*, one can easily create the mental image of the swing hanging on the tree. Later, during recall, the participants could effortlessly reconstruct this image (Paivio used the term *redintegration* for this process; Horowitz & Prytulak, 1969) and accurately recall the stimuli. Accordingly, the concreteness effect should be expected regardless of the presence of the cue and irrespective of the cue-target relatedness (Paivio et al., 1994).

According to the relational-distinctiveness hypothesis, recall relies on relational and distinctiveness processing rather than imagery (Marschark & Hunt, 1989; Marschark & Surian, 1992). The advantage of concrete words is attributed to their better organization in memory and their higher discriminability (distinctiveness) compared to abstract words. However, this discriminative advantage of the concrete word pairs could be evident only after the relational information has been provided by presenting the related cue. Consequently, the concreteness effect is either attenuated or eliminated in the free recall and when participants learn the unrelated word pairs (no relational information is present). Therefore, interaction is expected among concreteness, recall type, and cue-target relatedness, as Marschark and Hunt (1989) observed. They found the concreteness effect in the cued recall of associatively or semantically related targets. There was no concreteness effect in the cued recall of the unrelated targets, nor in the free recall, regardless of the relatedness.

## Perceptual richness

In the past decades, within the Embodiment approach (Barsalou, 1999; 2007; 2010; Glenberg & Robertson, 2000; Meteyard et al., 2012; Pecher & Zeelenberg, 2015), researchers were looking for a measure that captures perceptual information more accurately than concreteness. The critical point of the Embodiment theories is that conceptual processing relies on the sensory-motor system (Meteyard et al, 2012;

Pecher et al., 2003). For example, according to Perceptual symbol systems theory (PSST; Barsalou, 1999; Barsalou, 2007; Pecher & Zeelenberg, 2015), the mental representations of concepts are grounded in the sensory-motor experience with their external referents. Accordingly, concept representations are considered simulations of the previous perceptual experience. In other words, when evoking a concept, all sensory-motor pathways, which have been aroused during perception, are reactivated (i.e., the system is performing a simulation of perceptual experience; Barsalou, 1999). As an operationalization of this modality-specific perceptual experience, some authors proposed the measures of per-modality perceptual strength (Connell & Lynott, 2012; Filipović Đurđević et al., 2016; Lynott et al., 2019; Lynott & Connell, 2013; Speed & Majid, 2017; Vergallito et al., 2020). These measures represent the extent to which a concept could be experienced with a specific perceptual modality: visually, tactually, auditorily, gustatorily, and olfactorily. Based on modality-specific perceptual strengths, several measures of perceptual richness have been derived to better articulate the word concreteness (Lynott & Connell, 2013; Filipović Đurđević et al., 2016). Multiple studies have demonstrated the relevance of these measures for cognitive processing (Connell and Lynott, 2012; Filipović Đurđević et al., 2016; Lynott & Connell, 2013; Pecher et al., 2003; Živanović & Filipović Đurđević, 2011).

Relevant to this paper is the number of sensory modalities (NoM) through which the concept could be experienced, representing the diversity of perceptual experience (Filipović Đurđević et al., 2016; Popović Stijačić & Filipović Đurđević, 2015).

## Current goals

To the best of our knowledge, the only study so far that has dealt with the NoM effect on recall is the study in the Serbian language (Popović Stijačić & Filipović Đurđević, 2015). In this study, the participants recalled the concepts that could be experienced with many modalities more accurately than abstract concepts. Although the effect was present in the cued recall, the emotional valence and the context availability was not controlled for. Therefore, the main goal of this study was to explore the unique contribution of the perceptual richness as described by the NoM on memory performance.

To explore the unique contribution of this novel variable, we needed to control for the effects of other known variables that affect memory performance. Firstly, to make sure that the observed effects could only be attributed to perceptual information, we matched abstract and concrete words for the context availability (Schwanenflugel et al., 1992), emotional valence and arousal (Kousta et al., 2009; Kousta et al., 2011). Secondly, we divided concrete words into two groups. The first group contained concepts that could be experienced with a few perceptual modalities, and the second group enclosed concepts that could be experienced with many perceptual modalities. Two groups of concrete words were averaged for concreteness and imageability, thus approximated by the visual strength. Finally, to fine-tune our understanding of the NoM effect, we contrasted the predictions of the two hypotheses accounting for the concreteness effects in PAL, DCT and Peg hypothesis (Paivio et al., 1994) and relational-distinctiveness hypothesis (Marschark & Hunt, 1989). We did so by presenting our target words in the related and unrelated cue context and by testing memory performance in free and cued recall.

Following the DCT (Paivio, 1991) and the Perceptual symbols theory (Barsalou, 1999), we predicted that the recall accuracy would be a function of the NoM. It was expected that the highest recall accuracy would be recorded for the words which denoted objects experienced with a higher number of sensory modalities. Given the strict control that we imposed on our stimuli, it was essential to note that any observed difference between the two groups of concrete words would point to the unique contribution of the perceptual richness as expressed by the NoM. Finally, based on the inconsistent findings concerning the effect of the task and cue-target relatedness, we could not make precise predictions. However, we will be able to contrast the two accounts. According to the peg hypothesis, if the NoM reflects the perceptual richness, a larger number of modalities represents a larger number of pegs available during recall and will enhance retrieval both in free and cued recall tasks.

Additionally, according to the DCT, additional perceptual codes are available regardless of the cue-target relatedness. Therefore, the NoM effect is expected for related and unrelated cue-target words. In contrast, the relational-distinctiveness hypothesis (Marschark & Hunt, 1989) would indicate the NoM effect

only in the cued recall of related cue-target words as more relevant for retrieval is relational information (which is absent in free recall and when cue-target pairs are unrelated).

Considering these goals, we conducted two experiments: in Experiment 1, the participants took part in a cued recall task, and in Experiment 2, another group of participants performed a free recall task.

## Experiment 1

### Method

### Participants

A total of 72 undergraduate students from the University of Novi Sad, native Serbian speakers, took part in this experiment to partially fulfill course requirements. Participants were randomly assigned either to related or unrelated word pairs presentation condition (thirty-six in each condition). All participants signed informed consent after the researcher explained the experimental task and its purpose. The research was approved by The Ethics Committee of the Department of Psychology, Faculty of Philosophy Novi Sad (No. 201610101138_sYfu).

### Stimuli

We selected concrete nouns described by Filipović Đurđević et al. (2016) and abstract nouns from study by Popović Stijačić and Filipović Đurđević (2015). There were three groups of nouns regarding the number of sensory modalities through which a concept could be experienced (NoM): 1) abstract nouns ("zero modalities group"; things that cannot be perceptually experienced; e.g., *science*, *freedom*), 2) perceivable with a few sensory modalities ("few modalities group"; objects experienced by one or two sensory modalities; e.g., *moon*, *window*), and 3) perceivable by many modalities ("many modalities group"; objects that could be experienced by three, four, or five modalities; e.g., *apple*, *bee*). Within each NoM groups, targets were paired with related and unrelated cues.

The related and unrelated lists consisted of 33 cue-target pairs: 11 cue-target pairs from the "zero modalities" group (e.g., *theory-science* for the related list,

and *equality-science* for the unrelated list), 11 pairs from the few modalities group (e.g., *chimney – roof* for the related list and *radiator-roof* for unrelated list) and 11 from the many modalities group of the cue-target pairs (e.g., *honey-bee* for the related list and *keyboard-bee* for unrelated list). Finally, to control for primacy and recency effects (Glanzer, 1972; Murdock, 1962), we introduced four filler pairs at the beginning and four filler pairs at the end of each list.

Cue-target relatedness[1] was different for the list of related and the list of unrelated pairs: $F(1,64) = 404.10$, $p < .00$ ($M_{related} = 6.04 \pm 0.70$, $M_{unrelated} = 2.04 \pm 0.90$). The relatedness rating was identical for related pairs of zero, few, and many modalities word groups. However, the unrelated pairs of abstract words were more related than unrelated pairs of concrete words: $F(2,30) = 16.30$, $p < .001$ ($M_{zero} = 2.95 \pm 0.60$; $M_{few} = 1.7 \pm 0.90$; $M_{many} = 1.38 \pm 0.30$). Groups of zero, few, and many modalities were matched for word length, (log) lemma frequency (Kostić, 1999), context availability[2] (Schfanenflugel et al., 1988), and emotional valence[3] (Bradley & Lang, 1999). However, the abstract cues ($F(2,30) = 6.21$, $p < .01$; $M_{zero} = 5.65 \pm 1.50$; $M_{few} = 4.31 \pm 0.90$; $M_{many} = 4.14 \pm 0.60$), and targets ($F(2,30)=6.04$, $p<.01$; $M_{zero}=5.67\pm0.8$; $M_{few}=4.21\pm1.2$; $M_{many}=4.55\pm1.1$) had higher values of arousal than the concrete words. Therefore, both arousal and relatedness were introduced as the covariate variables. Two groups of concrete words were additionally matched for concreteness and visual perceptual strength (taken from Filipović Đurđević et al., 2016, but also described in Connell & Lynott, 2012). The lists of words with the corresponding values on the relatedness are given in Appendix 1.

## Design

We manipulated relatedness of cue-target pairs (related vs. unrelated) between subjects and within items, and the NoM (zero, few, many) between items

[1] as rated on a seven-point scale by novel sample of 20 native Serbian speakers.

[2] Ratings for the context availability were collected from 15 Serbian native speakers who did not participate in the experiments. Participants rated how easily the presented word evokes the context on the seventh point Likert scale.

[3] A novel sample of 15 Serbian native speakers estimated the emotional valence and arousal.

and within subject. The dependent variable was recall accuracy (coded 0 for incorrect and 1 for the correct recall).

## Procedure

Using Open Sesame software (Mathôt et al., 2012), word pairs were presented with the overhead projector on the classroom wall. The trial consisted of the fixation cross (1000ms) followed by a word pair (8000ms). There were 41 trials: eight fillers (four at the beginning and four at the end of the list), and 33 target trials, randomly sequenced. Since this experiment was a group study, we divided each condition (related and unrelated) into two testing sessions to have at least two orders of stimuli presentation. Accordingly, the participants were assigned to one of the four lists (two unrelated and two related, which had the same stimuli with different presentation orders). Without mentioning the recall test, participants were instructed to read word pairs carefully and in silence. After the stimuli presentation, participants were engaged in the cued recall task: they received a response sheet, with the table containing cues in one column and blank cells in the second column for the participant's answers. They were instructed to write down the matching target of the cues listed in the paper. There were three versions of the response sheets with three different random orders of the cues. Reproduction was limited to five minutes. After this time, the experimenter collected the response sheets.

## Data analysis

The data were analyzed in the R statistical software (R Core Team, 2018). We used the lme4 package (Bates et al., 2015) as a more powerful binary data analysis tool than traditional ANOVA over percentages of correct responses (Popović Stijačić et al., 2018). The R code of the analyses, together with the data set, is available on the OSF platform: OSF page link. Based on Barr's recommendation (2013), we started with the model with the most saturated random structure justified by design. However, we kept the model with the best-fit indices, as proposed by Matuschek and colleagues (Matuschek et al., 2018).

