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COMMUNICATION AND COGNITION THEORY: A THEORETICAL FRAMEWORK FOR CONDUCTING HELPFUL COMMUNICATION IN DIVERSIFIED ENVIRONMENTS IN THE 21ST CENTURY

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ABSTRACT

The current work assessed different aspects, steps and conditions that help people communicate appropriately in the current globalized world deeply affected by modern technologies, such the Internet and artificial intelligence. The results reported in this manuscript are based on an analysis of eight studies in different aspects of human communication and a review of 70 papers published from 2000 to 2023. An online search using WoS and SCOPUS databases was done to record the related published works. A total of 186 items were recorded, and after excluding 116 duplicated and irrelevant items, 70 papers were selected and reviewed thoroughly. According to the results, communication initiation, self-disclosure, overall well-being, positive attitudes, language proficiency, communication competence, and technical skills are among the main factors that affect interactions among individuals from different cultures. Based on the results, cognition, knowing different norms and values, and accommodation in the current diversified environments are the main aims and outcomes of daily interactions among people. The current work introduces communication initiation, disclosure, cognition, and accommodation as the four main steps, and self-knowledge, positive attitudes, self-regulation, heart coherence, cultural awareness, intercultural sensitivity, openness, purposefulness, respect differences, language proficiency, technical skills, communication competence, and effectiveness as the main conditions of effective human communication in the age of the artificial intelligence in the 21st century.

KEY WORDS

CLASSIFICATION

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INTRODUCTION

Communication is an essential aspect of human life in the current diversified societies deeply affected by the ever-growing and ever-changing modern technologies. The Internet and artificial intelligence (AI) are the main modern technologies profoundly influenced different aspects of human life, including human communication. Communication, as one of the main achievements and requirements of human life, enables human beings to interact with one another, share their information, and know each other. Communication among people enables them to establish relationships, perform their duties, and be helpful to one another as well. In the current globalized world, communication plays a vital role in enabling individuals and societies to exchange their personal, social, cultural and economic information, and to share their values and experiences [1-3]. Currently, people from different cultures, countries and societies are interdependent with one another. Thus, they need to interact with one another to perform their duties well and achieve their personal, educational, social and economic goals [4-6].

Communication competence is one of the main requirements that enable individuals to conduct proper interactions with one another. Based on the reviewed literature, the main elements of communication competence are communication initiation, personal and interpersonal skills, language proficiency, cultural awareness and intercultural sensitivity. Moreover, self-disclosure, effectiveness, conflict management, positive attitudes towards modern technologies, and technical skills are also among the main elements of communication competence [7-12]. The main aspects of technical skills are awareness about the importance, kinds and application of different communication technologies, the ability to use different kinds of modern technologies, and being updated with ever-changing aspects of modern communication technologies [13, 14].

Besides communication competence, communication theories and understanding of different communicative contexts and different communicative norms are among the main issues that help people to conduct successful interactions. Information about different theories may also help individuals evaluate their daily interactions with different people. As stated [15], a theory is not a particular communicative behaviour but helps people know different communicative behaviours and establish easy ways to interact. Communication theories primarily focus on the primary and fundamental levels of interactions among different people [16-19].

Moreover, the structures and requirements of modern communication in the current diversified environments and organizations profoundly influenced by AI and AI-powered technologies, such as ChatGPT. The requirements of ever-changing communication technologies in the 21st century are different from the structures and requirements of communication in times and communities that people used basic technologies to communicate. Nowadays, the ever-growing diversified and multicultural environments and also the ever-changing communication technologies ask people to know the different aspects of human communication, and improve their social and cultural awareness and skills. Nowadays, people need to gain essential technical and practical skills to conduct proper communication with different people [7, 8, 11, 14].

In the current diversified environments in the age of AI in the 21st century that experience rapid technological changes, human communication has three main and interrelated aspects that must be evaluated and improved. The first aspect of human communication in the current world that is deeply affected by modern technologies is the intrapersonal aspect of communication, which is connected with self-regulation abilities, heart coherence, and the overall well-being of individuals. The second and third aspects of human communication are communication competence and technical skills [8, 20-23]. Overall wellbeing is among the main requirements of conducting helpful communication, and besides other factors, economic and financial

situation of individuals affect their overall wellbeing as well [24, 25]. Based on some scholarly works [14, 26, 27], modern technologies, especially AI and AI-powered machines and systems, profoundly influenced different aspects of human life, such as communication. Thus, humans need to improve their communication, language and technical skills to communicate and learn effectively. As stated by [28], some scholars define AI as a technology that enables machines, including computers, to act intelligently.

Moreover, we have to know that artificial intelligence did not appear suddenly, but it has more than half a century of presence in different fields of human life, including communication. As pointed out, the term 'artificial intelligence' was produced in 1956 at the Dartmouth Conference, and prior to that, its primary aspect appeared in 1950 in Turing's "Game of Imitation" [29]. Since its establishment as an academic discipline more than six decades ago, and AI and its related technologies experienced fast changes and gained more attention [30]. Of course, with the generalization of the use of artificial intelligence in the last two years, access to the use of artificial intelligence has become universal, and widely affected different aspects of human life. Moreover, it should be noted that AI and AI-powered systems and chatbots, such as ChatGPT, work based on what is learned from humans and the commands received from humans and based on natural language processing abilities. For example, ChatGPT (Chat Generative Pre-trained Transformer), which is a natural language processing model, is trained to interact in a dialogue method. Its conversational format and ability enable ChatGPT to answer follow-up questions, confess probable mistakes, challenge and reject inappropriate requests and arguments [31].

According to some works [26, 30, 32], AI technologies offer more innovative functionalities supporting human-like interactions than other computer software, and AI-mediated practice of algorithmic responses increases communication speed and can change linguistic issues and social relations. However, to apply the mentioned modern technology effectively, people need to gain, improve and use some essential skills. Based on some published works [30, 33-36], the primary essential skills for helpful application of AI technologies are positive attitudes towards AI technologies, language skills, technical skills, awareness of the benefits and challenges of AI, prompting, machine-learning abilities, teamwork, and human-machine collaboration. Furthermore, as artificial intelligence can have severe effects on human communication, so can communication affect the development process of AI as well. It means that communication has and will play an essential role in developing and forming the applied aspects of artificial intelligence.

To understand and consider the mentioned issues well, the existence and application of helpful and updated theories and conceptual frameworks may help people to understand, improve and apply the mentioned requirements of human communication in the 21st century. However, based on some researchers and scholars [32, 37-41], the existing communication theories primarily developed in the Western parts of the world, based on Western liberal and individualistic norms, and prior to rapid growth and massive use of AI technologies in different aspects of human communication. Thus, such theories may not cover all aspects of communication in different parts of the world. According to the mentioned researchers and scholars, Western theorists and scholars developed their theories based on their norms and values, and the rapid growth and massive use of AI technologies deeply challenging the existing communication theories. Thus, conducting some helpful studies in different aspects of human communication, review of the existing published works in the field of human communication, identifying of main aspects and elements that affect communication among people and enable them to conduct helpful interactions, and developing a new theoretical framework based on results from the mentioned procedures may be helpful in the current diversified environments.

LITERATURE REVIEW

Communication is one of the most essential parts of human life in all parts of the globe. However, the available theories and conceptual frameworks in communication developed in the Western parts of the world and are based on Western social, cultural and communicative norms. As pointed out, communication science mostly belongs to the Euro-American scheme and communication theories developed by Western scholars, and the main object of communication studies in the West is their people and their issues; if Westerners work on the issues which belong to other people, they may be judged based on their norms and points of view as well [38-40]. According to [40], communication theories were primarily developed by Western scholars and under the Western context of communication. Additionally, there are fundamental differences between the Western liberal and individualistic lifestyles and the Asian collectivistic and indirect communication styles. People in the West primarily practice the low context of communication, which focuses on openness and directness, while people in the Eastern parts of the world practice the high context of communication, which focuses on politeness and indirectness [42-45].

Moreover, the existing literature and works from different societies and cultures focus on human communication's importance. For example, some famous Persian Poets, such as Mawlawi Rumi and Saadi Shirazi, focus on the importance of communication, cognition, and solidarity among human beings and societies. The famous poem of Saadi Shirazi (1210-1291) in his famous book *Gulistan* illustrates the mentioned issues [46]:

> Human beings are members of a whole
> In the creation of one essence and soul
> If one member is afflicted with pain
> Other members uneasy will remain
> If you have no sympathy for human pain
> The name of human you cannot retain..

Also, Mawlana Jalāl al-Dīn Muḥammad Balki Rūmī (1207-1273), another famous Persian poet, in the beginning of his masterpiece and famous book *Masnavi i Ma'navi* wrote [47]:

> Listen to the reed (flute) how it is complaining! It is telling about separations;
> (Saying), Ever since I was severed from the reed field, men and women have
> lamented in (the presence of) my shrill cries.

Those mentioned poems focus on the importance of human communication, cognition and cohesion among human beings. Some scholars and theorists, e.g. [48-51], who developed and introduced some of the mostly used theories in field of communication, focus on the importance and effectiveness of human communication as well.

Furthermore, in the 21st century, different types and aspects of human communication are interrelated, and people mostly conduct mediated interactions and share information and knowledge without consideration of time and space with the help of modern communication technologies [11, 52]. Modern communication theories may help individuals to distinguish and perform different aspects of human communication properly. A theory, which is an organized conceptual framework, helps people to know and distinguish different behaviors and skills and establishes helpful ways and methods to interact with one another [16-18, 41]. Thus, the current work assessed the available published works to develop and introduce a new theoretical framework based on the requirements of fundamental changes in different aspects of human communication the 21st century.

METHODS

Based on the experiences of the author of the current work from different studies and works and also based on results from different works by the author from 2014 to 2023 [2, 22, 41, 53-56], and based some other researchers and scholars [42, 43, 45], the existing communication theories that mainly developed in the Western parts of the world and prior to the vast application of different technologies in different types and aspects of human communication, cannot cover all aspects of human communication in the current diversified environments. To review the existing published works and somehow fill the mentioned gap by the identification, arrangement and introduction of the main aspects, elements and requirements of human communication in the 21st century, eight scholarly publications from the author of the current work, which includes six published papers and two dissertations (MA and PhD dissertations) reviewed and assessed thoroughly.

The main instruments used in the mentioned eight studies are the interpersonal competence questionnaire (ICQ) of Buhrmester et al. [9], and the intercultural communication competence questionnaire [57]. Both instruments are designed based on Likert Scale with five options per item. The first data set reported in the current work is from eight original research projects on communication among university students from different nationalities. The findings from the four original studies were analyzed using the actual tests from SPSS. Table 1 summarizes the eight mentioned studies conducted from 2014 to 2023.

The second data set stands on a review of 70 papers on human communication among different people published from 2000 to 2023 in 34 different WoS and SCOPUS-indexed journals. In the light of results from the mentioned eight works, an online search using Web of Science

Table 1. Summary of eight different studies conducted from 2000 to 2023.

Reference	Study	Method	Participants
[53]	Characteristics and factors affecting interpersonal communication among university students	IPC survey questionnaire	220 local and international students
[54]	The impact of English language proficiency on interpersonal interactions among students	IPC & ELP survey questionnaires	220 students
[41]	The relationship between interpersonal communication competence, intercultural communication competence and heart rate variability	ICQ, ICCQ & emWave PC biofeedback (1.0)	128 international postgraduate students
[2]	study of the relationship between intercultural sensitivity and intercultural communication competence	ISS & ICCQ	108 international postgraduate students
[22]	The effectiveness of the quick coherence technique using heart rate variability-biofeedback technology on the recovery of heart coherence	QCT of the HeartMath.org & emWave PC biofeedback	20 undergraduate students of an international university
[22]	A study on the relationship between English language proficiency and intercultural communication competence	ICCQ LEAP-Q	108 students of an international university
[55]	Assessment of the characteristics of interpersonal communication competence among students	ICQ survey questionnaire	130 international postgraduate students
[56]	Factors influencing interpersonal interactions among students from different nationalities	IPC & ELP survey questionnaires	220 students of an international university

(WoS) and SCOPUS databases was applied to record and review the existing related published works. Six key terms, which are 'human communication', communication competence', intrapersonal communication', intercultural communication', mediated communication', and 'factors affecting human communication', were used to conduct online searches.