## Results and discussion

Accuracy observed in six conditions is presented in Figure 1.

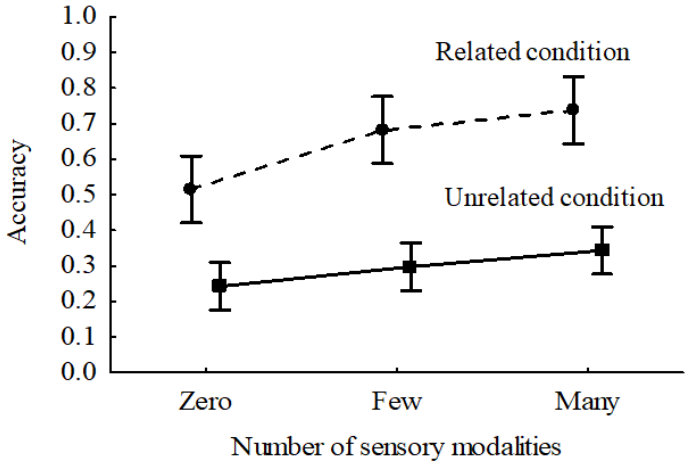


**Figure 1. Accuracy in the cued recall of the related and the unrelated noun pairs**

Generalized mixed-effects regression revealed that recall was more accurate for the targets in the related condition across the NoM groups. Additionally, we observed NoM by relatedness interaction, which revealed that the advantage of related pairs was less pronounced for abstract words. Finally, the effect of NoM was significant between zero and many modalities condition of both related and unrelated word pairs.

The observed differences could not be explained neither with context availability theory (because the stimuli were matched for context availability; Schwanenflugel et al., 1992), nor with the theoretical account that proposed the affective experience as relevant for the representation of abstract words (Kousta et al., 2011). The observed pattern of the NoM and relatedness effects is more in accordance with the DCT and the conceptual Peg hypothesis (Paivio, 1971; Paivio et al., 1994). Namely, the difference between concrete and abstract targets was observed in related and unrelated conditions, which was not predicted by the relational-distinctiveness hypothesis (Marschark & Hunt, 1989).

Table 1

The estimates of the coefficients of the fixed effects and the fit indices for the first model

| Predictors | Estimate | *SE* | *z* | *p* | Fit indices |
|---|---|---|---|---|---|
| Intercept: NoM = few; Relatedness = unrelated | -1.17 | .30 | -3.90 | .00 | |
| NoM: zero | - .37 | .31 | - 1.21 | .22 | *AIC*: 2512.70 |
| NoM: many | .32 | .30 | 1.07 | .28 | *BIC*: 2558.90 |
| | | | | | *logLik*: - |
| Relatedness: related | 2.21 | .35 | 6.35 | .00 | 1248.40 |
| NoM: zero/relatedness: related | - .58 | .25 | -2.27 | .02 | |
| NoM: many/relatedness: related | .01 | .25 | 0.07 | .95 | |
| | | | | | |
| Intercept: NoM = zero; Relatedness = unrelated | -1.54 | .30 | -5.08 | .00 | |
| NoM: few | .37 | .31 | 1.21 | .23 | |
| NoM: many | .69 | .30 | 2.28 | .02 | |
| Relatedness: related | 1.63 | .35 | 4.72 | .00 | |
| NoM: few/relatedness: related | .58 | .25 | 2.27 | .02 | |
| NoM: many/relatedness: related | .59 | .25 | 2.34 | .02 | |
| | | | | | |
| Random effects | | | | | |
| $\sigma^2$ participant (intercept) | 1.55 | | | | |
| $\sigma^2$ item (intercept) | 0.32 | | | | |

*Notes*. Both sets of coefficients belong to the same model. In the upper part of the table, the intercept was set to few numbers of modalities, and the unrelated condition; in the lower part of the table, the intercept was set to zero number of modalities. SE – standard error of an estimate; *z* – z test; *p* – p-value; $\sigma^2$ - variance.

Considering that concrete cues and targets (both in few and many condition) were less related than abstract cue-target pairs, we also conducted the analysis with relatedness as the continuous predictor (Table 2). As expected, an increase in relatedness was followed by an increase in accuracy of cued recall. However, when controlling for relatedness in such way, we also observed a more robust effect of NoM. Targets denoting objects that could be perceived with many

modalities were recalled more accurately than those from the few modalities group, and targets from the few modalities group were recalled more accurately compared to the abstract words. Thus, there was a weak but statistically significant effect of the NoM, regardless of the relatedness. This finding is in accordance with the Perceptual symbol systems theory (Barsalou, 2010; 2007), the DTC (Paivio, 1991; Paivio et al., 1994) and conceptual peg hypothesis (Paivio et al., 1994). Other theoretical explanations (context availability and influence of emotions and arousal; Schwanenflugel et al., 1992; Kousta et al., 2009; Kousta et al., 2011) could be excluded, at least in a cued recall condition, since the relevant groups of words were matched by the listed variables.

Table 2

**The estimates of the coefficients of the fixed effects and the fit indices for the second model**

| Model 2 | Estimate | *SE* | *z* | *p* | Fit indices |
|---|---|---|---|---|---|
| Intercept: NoM = few | -1.35 | .31 | -4.36 | .00 | *AIC:* 2497.50 |
| Relatedness (continuous) | 0.44 | .06 | 7.70 | .00 | *BIC:* 2532.10 |
| NoM: many | 0.49 | .25 | 1.96 | .05 | *logLik*: -1242.70 |
| NoM: zero | -0.76 | .25 | -3.07 | .00 | |
| Random effects | | | | | |
| $\sigma^2$ participant (intercept) | 1.57 | | | | |
| $\sigma^2$ item (intercept) | 0.25 | | | | |

*Note*. SE – standard error of an estimate; z – z test; p – p-value; $\sigma^2$ - variance.

# Experiment 2

## Method

### Participants

A novel sample of 78 students from the Department of Psychology, Faculty of Philosophy, University of Novi Sad, all native Serbian speakers, participated fulfilling the course credit. Participants were randomly assigned to either the unrelated condition, or to the related condition (thirty-nine participants in both of the conditions).

### Stimuli and design

The stimuli and design were identical to those in Experiment 1.

### Procedure

The procedure was the same as in Experiment 1, with one difference: participants were performing a free recall task instead of a cued recall. They were given a blank sheet of paper to recall as many as possible word pairs in five minutes.

### Results and discussion

Recall accuracy was low overall, as presented in Table 3. The observed tendency of higher accuracy for related word pairs was confirmed for relatedness both as categorical variable (Table 4a) and a continuous predictor (Table 4b). We did not observe significant effect of number of modalities, nor the interaction of relatedness and the number of modalities.

Table 3

Percent of recall accuracy by NoM and by Relatedness condition in the free recall task

| | | Number of Modalities | | |
|---|---|---|---|---|
| | | Zero | Few | Many |
| Relatedness | Unrelated | 19.6% (16.1; 23.6) | 20.1% (16.5; 24.1) | 20.8% (17.2; 24.8) |
| | Related | 22.4% (18.7; 26.6) | 29.4% (25.3; 33.9) | 30% (25.9; 34.6) |

*Note.* 95% confidence intervals are given in the brackets below the percent.

Table 4a

The estimates of the coefficients of the fixed effects and the fit indices for the first model

| Predictors | Estimate | SE | *z* | *p* | Fit indices |
|---|---|---|---|---|---|
| (Intercept) | -1.53 | .14 | -1.80 | .00 | *AIC:* 2718.8 |
| Relatedness: related | 0.44 | .19 | 2.34 | .02 | *BIC:* 2759.8 |
| | | | | | logLik: -1352.4 |
| Random effects | | | | | |
| $\sigma^2$ participant (intercept) | 0.29 | | | | |
| $\sigma^2$ item (intercept) | 0.18 | | | | |
| $\sigma^2$ item x relatedness (intercept) | 0.06 | | | | |
| $\sigma^2$ relatedness, related (slope) | 0.30 | | | | |
| Correlation (intercept & slope) | -0.69 | | | | |

*Note. SE* – standard error of an estimate; *z* – z test; *p* – p-value; $\sigma^2$ - variance.

**Table 4b**

**The estimates of the coefficients of the fixed effects and the fit indices for the second model**

| Predictors | Estimate | SE | *z* | *p* | Fit indices |
|---|---|---|---|---|---|
| (Intercept) | -1.71 | .18 | -9.50 | .00 | *AIC:* 2716.8 |
| Relatedness continuous | 0.10 | .04 | 2.70 | .01 | *BIC:* 2746.1 |
| | | | | | *logLik*: -1353.4 |
| Random effects | | | | | |
| $\sigma^2$ participant ( intercept) | .29 | | | | |
| $\sigma^2$ item (intercept) | .20 | | | | |
| $\sigma^2$ item: relatedness (slope) | .00 | | | | |

*Note. SE* – standard error of an estimate; *z* – z test; *p* – p-value; $\sigma^2$ - variance.

The results from the free recall experiment are in accordance with the Marschark and Hunt relational-distinctiveness hypothesis (1989). As predicted, the NoM was attenuated in the free recall since relational information during the recall phase was absent. Generally, the recall accuracy was low in both related and unrelated conditions. However, in the related condition, the recall accuracy was enhanced by relational information and not by the additional sensory modality-specific memory codes. The recall was statistically equal for all three groups of words, regardless of the number of sensory modalities.

## General discussion

Our results are partially in accordance with the DTC and the peg hypothesis (Paivio, 1971; Paivio et al., 1994) and partly in line with the relational-distinctiveness hypothesis (Marschark & Hunt, 1989; Marschark & Surian, 1992). The NoM effect was recorded in cued recall task after controlling for concreteness, context availability, emotional valence, and arousal. The highest accuracy was accomplished for the words denoting concepts that could be experienced with many perceptual modalities (three and more), and the lowest recall was recorded for abstract words. In other words, additional memory codes equally contributed to the recall accuracy in both relatedness conditions, i.e., the relational and perceptual information had an additive effect in the cued recall. These results were predicted entirely by the DCT

and conceptual peg hypothesis (Paivio, 1971; Paivio et al., 1994). It should be emphasized that perceptual information was defined as the number of perceptual modalities and not as word concreteness (two groups of concrete cue-target pairs were matched for concreteness). Thus, our results fit the Perceptual symbol systems theory (Barsalou, 2007; 2010). This finding implies that each additional modality-specific information contributed to the recall accuracy. This conclusion is straightforward: two critical groups of concrete words were matched not only for concreteness but also for visual perceptual strength. Thus, the difference in the recall accuracy between concepts experienced with few modalities and those experienced with many modalities can be attributed to richer perceptual experience. In terms of the conceptual peg hypothesis, a modality-specific perceptual experience related to concepts represents an additional memory peg. The results from the first experiment cannot be attributed to the context availability theory (Schwanenflugel et al., 1992) since the abstract and two groups of concrete terms had an equal degree of context availability. And finally, the NoM effect was not a consequence of the emotional experience (Kousta et al., 2009; Kousta et al., 2011) because the words were matched by emotional valence, and the arousal was statistically controlled in the analysis.