A total of 186 items were recorded through an online search, and after a quick title and abstract scan of all recorded works, 116 duplicated and irrelevant records were excluded, and 70 papers that published from 2000 to 2023 in 34 WoS, and SCOPUS-indexed journals were selected and thoroughly reviewed. The quantitative content analysis method was used to analyze the related works from the literature. The quantitative content analysis method determined the quantity and percentage of terms and attributes, including the min concepts and perspectives of communication in different contexts. According to Allen and Reser [58], the content analysis method as a fruitful analytical tool has been used in different studies. The flowchart in Figure 1 below includes the process of online search, record exclusion/ selection, and review of all selected papers.
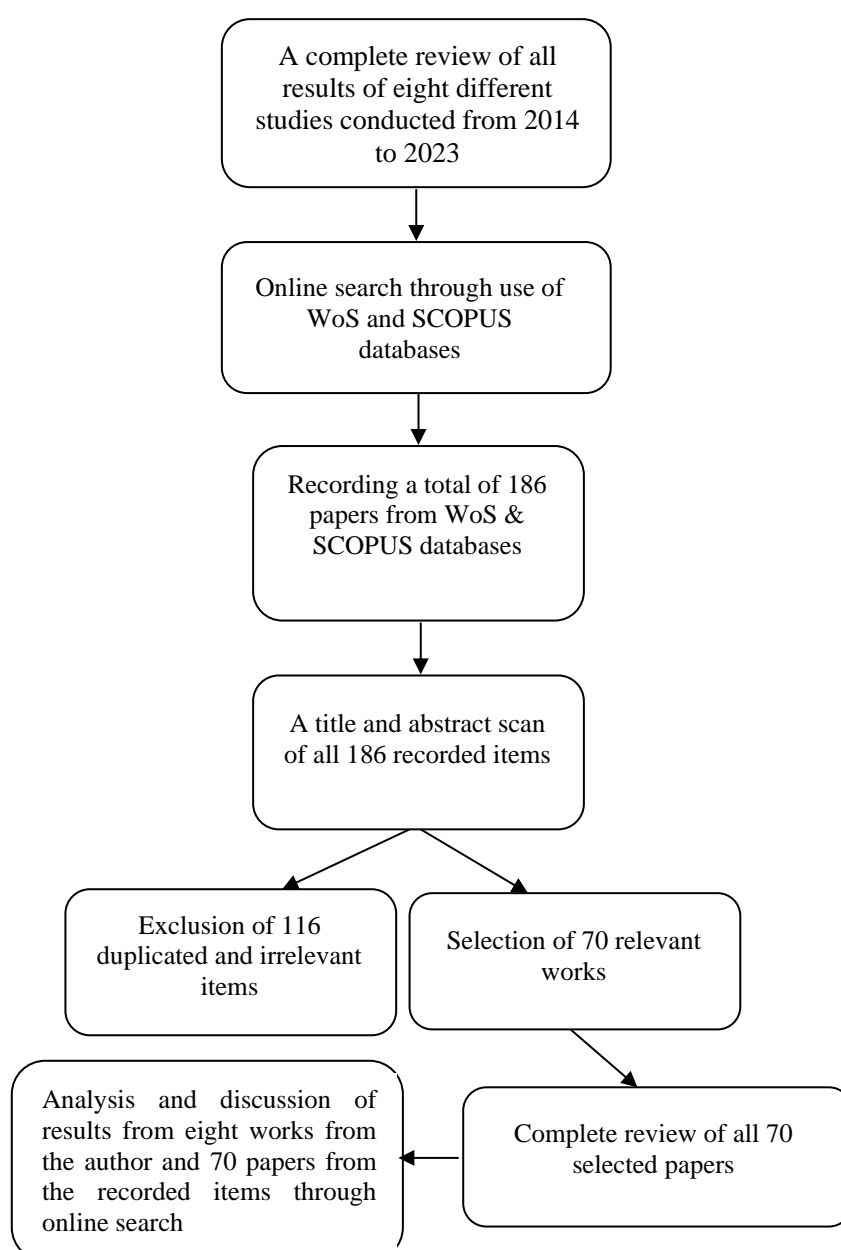
Figure1. The process of online search, record exclusion/ selection, and review of selected papers.

After selecting 70 papers, the index of all journals that published the mentioned works was checked through WoS and SCOPUS journal search options. Table 2 illustrates the name and index of journals published in the selected papers and the number of works selected from each journal.

Table 2. Name and index of journals that published the selected works (continued on p.8).

Name of Journal	Index	Number of papers selected
International Journal of Intercultural Relations	WoS (SSCI) & SCOPUS	15
Journal of Intercultural Communication Research	SCOPUS	6
Intercultural Education	WoS (ESCI) & SCOPUS	4
Computers in Human Behavior	WoS & SCOPUS	3
Human Communication Research	WoS & SCOPUS	3
Journal of Computer-Mediated Communication	WoS & SCOPUS	2
Communication Research	WoS & SCOPUS	2
New Media & Society	WoS	2
Teaching and Teacher Education	WoS (SSCI) & SCOPUS	1
American Communication Journal	SCOPUS	1
Computer Assisted Language Learning	WoS & SCOPUS	1
Journal of Social and Personal Relationships	WoS & SCOPUS	1
Journal of Computer Assisted Learning	WoS & SCOPUS	1
Education and Information Technologies	WoS & SCOPUS	1
Education Tech Research Dev	WoS	1
European Journal of Social Psychology	WoS & SCOPUS	1
Journal of Social Issues	WoS & SCOPUS	1
Journal of e-Learning and Knowledge Society	WoS (Emerging) & SCOPUS	1
Cogent Social Sciences	WoS (ESCI) & SCOPUS	1
Media Psychology	WoS & SCOPUS	1
Journal of Intercultural Communication	SCOPUS	1
Organizational Behavior and Human Decision Processes	WoS & SCOPUS	1
Journal of Language and Linguistic Studies	SCOPUS	1
ELT Journal	WoS (AHCI) & SCOPUS	1
Industrial Marketing Management	WoS (ESCI) & SCOPUS	1
Language Teaching	WoS (AHCI) & SCOPUS	1
Language and Intercultural Communication	WoS (AHCI) & SCOPUS	1
European Journal of Interdisciplinary Studies	SCOPUS	1
Research Papers in Language Teaching and Learning	DOAJ	1
Citizenship, Social and Economics Education	SCOPUS	1
tripleC	WoS & SCOPUS	1
Turkish Online Journal of Distance Education	WoS (Emerging) & SCOPUS	1
Social Science Computer Review	WoS & SCOPUS	1
Cogent Education	WoS (ESCI) & SCOPUS	1
Pertanika Journal of Science and Technology	WoS (ESCI) & SCOPUS	1
Educación XX1	WoS (ESCI) & SCOPUS	1
Journal of Personality Assessment	WoS (SSCI) & SCOPUS	1
Theory into Practice	WoS (SSCI) & SCOPUS	1
Annual Review of Psychology	WoS (SCIE) & SCOPUS	1
Multicultural Perspectives	WoS (ESCI) & SCOPUS	1
American Psychologist	WoS (SSCI) & SCOPUS	1
Interchange	SCOPUS	1
Thinking Skills and Creativity	WoS (SSCI) & SCOPUS	1
Nurse Education Today	WoS (SCIE) & SCOPUS	1
Education and Urban Society	WoS (SSCI) & SCOPUS	1
International Journal of Hospitality Management	WoS (SSCI) & SCOPUS	1

Table 2. Name and index of journals that published the selected works (continuation from p.7).

High Ability Studies	WoS (SSCI) & SCOPUS	1
Chinese Journal of Applied Linguistics	WoS (ESCI) & SCOPUS	1
Journal of Ethnic and Cultural Studies	SCOPUS	1
BMC Nursing	WoS (SCIE) & SCOPUS	1
Journal of Travel & Tourism Marketing	WoS	1
Journal of Medical Ethics	WoS (SCIE) & SCOPUS	1
Journal of Services Marketing	WoS (SSCI) & SCOPUS	1
International Journal of Chinese Education	SCOPUS	1
International Journal of Sociology of Education	WoS (ESCI) & SCOPUS	1
Nurse Education in Practice	WoS (SCIE) & SCOPUS	1
Educational Research Review	WoS (SSCI) & SCOPUS	1
System	WoS (SSCI) & SCOPUS	1
ETS Research Report Series	SCOPUS	1

FINDINGS

The findings reported in this manuscript are the main results of eight studies in different aspects of human communication from 2014 to 2023 conducted by the author of the current work and also based on a review of 70 papers published from 2000 to 2023. The results from a review of eight studies conducted on different aspects of human communication indicate the importance and effectiveness of communication initiation, information sharing, positive attitudes, and self-disclosure abilities of individuals in their personal, social and professional lives in the current diversified environments. Table 3 illustrates the main findings from analyzing eight studies conducted on different aspects of human communication.

Table 3. Main findings of eight studies conducted on different aspects of human communication.

Reference	Main findings
[53]	Communication initiation and information sharing among individuals positively affect their personal and professional lives. Obtaining new communication skills and cultural information helps individuals collaborate more and have broader perspectives towards the world.
[54]	English language proficiency (ELP) is among the main factors that affect daily interactions among international students. Individuals with higher levels of ELP have more interactions with different people.
[41]	Self-regulation abilities and the levels of individuals' heart coherence affect their interpersonal and intercultural communication competence (ICC). Communication initiation and daily interactions with different people help individuals to gain new skills and improve their communication competence.
[2]	Increasing cultural awareness and intercultural sensitivity enables individuals to improve their intercultural communication competence and conduct helpful intercultural communication. Cultural awareness belongs to obtained information and knowledge, cognitive and intercultural sensitivity belongs to personal attitudes, openness, and practicality.
[22]	Self-regulation abilities help individuals to improve the levels of their heart coherence and psychophysiological well-being.Their coherent heart and psychophysiological well-being enable individuals to increase their overall well-being.
[22]	ELP and ICC are the main factors that affect daily interactions among individuals from different cultures
[55]	Individuals with higher levels of ELP and ICC have higher communication initiation and effectiveness in culturally diversified environments.
[56]	Daily interactions among different people enable them to improve their ELP and gain new cultural information. ELP and communication competence are among the main factors that affect the personal and professional lives of students in current modern international universities

Results from a review of 70 works recorded and selected through an online search by the use of WoS and SCOPUS databases indicate the importance of modern technologies and technology-mediated communication, language proficiency, cultural awareness, intercultural sensitivity, positive attitudes and openness in daily interactions among different people in the 21st century. According to [11], in current modern societies, modern technologies and the Internet are essential for different aspects of human life. Mediated communication (MC) helps individuals know the clarity and ambiguity aspects of their interactions and enables students to have access outside their classrooms [59]. Table 4 summarizes the main findings from a review of 70 published papers recorded and selected through an online search from the existing literature.

Table 4. Summary of main findings from a review of 70 papers published from 2000 to 2023 (continued on p.10).

Ref.	Main findings
[59]	MC helps individuals to know the clarity and ambiguity aspects of their interactions
[60]	Language skills, adaption, flexibility, integration, and communication effectiveness are the main components of intercultural communication competence (ICC)
[61]	MC can experience more rapid changes than the emergence of scholars' work and publications
[62]	Communicators have higher self-disclosure levels in MC than in face-to-face communication
[63]	Acquisition of a second language and staying in other countries and cultures increase the level of intercultural sensitivity (IS)
[64]	Communicators use different symbols and cues in MC to express their emotions while interacting online
[65]	MC can be considered a quick way of information distribution
[66]	Individuals' personal characteristics and communicative goals affect the quality of their communication
[67]	MC enables individuals to establish relationships and acquire information
[6]	Cultural awareness (CA) and intercultural sensitivity (IS) are essential for healthcare professionals
[68]	MC is more effective in uncertainty reduction than direct interactions
[23]	People with effectual self-regulation practically direct their plans to attain their own self-arranged goals
[69]	Interactions through the Internet enable lonely people to connect with others
[70]	In increasingly diversified patient populations, IS is essential
[71]	ICC is a well-recognized aspect of modern life in local and global contexts
[72]	MC decreases shy communicators' receiving negative feedback from their interactions
[7]	Practical interventions could complement informative issues related to IA and IS
[73]	ICC is related to empathy, intercultural experience, and bilingualism
[74]	MC is an increasingly used approach in collaborations and decision-making processes in schools
[75]	MC helps students to increase the level of their cultural awareness and also their awareness regarding current events
[76]	Students' IS can be increased by participating in short-term courses
[77]	Their engagement in direct interactions helped students transform their prior information about other people
[78]	Self-regulation is to maintain one's focus on concentration on a particular goal in the presence of interruptions.
[79]	Individuals with good respect for cultural differences have higher interaction engagement
[80]	Attentiveness, self-disclosure, expressivity, impression-management, and other skills are among the main parts of MC competence
[81]	MC between friends through the use of instant messaging has positive effects on the overall well-being of teenagers

Table 4. Summary of main findings from a review of 70 papers published from 2000 to 2023 (continuation from p.9).

[82]	It is difficult for teachers with no multicultural experiences to help students increase there IS
[83]	Students who speak the same language use a foreign language more in MC than in face-to-face interaction in their classes
[84]	Both direct and mediated collaboration is helpful in the learning processes
[85]	Students with better academic ability reported higher IS
[86]	Computers, multimedia, and the Internet have revolutionized communication and mass media
[87]	Sensation-seeking can positively affect ICC
[20]	CA is essential in language teaching conceptualization
[88]	Good IS levels help people deal with differences
[5]	People from diverse cultures are interdependent with one another and are familiar with intercultural communication
[89]	MC enables people to share and exchange information without considering time and space limitations
[90]	The development of ICC includes observing emotions and feelings, questioning stereotypes, and dealing with confusion
[91]	Students focus on cultural aspects of language learning helps them increase their CA
[92]	The relationship between the disclosure reciprocity rule and the perceptual strengthening process in MC generates a perception-performance effect
[93]	Differences in the level of ICC of citizens affect the levels of eagerness, effort, and time they allocate to learning other languages
[94]	Self-differentiation mediates the relationship between spiritual comfort and ICC
[11]	In current modern societies, modern technologies and the Internet are essential for different aspects of human life
[95]	The value of ICC in international business is very high
[96]	Their stay abroad is a good chance for many students, but many students do not benefit from it
[97]	Assessment of ICC needs to be focused on practical aspects related to theories
[98]	ICC directly and positively relates to team performance
[99]	Some particular domestic programs help students improve their ICC
[100]	Improving ICC in different cultures is different
[4]	In the 21st-century, it is essential to increase ICC
[101]	The availability of opportunities for intercultural contact among students helps them to improve their ICC
[102]	Developing ICC with focus on IS as a should be considered in teacher education
[103]	Exposure to different cultures helped people improve their IS and ICC
[2]	A good level of ICC helps individuals to conduct helpful communication with other people
[104]	ICC has a relationship with interaction enjoyment and respecting different cultures
[105]	Intercultural activities can help students to promote their CA and ICC
[106]	As nurses need to look beyond individuals' cultural perspectives
[107]	IS decreases cultural distances between people of different cultures
[108]	Participation in seminars helps students improve their ICC
[109]	ICC is an essential requirement of the current globalized world
[8]	ICC is essential to today's economy
[110]	Meta-cognitive skills are related to ICC
[111]	ICC is essential in building harmonious communities
[112]	ICC plays a crucial role in the globalized environments
[113]	The improvement of ICC increase the effectiveness of workers
[114]	IS affects the improvement of ICC
[115]	Particular frameworks are required to assess ICC
[116]	The development of ICC manifests the vitality of transition
[117]	Overseas study is crucial to improving ICC
[118]	Engaging in online materials helps students to increase ICC

Moreover, the results from the reviewed works show that the vast majority (79 %) of the contents of the works belonged to Western issues and were collected and reported based on Western communication norms, especially the attribution theory of Heider [51], the psychosocial development theory of Chickering [49], the communication accommodation theory of Giles et al. [50], and the contact theory of Allport [48]. About 21 % works did not use a clear theoretical framework. Based on the results from the content analyses, communication initiation, disclosure, cognition, accommodation, communication competence, self-knowledge, respect differences, cultural awareness, positive attitudes, openness, purposefulness, effectiveness, intercultural sensitivity, self-regulation, technical skills, language proficiency, and heart coherence were mentioned in different parts of the contents as elements for communication competence and requirements for conducting successful interactions. Table 5 includes the results from the content analyses of the reviewed works.

Table 5. The descriptive results from the content analyses.

Element/Attribute	Number of works that used the term	Percentage
Initiation	53	75,7
Disclosure	42	62,8
Cognition	38	54,2
Accommodation	23	12,5
Comm. competence	62	88,5
Self-knowledge	27	38,5
Respect differences	46	65,7
Cultural awareness	42	60,0
Positive attitudes	27	38,5
Openness	43	61,4
Purposefulness	37	52,8
Effectiveness	35	50,0
Intercultural sensitivity	42	60,0
Self-regulation	17	24,2
Technical skills	41	58,7
Language proficiency	51	72,8
Heart coherence	9	12,8

Based on the analysis and assessment of findings from eight studies conducted in different aspects of human communication and the results from a review of 70 papers published from 2000 to 2023, four main steps and 13 primary conditions and requirements for conducting proper and helpful communication in the current diversified environments in the 21st century identified and introduced. Figure 2 includes the four steps and 13 conditions introduced for Communication and Cognition Theory.

Based on the results from eight studies and 70 reviewed works, in the current globalized world, people communicate with many people, have self-disclosure with some, remember information about some people they interacted with, and reach a level of accommodation with some people less than three other steps. Figure 3 indicates the four listed steps.

As Figure 3 indicates, based on the reviewed works, individuals communicate with many people based on their daily needs, but they share their personal information with some people based on their own needs and requirements, become familiar with a smaller number of people, and accommodate with a limited number of individuals. By following the above-mentioned steps, the number of communicators will be decreased, but the level of their closeness will be increased step by step.

Communication and Cognition Theory

Steps

Communication Initiation → Disclosure | Cognition → Accommodation

Conditions

Self-knowledge

Respect differences

Cultural awareness

Intercultural Sensitivity

Technical skills

Language proficiency

Communication competence

Heart coherence

Self-regulation

Effectiveness

Purposefulness

Openness

Positive attitudes

Figure 2. Four Steps and 13 Conditions of Communication and Cognition Theory.

Communication Initiation → Disclosure → Cognition → Accommodation
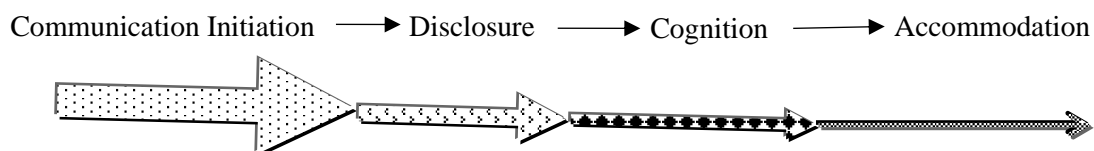
Figure 3. Four Steps of Communication and Cognition Theory.

DISCUSSION

Communication is an essential aspect and requirement of human life, and people of different cultures and societies are interdependent in the current globalized world, that deeply affected by modern technologies, such as the Internet and AI. The author of the current work, based on results from eight studies conducted in different aspects of human communication from 2014 to 2023 and based on his personal and academic experiences in different cultures and countries, found that the existing theories in the field of human communication developed and introduced prior to the rapid growth of ever-changing communication technologies and based on norms and values of homogenous societies or based on individualistic norms and values of some Western countries and societies cannot cover all aspects of human communication in the current diversified environments. Based on some researchers and scholars [42-45], people in the West primarily practice the low context of communication, which focuses on openness and

directness, while people in the Eastern parts of the world practice the high context of communication, which focuses on politeness and indirectness.

Moreover, the existing literature and works from different societies and cultures focus on human communication's importance. For example, some famous Poets, such as Mawlawi Rumi and Saadi Shirazi, focus on the importance of communication, cognition, and solidarity among humans and societies. To be active and productive in the current world, people need to interact with one another appropriately and correctly; they need to improve their communication competence, know how to interact with different people, and use the ever-growing modern technologies properly. Helpful communication theories enable and help people to adequately know, differentiate and apply different norms and skills when interacting with different people.

Thus, the current work assessed different aspects, steps and conditions that help people properly communicate in ever-growing diversified environments in the globalized world. Besides analyzing results from eight studies in different aspects of human communication, an online search of the existing published literature using Web of Science (WoS) and SCOPUS databases was applied to record and select related published works. A total of 186 items were recorded, and after the exclusion of 116 duplicated and irrelevant items, 70 papers published from 2000 to 2023 were selected and thoroughly reviewed.

The results from the mentioned eight studies focus on the importance and effectiveness of communication initiation, information sharing, positive attitudes, and self-disclosure abilities in individuals' personal, social and professional lives in diversified environments. The results show that overall well-being, language proficiency, and communication competence are among the main factors affecting interactions among individuals from different cultures. The results indicate that self-regulation, participation in daily interactions with different people, and technology-mediated communication help individuals improve their overall well-being, language proficiency, and communication competence [22, 55].

Moreover, results from a review of 70 works published from 2000 to 2023 indicate the importance and effectiveness of modern technologies and technology-mediated communication, language proficiency, cultural awareness, intercultural sensitivity, positive attitudes and openness in daily interactions among different people in the 21st century. Results from the reviewed works focus on the importance of ICC in human life in the current diversified environments. Based on the results, engaging in online materials helps students to increase ICC, and language skills, adaption, flexibility, integration, and communication effectiveness are the main components of ICC [4, 60, 90, 111]. Moreover, the improvement of cultural awareness, intercultural sensitivity, and English language proficiency are essential for individuals working in different professions in the current globalized world [63, 77, 88]. Based on the results, CA and IS are different but interrelated concepts, as CA is mainly related to individuals' obtained information and cognitive skills. In contrast, IS is mainly related to individuals' attitudes, intercultural experiences, and affective abilities.

The results indicate that personal attitudes and levels of openness and purposefulness affect daily interactions among different people. The results focus on the effectiveness of self-regulation and heart coherence on overall well-being, especially in daily interactions among different people [22, 23]. The results indicate that overall well-being is a requirement of conducting helpful interactions, and their financial and economic situations affect the overall well-being of individuals. Based on the results, cognition, getting information, knowing different people, understanding different norms, values and perspectives and reaching a state of accommodation in the current ever-growing multicultural environments in the 21st century are modern communication's main aims and aspects.

Some researchers and scholars [1, 2], focus on the effectiveness of interactions among people in sharing their different values and establishing social and cultural relationships. According to them, social skills, intercultural sensitivity, communication competence, and understanding and applying unified theories and conceptual frameworks help different people conduct fruitful interactions. Miller [15] believes that communication theory helps individuals to know different communicative norms and to choose suitable ways to communicate.

So far, most theories and conceptual frameworks in communication have been developed by Western scholars and focus on the Western norms of social lives and communication. Based on [38] and [40], communication theories mainly focus on Western communicative and social norms because almost all communication theories were developed by Westerners. As different societies and cultures have their communicative norms, thus theories which developed based on the social and cultural norms of one context of communication may not work in other areas and under different contexts of communication.

Theories developed based on Western norms and Western cultural values mainly focus on individualistic and liberal lifestyles. At the same time, people in the Eastern parts of the world primarily practice different perspectives and interact based on the collectivistic norms of communication. According to [42] and [43], there are many differences between Western and Eastern lifestyles and communicative norms. Westerners prefer to be open, friendly, dramatic and direct when interacting, while Easterners prefer to be polite and exchange their messages indirectly. Thus, the theoretical norms could also bring different results from one context to another. The results from this study confirmed that some principal elements and attributes that help individuals interact with different people in the Eastern parts of the world are different from the main elements of the same process under the Western context of communication.

Based on the results reported in the current work, communication initiation, disclosure, cognition, and accommodation are the main steps of human communication in the 21st century. According to the mentioned results, self-knowledge, positive attitudes, self-regulation, heart coherence, cultural awareness, intercultural sensitivity, openness, purposefulness, respect differences, language proficiency, technical skills, communication competence, especially intercultural communication competence, and effectiveness are among the main conditions and requirements that help and enable individuals to conduct proper interactions in the current multicultural environments.

Moreover, according to researchers and scholars [30, 33-35], positive attitudes towards AI technologies, language skills, technical skills, awareness of the benefits and challenges of AI, prompting, machine-learning abilities, teamwork and human-machine collaboration are among the main AI skills. Thus, some conditions proposed in the current theory, such as positive attitudes, language skills, technical skills, openness and flexibility, can help individuals to overcome some probable AI-related challenges in their daily interactions. The findings, steps and conditions reported in the current manuscript may help individuals and researchers to conduct proper communication with different people and design and conduct helpful studies in the field of human communication in the age of artificial technology.

CONCLUSIONS

Communication is an essential aspect and requirement of human life in the current world diversified and globalized world deeply affected by modern technologies, such as AI. To interact appropriately with one another, individuals need to improve their communication competence and know how to interact with different people. The current work assessed different aspects, steps and conditions that help and enable people to communicate correctly in the current diversified environments. The findings reported in the current manuscript stand on

an analysis of the results of eight studies conducted in different aspects of human communication and a review of 70 papers published from 2000 to 2023. The results from eight studies from 2014 to 2023 focus on the importance and effectiveness of communication initiation, information sharing, positive attitudes, and self-disclosure abilities in individuals' personal, social and professional lives in the current diversified environments. The results show that overall well-being, language proficiency, technical skills, and communication competence are among the main factors affecting interactions among individuals from different cultures.

Moreover, a review of 70 works indicates the effectiveness of modern technologies and technology-mediated communication, language proficiency, cultural awareness and intercultural sensitivity, technical skills, positive attitudes and openness in daily interactions among people in the 21st century. The results from the reviewed works focus on the importance of overall well-being, positive attitudes, openness, cultural awareness, intercultural sensitivity, English language proficiency, and intercultural communication competence in human life in the current diversified environments in the 21st century as well. Results reported in the current study indicate that cognition and knowing different people and different norms and values, and reaching a state of accommodation in the current diversified environments are among the main aims and outcomes of daily interactions among different people.

Based on the results reported in the current manuscript, communication initiation, disclosure, cognition, and accommodation are the main four steps, and self-knowledge, positive attitudes, self-regulation, heart coherence, cultural awareness, intercultural sensitivity, openness, purposefulness, respect differences, language proficiency, technical skills, communication competence, and effectiveness are the top 13 conditions and requirements that help and enable individuals to conduct proper interactions with different people in the current multicultural environments in the age of AI in the 21st century. Furthermore, based on the literature, the primary and essential skills for the helpful application of AI technologies are positive attitudes towards AI technologies, language skills, technical skills, awareness of the benefits and challenges of AI, concise prompting, machine-learning abilities, teamwork, and human-machine collaboration. Steps and condition proposed in the current manuscript/ theory could help individuals from different cultures to conduct proper interactions in the current world broadly diversified and deeply affected by modern technologies, such as the Internet and AI. Some conditions proposed in the current theory, such as positive attitudes, language skills, technical skills, openness and flexibility, can help individuals to overcome some probable AI-related challenges in their daily interactions.

PRACTICAL ASPECTS

The current work suggests a new theoretical framework based on the consideration of different aspects of human communication in the 21st century. This work addresses the different social, cultural, and communicative norms in the different communication contexts and societies, and also focuses on the ever-changing aspects of communication technologies. This work suggests some practical steps and conditions for conducting helpful communication in the current diversified environments deeply influenced by modern technologies. Thus, this work could help individuals to conduct effective communication with one another, could help researchers and scholars to assess daily interactions among different people, and also could help policymakers to establish and apply helpful communication strategies based on the requirements of current ever-growing diversified environments.

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REVIEW OF RECENT LITERATURE ABOUT LEISURE TIME OF SCHOOL-AGED CHILDREN AND YOUTH IN CROATIA

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ABSTRACT

This review covers peer-reviewed publications about free time of school-aged children and youth in Croatia, published since 1990. We briefly present these publications and extract their common points. Based on that, we suggest possible addition to leisure time activities of school-aged children and youth.

KEY WORDS

CLASSIFICATION

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INTRODUCTION

Free time is an important part of lives of school-aged children and youth [1-9]. Many researchers approached that notion, in order to characterise it, to contextualise it, to understand whether there exists a universal form or many specific forms of free time, to analyse or propose its structurisation and to address other topics related to that notion [1-4].

Additional topic is the free time structure. How to describe it? Is there some optimal form? Does that structure change over time? If it changes, does it change primarily because of a persons' age, because of changes on societal level, or because of some other reason? Moreover, are the answers to stated questions universal, or differ among communities?

The structure criterion is one of the main scientific and research starting points for determining the quality of free time. Although, in addition to the structure, the quality of free time is also defined by other micro and macro systemic factors, it has been shown that the structure of free time is of great importance for the potential development benefits of children and young people. Until now, the Croatian scientific framework has dealt with research that goes in the direction of analysis and research of the basic structure of free time. Despite the valuable scientific conclusions derived from these analyses, the interdisciplinary field of free time brings limited scientific results in relation to the world science of free time, which advances both scientific evidence of the optimality of free time for children and young people, as well as practical implications. Although international research is important and provides valid scientific research guidelines, scientific conclusions are not always applicable to every area of free time presence due to the cultural determinants of free time. From this comes the importance of scientific research on free time in Croatia.

Our long-term objective is to contribute to better structuration of the leisure time, as part of a free time of children and youth. This article is our starting point in achieving the stated objective. It analyses existing, recent literature about free time of school-aged children and youth in Croatia. However, because time spent in school and time spent in conducting school-related tasks (e.g. homework and learning) are important and significant parts of childhood and adolescence, there is a diffuse boundary between them and the free time. In particular, here we consider free time as consisting of leisure time, time for out-of-school activities and time for out-of-class activities. Before proceeding, let us note that majority of approaches utilise definition of free time formulated by J.R. Kelly [8; pp.54-55] or J. Dumazedier [8; p.66], which is why we do not address here the definition of free time in details.