However, the results from the free recall were not in line with the DCT and peg hypothesis assumptions since the NoM did not influence the recall accuracy in either relatedness conditions. The relatedness between word pairs was the only significant predictor of the recall accuracy, where the participants were more accurate in a related condition. Thus, the results from free recall tasks were in accordance with the relational-distinctiveness hypothesis. According to this hypothesis, recall is not enhanced by a perceptual richness of cue-target pairs but only by their relatedness in the free recall. Again, none of the alternative theoretical explanations was eligible since the same lists of words were used in this task as in the cued recall.

Finally, this paper demonstrates that the perceptual richness of the words plays a significant role in the recall and the PAL paradigm. However, this benefit of the perceptual information is conditioned by a recall task. Namely, cued recall is enhanced by a larger number of sensory modalities through which a concept could

be experienced, regardless of the cue-target relatedness. On the other hand, in a free recall task, the benefit of the perceptual information is diminished.

It should be pointed out that the participants did not receive instruction to remember the words in any of the experiments. According to some authors (Barsalou et al., 2003; Pecher et al., 2009), it is essential to demonstrate that perceptual information spontaneously stimulates cognitive processes since such results would indicate that sensory-motor simulations are part of the conceptual knowledge. Moreover, it is essential to distinguish the imagery processes from sensory-motor simulations related to conceptual knowledge. The imagery is considered intentional, and it is related to the ability of individuals to create mental images. On the other hand, conceptual knowledge and retrieval are mostly not under conscious control (Pecher et al., 2009). Therefore, if sensory-motor simulations are part of concept representations, they should be retrieved unconsciously. Since, in our experiments, the participants were not instructed to use imagery as a mnemonic technique, nor were they informed about the later recall task, we could say that the effect of perceptual diversity was a consequence of the modality-specific simulations and not the imagery processes. This conclusion is promoted by the fact that both groups of concrete words were matched for visual strength (the extent to which a concept is experienced visually), the variable that extrapolated imageability. Both experiments could be administered as explicit memory tasks to explore whether such experimental manipulation would advance the influence of the perceptual richness in free recall.

This study has several weak points, which could be advanced in future studies. Firstly, by the recommendation of Brysbaert (2020) and Brysbaert and Stevens (2018) concerning the statistical power in mixed linear models, the number of participants should be enlarged, especially if the interaction is tested (which is the case in this study). Secondly, the low recall rate in free recall suggests that recall of word pairs was demanding for the participants. Thus, in future research, one should reconsider changing the instruction of the free recall task. For instance, participants should be encouraged to recall any words they could come up with (cue or target), not just word pairs. Finally, in an unrelated condition, we sampled different cue words in this study. However, using the same but reorganized cues in

unrelated conditions would be more informative. It would provide more precise insight into the relevance of contextual information for Paired-Associate Learning.

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*Conflict of interests*

The authors declare no conflict of interest or competing interests.

*Ethical approval*

This study was performed with the principles of the Declaration of Helsinki. The approval was granted by the Ethics Committee of the Department of psychology, Faculty of Philosophy, University of Novi Sad, Republic of Serbia, License No. 20151025144144_juke. All participants in this study signed the informed consent to participate in the study and consent for data publication.

*Open data access*

The data of this study, together with the R statistical codes, are placed on the author's OSF page: OSF page link.

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# Apendix A

## List of word pairs in related and unrelated situations, with value of relatedness for each pair

| CUE word | TARGET word | NoM | Relatedness category | Relatedness |
|---|---|---|---|---|
| Teorija | nauka | ZERO | RELATED | 6.6 |
| memorija | znanje | ZERO | RELATED | 6.3 |
| Duša | smrt | ZERO | RELATED | 4.65 |
| Sreća | bogatstvo | ZERO | RELATED | 4.15 |
| ljubomora | zavist | ZERO | RELATED | 6.15 |
| Vreme | istorija | ZERO | RELATED | 6.1 |
| sloboda | misao | ZERO | RELATED | 5.7 |
| San | mašta | ZERO | RELATED | 5.85 |
| Mit | religija | ZERO | RELATED | 6.4 |
| dogovor | politika | ZERO | RELATED | 5.7 |
| osećanje | potreba | ZERO | RELATED | 5.2 |
| Plakat | bilbord | FEW | RELATED | 6.5 |
| Odžak | krov | FEW | RELATED | 6.8 |
| Igla | ubod | FEW | RELATED | 6.55 |
| Sijalica | bandera | FEW | RELATED | 6.2 |
| sveska | olovka | FEW | RELATED | 6.25 |
| Leptir | cvrčak | FEW | RELATED | 5.75 |
| Suknja | pantalone | FEW | RELATED | 6.5 |
| fotografija | slika | FEW | RELATED | 6.7 |
| Nož | kutlača | FEW | RELATED | 5.85 |
| Ekran | monitor | FEW | RELATED | 7 |
| Cigla | kamen | FEW | RELATED | 5.75 |
| Patika | čarapa | MANY | RELATED | 6.2 |
| Nokat | aceton | MANY | RELATED | 5.8 |

| | | | | |
|---|---|---|---|---|
| Vosak | sveća | MANY | RELATED | 6.9 |
| deterdžent | sapun | MANY | RELATED | 6.25 |
| autobus | automobil | MANY | RELATED | 6.55 |
| pepeljara | cigareta | MANY | RELATED | 6.9 |
| bosiljak | cimet | MANY | RELATED | 5.3 |
| Žaba | kiša | MANY | RELATED | 5.05 |
| Lepak | smola | MANY | RELATED | 5.85 |
| Voda | vatra | MANY | RELATED | 5.55 |
| Cvet | pčela | MANY | RELATED | 6.45 |
| jednakost | nauka | ZERO | UNRELATED | 3.1 |
| Stil | znanje | ZERO | UNRELATED | 2.9 |
| Istina | smrt | ZERO | UNRELATED | 3.85 |
| bliskost | bogatstvo | ZERO | UNRELATED | 2.45 |
| Dosada | zavist | ZERO | UNRELATED | 2.75 |
| Požuda | istorija | ZERO | UNRELATED | 1.9 |
| Kriza | misao | ZERO | UNRELATED | 2.7 |
| profesija | mašta | ZERO | UNRELATED | 4.25 |
| Humor | religija | ZERO | UNRELATED | 2.95 |
| sudbina | politika | ZERO | UNRELATED | 2.8 |
| Dobrota | potreba | ZERO | UNRELATED | 2.85 |
| Lava | bilbord | FEW | UNRELATED | 1.1 |
| radijator | krov | FEW | UNRELATED | 2.65 |
| reflektor | ubod | FEW | UNRELATED | 1.55 |
| Žbun | bandera | FEW | UNRELATED | 2.6 |
| vetrenjača | olovka | FEW | UNRELATED | 1.5 |
| Varnica | cvrčak | FEW | UNRELATED | 1.6 |
| dalekovod | pantalone | FEW | UNRELATED | 1.25 |
| putokaz | slika | FEW | UNRELATED | 4.05 |
| Planina | kutlača | FEW | UNRELATED | 1.1 |
| Ptica | monitor | FEW | UNRELATED | 1.3 |

| | | | | |
|---|---|---|---|---|
| Šal | kamen | FEW | UNRELATED | 1.05 |
| Nafta | čarapa | MANY | UNRELATED | 1.35 |
| Seno | aceton | MANY | UNRELATED | 1.3 |
| Prašina | sveća | MANY | UNRELATED | 2.1 |
| paprikaš | sapun | MANY | UNRELATED | 1.25 |
| bajadera | automobil | MANY | UNRELATED | 1.3 |
| Prase | cigareta | MANY | UNRELATED | 1.1 |
| Testera | cimet | MANY | UNRELATED | 1.4 |
| Slag | kiša | MANY | UNRELATED | 1.45 |
| Pljesak | smola | MANY | UNRELATED | 1.25 |
| Slon | vatra | MANY | UNRELATED | 1.55 |
| tastatura | pčela | MANY | UNRELATED | 1.15 |

*Notes.* Cue – cue word, Target – target word; NoM – number of modalities category; Relatedness category – related and unrelated; Relatedness – mean rating of relatedness for a given word pair

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Research Article

# Relationship between the Broader Autism Phenotype and empathy among students

Bojan Z. Dučić ✉[1], Svetlana S. Kaljača[1] and Irena B. Stojković[1]

*1 Faculty of special education and rehabilitation, University of Belgrade, Serbia*

ABSTRACT

Previous research has shown that persons with a higher level of the broad autism phenotype (BAP) experience deficits in empathy. The aim of the present study is to investigate a multivariate relationship between the BAP and different aspects of empathy. In a sample of 293 university students, we explored the relationship between the BAP and the following aspects of empathy: fantasy, empathic concern, perspective taking, and personal distress. The BAP level was measured using The Broad Autism Phenotype Questionnaire, and the Interpersonal Reactivity Index was used for multidimensional assessment of empathy disposition. Canonical correlation analysis yielded two functions (Function 1 – $R_c^2$ = 18.27%, Function 2 – $R_c^2$ = 11.02%). In Function 1, Interpersonal Reactivity Index dimensions Personal Distress ($r_s$ = -.93) and Perspective Taking ($r_s$ = .36) are associated significantly with two domains of the BAP (Rigid and Pragmatic Language Deficits). In Function 2, Interpersonal Reactivity Index dimensions Empathic Concern ($r_s$ = -.78), Fantasy ($r_s$ = -.47) and Perspective Taking ($r_s$ = -.53) are related to the Aloof domain of the BAP. The results imply that the relationship between BAP and empathy differs for different aspects of these two constructs. The more detailed understanding of the relationship between BAP and empathy obtained through the multivariate approach provides a basis from which to create programs for the more efficient promotion of empathy skills.

*Keywords:* broader autism phenotype, empathy, empathic concern, perspective taking, personal distress

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✉ Corresponding author email: bojanducic@fasper.bg.ac.rs

# Introduction

## The broader autism phenotype

The concept of autistic continuum implies that various pervasive disorders, although significantly different in terms of symptom severity, belong to the same continuum. Further, by applying the quantitative approach, a normal distribution of autistic traits in general population has been established (Bolte et al., 2011). The concept of the autistic continuum provides a considerably broader framework for the investigation of autism spectrum disorder (ASD) (Berney, 2000; Constantino & Todd, 2003; Wheelwright et al., 2010), which includes varying levels of symptoms reflected in deficits in social communication and repetitiveness and rigidity of behavior and interests (American Psychological Association, 2013, 2017). The broader autism phenotype (BAP) is a set of subclinical personality traits that manifest in subtle impairments in the social relations of a person, based on his/her feelings of discomfort and diminished wish for close friendships (Bishop et al., 2004; De Groot & Strien, 2017; Murphy et al., 2000; Piven et al., 1997), milder deficits in social communication (Losh & Piven, 2007), and behavioral rigidity tendencies (Bolton et al., 1998).

## The broader autism phenotype and empathy

Persons with higher levels of BAP characteristics display lower empathy, which, although not at a clinical level, negatively influences satisfaction with, and the duration of, their friendships (Jamil et al., 2017). The BAP personality traits are more common among relatives of persons with autism (Bolton et al., 1994; Piven et al., 1997). Although the manifestations of the BAP are non-clinical in their character, recent studies suggest that children (siblings of children with ASD) who are at a higher risk of developing BAP, during the first two years of life, exhibit some behavioral patterns in the areas of social, language, and cognitive development more often than children from general population, which may indicate early signs of future subclinical symptoms of ASD (Kellerman et al., 2019).

These early signs as decreased interest in reciprocal social interactions and decreased flexibility are also found in the general population (Constantino & Todd, 2003), independently of whether or not a person has a relative with autism (Sasson et al., 2013; Wainer et al., 2011). Two studies investigated the relationship between particular domains of empathy and BAP and yielded inconsistent results. Grove et al. (2014) differentiated between the cognitive, emotional, and social skills dimensions of empathy, as measured by the Empathy Quotient questionnaire (Baron-Cohen & Wheelwright, 2004), and found that parents of children with autism scored higher than persons with autism, but lower than general population controls, on all these dimensions. In a study conducted by Tsang et al. (2016) on a sample comprising young school-aged children with ASD, siblings of children with ASD, and children without a sibling with ASD, it was found that BAP is related to lower cognitive dimension but is unrelated to the emotional dimension of empathy, as assessed by a parental report on the Griffith Empathy Measure (Dadds et al., 2008).

The studies suggest that persons from typical population who exhibit higher BAP features display lower levels of empathy (Jamil et al., 2017; Lepage et al., 2009; Spreng et al., 2009; Wheelwright et al., 2006). It is presumed that these persons, due to impairments in recognizing and understanding others' feelings, avoid initiating and maintaining relationships that require empathy, such as romantic relations (Lamport & Turner,2014) and friendships (Jamil et al., 2017).

Problems with social functioning and a tendency toward social isolation ensue from an emotional state of discomfort, which persons with BAP experience in interpersonal relations. Impairments in orienting toward and reacting to direct eye gaze, as well as diminished sensitivity to other persons' facial emotional expressions and the ability to understand facial expressions and the mental states of others (Ingersoll & Wainer, 2014), are related to socio-cognitive difficulties and feelings of discomfort experienced by persons with BAP in interpersonal relations. A similar hypothesis is suggested by authors who point to impaired recognition of other persons' emotions in siblings of children

with autism who themselves have a higher level of nonclinical autistic symptoms (Eyuboglu et al., 2017).

## Empathy

Empathy is a basic aspect of social-cognitive abilities and is related to prosocial behavior, aggression, and various indices of interpersonal functioning, such as the quality of peer relationships (Knafo et al., 2008; Lockwood, 2016; McMahon et al., 2006; Portt et al., 2020; Tampke et al., 2020). Studies on the relationship between BAP and empathy differ in terms of the assumptions regarding the dimensionality of empathy. In studies by Lamport and Turner (2014), and Jamil and colleagues (2017), empathy was regarded as a unidimensional construct, and negative correlations between empathy and BAP were found. Sucksmith et al. (2013) also investigated empathy as a unidimensional construct, and found that fathers, but not mothers, of children with autism spectrum conditions exhibited lower empathy compared with controls.

Davis (1983) has proposed an elaborate model of empathy that includes diverse aspects of cognitive and emotional empathy. According to the model, the cognitive domain of empathy consists of two components: Perspective Taking, which manifests as a prosocial tendency of a person to spontaneously understand the psychological perspective of others, and Fantasy, which refers to the ability to identify with the feelings and actions of fictional characters (e.g., in books, movies etc.). The emotional domain of empathy also comprises two components: Empathic Concern, which refers to the tendency to respond empathically (with concern and sympathy) toward a person in an unfortunate life situation, and Personal Distress, which reflects a set of negative feelings (discomfort, worry, anxiety) experienced by a person when he/she perceives the other person as being in an unpleasant, stressful situation. Personal Distress may inhibit the empathic response despite adequately recognized emotional states of others, presumably due to activated mechanisms of egoistic motivation (Díaz-Galván et al., 2015; Seidel, et al., 2013).

The Personal Distress scale taps the level of stress, i.e., the intense feelings of unease and discomfort experienced in response to the unpleasant emotions evoked by recognition of other person's suffering (Batson et al., 1987; Davis, 1980). According to Liccione et al. (2009), Personal Distress refers to deficits in the ability to differentiate one's own standpoint and emotions from the emotional context and emotions of other persons. A higher level of the Personal Distress, especially in males, may be associated with difficulties in developing and maintaining close interpersonal relationships (Hartley et al., 2019). Persons who experience a high level of Personal Distress tend not to help others in need; rather, they opt for strategies of avoidance or distancing in order to alleviate their own distress (Grynberg, & López-Pérez, 2018). According to Lazarus (1993), the way in which a person copes with a stressful situation is determined by his/her appraisal of whether or not the stressful situation can be changed. If a person believes he/she can change a stressful situation, he/she will decide to undertake a certain action with the aim of helping another person, i.e., to solve a problem. However, if he/she estimates that his/her engagement in helping other will not be fruitful, he/she will choose the strategy of elimination or reduction of his/her negative emotional experience caused by the stressor. This strategy seems to be pronounced in persons with higher levels of Personal Distress. Although the empathy components are interrelated, there is empirical evidence to suggest they also may be expressed as mutually independent performances (Beven et al., 2004; Kim & Han, 2018).

The aim of this study is to investigate the relationship between the BAP and the following aspects of empathy, in accordance with Davis' (1983) model: Fantasy, Empathic Concern, Perspective Taking, and Personal Distress, in general population. According to our knowledge, this study is the first to use a multivariate approach to investigate the relationship between the BAP and empathy. This allows to examine the patterns of associations between various domains of these constructs when controlled for intercorrelations between the domains of each construct. We assume that there is a high positive correlation between aloofness and pragmatic language deficits which represent so called

social components of the BAP and affective (empathic concern and personal distress) and cognitive (perspective taking and fantasy) empathy dimensions. Further, we assume that there is a positive correlation of a lower magnitude between rigidity and empathy dimensions.

Insights into the relationship between aloofness, pragmatic language deficits and behavior rigidity and dimensions of empathy will elucidate the difficulties in social functioning of persons with pronounced BAP characteristics. This may provide a basis for designing programmes of support focused on specific domains of deficits of these persons.

## Method

### Participants and Procedure

Questionnaires were filled out by 293 students at the University of Belgrade (49% male), whose ages ranged from 19 to 24 years ($M$ = 21.67, $SD$ = 1.29). Participation in the study was voluntary. Before completion of questionnaires, participants were informed that the data of the study will be anonymous and used for scientific purposes. Instructions about questionnaires completion were provided in a written form and in accordance with the instructions created by the authors of the questionnaires. Data were collected at faculty premises before or after lectures. Questionnaires were distributed to 350 students, of which 330 completed and returned questionnaires. Students who provided answers to all questionnaires' items were included in the study sample ($N$ = 293). Participants attended the following faculties at the time of data collection: Faculty of Special Education and Rehabilitation ($N$ = 73), Faculty of Transport and Traffic Engineering ($N$ = 65), Faculty of Organizational Sciences ($N$ = 51), Faculty of Political Sciences ($N$ = 38), Faculty of Medicine ($N$ = 29), Faculty of Physics ($N$ = 23) and Faculty of Mathematics ($N$ = 14). The study was approved by the Research Ethics Board of the Faculty of Special Education and Rehabilitation, University of Belgrade.

## Instruments

*The Interpersonal Reactivity Index (Davis, 1980)*

The Interpersonal Reactivity Index (Davis, 1980), is a 28-item questionnaire which provides a multidimensional assessment of empathy disposition. The questionnaire consists of four subscales, each comprising seven items. Two subscales assess the cognitive domain (Perspective Taking and Fantasy), and two subscales assess the emotional domain of empathy (Empathic Concern and Personal Distress). The participants' responses are given on a 5-point Likert scale ranging from "Does not describe me well" to "Describes me very well". The author of the scale reports Cronbach's alpha coefficients of internal consistency ranging from .68 to .79 (Davis, 1980). Factor analysis of the Interpersonal Reactivity Index was performed in order to establish whether the instrument is suitable for the use in the population of students in Serbia. Bartlett's test of sphericity was statistically significant ($p < .001$) and Kaiser-Meyer-Oklin measure was above 0.60. Maximum likelihood estimation method with orthogonal Varimax rotation was applied for the extraction of factors. The number of factors to be extracted was set to four. The obtained four-factor solution explains 34.0% of the variance. The loadings of items on the factors correspond to the structure of the scale, save that some items had low loadings on factors corresponding to their position in the Interpersonal Reactivity Index scale (items No. 15 – .106, No. 12 – .170, No. 4 – .217, and No. 18 – .235).

*The Broad Autism Phenotype Questionnaire (Hurley et al., 2007)*

The Broad Autism Phenotype Questionnaire (Hurley et al., 2007) consists of 36 items distributed across three subscales: Social aloofness (refers to withdrawal and being aloof in social relations), Pragmatic Language Deficits (problems in social aspects of language), and Rigid (unwillingness to accept changes, and difficulties adapting to changes). Each subscale contains 12 items. The participants' responses to the Broad Autism Phenotype Questionnaire are given on a six-point Likert type scale from 1 (*never*) to 6 (*always*). Hurley et al. (2007) report high to satisfactory internal consistency of the questionnaire and

its subscales, as measured by Cronbach's alpha coefficients: Aloof (α = .94), Pragmatic Language Deficits (α = .85), Rigid (α = .91), and for the Broad Autism Phenotype Questionnaire total score (α = .95). After establishing that the Broad Autism Phenotype Questionnaire item pool is appropriate for factor analysis (KMO > 0.60 and Bartlett's test of sphericity statistically significant, p< .001), a three-component predefined solution was obtained using Maximum Likelihood estimation. In accordance with correlations between the components, a nonorthogonal Direct Oblimin rotation was applied. Loadings of items on particular factors were in accordance with the theoretical model of the BAP and with the structure of the Broad Autism Phenotype Questionnaire.

Factor scores of The Interpersonal Reactivity Index and The Broad Autism Phenotype Questionnaire obtained using regression method were used in the subsequent analyses.

## Results

Descriptive statistics of the study variables are presented in Table 1. The values of skewness and kurtosis suggest that the scores on all dimensions are normally distributed (Evans, 2007, as cited in Razali et al., 2012).

**Table 1**
**Values of skewness and kurtosis for the study variables**

| | | *Skewness* | *Kurtosis* |
|---|---|---|---|
| The Broad Autism Phenotype Questionnaire | Aloof | .355 | -.206 |
| | Rigid | -.253 | .180 |
| | Pragmatic Language Deficits | .007 | -.128 |
| | Total | -.011 | -.123 |
| Interpersonal Reactivity Index | Fantasy Scale | .509 | -.204 |
| | Empathic Concern | -.047 | .258 |
| | Perspective Taking | -.033 | .151 |
| | Personal Distress | .555 | .508 |

## Correlations between the Broad Autism Phenotype Questionnaire and the Interpersonal Reactivity Index

Bivariate correlations between the Interpersonal Reactivity Index and the Broad Autism Phenotype Questionnaire dimensions are presented in Table 2. The correlations are mostly statistically significant and low (Pearson *r* from .13 to .34). Personal distress is statistically significantly positively related to Rigid (*r* = .34), and Pragmatic Language Deficits (*r* = .26), whereas other empathy dimensions are negatively related to the dimensions of the Broad Autism Phenotype Questionnaire.