It is important to characterise the texts included. We included texts from 1990, as that year mark the beginning of significant political and societal changes, which rather soon brought about correspondingly significant changes in the education and overall, in relation between the society in general and its youth. Since we restrict the review to free time of school-aged children and youth, further in the text we will assume that children and youth attend primary or secondary school, if not stated otherwise. However, some of the literature encountered is not devoted precisely for them, the children and youth in schools. In order to gain a broader and better insight into free time, apart from the population included in the regular education system, this paper provides an insight into free time that applies to young people outside the education system as well as adults.

One must be aware that free time is important for children and youth primarily because of its role in their formation. Because of that, during free time many important processes take place, such as value formation, socialisation, sub(culture) adoption, various aspects of risky behaviour, etc. Articles which explicitly cover such topics, but do not contextualise it clearly in a free time, are not covered here.

Although it includes all important relevant scientific conclusions about free time, this work does not show the historical context of free time and does not deal with historical facts related to free time in general. We tried to represent included articles with mentioning briefly their main points, however, we are aware that it cannot be optimally done and consider that this review will serve the readers as starting point for their reading of the covered literature.

While on the one hand we extensively searched the publications related to that topic, we are aware that some of the publications could be missing from the presented collection. In a small part we purposefully avoided publications that were prepared for specific purposes and are shortened versions of other publications presented here. Despite our efforts, it is possible that we unintentionally missed some of the publications devoted to the topic of free time of children and youth in Croatia.

In the second section we present an extensive list of such a literature, and briefly characterise it. Third section concludes the article and provides a particular perpsective.

REVIEW OF THE LITERATURE

There are the following forms of the literature about free time of school-aged children and youth in Croatia: monographs, proceedings and project reports, and articles.

As an introductory, yet summarising text of existing needs and constraints, we emphasise a text by V. Previšić, part of a foreword in [5; pp.9-10]:

> *Free time is still today ... a very modern and current topic. Intended for rest, leisure, recreation and personality development of each individual – separated from daily biological, needs, work obligations, family duties and social-individual life – free time offers what to do when there is "nothing to be done"! How to carry it out in a meaningful way or just "get lost" in ignorance and not getting along with this benefit and the reach of modern life in time of the fourth scientific and technological revolution. As it was during time of Danica Nola's work, today the following question is actual: what to do through institutions and societies intended for the life of children and youth outside of school and family, to fulfil their free time in an organized way, but the way that will not be overly programmed, pedagogic and arranged to exterminate the essence of the child's natural and natural development.*
>
> *Children and youth need "unstructured free time". But, equally, how to resist commercialized offers and consumerist contents that do not care about the natural children growth; their individual and social integrity.*

In diverse forms, thoughts presented in that text are found in other included texts, thus one can argue about a spontaneously and independently reached consensus regarding more important aspects of children and youth free time.

Before proceeding, as a specific theoretical approach encompassing national context and diverse concurrently realised processes, we extract another V. Previšić's contribution [10], in which he points that free time is contemporary important phenomenon. Work and free time are to be considered on equal footing as they both are non-separable human activities [10; p.404]. He states that "it is possible that children and young people do not really decide and do not manage their free time (due to the different influences of parents and aggressive external manipulators primarily aimed at children and young people)" [10; p.405]. Previšić considers that family is the first and foremost factor of educational during free time, followed by school and by out-of-class and out-of-school activities [10; pp.405-407]. However, according to him the role of the school should be enhanced since its actions are incorporated into the basis of education.

TEXTBOOKS AND MONOGRAPHS

Monographs dealing with free time of children and youth cover in detail both the theoretical notions originating within the pedagogy of free time, and experience collected from realisations of initiatives related to free time of children and youth.

In particular, the university textbook by J. Plenković [2] encompasses the theoretical background from pedagogy of free time. But, pedagogy of free time is much more than a scientific discipline. It is so because there is a world-wide actuality of pedagogy of free time, and especially its futuristic importance for the theory and practice of education in the 21st century, which the author explicitly states as one of the three main reasons for dealing with pedagogy of free time [2; p.5]. Following that, the fundamental task of a pedagogy of free time is to enable all people to fill their free time, which remains after they conduct their duties, with activities which will ensure the optimal opportunities to develop their strengths and capability for personal and societal development [2; p.45].

The author defines free time and emphasises that it is to be approached as a collection of activities [2; p.9]. Based on the activities of a pupil, free time is divided into tri basic groups: time for rest, time for recreation and time for personal development [2; p.40]. There is societal need for coherent action devoted to organisation of free time, because the free time is also the source of large number of problems, which are important for positive or negative human development [2; p.10]. Free time is characterised with its dynamics, as it is an ever-changing process in human history and development of work [2; pp.20-21] within which one observes continuous confrontation of models belonging to earlier approaches with novel educational needs [2; p.91].

D. Nola, with her impressive opus about the interplay between the child games and child creativity, in the following two works emphasised the importance of free time for children and youth: "Culture and Free Time of Youth" [5; pp.109-116] and "Free Time – a Distinct Phenomenon of New Informatic Civilisation" [5; pp.117-124]. Because the development of civilisation brought about significant rise in average free time of a person, there is a need to structure it with appropriate out-of-school activities, and that need is to be fulfilled promptly as there are many intentional, yet not benevolent, initiatives that also tend to take over the youth free time [5; p.112]. The author emphasises the importance of free time for proper societal, developmental action [5; p.121], and moreover emphasises the role that free time has in making possible the revealing and expressing of creativity of individuals and groups [5; p.122].

G. Livazović exhaustively describes existing approaches and individual contributions of experts and scholars to the pedagogy of free time [6]. He provides the readers with the history of research about free time in Croatia [6; pp.178-181], and similarly to other authors relates the rise in the amount of free time as well as the rise of the importance of its structuration to development of industrial societies [6; pp.76-77]. He contributes to free time structuration by dividing the existing, rather large number of activities conducted within free time into well-described groups: games, hobbies, creativity, and group of mixed activities [6; p.254, 6; 263]. There are further theoretical contributions to pedagogically founded structuration of free time by the same author, but with surveying higher education students [11].

V. Puževski, in a part of his large collection of articles devoted to diverse school-related topics, from theoretical to practical approaches, he deals with the notion of free time [7; pp.97-98]. He states that free time is a general societal fact. Gradually, average person's free time enlarge as a consequence of several competing processes; lessening of working time but devoting more time to societal obligations and to emerging system of a permanent education [7; p.97]. Having in mind that children and youth are subject to diverse influences from their environment, it is of ultimate importance to determine who and how will conduct the development of their relation toward free time and culture [7; p.98]. Regarding free time, V. Puževski concludes that as a

consequence of all stated, a new task for schools emerges: the education for free time [7; p.98]. However, he treats out-of-class and out-of-school activities in more details, as he considers a reformed, new, "open school" as a school for more out-of-class activities. Schools will be, according to him, creators, facilitators and coordinators of diverse education programs, with ultimate aim to enable students to maximise their potentials, sociability and preparation for life [7; p.120]. He mentions paradoxical examples of out-of-school activities that have become almost school-based activities, as a spontaneous consequence of a tendency for their better organisation. That should in fact be avoided so that out-of-school activities can become basis for authentic companionship and true youth-societies [7; p.120]. He concludes that development of out-of-school activities is a combined task of schools and many shareholders ranging from families to economy institutions [7; p.128]. He analyses in details notions of extended and full-day schooling [7; pp.137-163] and lists approaches that has already existed in practice.

V. Rosić [8] provides the readers both with the detailed approach to pedagogy of free time and its various aspects, and the guidelines for its successful organising and conducting. He presents genuine importance and characteristics of free time [8; 65-132] and provides readers with more action-oriented approaches to free time [8; pp.163-190]. Moreover, he lists ten rules how to organise better out time (implicitly: free time) and achieve success [8; pp.176-179] and develops in details workshops devoted to rising awareness of various aspects of free time [8; pp.199-203].

V. Mlinarević and M. Brust Nemet [12], in the extensive monograph, present detailed review of scientific and professional texts devoted to free time of children and youth, additionally presents historical development of our understanding of that notion, to which they add description of existing approaches and definitions. They stress modern characteristics of free time [12; pp.24-25]. The authors list four conditions for reasonable and cultured use of free time: "to provide various opportunities for cultural, social and individual use of free time; to train children and young people to systematically and optimally use these opportunities; to encourage the establishment of youth centres at the national, county and city levels; and to encourage the opening of 'schools for parents' and organizing projects for awareness and training of parents" [12; p.40]. Mlinarević and Brust Nemet list contemporary problems about free time of children and youth, discuss media influence, emphasise educational role of sport and in particular deals with extracurricular activities in school curriculum (both out-of-class and out-of-school). Regarding that last point, the authors stress that in such activities both the students and the teachers who lead the activities – are sucreators. Important contribution to such activities is animation and encouragement [12; p.190].

The authors conducted empirical study in school year 2010/2011, in 3 urban and 3 rural primary schools in three counties of region Slavonia, incorporating in total 344 respondents: students of these schools, leaders of extracurricular activities and teachers. Almost all the students participate in several extracurricular activities, most of them in choir, sport and drama-recitation activity. Along with data about distribution of participation in activities, the authors present teachers' attitudes and reasons why students participate in some activity.

Previously, Valjan Vukić prepared a review article about free time of children and youth [13], that included also a detailed theoretical approach to the notion of free time.

There are several proceedings of conferences and thematic issues of scientific and professional journals devoted to free time, either solely to free time of children or generally to free time for all age groups.

GENERAL APPROACH TO FREE TIME

Cindrić presents part of the larger project devoted to the out-of-curriculum and out-of-school activities of primary school students [14]. The research is partly motivated by the observed need to modernise the organisation of these activities, taking into account developmental

particularities of the classroom and of the subject teaching. Out-of-class and out-of-school activities contribute to confirming the children's creative abilities [14; p.51]. Generally, these activities are characterised by the activity itself, by the organisation and by the voluntary participation [14; p.51].

The peculiarities of teaching, as a consequence of the appropriate age, are that in classroom teaching the basis is group connection, so out-of-class and out-of-school activities require compact groups and joint activity [14; p.53]. In contrast, the age of students in subject classes is characterised by individuality, separation from parents and family and striving for independence. At that age, the group is a necessary living environment for the child, it is hierarchically organised, and friendship is important to children [14; p.54].

The author considers in detail many aspects of the mentioned activities, such as basic starting points, organization of work, preparation of the new school year, scope of the program and work schedule, form and method of work, personnel prerequisites and pedagogical documentation [14].

Vukasović [15] points that proper education is powerful and the only protection of youth from physical and moral degradation. In circumstances valid during time of his writing, he concluded that education in free time is rather new and unavoidable pedagogical need. Along with these statements he suggests possible way of inclusion of relevant institutions. He argues about contemporary battle for free time. Earlier tendencies resulted in quantitative enlargement of free time, while in the time of preparing his text the main problem is quality of free time and culture of its implementation [15; p.452]. According to Vukasović, family, school, church, cultural institutions and media may contribute in solving that problem.

Puževski, in a reminder about some historical moments in national pedagogy [16], deals with two topics. First, he considers research and development of our own type of elementary school and secondly he considers how is free time related to development of elementary school. His work combines historical notes and theory of future school, with practical examples.

Ilišin, in a collection of articles devoted to free time and other parts of youth life, covers extensively its diverse aspects [17-24].

She analyses data collected in 1986 and 1999 about young people aged 15-29, to analyse the structure of free time and the changes that occurred in the observed period [17]. One of the stated hypotheses is that changes affected more the hierarchy than the structure of free time. According to Ilišin "Free time survives/remains primarily as a training ground for leisure, relaxation, and recreation. At the same time, this means that the realization of the function of free time that contributes to personality development can only be discussed sporadically, and more in the context of patterns that belong to the field of mass culture, than as part of elite-cultural pattern, since they are used by a small number of young people" [17; p.423]. Here, the elite-cultural pattern represents playing electronic games [17; p.423] and is significantly connected to education, urbanisation of the neighbouring places and to regional specificities.

Ilišin [18, 19] presents results of a detailed study regarding children' free time, a part of a larger research about children and media. Following survey in 2000, 1000 questionnaires were obtained for further analysis, all filled by children from 5th to 8th grade of 10 Croatian primary schools. Overall, 25 questionnaires were collected from each of 40 surveyed classes, with due attention devoted to their representativeness [18; pp.34-35]. Research concentrated on leisure time, to be differentiated from semi-leisure time, within which out-of-school activities are conducted [19; p.101].

The author pays attention to "... several indicators of children's free time: involvement in extracurricular activities, amount of time they spend alone at home, favour forms of socializing,

way of spending school holidays, experiences with psychoactive substances, and amount of daily free time and activities in that. With regard to the topic of the research, among the activities a special place was given to the use of various mass media, while some activities were deliberately omitted" [19; p.102].

The data show "that a quarter of children are not engaged in any extracurricular activities, and that the most popular is active participation in some kind of sport. A fifth of children learn a foreign language, and a little less of them attend a music school or course, and only one in twenty tries to express themselves in literature or acting" [19; p.103].

Another result of Ilišin is that "Children who are not occupied with some extracurricular activity do not have more free time (which would be expected), and the reason for this is probably that these children are occupied with some other obligations (eg helping with household and similar tasks)" [19; p.105].

After analysing the data "it can be concluded that the majority of students are not without the supervision of their parents or some other family members for a long time" [19; p.109].

Author presents detailed distribution of leisure time [19; pp.116-117] and analyses its connection with age, gender, size of living space and other respondents' characteristics. She concludes "that the examined children do not have an enormous amount of free time, but still more than enough to think about how to fill that time with contents through which the children will be entertained and educated at the same time" [19; p.117], and overall argues that "it could be stated that the surveyed children are relatively disciplined" [19; p.118]. Children spend most of their free time on the media, but when looking at individual activities, social contacts are the most common [19; p.119-120]. Several patterns of behaviour were observed from the data, which fit in with previous research on young people [19; p.126-127].

Ilišin conducted and presented additional research about children and media [20]. Media analysed [20; p.21] were printed media for children and youth, radio, television and personal computers. In particular "It was revealed that the use of different media, apart from socializing with peers, is the most common activity in children's free time. As in the world, the most used media is television, and children most often watch film programs and quizzes" [20; p.9]. As one of the conclusions of the research, Ilišin points out as a surprising and devastating finding that "the level of education of parents does not affect the use of media by children, nor their communication with children about media content. This tendency suggests that, although parents are considered to have the greatest responsibility for training children to use the media selectively, they are not (yet) ready to assume the role of media educators" [20; p.9].

Along with presented articles, devoted to free time of children, Ilišin analysed free time of young persons, aged 15-29 [21, 22], based on data collected in 1999 and 2004 about 30 activities that they conduct. Despite the rather small time period between two data collecting, data from 2004 show somewhat larger participation of youth in all listed activities along with rise in their interest for these activities [21; p.198]. Data, analysed in details, reveals heterogeneity of the youth, as seen in many aspects [21, 22]. Overall, eight patterns of youth behaviour are mutually differentiated. It is found that "Situational (marital and socio-professional status) and socialization (age and level of education) circumstances are the characteristics differentiate young people to the greatest extent in accepting or rejecting certain forms of free time" [21; p.198].

Ilišin analyses interests of young people and their relation with free time [23]. She theoretically clarifies these notions. Regarding interests, she focuses onto the list of 15 interests about which young people were surveyed twice in the past. In later survey respondents showed larger interest for almost but not all the tested phenomena [23; pp.273-275], while relative importance of interests was also somewhat changed [23; p.275]. Ilišin reveals and describes four groups of

interests. Generally, interests for private sphere are stronger, and interests for public sphere weaker [23; p.298]. Activities in free time are factorised into seven groups. Author lists and discuss the respondents' characteristics which significantly influences activities conducted in their free time. Since respondents were young people aged 15-29, as in some other papers, a care must be taken if one wants to address some of the findings onto youth aged 15-19.

Ilišin formulates simple yet profound analogy: "the more varied the interests of young people, the more meaningful and richer their free time" [24; p.299] to which she adds that "Free time is part in which the socialization of young people takes place, and cultivated free time can contribute the most to the development of their identity" [24; pp.300-301]. In her work [24] she in details presents data and compares results of two surveys, the national one conducted in 2004 and the Zagrebačka county one conducted in 2006. Hierarchy of 15 interests that were presented to respondents in these two surveys is almost identical. The most important interest is friendships and acquaintances, although generally young people in county have lower interest for phenomena than young people at the national level [24; pp.302-309] – it is to be emphasised that methods of implementation are compliant, yet participation in available activities is lower on county level than on national level [24; p.307].

Hanžek et al. undertook research to find out interested in the needs of young people in local communities, and to formulate recommendations, the implementation of which will make future national and local youth policies more aligned with the needs of young people [25; p.58]. In order to achieve stated task, first they surveyed 358 students from 2nd grades of 10 secondary schools in 5 Croatian cities [25; p.60]. Distribution of free time is similar in all cities, with 43 % of respondents having more than 4 hours of free time daily [25; p.62]. Respondents are rather satisfied with their free time, however in the largest city included in the survey none of the respondents was completely satisfied with it. The authors present in detail in which activities the respondents participate, frequencies of these participations and level of importance that respondents attribute to the activities.

Regarding characteristics that some person should have to work with young people, respondents listed communication skills, listening skills, skills to motivate young people, creativity and tolerance as important characteristics [25; p.87].

Hanžek et al. conclude that "young people are extremely poorly informed about the role of youth organizations in their local communities. It has been shown that in no city do students know about the existence of youth centres, youth clubs and youth associations. In addition, respondents are dissatisfied with the offer of free time activities, which they mostly get information about via the Internet" [25; p.89].

Gvozdanović et al. [26] conducted exhaustive research about young people. The survey conducted in 2018, included 1500 respondents, aged 14-29 [26; p.5]. Out of that group, 35 % of respondents have 14-19 years [26; p.7] which is why many of results cannot be straightforwardly interpreted from the point of view of free time of children and youth as we specified in this article.

Miliša, Tolić and Vertovšek [27] are some of the authors focusing onto the influence of media onto children and youth. That influence is pervasive, gradually increasing and influences many dimensions of children development, free time structure being just one of them. In particular, they state "In this part of the book, the warning fact is pointed out that the time young people spend in front of screens (television, mobile phones and computers) has become equal (and sometimes exceeds) the time spent in schools" [27; p.177], and add to that "Nowadays, it is impossible to consider any aspect of young people's lives outside the context of media influence" [27; p.177]. The authors observe that the very negative orientation in structuring free time is the most dominantly represented [27; p.180] and continue with several more aspects of the influence that media has on children and youth.

The authors undertook empirical study by surveying 227 students from 7th and 8th grade of 3 elementary schools in Zadar. Data revealed that: 30 % of respondents watch television programme 3 or more hours [27; p.185] (expectedly daily) with girls prevalently watching series and boys sport; more than one third of respondents use mobile phone more than 1 hour per day [27; p.187]. By comparing various papers that collected data about the use of technology, the period represented in this article is shown to contain significant technology changes, and rather fast consequent changes in the social domain.

Miliša and Milačić further develop stated notions about the role that media have on development of young people [28]. Thes stress the current lack of experts in the field of media pedagogy, the need for whom is related to more entertaining but also manipulative content in the media, the consequences of which are more and more disastrous for the creative expression of youth [28; pp.572-573]. They analysed data collected during 2009 from 319 secondary school students and university students to obtain distribution of activities that respondents attend in their free time, as well as to obtain diverse additional data.

Potočnik [29] concentrates on the relation between the young persons and technology use. It is indirectly related to free time, since new technology brings about additional activities and redistribution of duration and intensity of activities that have been previously conducted. Goals of her research [29; p.108] include, among others, comparison of activities in 1999 and in 2004 for young people, and comparison in activities between young and older people (older being people of age 30 or more). Data point out the tremendous enhancement in owning of high-technology gadgets [29; p.109], presumably but not exclusively among younger group. Moreover, "By comparing the data for the younger age group, we see that the biggest growth occurred in the possession of mobile phones. The growth in mobile phone ownership is also noticeable because it is a device that is mainly used for personal purposes and is most often associated with personal ownership, while all other devices are owned at the household level" [29; p.110]. Along with detailed data about socio-demographic characteristics of users of technology, author also in detail analyses reasons underlying absence of use of technology [29; pp.115-117]. Author carefully analyses data about regional concentration of technology gadget owners and points out that it has regular, previously observed gradual dynamics [29; p.114].

Polić presents a theoretical approach to understanding trends in education and society that generally influences development of children and youth [30]. She critically addresses a wide range of aspects that form leisure time of children and youth, as well as of adults. On the one hand she effectively reviews available literature and on the other hand she rises questions that may serve as starting points for future studies. In particular, she notes that "The question that arises after all is: can people recognise leisure as their need? According to everything, it seems that there is little room left for leisure, and then also for learning, which would not serve this or that purpose, but would simply be the satisfaction of a personal need. A big role in this is certainly played by 'education' that does not nurture personal research ability – and then the need for creativity – which begins with that well-known and often repeated children's question: *why*? [30; p.35]. The author concluding thought is that "modern education should encourage and nurture, and not, as it seems to do now, denounce the need for leisure, which should not be equated with useless idleness, but precisely with the time of freedom in which and through which people as cultural and historical beings they only have a future" [30; p.36].

Perasović [31] discusses relationship between the leisure time and subcultural identity within sociology of youth subcultures. He considers free time to be at the centre of discussion about subcultures, and is considered to be the source of subcultural identification [31; p.411]. He further states that "the fact that the process of subculturalization most often begins in the 'sphere of free time' does not imply limiting the results of that process in any way ... to the sphere of free time ... this will also persist in the spheres of school, parents' home or work [31; p.407].

Perasović and Bartoluci [32] combine many studies about youth free time and derive several conclusions. In particular, they consider leisure time as a crucial for young person's development; within their leisure time domains, young people often build up their own identities and lifestyles; leisure time is important for quality of life, but it cannot have the leading role as does the formal education, employment and tenancy; kinesiological activities – in the widest meaning of the expression "doing sport" is of crucial importance for health of each individual and the whole society, but still, practising sport is at the level much below the needed, or expected one [32; pp.16-17]. There is a trend of lengthening the period in which young people live with their parents, which leads to complex economic and psychological dependence [32; p.19]. The authors considers that it is of vital importance to find modalities strengthening the recreational, regularly conducted physical activity [32; p.22]. As an additional note, the authors observe that there are reasons for both pessimism and optimism about the changes, the latter being a consequence of the fact that in post-industrial societies there is a stronger interest in, among other topics, one's own body and health [32; p.23].

Along with these two contributions to free time of young people in which it is connected with the notion of subculture [31, 32] there are many contributions solely to subculture. Implicitly, many aspects of subcultures are formulated, conducted and modified in free time of their members, see. e.g. [33]. However, such implicit references to free time are generally avoided here.

It is seen that many authors deal with socialisation of the youth, and stress the importance of free time for that, gradual and all-life important process. Socialisation, and overall value formation is a much broader topic. More detailed contribution to values of young people is a review article by Franc, Sučić and Šakić [34]. In addition to general approach to values, these authors analyse surveys about values of young people in Croatia, that were conducted in 1998 and 2006. The authors were, in particular, interested in answering "What are the value priorities of young people, and do they change over the years? Are values related to the attitudes and behaviours of young people, and can they be considered risk or protective factors in the development of young people?" [34; p.144]. The analysis of collected data about attitudes toward 18 individual values revealed that, for both surveys, values group into three value orientations, that were on average all estimated to be important: self-actualisation (which was shown to be the most represented by Croatian secondary school students), the conventional orientat, and the hedonistic orientation (the least represented by Croatian secondary school students) [34; p.139].

Mlinarević analyses diverse aspects of free time [12, 35-44]. In a short, yet profound statement, she stresses importance of the structure of free time: "Because, in order for free time to optimally contribute to the developmental and preventive role in the life of young people, it is first of all necessary to determine the structure of the total free time, and especially the individual activities that take place in it" [35; p.54]. Following that, she conducted empirical work based on which she concluded that structure of free time of children and youth contains four substantially different factors which qualitatively differentiate free time of respondents [35; p.166]. Mlinarević states that "Youth of the 21st century enjoy the chaos of information and ideas and often create new ones precisely in negation trends. Sometimes they do not respect the traditional way of life rules, seeks spontaneity, and the ideal is to be stunned" [36; p.244]. It is important, because "with constant, painstaking pedagogical work with children from their earliest childhood, children can be taught to perceive free activities as an incentive to 'use' time, and not 'kill' it" [36; p.243]. Mlinarević connects these statements with their longer- time importance for society by stating that "Young people are the bearers of change and the bearers of a new, better way of working that can contribute to the realization in all spheres of society. Unfortunately, very few things come as a youth initiative. This is worrying, especially if one takes into account the fact that young people will be leading this country in a few years" [37; p.56]. She considers a culture rather important in effective two-

way communication with young people, within which one can find what they really think. Mlinarević alone [35-38], or in collaboration [39-44], conducted a series of empirical studies in primary and secondary schools in region of Slavonia in Croatia in order to find out quantity and distribution of free time [35-37], attitudes of students and teachers towards these activities [39, 40], styles of spending the free time by school-age students [36]. Mlinarević, Miliša and Prorotović compare results of two empirical studies to determine "with which activities young people (high school students and students) fill their free time, how satisfied they are with it and what is their value orientation towards education and work" [39; p.86]. The authors argue that "It seems that we are in a time where young people are personally uninterested and passive, so the question arises of the further development and prosperity of young people in terms of education, learning and future work" [39; p.96]. Mlinarević and Brust [41] surveyed 53 students, 17 teachers and a director of one primary school to find out attitudes of all respondents toward extracurricular activities. That approach was further developed by Mlinarević and Matanović [40]. These authors stress that students generally are highly motivated for activities in which they participate in their free time [40; p.334], survey 23 teachers and 103 elementary students from 6 primary schools, and after analysis of collected data reveal several reasons why surveyed teachers' lead extracurricular activities along with student respondents' attitudes toward the activities [40; p.344]. Within that approach, Mlinarević and Brust Nemet [42] surveyed 344 primary school students to find out about the distribution of their involvement in extracurricular activities, about their reasons to participate in some activity and satisfaction with it, and about the possibility that the students contribute suggest some activity. All three studies [40-42] state that students are marginally involved in creation and structuration of extracurricular activities.

Mlinarević and Gajger in details discuss contemporary situation regarding on the one side children and youth needs and aspiration, and on the other response from societal environment, particularly school [43]. They critically approach the subject and, among other aspects state that "instead of offering activities for which students are interested and motivated, schools offer those activities for which they have the conditions … and the organization and offer does not correspond to the diverse interests and needs of young people, and if they do not have an adequate quality offer even outside of school (which is often the case in smaller communities), the space of free time remains open to all other, often negative influences" [43; p.50]. Moreover, they argue that "Young people are less and less organizers of entertainment and free time, and more and more consumers of content offered by highly professional machinery" [43; p.44]. The authors present data about two extracurricular activities, that are held annually for several decades: one for gifted primary school children and the other for creativity in art.

Rattinger focuses onto quality of life [45, 46]. In their research she stresses the importance of online social networks, because youth rather rapidly adopted these new technologies and integrated them in many aspects of their life, including free time. Overall, Rattinger recognised and explained the need to analyse in detail the relationships among youth leisure time activities, their attitudes about online social networks and their overall quality of life [45; p.45]. She surveyed 150 students, from 1st to 4th grade of different secondary schools in the city of Zagreb and Zagrebačka county [45; p.45]. Data shows that respondents have on average between 4 and 5 hours of free time daily, but some of them stated that they do not have free time. Respondents on average spend 2,3 hours per day using online social networks, usually between 2 and 3 of them [45; p.46]. They use online social networks primarily for continuation of communication with friends and then for viewing pictures and videos [45; p.47].