**Table 2**

**Bivariate correlations between the Interpersonal Reactivity Index and the Broad Autism Phenotype Questionnaire (Pearson r)**

| | | Fantasy Scale | Empathic Concern | Perspective Taking | Personal Distress |
|---|---|---|---|---|---|
| Aloof | *r* | -.13* | -.28** | -.20* | .03 |
| | *p* | .026 | .000 | .001 | .636 |
| Rigid | *r* | -.02 | -.05 | -.21** | .34** |
| | *p* | .749 | .446 | .000 | .000 |
| Pragmatic Language Deficits | *r* | .04 | -.18* | -.05 | .26** |
| | *p* | .467 | .002 | .375 | .000 |

*Notes*. * p < .05. ** p < .001.

## Canonical correlation between the Broad Autism Phenotype Questionnaire and the Interpersonal Reactivity Index

We performed canonical correlation as a multivariate procedure to investigate the overall relationship between domains of BAP and empathy components (Table 3). The goal of canonical correlation is to examine the relationships between two sets of variables (Tabachnick & Fidell, 2014). As Harris (2001) points out, canonical correlation is a perfectly symmetric technique in a sense that the sets of predictor variables and of outcome variables are statistically equally treated. However, a common practice is to denote one set

of variables as predictor variables and another as criterion variables (e.g., Sherry & Henson, 2005). The three dimensions of The Broad Autism Phenotype Questionnaire were entered as the criteria variables, and the four dimensions of the Interpersonal Reactivity Index were entered as predictors.

Table 3

**Canonical Solution for relationship between the Broad Autism Phenotype and Empathy for Functions 1 and 2**

| Variable | Function 1 | | | Function 2 | | | |
|---|---|---|---|---|---|---|---|
| | *Coef* | $r_s$ | $r_s^2$(%) | *Coef* | $r_s$ | $r_s^2$(%) | $h^2$(%) |
| Aloof | .21 | -.28 | 8.95 | 1.13 | .94 | 90.19 | 99.14 |
| Rigid | -.81 | -.90 | 80.66 | -.14 | .12 | 1.56 | 82.22 |
| Pragmatic Language Deficits | -.51 | -.66 | 43.54 | -.29 | .20 | 4.05 | 47.59 |
| $R_c^2$(%) | | | 18.27 | | | 11.02 | |
| Fantasy Scale | -.03 | -.08 | .65 | -.38 | -.47 | 22.34 | 22.99 |
| Empathic Concern | .13 | .16 | 2.64 | -.68 | -.78 | 60.87 | 63.51 |
| Perspective Taking | .32 | .36 | 12.97 | -.41 | -.53 | 28.15 | 41.12 |
| Personal Distress | -.92 | -.93 | 86.52 | -.25 | -.28 | 7.78 | 94.30 |

*Notes*. $R_c^2$ = squared canonical correlation coefficient; *Coef* = standardized canonical function coefficient; $r_s$ = structure coefficient; $r_s^2$ = squared structure coefficient; $h^2$ = communality coefficient.

The analysis yielded three functions with squared canonical correlations ($R_c^2$) of .18, .11, and .04, successively. The full model across the three functions was statistically significant, Wilk's $\lambda = .70$, $F(12, 756.98) = 9.15$, $p < .001$. The dimension reduction analysis revealed that Functions 2 to 3 and 3 to 3 were also statistically significant ($F(6, 574) = 7.79$, $p < .001$, and $F(2, 288) = 5.86$, $p < .05$, respectively). As Functions 1 and 2 had also substantial canonical correlations (.43 and .33, respectively), while the canonical correlation of Function 3 was low (.20), Functions 1 and 2 were considered relevant. Table 3 presents canonical solution for Functions 1 and 2.

As the observed variables within the two sets are correlated, we rely on structure coefficients in determining what variables are contributing to the relationship between the variables sets across the two functions (Sherry & Hanson, 2005). Looking at the Function 1 structure coefficients, one sees that Rigid and Pragmatic Language Deficits are relevant criteria variables. Regarding the predictor variable set in Function 1, Personal Distress was the primary contributor to the predictor synthetic variable, with a secondary contribution by Perspective Taking. Personal Distress relates positively and Perspective Taking relates negatively to BAP domains.

For Function 2, the structure coefficients in Table 3 suggest that the only criterion variable of relevance was Aloof. With regard to empathy aspects, Empathic Concern was the dominant predictor, with Perspective Taking and Fantasy making a secondary contribution to the predictor synthetic variable, while Personal Distress was not relevant. Aloof is negatively related to the empathy aspects. In sum, the results of canonical correlation suggest that empathy and BAP are related along two functions. The first canonical function suggests that Personal Distress and, to a lesser degree, Perspective Taking predict Rigid and Pragmatic Language Deficits. The second canonical function suggests that Aloof may be understood as resulting from deficits in Empathic Concern, Perspective Taking and Fantasy, with Empathic Concern playing the most important role.

## Discussion

According to our knowledge, previous studies have rarely investigated the relationship between various components of BAP and the multidimensional construct of empathy defined by Davis (1983) using a multivariate approach. Canonical correlation analysis applied in the present study yielded two functions of the relationship between empathy and BAP. Function 1 demonstrates that rigid behavior tendencies and pragmatic language deficits are related to higher stress, insecurity and/or fear in situations requiring creation of close social relationships and helping other persons (Personal Distress), as well as to

difficulties in recognizing the intentions and emotions of other persons (Perspective Taking). The BAP may be associated with difficulties in creating and maintaining emotionally close relationships, as well as with reduced flexibility of behavior, which is important for adequate social relationships (Hartley, et al., 2019). It may be assumed that persons with higher levels of BAP characteristics, in situations in which other persons need help, tend to focus more on their own emotional experience because they perceive themselves as incompetent to provide help due to their social-skills deficits. In order to maintain a positive self-concept and to justify their emotional and physical distancing from others in need, persons with a high level of Personal Distress tend to see other persons as responsible for their own misfortune (Grynberg, & López-Pérez, 2018).

In a study in which siblings of children with ASD were faced with an examiner pretending to be hurt, it was found that their level of Personal Distress was negatively related to prosocial behavior, communication, and social skills. Interestingly, children with ASD displayed a lower level of Personal Distress compared to their siblings without ASD. However, these two groups did not differ in the level of prosocial behavior. The authors of the study assume that children with ASD may have learned to act prosocial even when these reactions are not motivated by emotional empathic responses (McDonald et al., 2017). A lower level of Personal Distress in adults with ASD, compared with typical adults, was also found using self-reports on emotional responding to images of persons in distressing situations. In empathic reactions to images of persons in neutral situations, no significant differences between these two groups were found (Holt et al., 2018). Based on the results obtained in our study, it can be concluded that Personal Distress is the empathy component, which is associated with the greatest proportion of the variance of Rigid and Pragmatic Language Deficits BAP domains.

Perspective Taking is another empathy component of the Davis' model which is related to the BAP domains Rigid and Pragmatic Language Deficits. The level of Personal Distress is generally not related to Perspective Taking which,

according to Davis (1983), presents a cognitive component of empathy, except that intense emotional arousal may compromise the ability to infer others' mental states (Kanske et al., 2016). The results show that besides Personal Distress, Perspective Taking also explains the significant proportions of variance of Rigid and Pragmatic Language Deficits, albeit to a lesser extent than Personal Distress. As the ability to comprehend another person's thoughts, emotional states, and intentions, Perspective Taking is a basis for understanding complex social relations. It was shown that the level of BAP relates negatively to the performance on theory of mind tasks (Stewart et al., 2020). Among parents of children with ASD, it was also found that they experience problems in understanding another person's social cognitions, intentions, and emotions (Gokcen et al., 2009), and have difficulties creating social relationships (Mugno et al., 2007). Among university students of psychology, Rigid, as measured by The Broad Autism Phenotype Questionnaire, was related to the Perspective Taking scale of the Interpersonal Reactivity Index (Vachon & Lynam, 2016). A higher level of Rigid was related to a better performance in tasks involving understanding complex social interactions involving joking, sarcasm, and white lies, i.e., to a better understanding of messages of a person whose non-verbal signals were incongruent with the verbal content (Jakobson et al., 2018). Despite deficits in the domain of social skills being considered core characteristics of persons who belong to the BAP (Kadak et al., 2014), the Pragmatic Language Deficits and Aloof which pertain to social aspects of the BAP, were unrelated to performance on this task. The authors of the study assume that persons who have more rigid behavioral tendencies tend to focus on details, i.e., on non-verbal signals (Jakobson et al., 2018).

There is empirical evidence that impaired ability to identify and describe one's own feelings is related to difficulties in recognizing emotional experiences of other persons, i.e., to the scores on the Perspective Taking subscale of the Interpersonal Reactivity Index (Di Tella, 2020). Further, difficulties of persons with BAP in recognizing emotions of other persons may be explained by their

impaired ability to recognize emotional facial expressions, as evidenced in previous research (Kadak, et al., 2014).

Function 2 yielded Empathic Concern as a dominant variable, explaining, along with Fantasy and Perspective Taking, 11.02% of the shared variance of Aloof. The negative correlation between Aloof and these empathy domains is in accordance with the results obtained by Vachon and Lynam (2016) in a sample of university students. It was found in a nonclinical sample that Aloof has a positive correlation with social anxiety, characterized by the avoidance of social relations. Moreover, Aloof is related to lower satisfaction with romantic relationships among students (Beffel et al., 2021). When analyzing the results of the relationship between Empathic Concern and BAP, differences between empathy, as an emotional reaction, and Empathic Concern, which pertains to cognition and behavioral responses, should be considered. Empathy is an emotional experience, which is identical to the emotion of the other, or congruent with it (Batson & Coke, 1981). The Empathic Concern dimension of the Interpersonal Reactivity Index refers to compassion and concern for the welfare of others, and it is the basis of prosocial behavior. Although empathy may be related to Empathic Concern, it is not a *sine qua non* for caring for the welfare of others and for moral behavior. In certain circumstances, empathy may be related to morally wrong decisions, and to breaking social rules (Bloom, 2017).

Lower scores on the Fantasy dimension of the Interpersonal Reactivity Index are associated with deficits in the area of social-cognitive abilities. The finding suggests that persons who have deficits in imagination and motivation to interact with other people are less able to recognize and understand non-verbal signals displayed during communication and, consequently, incorrectly interpret the intentions of persons with whom they communicate. Although the Fantasy mostly assesses the capacity to empathize with fictional characters (film, literature), the authors of the instrument suggest that, besides cognitive empathy, the Fantasy covers the capacity for imagination and emotional self-control in a broader sense, in various real-life social contexts (Jakobson et al.,

2018). Considering the negative relationship between Fantasy and Aloof, we may presume that reduced capacity for identification with fictional characters is related to the impaired ability to interpret socially relevant information, which, subsequently, leads to lower motivation for social interactions and to social withdrawal. This assumption is in accordance with the results of a previous study, which revealed that among Interpersonal Reactivity Index dimensions, only Fantasy and Rigid were related to the performance of university students on a task requiring understanding of a person's intentions when his/her verbal and non-verbal expressions were inconsistent (Jakobson et al., 2018). However, it is important to note that the concept of the Fantasy has been criticized. Cliffordson (2001, 2002a, 2002b) suggests that Fantasy should be regarded as belonging neither to the cognitive nor to the affective domain of empathy, because it represents a combination of both domains. Some authors regard Fantasy as encompassing a concept much broader than the cognitive and affective domains of empathy (Baron-Cohen & Wheelwright, 2004). The items of the Fantasy, besides identification with fictional characters, refer also to imagining one's own future (Davis, 1980). De Corte et al. (2007) suggest that items of Fantasy cover various dimensions, and that regarding Fantasy as a unitary factor is not justified.

The relationship between Perspective Taking and Aloof obtained in this study is consistent with previous research. It is presumed that persons with higher BAP scores, due to impairments in recognizing and understanding of others' feelings, avoid initiating and maintaining relationships that require empathy, such as romantic relations (Lamport & Turner,2014) and friendships (Jamil et al., 2017). Personal Distress wasn't relevant for Function 2, which refers to the relationship between Aloof and empathy. Function 2 suggests that the tendency to avoid emotionally close social relationships is related to a lower level of proactive social behavior and to difficulties comprehending other people's feelings.

## Limitations

It is important to note some limitations of this study. The first limitation refers to the method of measuring empathy. We employed only a self-report measure of dispositional empathy. Some authors of earlier studies point out that self-report empathy measures may, to a certain extent, lack validity and objectivity (Gleason et al., 2009; Jamil 2016; Lamport & Turner, 2014). It would be beneficial to use observational measures of empathy in naturalistic or controlled laboratory settings in future research, in addition to dispositional empathy measures, in order to capture actual empathic behavior in concrete situations. As the study included the convenience sample of university students, generalization of the results is limited. In future studies, general community samples should be included. In accordance with the aim of the study, we employed the concept of a continuum of the BAP, so that the differences between persons who fulfill criteria for the BAP and persons whose scores are below cut-off scores were not analyzed.

## Conclusions

The results reveal an overall relationship between BAP and empathy aspects but point that the relationship between BAP and empathy differs for empathy aspects. Personal Distress was the primary contributor to the synthetic variable which, together with Perspective Taking, explains 18.27% of the variance of the three BAP domains. It may be assumed that the higher level of Personal Distress among persons with BAP is a consequence of their difficulties in acquiring and applying emotion-regulation strategies and social-skills in general. The results further suggest that lower Perspective Taking, Empathic Concern and Fantasy may lead to tendencies of aloofness as a characteristic of BAP, while rigid behavior and pragmatic language skills are unaffected by these components of empathy among university students. The relatively low shared variance between BAP and empathy domains leaves space for the influence of other variables not included in this research.

## Implications

The identification of subtle difficulties in social functioning of persons from university student population, who exhibit higher BAP features, provides information on specific ways in which these persons experience the world, and provides directions for programs aimed at supporting these persons in coping with certain challenges. The results of the present study suggest that supporting persons with higher BAP features to overcome tendencies of personal distress may contribute to the improvement in all the domains in which the BAP is manifested: rigid behavior, aloofness, and difficulties in language pragmatics. On the other hand, when targeting specifically the aloofness of the persons with the higher BAP features, it is recommendable to promote cognitive and empathic perspective taking both in real life situations and in situations from the literature and other arts.

When counseling students who have difficulties in creation and maintenance of social relations, it is important to recognize persons with higher levels of the BAP and deficits in empathy and support them to develop skills to cope with stressful situations in social interactions. While respecting individual differences, it would be beneficial to teach them strategies of forming social relations and creating the level of social closeness in accordance with their needs.

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*Conflict of interest*

We have no known conflicts of interest to disclose.

*Data availability statement*

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Research Article

# Should I be bothered or not? Development of the Environmental Attitudes Scale (EAS)

Darko Hinić[1]✉

[1] *Department of Psychology, Faculty of Science & Faculty of Philology and Arts, University of Kragujevac, Serbia*

ABSTRACT

The aim of this paper was to develop a reliable scale evaluating values, beliefs, and attitudes towards the environment, and to test its basic psychometric properties relative to its employment in Serbia. The final sample included 1020 participants (46.9% male and 53.1% female), aged from 18 to 86 ($M$ = 39.29, $SD$ = 15.77). All the participants completed the demographic questionnaire (age, sex, region, education, work, and economic status), and the EAS scale. This final scale included 34 items grouped into seven dimensions explaining 51.84% of the common variance: Love of nature 18.72%, Population growth policies 10.24%, Pro-environmental behaviours 8.94%, Preservation measures 4.28%, Environmental concern 3.87%, Instrumentalism 3.12%, and Environmental activism with 2.27% of the variance explained. EAS showed internal consistency ranging from .74 to .82 for the factor scales, and test-retest $r_{tt}$ = .80. Results confirmed three second-order factors (84.17% of variance explained): Pro-environmental factor (explaining 46.11% of the variance), contained the Love of nature, Environment concern, Pro-environmental behaviour, Environmental activism, and Preservation measures factors, the second contained only Population growth policies factor, explaining 25.19% of the variance, while the third contained the Instrumentalism factor, explaining 12.87% of the variance.

*Keywords:* environmental attitudes, environmental behaviour, psychometric properties

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✉ Corresponding author email: dhinic@kg.ac.rs

## Introduction

The environment is a dynamic system of natural and human-made domains being in a certain balance (Marković, 2005), to which individuals are connected by their basic needs. Human interactions with the physical environment components, such as weather and climatic conditions, exert a permanent effect on the human species, and the elements of the built environment, like living spaces and workspaces, neighbourhoods, districts, cities, shape our living in addition. However, despite changing the environment, humans remain its integral part, and consequently, by changing the environment, humans permanently change themselves at the same time.

It is evident that psychologists cannot resolve the issue of harmful environmental changes, but they can certainly provide reliable data on understanding and changing human behaviour, which considerably contributes to these negative effects. Aligning human needs, goals, and ways of satisfying these needs with environmental needs (cf. environmental sustainability), is thus becoming the subject matter of psychological research. As human behaviour is the result of their knowledge, beliefs, attitudes, values, motives and needs, the investigation of the said psychological variables in the process of changing human destructive behaviour towards nature is becoming an increasingly topical subject (Hinić, 2019). Stern suggests that the four groups of variables influence environmental behaviour: attitudinal factors (norms, beliefs, and values), contextual forces, personal capacities, and personal habits and routines (Stern, 2000).

### Environmental attitudes

Environmental attitudes (EA) are typically defined as "the collection of beliefs, affect, and behavioural intentions a person holds regarding environmentally related activities or issues" (Schultz et al., 2004, p. 31). EA can be also defined "as a hierarchical attitude system that connects and organizes more specific attitudes about a range of environmental topics" (Cruz & Manata, 2020: 2). EAs are a construct that psychologists predominantly investigate in the field of Environmental Psychology, and there is a large number of diverse EA measures (Cruz & Manata, 2020; Dunlap & Jones, 2003), which may be indicative of the

popularity of the concept, but also of the existence of certain problems within this area of psychology. First, there is difficulty in defining the behavioural indices and the attitude object itself, which are typically present in investigating latent psychological constructs, such as pro-environmental attitudes (Kaiser et al., 2018). One of the biggest methodological issues is the employment of self-reports with possible interference of self-presentation tendencies and social-desirability bias. Despite the data indicating that a great portion of the world population expresses pro-environmental attitudes (a high social desirability), their participation in the activities that implement such ideas rarely illustrates the reported intensity of pro-environmental attitudes and beliefs. This is known as "environmental values-behaviour gap" (Kennedy et al., 2009) or the "environmental concern-behaviour gap" (Rhead et al., 2015). There is a consensus that attitudes bear some positive relationship to environmental behaviour; however, different aspects of attitudes, and behaviour, influence the magnitude of such a relationship (Wallace et al., 2005).

Three different components of EAs are generally distinguished: individual's beliefs, thoughts, and knowledge about the environment; emotions and feelings about the environment, and individual's behavioural intentions towards the environment (Gifford 2014). Similarly, one of the constructs that has frequently been equated with environmental attitudes in this context, is the notion of environmental concern. It is also usually comprised of three components (Franzen & Vogl, 2013): an individual's insight that humans endanger the natural environment (cognitive), an individual's willingness to protect nature (conative), and emotional reaction to environmental problems, pollution, degradation, etc (affective). For this reason, we were governed by the classical idea of the three components when constructing the EAs items.

Pro-environmental behaviour results from the interactions between an individual's attitudes towards the environment, and other variables such as demographic variables, childhood experience, knowledge and education, personality, sense of control, values, and worldviews, etc. (Gifford & Nillson, 2014). In the light of the stated, a growing number of psychologists are accepting the idea behind the Theory of planned behaviour when interpreting and predicting different forms of pro-environmental behaviours. According to this theory (Ajzen, 1991), attitudes are not an immediate antecedent of the behaviour

in question, but rather an array of components, from subjective and social norms, to perceived control over intended behaviour. A meta-analysis (Wallace et al., 2005), showed that the attitude–behaviour correlation was lower when people experienced a higher level of social pressure and greater difficulty to perform specific behaviour. Similarly, in another study (De Groot & Steg 2007), pro-environmental intentions were in strong positive correlation with pro-environmental attitudes, subjective norms, and perceived control over environmental behaviours. Consequently, we attempted to include as many items pertaining to social and individual norms and values, and concrete examples of intentions towards pro-environmental behaviour, in line with the idea that environmental beliefs, intentions, and behaviours are part of a single EA system (Dunlap & Jones, 2002).

The aim of this paper was to develop a reliable scale evaluating values, beliefs, and attitudes towards the environment, and to test its basic psychometric properties relative to its employment in Serbia. In the first part of the study, basic psychometric properties were tested, and a preliminary factorial structure determined, while in the second part the final structure of the instrument was confirmed on another independent sample via confirmatory factor analysis.

## Method

### Procedure and sample

The study was conducted during 2018 in the Serbian municipalities of Kragujevac (24%), Niš (26%), Novi Sad (30%) and Novi Pazar (20% of the participants). Out of total 1310 participants, the final sample included only the participants who fully completed the questionnaire ($n$ = 1020, 46.9% male and 53.1% female), aged from 18 to 86 ($M$ = 39.29 ± 15.77). The sample was voluntary response sample, and anonymity was assured. All procedures performed in the study were in accordance with the ethical standards of the institutional and/or national research committee, and with the Declaration of Helsinki or comparable ethical standards. All the participants provided informed consent. After a month, 250 participants completely filled in the scale anew, with the aim of determining the test-retest correlation.