Respondents are generally satisfied with the quality of their life: "the surveyed students are satisfied with themselves, their work ability and interpersonal relationships. They believe that their life has meaning, they enjoy life, they generally have a good ability to concentrate and have enough vital energy. They accept their external appearance well. They consider

themselves informed and have time for themselves and activities according to their own wishes. They are satisfied with living conditions, mobility and health care" [45; p.50]. They are not so satisfied with their sleeping and their concentration [45; p.50].

Rattinger analysed collected data and showed that there is statistically significant difference about self-evaluation of quality of life and gender: boys are more satisfied with their quality of life than girls. There were no statistically significant differences in that self-evaluation regarding location of the school [45; p.52], regarding school achievement and major in school [45; p.54].

In another work, Rattinger considerably broadened scope of her research [146]. In 2018, she surveyed 594 secondary school students from city of Zagreb and Zagrebačka county, and additionally interviewed 23 of them [46; pp.147-148]. General result is that "Activities in free time have the greatest influence on the quality of life, that is, meeting the psychological needs of the respondents when participating in these activities. Although the quantitative part of the research did not show a statistically significant connection between social networks and quality of life, the qualitative part shows that students very clearly connect social networks with the quality of their lives" [46; p.227].

Blažević theoretically approached the relationships between the child's social development and the family, peers and school [47]. She founded her approach with theories of social development. The author discusses how "The middle childhood is developmental period of intensive social interactions where the first friendships are made" [47; p.44]. She conveys family influences by four types of parent's education; authoritarian, authoritative, indifferent, and indulgent [47; p.45]. Overall "In the period of the middle childhood, influence of the family is still present even though the influences of the school and peer are involved when they start the school" [47; p.47] with emphasis put on the teachers as the most representative conveyors of the influence of school [47; p.47].

Miljević-Riđički, Pahić and Vizek Vidović [48] focused onto parental perspective. They were interested in parents' perception of the cooperation with schools which their children attend, namely whether there exist differences in that relation regarding rural or urban environment of schools. For preliminary data collecting they utilised focus groups. Final data collecting was conducted in 2009 in the form of interviews with 1052 parents of children attending 2nd to 8th grade of 30 elementary schools in Croatia – 14 from rural and 16 from urban settings. The basis of the approach is the theory of parental involvement by Joyce Epstein according to which "parents and school share responsibility for the socialization of the child; the goals and objectives of parents, schools and communities overlap; for children's growth and development, the most important contexts are family, kindergarten, school and community" [48; p.167].

The results show that "parents consider that it is the sole job of the school to do everything to ensure that the teaching is good and that their child is safe at school ... and that it is largely responsible for the organization of a good extracurricular program ... They see it as the sole job of parents to take care for the children to write their homework ... while for all other issues they consider that they are mostly equally the responsibility of the school and the parents [48; p.170]. In short "parents in Croatia do not see themselves as a significant factor that could or should contribute to improving the quality of education itself" [48; p.177]. However, as authors discuss in detail, one can conclude that parents are willing to participate more, but they expect the schools to initiate that change [48; p.178].

The authors found difference in parents-school relationship based on the rural or urban setting of the school, as the "results indicate a higher level of cooperation between school and parents in rural settings as well as higher levels of general satisfaction with school and possibility to influence school decision making" [48; p.181].

Belošević and Ferić [49] give critical overview of the leisure time, from defining to analysing contribution of leisure to developmental outcomes of children and youth. On the one hand, leisure time contributes significantly to positive development of adolescents, but on the other hand "leisure can represent a context that can stimulate youth to participate in risk behaviours and/or develop behavioural problems" [49; pp.641-642]. The basis for their approach is Leisure Activity-Context-Experience Model, a model focused on understanding adolescent development through leisure.

Ličina [50], similarly to other authors, points that there is a significant quantity of free time, that should be filled properly, but being aware that sidetracks are possible. But, as he observes, filling the free time brings us very close to the state in which there is in practice no free time for children and youth, because activities that they participate in during time become too heavy load. In practice, participants then leave the activities [50; pp.334-335]. Ličina presents further details of situation in Petrinja, where around 26 % of children are enrolled in organised out-of-school activities: 15 % in sport activities and others in diverse other activities like scouts, mountaineering, music, dance, etc.

Previšić notes already in 1994 that "school is reduced to acquiring knowledge through books, verbalism, learning definitions, rules and everyday facts" [51; p.151] to which he adds that "young people want to spend their free time actively ... by no means on the model and stereotype of schoolwork" [51; p.152]. He critically addresses relationship between school and creative spending free time. Along with this work, in the same proceedings one can find more contributions to the out-of-class and out-of-school activities devoted to science and technology.

Flego edited the Proceedings [52] which contains many contributions to free time of children. In particular, Puljiz stresses the recent, rather large and rapid changes in daily life which brings about significant number of challenges both to children and to parents [53]. Puljiz emphasises both extremes, one being the lack of structuration of children's free time and the other being too-structured free time; "Some parents go to extremes by controlling every free moment of their child, driving them to various activities and directing them in accordance with their own ambitions. ... The emotional aspect is neglected, the pressure on children is increasing, and they often develop into non-independent and immature personalities" [53; p.23]. She describes activities for creative structuration of children's free time in the Centre for Children, Youth and Family Velika Gorica, that are organised by estimated needs of local community [53; p.24] and that are more intensively conducted during the school vacation [53; p.26]. Reič Kukoč and Pezo presents the legislative situation, which recently changes in a way that gives more important role to the local community. They list the possible improvements in local communities that would bring about complete fulfilment of children's rights: "better vertical and horizontal flow of information between entities in the community, cooperation between institutions, clear division of roles and assumption of responsibility, better awareness of local authorities for children's needs and problems, and continuous assessment and evaluation of the situation" [54; p.34]. Opačak focuses onto free time of children with different abilities [55]. She addresses in detail the inclusive and non-inclusive approaches and states that "Inclusive leisure activities should offer the necessary adaptations, so that individuals of different abilities can participate. Of course, in accordance with the trend of inclusion, in accordance with the talent and persistence and commitment of individuals, a certain number of children with different abilities are included in regular sports clubs and music and dance groups in Croatia" [55; p.41]. Free time of youth with different abilities is extensively addressed, but for university students [56], thus different age group than the age group of children and youth considered in this article.

Almost all the literature about free time of children and youth in Croatia deals with that topic in regular societal environment, or societal environment that is considered long-term. An important, partially implicit, contribution to free time of children and youth in different

situation is work of Ćurković, Lukačin and Katavić [57] who focused onto recent period of imposed pandemic measures and analysed their influence onto several characteristics of free time of children and youth. In particular, in 2020 the authors used surveys to collect data from about 30 % of students in 5th and 7th grades of all primary schools in Croatia, and about 20 % of graduates of all secondary school in Croatia [57; p.276]. Ćurković, Lukačin and Katavić were interested in their physical activity and diet, both before and during the pandemic measures (in particular, during self-isolation) and additionally analysed gender and age differences. They found out that self-isolation brough about significant decrease in motivation for physical activities, and that it is more pronounced for boys in all age groups [57; p.280]. Self isolation influenced eating habits in the sense that diet become less healthy while the number of both the small and the large meals increased for all age groups [57; pp.281-282].

Brdar and Lončarić [58] analyse whether it is possible to classify primary and secondary school students into groups regarding the combination of their involvement in free time activities and coping with school-related stress. Their reasoning is as follows: "If the way of spending free time can reduce stress, then it can also be seen as a way of dealing with stress. Since school is the most common stressful context for children and adolescents, ... this research focused on coping with academic stress" [58; p.970]. In particular, they searched for contribution of gender and age to stress-coping methods and free time activities, as well as for links of stress-coping methods with school results, self-respect and anxiety [58; p.970]. Operationally, they collected data from 455 students from two primary and one secondary school and utilised 4 instruments to analyse the data (they specifically developed one of the instruments, *Questionnaire on the way of spending free time*, for the research conducted,) [58; pp.971-973].

Analysis revealed four clusters. The first cluster includes students who spend most of their free time in entertainment and relaxation (going out to cafes, cinema, disco clubs, etc.). The second includes students who have below-average results in all free activities, so they devote less time to them. The third consists of students who spend most of their free time reading books and visiting cultural events (theatre, exhibitions), while the fourth is made up of students who spend most of their time in sports activities, and additionally they are the least prone to socially undesirable entertainment, they spend a lot of time working on computers, relaxing and socializing with their brothers and sisters [58; p.974]. Age is shown significant for clustering, while gender is shown significant for anxiety, average free time and success in school [58; p.975].

Clusters differ in satisfaction with free time: the cluster connected with sports is the most satisfied, and the cluster focused on fun and relaxation is the least satisfied [58; p.976]. The later also have the weakest result in solving problems and addressing parents [58: p.977]. There is complex correlation between variables considered, that authors address in detail. Along with results presented, the authors state that "The mentioned research showed that free time and activities in free time are unjustifiably neglected constructs in models of psychosocial adjustment, coping with stress and health outcomes of children. In addition to indirectly, through coping strategies, the way you spend your free time can also directly help reduce stress" [58; p.982].

Babić [59] deals with free time of youth in three island communities within Zadar county. Based on survey conducted in 2001 among 107 primary and secondary school students from three islands, he analyses relation of type of school (primary or secondary school), belonging to a specific island community, and gender to amount of free time and to activities conducted within it. He in details presents various aspects of daily life, a mixture of traditional and modern contributions. Regarding the interplay among the school, other social environment and individual free time he states "The distinction between school classes and other activities is precisely expressed in terms of time and is therefore similar to the attitude of a factory worker towards work obligations, but the extracurricular part of the student's day is more similar to the traditional (rural) daytime. The most important feature of traditional village time is its

completeness ... When students come home, they are both free and not free. They are free to the extent that they can make their own schedule of duties (similarly to a peasant who can choose whether to dig or plow) during the day, but mostly they cannot avoid them. Double social control, parental and school, at the same time represents a strong pressure on that population" [59; p.396]. Regarding the amount, primary school students have significantly more free time [59; p.397] and there is no significant difference in its amount between boys and girls [59; p.398].

However, subjective experience of students brings about large number of additional aspects. Respondents consider that they lack free time, presumably because of school-related work. The specificity of islands is seen in traveling between home and school as an additional time-consuming school-related activity, which is significant for secondary school students [59; p.398].

Regarding type of free time activities "Music among young people has an almost cult status among forms of entertainment and spending free time" [59; p.401] as it is overall the most frequent free time activity. However, after differentiating results by type of school, it is seen that listening to music is the second most frequent free time activity: among primary school students the most common free time activity is watching television programs, and among secondary school students it is sport [59; p.401]. However, secondary school students' involvement in sport is again an island specialty, because these students mostly stay in the city of Zadar, where there are more such opportunities. Henceforth, based on the analysis of the responses of primary school students, there are too few sports activities available to children and youth in islands [59; p.402].

The distribution of the free time activities differs among the islands, but not statistically significant [59; p.402]. There is a significant difference in that distribution between boys and girls, which author connects with the way of life [59; p.404]. The majority of young people are dissatisfied with available leisure activities [59; p.405], primarily because there is not enough content [59; p.406]. According to the author: "The predominance of passive forms and contents of free time and the consumption of media-shaped reality corresponds with global trends in that sphere. The symbolic sphere, dominated by the rule of the image, has a growing influence on the shaping of free time" [59; p.407].

Zrilić and Košta [60] approach the teachers as conveyors of creativity. They base their approach on the statement that "Creativity is an elementary starting point in the education of young people. ... Teachers have a great responsibility to identify the scope and type of creative potential of each of their students, considering the fact that creativity has its beginning contained in a creative individual, who through the creative process comes to of new and original solutions as a special product that has personal or wider social value. Therefore, the education of future teachers should also be in the function of developing and releasing creative potentials" [60; p.161]. Authors argue that "Nowadays, school is focused on the result, strives to adopt content, to achieve results, and to frame opinion. Therefore, extracurricular activities are an opportunity for students to develop in other areas of their personality, and on their informal initiative, teachers can also change their teaching style" [60; p.163]. Zrilić and Košta describe some generic situations like encouraging or restricting the participation of children in extracurricular activities, along with their long-term consequences [60; pp.165-166].

Zrilić and Košta focused onto Zadar county and interviewed pedagogues in its 36 primary schools having extracurricular activities. In addition, they collected data from County office to obtain detailed distribution of altogether 33 such activities [60; pp.166-167]. Authors argue about the multidimensional role of sport, that is not appropriately represented in practice [60; p.167] as well as the role of music [60; p.168]. In further observations, authors provide additional details about realistic position of extracurricular activities [60; p.168].

SPECIFIC GRADES

Opić and Đuranović [61] collected data about leisure times of school-aged children and youth in order to track the influence of gender, place of residence and type of school (elementary or secondary). Their sample included 1062 respondents from 8 elementary and 7 secondary schools in Sisak-Moslavina county. They expressed ways of free time using the following six composite variables: Electronic media, Internet, Sports, Cultural activities, Socializing and outings, and Relaxing activities [61; p.548]. Data reveals that all the ways of spending free time are actually relatively poorly represented. Regarding maximal and minimal values, students spend most time on the Internet, while the least of free time is spent doing cultural activities [61; p.548]. Boys and girls use Internet equally often; boys spend more times doing sport, while girls spend more time in all other composite variables [61; p.549]. Furthermore, primary schools' respondents more often spend their free time on electronic media and doing sports, and secondary school respondents on activities of socializing and relaxing activities [61; p.549], and finally there was no statistically significant influence of place of residence onto time spent in some free time activities [61; p.550].