The majority of the participants had completed secondary education (44.6%), 29.1% were university students, 6.6% had primary education, and 19.8% higher education. There was no difference in educational levels according to the regions ($\chi^2(6) = 1.548$, $p = .956$), but the sample was of somewhat "higher" educational status in comparison with the general population, judging from the State census records (Statistical Office of the Republic of Serbia, 2013). A quarter of the participants (24%) reported that they were in their studies, 50% were employed, 18% unemployed, and 8% retired. Slightly over a quarter of the participants (26.9%) estimated their economic status as poor, 38.2% as middle, upper middle 26.7%, and 8.2 % as a high status.

The sample was divided into two balanced subsamples ($n_1 = 510$, $n_2 = 510$), with an even number of the participants according to sex ($\chi^2(1) = .001$, $p = .98$), age groups ($\chi^2(5) = 1.39$, $p = .74$), education ($\chi^2(3) = 2.33$, $p = .42$), and economic status ($\chi^2(3) = 1.12$, $p = .84$), so as to be able to conduct additional analyses on two balanced samples (explorative factor analysis on the first and confirmatory factor analysis on the second subsample).

## Instruments

All the participants completed the demographic questionnaire (age, sex, region, education, work and economic status), and the EAS scale. The basis for the development of the initial items for the current scale were the Environmental Attitudes Inventory (Milfont & Duckitt, 2010) and the New Environmental Paradigm Scale (Dunlap et al., 2000). According to these frameworks, the structure of EA can be characterised by 10 to 12 first-order factors and two second-order factors (preservation – the general belief that priority should be given to preserving nature and natural species, and utilization – the general belief that it is right, appropriate, and necessary for nature and all species to be used or altered for human objectives). After the comprehensibility of the items was evaluated by two independent psychologists (content validity), the initial scale included 52 items, that can be categorized into seven subscales according to the theory and empirical results: Love of nature (e.g., *I enjoy spending time in nature, watching birds, trees, or water*), Preservation measures or policies (e.g., *The government should impose harsher penalties on those who release contaminated water into rivers and lakes*), Environmental activism (e.g., *I'd like to*

*take an active part in a campaign for nature conservation*), Personal conservation practice or pro-environmental behaviours (e.g., *I always switch the lights off in the room when I don't need them*), Population growth policies (e.g., *If the number of people in the world keeps growing at this pace, we won't have enough food and water for everyone*), Instrumentalism, which subsumes the concept of altering nature to suit human needs (e.g., *Nature conservation is less important than securing employment and a higher living standard*; *When nature is tailored to human needs, we have the right to alter it to better suit our needs*), and Environmental concern (e.g., *Humans' agency in environmental destruction and pollution will lead to the occurrence and spread of diseases and epidemics*). The participants rated their agreement with every item on the scale, within the range from 1 (*not at all*) to 5 (*completely*).

### Statistical analyses

The data were processed by using the SPSS 21. Internal consistency of the EAS subscales was measured by Cronbach's alpha. Differences in frequencies and scores were computed by means of *t*-test and ANOVA, while the Pearson coefficients were calculated to examine correlations. Exploratory factor analysis was employed (Principal axis factoring with Direct Oblimin rotation) to determine the factorial structure, and Confirmatory factor analysis (Maximum likelihood method) in Amos 18 to confirm it.

## Results

### EAS psychometric properties

Since the scale showed satisfactory preliminary results (Bartlett's test of sphericity $\chi^2(780) = 4938.24$, $p < .001$; measure of representativeness $KMO = 0.78$), the items were consequently factor-analysed on the initial subsample, via Principal axis factoring with Direct Oblimin rotation. The items were assigned to subscales if they loaded >.50 on a specific factor. After excluding items due to

comprehension issues,[1] a low loading or high multiple factor loadings,[2] 34 items were retained. These items constituted a seven-factor latent structure, explaining 49.92% of the total variance observed.

Subsequently, we tested this correlated factor model on an independent subsample via Confirmatory factor analysis (Maximum likelihood method) in Amos 18. In order to evaluate model fit, the following indices were used (Schermelleh-Engel et al., 2003): comparative fit index (*CFI*) >.95, goodness-of-fit (*GFI*) >.95, Bentler-Bonett normed fit index (*NFI*) >.95, a root mean-square error of approximation (*RMSEA*) and standardized root mean-square residual (*SRMR*). Cut-off levels for *RMSEA* and *SRMR* were <.06 for "good fit" (Hu & Bentler, 1999). The model with fit indices is shown in Table 1. The final model shown in Table 1 is the model where certain items were intercorrelated within their subscales, which resulted in the reduction of chi-square values as well as the improvement of other model fit indices in comparison to the initial model.

Table 1
Model fit indices

| Model | $\chi^2/df$ | *RMSEA (90% CI)* | *SRMR* | *GFI* | *CFI* | *NFI* |
|---|---|---|---|---|---|---|
| Initial model | 3.18 | .057 (.054 - .060) | .056 | .86 | .85 | .83 |
| Final model | 2.62 | .049 (.046 - .053) | .048 | .89 | .90 | .87 |

This final scale included 34 items explaining 51.84% of the common variance observed (Table 2).

[1] e.g., It was shown that the participants had difficulty with the wording of the item "I believe nature is important and valuable in its own right"

[2] e.g., Item "People uncontrollably abuse and exploit nature" showed moderate loadings, both on the Environmental concern factor and Preservation policies factor; Item "Nature conservation is less important than securing employment and a higher living standard" had moderate loadings on the Instrumentalism factor as well as Environmental concern factor, whereas Item "I'm sad to see people polluting lakes and rivers, and destroying forests" had moderate loadings on the Love of nature as well as Environmental concern factor.

Table 2

Percent variance in the latent space of the EAS

| Factor | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|
| | EV | % of Variance | C % | EV | % of Variance | C % |
| 1 | 6.69 | 20.26 | 20.26 | 6.18 | 18.72 | 18.72 |
| 2 | 3.88 | 11.76 | 31.99 | 3.38 | 10.24 | 28.96 |
| 3 | 3.45 | 10.45 | 42.44 | 2.95 | 8.94 | 37.90 |
| 4 | 1.91 | 5.80 | 48.24 | 1.41 | 4.28 | 42.18 |
| 5 | 1.78 | 5.39 | 53.63 | 1.28 | 3.87 | 46.05 |
| 6 | 1.52 | 4.62 | 58.25 | 1.03 | 3.12 | 49.17 |
| 7 | 1.45 | 4.40 | 62.65 | .87 | 2.67 | 51.84 |

*Note.* EV = Eigenvalues, C % = Cumulative percent of the total variance observed

EAS factor loadings are presented in Table 3. Factor 1 – Love of nature, which accounted for 18.72% of the variance, typifies emotional reactions to cherishing different forms of the environment (e.g., *Being in nature helps me relax and relieve stress*). Factor 2, explaining 10.24% of the variance, includes Population growth policies (e.g., *We should aspire to slower population growth*). Factor 3, explaining 8.94% of the variance, illustrates Pro-environmental behaviours that individuals may perform in everyday life to preserve or protect the environment (e.g., *I avoid using plastic bags and plastic packaging*), while Factor 4, accounted for 4.28% of the variance, represents the measures that the participants believe should be taken by institutions, so as to avoid the said negative effects (e.g., *The government should control the extent to which raw materials are used to prevent the depletion of their reserves*). Factor 5 – Environment concern, with the items typifying fears of harmful consequences of exploiting nature (e.g., *If we continue exploiting natural resources and destroying nature at this pace, we will witness devastating natural disasters*), accounted for 3.87% of the variance. Items exemplifying an anthropocentric worldview and those placing satisfaction of human needs at the forefront (e.g., *People should control nature*), formed Factor 6, Instrumentalism (explaining 3.12% of the variance). Environmental activism (e.g., *I am willing to take part in raising money*

*for environmental charities*) is represented in Factor 7 (explaining 2.67% of the variance).

Table 3

EAS factor loadings

| | Love of nature | Population growth policies | Pro-environment. behaviour | Preservation measures | Environment concern | Instrumentalism | Environment. activism |
|---|---|---|---|---|---|---|---|
| LoN01 | .572 | | | | | | |
| LoN02 | .657 | | | | | | |
| LoN03 | .735 | | | | | | |
| LoN04 | .691 | | | | | | |
| LoN05 | .745 | | | | | | |
| PGP01 | | .530 | | | | | |
| PGP02 | | .572 | | | | | |
| PGP03 | | .682 | | | | | |
| PGP04 | | .669 | | | | | |
| PGP05 | | .604 | | | | | |
| PEB01 | | | .528 | | | | |
| PEB02 | | | .512 | | | | |
| PEB03 | | | .639 | | | | |
| PEB04 | | | .940 | | | | |
| PEB05 | | | .925 | | | | |
| PM01 | | | | -.642 | | | |
| PM02 | | | | -.701 | | | |
| PM03 | | | | -.655 | | | |
| PM04 | | | | -.639 | | | |
| PM05 | | | | -.691 | | | |
| EC01 | | | | | .865 | | |
| EC02 | | | | | .618 | | |
| EC03 | | | | | .575 | | |
| EC04 | | | | | .506 | | |
| EC05 | | | | | .716 | | |
| INS01 | | | | | | .529 | |
| INS02 | | | | | | .546 | |
| INS03 | | | | | | .591 | |
| INS04 | | | | | | .589 | |
| INS05 | | | | | | .510 | |
| EA01 | | | | | | | .573 |
| EA02 | | | | | | | .579 |
| EA03 | | | | | | | .719 |
| EA04 | | | | | | | .518 |

*Note*. Original scale in the Serbian language can be obtained from the author

EAS showed internal consistency of *subscales* ranging from .74 to .82 (Table 4), and test-retest reliability of the total score $r_{tt}$ = .80.

Table 4
Descriptive statistics

| | *m* | *Min* | *Max* | *M* | *SD* | *Skewness* | *Kurtosis* | α |
|---|---|---|---|---|---|---|---|---|
| Love of nature | 5 | 5 | 25 | 20.40 | 4.10 | -.87 | .20 | .81 |
| Population growth policies | 5 | 5 | 25 | 11.74 | 4.57 | .40 | -.38 | .75 |
| Pro-environmental behaviour | 5 | 5 | 25 | 16.93 | 4.49 | -.30 | -.66 | .82 |
| Preservation measures | 5 | 5 | 25 | 18.56 | 4.90 | -.47 | -.55 | .80 |
| Environment concern | 5 | 8 | 25 | 20.90 | 3.27 | -.77 | .14 | .79 |
| Instrumentalism | 5 | 5 | 24 | 13.87 | 3.88 | .24 | -.42 | .74 |
| Environmental activism | 4 | 4 | 20 | 13.95 | 3.52 | -.40 | -.29 | .74 |

*Note*. *m* = number of items, *Sk* = coefficients of skewness, *Ku* = Kurtosis coefficient, α = Cronbach's alpha

As seen from Table 4, all summative scores by a factor were within ±1 boundary for Skewness and Kurtosis. Finally, intercorrelations were calculated for thus obtained factor scores, showing mainly weak correlations (Table 5). The highest, but still only moderate correlations were between Love of nature and Environment concern, and between Love of nature and Environmental activism.

Table 5
Factor scores intercorrelations

| | Environment. activism | Pro-environ. behaviour | Population growth policies | Instrument. | Environment concern | Preservation measures |
|---|---|---|---|---|---|---|
| Love of Nature | .396** | .273** | -.057 | -.277** | .436** | .345** |
| Environmental activism | | .359** | .071 | -.255** | .287** | .247** |
| Pro-environment. behaviour | .359** | | .120** | -.146** | .252** | .285** |
| Population growth policies | .071 | .120** | | -.068 | .048 | .147** |
| Instrumentalism | -.255** | -.146** | -.068 | | -.257** | -.337** |
| Environment concern | .287** | .252** | .048 | -.257** | | .342** |

*Note*. ** $p < .01$

From this factorial structure, three second-order factors have been extracted (using the same FA method as in first-order FA, except that we used the Varimax rotation since we did not expect latent factors to be strongly correlated), explaining 84.17% of the common variance. The first (Pro-environmental factor), explaining 46.11% of the variance (α = .87), contained the Love of nature, Environment concern, Pro-environmental behaviour, Environmental activism, and Preservation measures factors, the second contained only Population growth policies factor (α = .75), explaining 25.19% of the variance, while the third contained only the Instrumentalism factor (α = .74), explaining 12.87% of the variance (Table 6).

Table 6
EAS second-order factor loadings

| | Factor | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Love of Nature | .757 | | |
| Environmental activism | .658 | | |
| Environmental behaviour | .551 | | |
| Population growth policies | | | .935 |
| Instrumentalism | | .556 | |
| Environmental concern | .689 | | |
| Preservation policies | .636 | | |

Pro-environmental factor was in weak correlation with Population growth policies ($r$= .10; $p$ < .01), and moderate with Instrumentalism ($r$= -.38; $p$ < .01). There was no correlation between Instrumentalism and Population growth policies factors ($r$= -.07). Since EAS is not unidimensional, we may herein propose that the three total scores, illustrating the intensity of pro-environmental behaviour, be calculated. The first score would make the sum of scores on all items from the first higher-order factor (Pro-environmental factor). Moreover, our proposal is that the items from the Instrumental factor would make a sum with reverse coded scores, whereby higher scores would relate to a greater tendency towards pro-environmental behaviour, as is the case with the other two scores.

## Attitudes and demographic characteristics

Previous studies frequently reported differences in scores on EA dimensions in relation to demographic variables (Franzen & Vogl, 2013; Hurst et al., 2013), therefore we checked whether the same might be true for this scale. A weak negative correlation was found between age and Pro-environmental behaviour ($r$ = -.11, $p$ < .05), a weak positive correlation between age and Instrumentalism ($r$ = .07, $p$ < .05).

In male participants, Instrumentalism was more dominant ($t$(1018) = 1.98, $p$ < .05, $g$ = 0.02), whereas the scores on Love of Nature and Environment concern subscales were higher in female participants ($t$(1018) = -2.18, $p$ < .05, $g$ = 0.02; and $t$(1018) = -2.03, $p$ < .05, $g$ = 0.02 respectively), however, effect sizes were quite small. A lower level of education was followed by lower scores on Pro-environmental behaviour ($F$(3,1016) = 5.12, $p$ < .01, $\eta^2$ = .023), Preservation measures ($F$ (3,1016) = 16.92, $p$ < .01, $\eta^2$ = .071), and a higher score on Instrumentalism ($F$(3,1016) = 8.57, $p$ <.01, $\eta^2$ = .038), which was lower in university students.

# Discussion

## Scale dimensions

The main goal of the study was to test the psychometric properties of the Environmental Attitudes Scale (EAS). The results show that the scale has satisfactory properties, in terms of reliability and validity. Some of the model fit indices were slightly below the recommended values, as might have been expected due to the complexity of contents that this scale aims to systematize. Similar results were obtained in other studies involving similar scales as well. For example, one of the most commonly employed scales (NEP) frequently displayed problems with reliability, with alpha values around .68 (Hawcroft & Milfont, 2010). The final version of the scale includes 34 items, grouped into seven dimensions. This factor structure is in line with the previous findings.

The love of nature factor, a lifestyle wherein the connection with nature is highlighted, is similar to the connectedness with nature concept, which was extracted in previous studies (Gkargkavouzi et al., 2021; Hedlund-de Witt et al., 2014). The expressions of fears of harmful consequences of exploiting nature

formed another factor, which is similar to the construct of environmental concern found in the mentioned studies. The next two factors extracted in this study (pro-environmental behaviours and environmental activism), were also extracted in previous research, through factors illustrating behaviours that individuals may perform in everyday life to preserve or protect the environment (conservation of resources*)*, and actions typifying ecological activism (Gunduz et al., 2017; Milfont & Duckitt, 2010). Measures that the participants believe should be taken globally (or institutionally), so as to avoid the said negative effects formed the factor similar to the conservation policies factor in the Environmental Attitudes Inventory (Milfont & Duckitt, 2010).

The items exemplifying an anthropocentric worldview and those placing satisfaction of human needs at the forefront (often at the expense of the environment), formed a factor that is similar to the dimension of instrumentalism in other studies (Hedlund-de Witt et al., 2014): belief in the instrumental values of nature, as well as in the fact that environmental requirements should not become obstacles to human needs, such as economic growth.

Finally, a factor pertaining to population growth policies was also extracted, similar to concepts (e.g., limits to growth) in other studies (Cruz & Manata, 2020; Milfont & Duckitt, 2010).

Although three higher-order factors have been obtained, our results may be compared with previous two-factor models: preservation of nature and natural species (pro-environmental factor in our study), and utilization of nature and all species for human needs and objectives (instrumentalism in our study). The third higher-order factor obtained is quite unique because it entails environmental protection at the cost of reproduction, i.e., the parental motive, which is one of the most basic human needs. Despite the fact that some other types of pro-environmental behaviour include refraining from human needs or at least their convergence with the environmental requirements, this factor quite straightforwardly points to the deprivation of fundamental needs, which is most likely the reason why this factor was extracted as an independent factor in our analysis.

The Value-basis theory or the Value-belief-norm theory provides further theoretical explanation of these results, through values and affects that pro-

environmental behaviours are based on. According to this theory (Stern & Dietz, 1994), environmental attitudes are the result of an individual's set of three value orientations: (a) biospheric value orientation (i.e., concern for the inherent value of the natural environment and biosphere); (b) social altruistic value orientation (i.e., concern for the welfare of other human beings); and (c) egoism or self-interest (i.e., concern for the well-being of the self or the inner circles). The preservation measures and protection of nature are grounded in biospheric values, and partly in altruistic values. Population growth policies are grounded in altruistic values, while utilisation behaviours are grounded in egoistic and self-interest values.

## Pro-environmental attitudes and pro-environmental behaviour

The largest number of environmental training courses is focused on the cognitive component of EA (e.g., expanding environmental knowledge). Some studies also showed interest in the effect of the affective component of EA (Gunduz et al., 2017), and certain educational programmes are trying to increase an individual's emotional affinity towards nature, or commitment to nature (Kals et al., 1999). It is the behavioural attitude component that poses the biggest problem for research work and prediction of pro-environmental behaviour.

Our participants reported positive attitudes expressing love of nature, environmental concern, along with moderately positive attitudes towards the measures that a country, its government or an institution should adopt. However, these affective tendencies and suggestions for the actions of others are not always accompanied by corresponding ideas about taking adequate personal actions.

A theoretical grounding providing explanations for our results holds that a personal concern over environmental issues depends largely on the fact whether an individual is personally involved in the problem and whether they have some control over it (García-Mira et al., 2005). Problems are felt like less serious (which at the same time requires fewer personal actions), if they involve more active engagement of an individual, and more serious if they involve a lower level of control, less active engagement, and a greater distance (Uzzell, 2000). When the attitudes in our research entailed legal regulations and

institutional activities, whereby the items implied less active engagement of the participants, they had higher scores. In contrast to this, when the attitudes implied more active engagement of the participants in the protection and preservation of nature, the items had somewhat lower scores because the participants express rather neutral attitudes to personal pro-environmental actions, and environmental activism. Environmental activism (initiating and participating in activities, signing petitions, providing financial support), together with individual's habits concerning natural resources conservation (turning off lights, saving water), as well as using public utilities (recycling, public transport) are frequently the least developed component of environmental attitudes, which is the hardest to influence (Kennedy et al., 2009). Although the participants reported that they were relatively inclined to support pro-environmental behaviour, when such actions jeopardize or aggravate their daily lives and needs (for instance, when one needs to exert an effort to do something or spends too much of their "valuable" time), they seemed to express a lower level of agreement with such items, especially with environmental activism items. This is in line with the Theory of planned behaviour, according to which individuals choose options they perceive as the most beneficial but with fewer costs (Ajzen, 1991).

This may be corroborated with other attitudes, speaking in favour of the fact that people tend to overvalue the importance of gratification of personal needs in comparison to the importance of nature conservation. Namely, neutral attitudes were reported to anthropocentric view on the individual-nature issue, whereby humans are considered as more dominant and more important than other species, and thus may put their own needs before the needs of others or nature conservation.

Likewise, Goal framing theory suggests that three different types of goals or motivations govern environmental behaviour (Lindenberg & Steg, 2007). Acting pro-environmentally is often considered appropriate (normative reasons); however, in many cases it costs money and is less profitable (gain reasons), less pleasurable and more time-consuming (hedonic reasons) than environmentally harmful actions.

Among many demographic characteristics associated with individuals' environmental concern and attitudes, the most frequently underlined are age, education, sex, and income (Franzen & Vogl, 2013; Hurst et al., 2013). Previous research has often found that women are more concerned than men due to different socialization and social roles (Domingues & Gonçalves, 2020). Females are socialized to be more expressive, to care, and to be more compassionate, nurturing, and helpful. Younger persons, individuals with a higher level of education and from middle and upper-middle-classes, display a tendency to care more about the quality of environmental characteristics, have a higher level of environmental concern than older and less educated citizens (Domingues & Gonçalves, 2020). Similar findings were obtained in our study which support the validity of EAS.

## Conclusion

The degree of man-made environmental changes is becoming more and more prominent with technological advancements, resulting in overpopulation, rapid urbanisation, pollution, production of substances that are not available in nature, and so on. This is the reason why it is of paramount importance to organize and plan the development of scientific disciplines which would monitor these changes and propose adequate ways for their amelioration, through rational control and adjustment of human behaviour causing them.

The results of the current study have corroborated the findings of the studies underlining that the conative or behavioural component is the biggest problem in terms of prediction and stimulation of pro-environmental behaviour. Content analysis of the responses also confirmed the importance of the engagement and personal actions in pro-environmental movement. Thus, problems are perceived as less serious if they entail a more active engagement of the individual, and more serious if they involve a lower degree of control and a larger distance. The psychometric testing of the scale showed satisfactory properties. The main limitation of the paper lies in the fact that external validation of the scale has not been performed. Moreover, the influence of volunteer bias may be at work herein. Namely, the participants who volunteered to take part in the study may have already been interested in this topic, and thus had positive attitudes towards pro-environmental behaviours.

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