Arbunić, in series of articles [62-64] analyses daily structuration of children's free time, based on data, collected during 1995 in two primary schools on island Hvar, from 290 children and their parents. In particular, the aim of research in one of the articles was to determine the structure of children's and their parents' interest in leisure activities [62; p.118]. The children's interests were investigated from the point of departure of the desirability of the activities, and the interests of the parents were the desire for such activities to be available to the children [62; p.118]. For both groups, sports activities are the most important, while other activities show statistically significant differences, a consequence of differences in social experience [62; p.120] and of parents' awareness of the role of free activities in their children's free time as well as of their significance for the development of children's personalities [62; p.121]. Arbunić, furthermore, as a rather rare contribution to research about children free time, analyses data to obtain average hourly distribution of different contributions to free time, ranging from school-related and other work to leisure time [63]. He found that type of the day (weekend or not) and children age significantly influence structure of free time. Finally, he analyses, and finds it to be significant, the difference in children's and their parents' reports about the use of free time particularly considering those activities which indicate behaviour disorders, risky behaviours, and fun [64; p.221]. As a novel result of the analysed data, the area of quantity of activities in free time was differentiated into 9 substantively and 5 qualitatively different sub-spaces [64; p.227]. The data revealed that parents do not know enough about their children's free time, especially in that segment that indicates leisure and "spare time", [64; p.227]. Overall [64; p.228]: "the new challenges of free time and the decreasing possibility of control over the upbringing of children due to the obligations of parents and the multitude of factors involved in the formation of the young generation require parents to focus their educational activities more on attitudes and personality than on control itself" – but it is necessary to make them competent to recognize risk factors.

Vidulin-Orbanić conducted study to find out which extracurricular activities for primary schools are represented and in what percentage [65, 66]. In order to obtain initial data, she surveyed 275 children attending from 5th to 8th grade of two primary schools, one in Rovinj and the other in Tar, in Croatia. Survey contained a list of 38 extracurricular activities. Distribution of participation show that most of the respondents participate in the sport-health-recreational group of extracurricular activities. Great majority of respondents participate in at least one such activity [65; pp.29-30]. When focus was put onto musical activities, one obtained a specific distribution of participation of respondents in them [66; p.736].

Šiljković, Rajić and Bertić [67] use data from rather large group of respondents to reveal specific aspects of participation of primary school students (from 5th to 8th grade) in out-of-class

and out-of-school activities. They concentrate on gender and age differences. While, generally, respondents show a significant degree of motivation for participation in such activities, there are additional, rather non-trivial differences in that participation between boys and girls, and between different grades.

Matijašević [68] analyses data about free time use by primary school students in two Croatian counties. He concentrates on possibilities of spending free time of primary school students as well as on differences in regard to gender, age and place of residence.

Martinčević [69] points the fact that out-of-class activities significantly contribute to children's development, since "Extracurricular activities at school are the space where it is easiest to reach students, their needs, wishes and aspirations. It is a part of school practice in which there is no numerical assessment" [69; p.22]. She surveyed 123 primary school students, from 6th and 7th grade, asking for participation in extracurricular activities and socio-demographic data. She found statistical significance between respondents' characteristics and two free-time activities, namely reading popular literature, and playing computer games [69; p.32].

Matić Tandarić [70] similarly, conducts empirical research on several hundreds of students from two Osijek secondary schools, in order to analyse age and gender related differences in prevalent mode of free time use.

Prlić and Ilić surveyed 616 students of Medical school Osijek, aged 14-19 [71]. They found out that 95 % of respondents have free time, and that 56 % od respondents would like that school offer them free time activities. Moreover, 66 % of respondents have their own suggestions for organisation of free time. According to the authors "We discover talent more in the free time than in everyday classes" [71; p.458].

Dragun [72] focuses onto leisure time activities and value set of secondary school graduates. In particular, in 2009 he surveyed 254 graduates from 10 (out of 16) secondary schools in the city of Zadar. Survey contained list of 19 leisure time activities and 21 values. The initial assumption of the research is that "different samples of young people – from different (and differently modernized) regions of Croatia – are more like each other in terms of forms of use of free time than in terms of values. This assumption stems from the general expectation that the field of free time is more susceptible to the influence of modernization and globalization than the field of values" [72; p.489].

Following that assumption, Dragun formulated the research goals: to learn more about the leisure and value aspects of the sociocultural identity of high school graduates in Zadar (as a subgroup of young people in urban areas of Dalmatia); to learn about the different conditioning of these two aspects by the complex social context; and to learn more about the similarities in the area of free time, as well as in the area of values among the examined subgroups of young people in Croatia [72; pp.490-491].

Respondents stated what activities they practice and what values they consider significant, along with other socio-demographic questions. Three most often practiced leisure time activities relate to media: *listening to music at home*, *watching television program* and *surfing the Internet* [72; pp.497-498]. Regarding values; *health*, *friendship* and *good family relations* are three most important values [72; pp.502-503], followed with the *honesty* and *love* [72; p.503].

Dragun in details considers and contextualises many correlations between values. In particular, values with the largest number of significant positive correlations with other values are *be respected* and *health* while the value with the largest number of significant negative correlations is *power over others* [72; pp.502-503]. Along with that, value *to be yourself* does not have any significant correlation with other values, neither positive nor negative, which is in fact self-explanatory [72; p.500]. Dragun concludes that "It is obvious that the respondents

attach the greatest importance to 'conventional-moral' and 'conventional-self-realization' values, and less importance to 'hedonistic' and 'autonomy' values, even less to 'conventional-patriotic' values, and they value 'self-realization through prestige' the lowest" [72; p.504].

Grabić [73] describes experience in out-of-school activities with children and youth aged from 7 to 18 years in Centre for Providing Services in the Community Klasje in Osijek. During activities the users developed community feeling, they adopted teamwork and cooperation, communicated better and overall, there was relaxed atmosphere in the group [73].

Many texts show that that watching television is the most often, or one of the more common free time activities of children. Regarding watching television, as Citković [74] states, focus is regularly on its negative influence onto children development. However, Citković discusses possible positive influences that should be analysed in more detail and subsequently enhanced, in particular: development of empathy, solving conflicts, cooperativity and respecting others. Author bases its conclusions prevalently on the international literature since, as she states, there are few domestic contributions in literature about that topic.

Some authors treat free time sporadically, and they concentrate on activities regularly conducted in free time and analyse literacy of communication within social networks [75].

VOLUNTEERING

Some authors address volunteering as an activity, regularly conducted in free time, that is important for socialisation, empathy and generally formation of point of view of children and youth [76-80]. Volunteering has many important characteristics, both from the personal and from the societal point of view, and some of them are rather complex [76]. Zrinšćak et al. [76] present in detail the results related to Croatian students and put them into broader perspective revealed within the international research project.

Miliša [77] critically analyses free time of children and youth, especially distribution of initiatives aiming to free time, to youth and for youth, with emphasis put on volunteering. His conclusion is that high-quality use of free time activities implies, above all, active volunteering [77; p.111]. He develops that conclusion in a significant part based on the data presented in the existing literature, in particular in report of the project conducted in 2005 by the National Foundation for Civil Society Development. The project collected the data about attitudes of 1000 randomly chosen young people with age not less than 15 years. It was shown in literature that more than half of the interviewed persons do not think about volunteering, while only 5 % of them volunteer [77; p.102]. Miliša further points that volunteering is not only a way of spending quality free time, but also prevention of addiction [77]. However, in order to change attitudes towards volunteering, it is necessary to work on changing attitudes towards work, to teach young people (by examples) that persistence, frugality, helping others, material independence, criticism, self-criticism and responsibility are the most important elements of the educational dimension of work [77]. Furthermore, Miliša develops the well adopted fact about rise in free time by pointing out its unintentional consequences: "The excess of boredom and the lack of ambition are called by some the new vice of young people. The fact is that we have an unorganised and optional way of creating leisure activities for young people. Organized care for the free time of young people prevalently remains at the level of non-governmental organisations and rare activities of enthusiasts encouraged by the local and regional self-government bodies" [77; p.105], but one must bear in mind many examples that listed organisations reveal instrumentalization, and other deficiencies [77; p.102].

As an important contribution to reflection about volunteering in relation to free time, Hazdovac Bajić [78] presents the research "My free time". The obtained results "suggest areas and directions which requires more intensive work in order to respond more successfully to the

needs of young people, specifically in Dubrovnik. The application and development of volunteer practices is a recommendation to all institutions, organizations and clubs working with young people as a supplement, but also as a fresh approach to the process of upbringing and education" [78; p.2]. She tests and confirms the hypothesis that majority of secondary school students spend their free time "passively" (following media and socializing with peers). In addition to other conclusions, that are aligned with overall conclusions about volunteering and free time of children and youth, she argues that regarding the organisation of free time "simultaneous action on adults and on promoting the value of volunteerism in the wider society would have a great impact on secondary school students" [78; p.27].

Within the group of authors emphasising volunteering as part of free time activities, there are Ćavar, Pavić and Racz that conclude, based on the local empirical research, that "83 % of their respondents consider volunteering as a good way to spend their free time" [79; p.153]. These authors state a high percentage of volunteering in church communities and argues that this is related to the church's position on the importance of helping others, which includes volunteering [79; p.154].

Additionally, research was conducted on gender differences in volunteering as part of free time activities, based on the data collected about students from Nursing school in Vrapče in 2014 [80].

FREE TIME AND KINESIOLOGICAL ACTIVITIES

Doing sport, or generally doing kinesiological activity, is important part of structured free time activities. It can be done either in out-of-class or out-of-school activities. If conducted within a sport club it is not considered as a leisure time activity. Competitive or recreational sport activities are included in many other literature sources which do not consider sport explicitly, but instead analyse distribution of participation of children and youth in available free time activities. In this section we concentrate on literature sources which analyse solely on doing kinesiological activities in free time.

Prskalo, alone and with collaborators [81-87], covered sport-related free time in significant details with profound conclusions. He summarises importance of the sport, and more generally kinesiological activities, as follows: "Systematic, scientifically based exercise can significantly influence not only the regulation of morphological, motor and functional characteristics, but also to a considerable extent cognitive functions and conative dimensions responsible for behavioural modalities and effective socialization of young people to variable living and working conditions. There are few human activities that can simultaneously influence such a large number of human characteristics as is possible with expertly designed kinesiology activities" [83; pp.162-163]. On the sample of 287 pupils from 1st to 4th grade of two primary schools in Zagreb, in 2007 he tested attitudes about the importance of the school subject *Physical and Health Culture* and influence of age and gender onto answers. As the author further states "there is no optimal growth, development and upbringing without physical exercise, because it is partly a conditional need that cannot be compensated for by anything. On the contrary, from a kinesiology point of view, it is important to state that neglecting or preventing the need for exercise is one of the important causes of disorders of overall development" [83; p.166]. Author analyses in details obtained data, according to which, among other results, it is found that "Spending free time in some characteristic static activity is significantly higher (27%) than in some kinesiological activity (17%)" [83; p.170].

Prskalo conducted another survey in 2012 [84] on the one hand to gain clearer insight into respondents' attitudes and on the other hand to compare results with the results obtained in 2007 [83]. In 2012 he surveyed 341 pupils from 1st to 4th grade of the same two primary schools in Zagreb as in 2007 survey. The author found considerable changes in respondents' attitudes,

namely "Preference for Physical Education was significantly reduced from 37% in 2007 to 27% in 2012. Spending leisure time in a typically static activity was significantly higher (44%) than doing kinesiological activities (25%) in 2012 as opposed to 2007 when leisure time spent in a static activity was 27% in comparison to 17% spent doing kinesiological activities" [84; p.118].

Badrić and Prskalo [85] in details review literature about free time. They emphasise the kinesiological activities among other free time activities, since "For the purpose of increasing the general health of children and young people, raising the level of muscle activity is a significant contribution to satisfying the biological need for movement, and thus contributes to the improvement of their anthropological status. The survival and development of humans as creators of positive values and material goods is conditioned by motor activities and movement" [85; p.487].

The authors state that "The key task of contemporary society must be to create a habit for lifelong meaningful use of free time, which includes independent physical exercise of children and youth in their free time. Children must use all natural resources, because only in such conditions will they recognize the value system, that is, that they have a natural environment that provides countless possibilities for the affirmation of various forms of sports activities" [85; p.488].

Badrić, Prskalo and Barić [81] surveyed 300 boys and girls from 5th to 8th grade of elementary school about their kinesiological activities in their free time. They found out that 59 % of boys and 29 % of girls participate in some sport activity in their leisure time. Boys prevalently enrol in soccer and girls in driving bicycle and roller skating. Main reasons for doing kinesiological activities are fun, socialising, while health comes after these [81; p.48]. Majority of respondents would like to continue doing sports in the secondary school [81; p.49].

The authors note that "Young people spend their free time in activities that do not require muscular effort. Precisely because of this state, the preservation and improvement of physical and mental health becomes an imperative of the present time. Creating the habit of proper use of free time, dedicated to exercise and movement, becomes the primary educational method from a kinesiology point of view" [81; pp.44-45].

Badrić, Prskalo and Pongrašić [82] surveyed 60 boys and girls from 4th grade of elementary school to find out about their participation in sport activities in leisure time. They found out that 20 % of respondents participate in some kinesiological activity in their leisure time. Along with that, 72 % of respondents consider school subject *Physical and Health Culture* to be the school subject which is most important for their lives.

Badrić, Prskalo and Matijević in 2010 surveyed 847 students from 5th to 8th grade of primary schools, who live in urban areas of Sisak and Petrinja in Croatia [86]. The survey aimed at collecting data about distribution of free time activities in which respondents participate, and for that purpose contained a list of 15 kinesiology related and 13 non-kinesiology related activities, with the possibility that respondents add further activities [86; pp.304-305]. Respondents were asked to state how many times they participated in some activity during the last seven days. Respondents mostly participated in cycling and soccer, and in most of the activities respondents prevalently participated three times. For each of the listed, kinesiology related activity there were respondents who conducted it seven or more times [86; p.305-306].

Regarding non-kinesiology related activities most of the respondents watched television (and more than half of them did that almost every day in the observed week). Gender differences were shown to be significant in 11 and non-significant in 4 kinesiology related activities, and furthermore significant in 12 while non-significant only in 1 non-kinesiology related activity [86; p.307-308]. Age was significant for only one kinesiology related activity, but for seven out of the 13 non-kinesiology related activities [86; p.309-310].

Authors compare their results with surveys carried out earlier, and argue about considerably larger percentage of time spent in electronic-media related free time activities like is television watching, internet surfing and playing electronic games. According to the authors "These results are a cause for concern because spending time in front of various media has almost doubled in the last 10 years and has brought with it implications of sedentary lifestyle and consequently these activities are given precedence over kinesiology related activities" [86; p.312], and these facts are more pronounced for older respondents [86; p.313] so that "The results obtained in this way show that the age of students can serve as a good predictor of the students' participation in particular free time activities [86; p.314].

Jurakić, Trošt and Visković [87] surveyed 148 pupils in 5th to 8th grade of elementary school "Bartol Kašić" in Zagreb. That number represents 90 % of pupils in that school. Data shows that 50 % of respondents are train in sport clubs out of the school. The authors critically observe that "most of them play sports very competitively, the selection is stricter in older age groups, and it is expected that a large percentage of children will stop training after primary school. The big question is what percentage of them will continue to play sports recreationally. There should be extracurricular activities to enjoy participation, movement and exercise" [87; p.73]. Bobić, Trošt and Jurakić [88], similarly surveyed students from one elementary school in Ivanić Grad to find out what are the preferred and desired sports-recreational activities of respondents, and to check significance of gender in answers. Data reveals that most of the respondents would prefer swimming. However, girls prefer individual, non-competitive activities like aerobic and dance, while boys prefer team sports such as football, handball and basketball.

Petračić [89] surveyed 284 children aged 10-13 years, from two elementary schools, and who live in Petrinja. The author found out that 47 % of boys and 9 % of girls are involved in sport-recreational activities in their free time [89; p.199]. As part of recreational activities, author considered vacations and found out that 73 % of respondents go to summer vacation, while 14 % of them go to winter holidays [89; p.200].

Pećar-Mraković and Mraković stress that "Play is generally an unavoidable factor in the optimal growth and development of all living beings, including humans ... Currently, there is no tool or method that could replace muscular or motor play" [90; p.44]. Moreover, they point out the complementary trends in free time of adults and of children: "for adults, working time is reduced and free time is increased, while for children and young people, free time is drastically reduced and working time is unscrupulously increased, and in a visibly dangerous way ... reduction of play, and that is necessary, all kinds of motor games" [90; p.45].

Jenko Miholić, Hraski and Juranić note that "the ratio of school work time and leisure time is increasingly changing for children and the youth. Children are overloaded with extensive academic obligations and therefore it is even more important to provide them with quality content for the rest of the day" [91; p.248]. Following that and other facts, they were motivated to find out how the primary school students spend their free time, with emphasis on possible differences regarding their place of living. For that matter they surveyed 139 students from first four grades of four primary schools in north-western Croatia [91; p.249]. Results show that most of the respondents watch television program or play video games in free time, while relatively small number of them participate in some sport, or more generally kinesiological activity in free time [91; p.251], among the later the soccer being most frequent sport [91; p.253]. The prevalent reason why respondents do sports is fun and hanging out with friends [91; p.253]. The authors analysed in details differences between respondents from schools in urban or rural areas and from boys and girls.

Vrbanac [92] collected data about free time of female students in one secondary school in Pula. Results show that respondents use more than 60 % of their free time for school-related learning, up to 30 % for cultural and similar activities and around 10 % for sport and sport-recreational activities.

Negotić [93] emphasises the role that sports games have in development of children and youth.

Matijašević and Maglica [94] point out importance of sport clubs and other civil society organisation dealing with prevention and treatment of behaviour problems in free time of children and youth. Furthermore, they emphasise cross-curricular topics contribution to free time organisation from the side of formal education.

FREE TIME IN RELATION TO CULTURE, FINE ART AND MUSIC

Several papers presented results about different out-of-class school activities, with art-related activities emphasised [95, 96]. In particular, Blažević [95] explored the types of out-of-class activities available to students, with details about the school in which they are conducted and about teachers who lead them. She was interested on the one hand in finding out the distribution of activities, and on the other hand in analysing in more details play belonging to sciences and play belonging to humanities and social sciences, among other types of play.

For that, in 2015 she surveyed 146 teachers for 1st-4th grades of primary schools, from the two Croatian counties. She found out about 42 activities that were considered different. Ratio of activities to teachers surveyed determined further analysis. The activities span broad range of disciplines, reveal rather creative and substantial approach of teachers, and point to the relation between teachers' level of advancement and the extraordinariness in creativity, innovativeness and contemporariness of activities they created. Blažević extracted additionally the play and observed that "results point to the awareness of teachers about the importance of using play in extracurricular activities, but also in classes in general".

Blažević and Matijašević [96] continued that line of research, starting with observation that the implementation of art in schools was not intended to create new artists and world-famous masterpieces, but to release creativity in children [96; p.210]. They wanted to find out how many art-related out-of-class activities are available to primary school students, because of previous introduction of the concept of Education through Art. For that, in 2019 they surveyed 176 teachers for 1st-4th grade primary school, from two Croatian counties asking questions about art-related out-of-class activities, about the school and other questions. Part of the questions tended to find out how many art-related programs exist and how often are they conducted, while part was focused onto self-evaluation of teachers.

Balić [97] discusses spending of free time, education during free time and education for free time. She considers art education to be crucial for creative work throughout our lives, and henceforth also for creative free time [97; p.235]. She analyses in detail who will deal with culture. Along with the culture, she analyses the relation between the amateur and professional sports.

Pejić Papak, Vidulin-Orbanić and Rončević [98] analyse in details out-of-school cultural activities as part of the students' free time. They analysed in what amount do students, who specifically are all involved in fine art activities, visit cultural institutions such as museums, galleries, etc., and in what amount do they participate in their programs. Their approach is one the one hand motivated by the importance that culture contributes to human development, affirmation and creation of new life patterns [98; pp.191-192], and on the other hand by emphasising the importance of culture in life of young persons by National program for youth, formulated in 2003 [98; p.192]. They started with data from school directories of 17 primary schools in the city of Rijeka and extracted data of 343 students from all eight grades, who at the same time attend some out-of-school cultural activity, altogether 42 activities the two most represented being musical and dance activities. In 2010 they surveyed these students anonymously in order to obtain data about frequency with which they visit cultural institutions, how do they find information about available cultural manifestations, as well as in what amount is their behaviour influenced by their environment and in particular by their parents'

behaviour [98; p.194]. Results are gender dependent as prevalently girls participate in cultural activities, and boys in sports activities. There are differences in methods of learning [98; p.195]. Regarding visiting the cultural institutions, majority of students visit libraries, however that is in a significant amount caused by required school tasks [98; p.196]. On the other hand, majority of students never visited a gallery, the exceptions being students who are themselves enrolled in fine art activities [98; pp.196-197]. Parental visits to cultural institutions are directly reflected in visiting of these institutions by their children, but one must also have in mind that parents, independently of their own behaviour, encourage children to participate in cultural out-of-school activities [98; p.197]. Majority of information about cultural programs come from peers and parents [98; p.198]. It is surprising that a rather small number of respondents found out about the program offered by cultural institutions by the very leaders of the cultural activities in which they participate [98; p.198]. Finally, most of the respondents visit the cultural institutions with school and their peers [98; p.199].

Dubovicki, Svalina and Proleta [99] concentrate on the musical extracurricular activities. Underlying reason for that is that music has considerable positive effects for the proper structuring of children's and young people's free time, for their psychological freedom and security [99; p.558]. They analysed the curricula of 30 primary schools from the city of Osijek and surrounding towns to see how many and which extracurricular activities were offered to students, with an emphasis on musical activities. Then, in the 2012/2013 school year, they surveyed 24 pupils from 3rd and 4th grade of an Osijek primary school who attend extracurricular musical activities, to find out which activities they attend and how satisfied they are with them. Data collected reveal that schools in the city offer more extracurricular activities than schools in smaller towns, and the number of activities is greater for children in higher grades of primary schools [99; p.562]. However, specifically for music, on the one hand there is significant difference in the number of musical activities offered in the city in comparison with their number in the surrounding towns [99; p.565], but on the other hand there is no significant difference in the share of musical extracurricular activities between classroom and subject teaching [99; p.566]. The largest number of participants has the choir as an extracurricular musical activity [99; p.564] and overall, singing is the most represented type of musical activity, while musical creativity is not represented anywhere (in regular primary schools) [99; p.566]. Participation in musical activities have different meanings for students, but for most it is a place of joy, socializing and learning, while for no one it is just another school obligation [99; p.572]. Authors present some details of children's opinions [99; p.572], conclusions and proposals for expanding the representation of such activities [99; p.575].

Šulentić Begić, Begić and Kir in 2018 surveyed 510 students from 4th to 8th grade, of two elementary schools in Osječko-baranjska county; one school in urban and the other in suburban environment [100; p.212]. They wanted to check whether the attending out-of-class and out-of-school music activities significantly depends on the location of the school (urban or sub-urban) gender, age and their parents' involvement in music [100; p.211]. Around 1/3 of respondents attend some out-of-class music activity [100; p.214] and somewhat larger part attend out-of-school music activity [100; p.216]. Girls attend such activities significantly more [100; p.220], while age is significant for out-of-school music activities but is not significant for out-of-class music activities [100; p.221]. Finally, parents' involvement in music significantly influences children attendance of all music activities [100; p.222].

Vaštuka [101] describes a specific activity enabling students to spend their free time in a well-structured manner. She describes the program "Pupils Days" ("Đački dani") aimed for school aged children, held annually since 1996 in City Library of Karlovac, for two months during school holidays. Program consists of guided workshops, "… but still leaves enough space for the development of children's imagination, spontaneity and creativity. The program

is always open to new ideas from the participants, which further encourages them to be active, imaginative, and at the same time develops a sense of appreciation for their opinions. The 'Pupils Days' program deserves special attention as one of the leading examples of good practice in spending free time" [101; p.67]. Year after year, children show an increasing interest in attending the program, and parents are interested in including their children in the program. The librarians recognized the need of children and young people for meaningful and high-quality leisure time, especially during school holidays, and began to implement the program [101; p.67]. The program consists prevalently of cultural and art workshops. Over the years, ecological workshops and game workshops have been held, and more recently workshops about robotics and informatics have been held [101; p.69]. Numerous participants apply for participation over several years [101; p.69].

The program includes intensive cooperation with the public and is one of the contributions to the development of the library's interdisciplinary activities such as cultural management and cultural tourism [101; p.71]. Based on the observed interest of the students and many participants, the author argues that the program "Pupils Days" is an example of good practice, in terms of free time well spent through socializing, having fun and acquiring knowledge and skills. The participation of pupils in the program positively influences the use of other library services and the increase in the total number of its members [101; pp.74-75].

Đoreski and Marinić [102] also deals with libraries, in particular the school libraries, and argue about their contribution to free time, specifically within the context of life-long learning. Their starting point is that if one wants that pupils stay in the library then one should understand pupils' interests and should recognize certain styles of their behaviour [102; p.163].

Rosić focuses onto role that student dormitories have in the education system [103]. Presently, dormitory pedagogy is insufficiently developed. Having in mind that students live there, it is important to structure their free time. Rosić emphasises the dormitory educator as "at least a teacher and lecturer; he is a collaborator and adviser, leader and skilled organizer" [103].

FREE TIME IN RELATION TO SPECIFIC ACTIVITY OR CLASS

Pešorda [104] considers the impact that a history curriculum can have on leisure time. Using survey, in 2006 she collected data from 124 students of one secondary school in Sesvete. Data included frequency of students' participation in listed 40 free time activities. The author analyses how a particular activity is related, directly or indirectly, to the history curriculum and cultural aspect of free time. The novel ideas presented could help history teachers in designing, encouraging and organizing students' free time and influence the modernization of the history curriculum [104; p.42]. Author emphasises the proactive and creative approach that a history teacher should have, and stresses their general lack of knowledge about pedagogy of free time [104; p.49].

Jagić [105] theoretically approaches the notion of the *youth tourism*, a type of cultural tourism consisting of school trips and excursions, because it "provides significant pedagogical and intercultural opportunities" [105; p.208] and is an important part of a set of out-of-school activities. Youth tourism is in Croatia practised in the final grades of primary and secondary school, is aligned with the educational objectives of the school and is considered as a contribution to pupils' cosmopolitism [105; pp.208-209]. "The creation and shaping of tourist culture is of exceptional value, and a high pedagogical requirement and obligation of many educational factors" [105; p.212].

Bogut, Obranić and Mlinarević analyse specifically scouting as an extracurricular activity [106]. They state that "The characteristics we expect from children/students today are the ability to make independent decisions, but also the ability to solve problems through teamwork and

group work … In the Scouts, children socialize, learn through research, discovery, and acquire teamwork skills, share tasks and obligations, and develop a sense of responsibility, but also a sense of self-affirmation. Such free activities are very suitable for developing work habits among students. The scouts also learn communication skills and the ability to understand, work habits and cooperation in a small group under the guidance of the older and more experienced, organizational and leadership skills, planning and implementation of the agreed, resourcefulness and independence in solving problems" [106; p.300]. They surveyed higher education institutions students, future teachers, regarding scouting. That is eventually important for children and youth free time because the future teachers will lead scouting organisations for them.

Kovačević analyses and data about playing computer games among primary school students, collected in 2006 from 195 boys and girls attending 5th to 8th grade in 3 schools in Splitsko-dalmatinska county [107]. According to Kovačević: "Playing computer games in free time is free from the influence of parents and represents the child's voluntary activity. Some parents support this kind of entertainment in their children's free time, and some do not. However, it is hard to believe that it is the parent who suggests the child to play at the computer design your free time" [107; p.51]. However, stated views of the parents should be taken with a caution because they were collected indirectly, i.e. also from respondents [107; p.60]. Out of an average of 4 hours of free time, around 2 hours are spent at the computer. In that year 2006, respondents mostly used the computer for games, then for obtaining information and finally for communication [107; pp.55-56]. Overall, the data are presented depending on the class attended, gender and type of computer game.

Playing computer games is one example of a general attitude about the risk of insufficient leisure time, in particular: "it seems worrying that a very high percentage of respondents spend most of their free time at the computer, playing computer games. Such activities, (and to such an extent) do not lead to complete personality development, as the ultimate goal of institutionalized and free forms of education" [107; p.61].

FREE TIME AS SOURCE OF RISKY BEHAVIOUR

Many authors mentions that free time brings about the risk for development of misbehaviour, either because of the non-structured use of free time by children and youth, or by purposeful influence of manipulators. In this subsection we cover articles in which misbehaviour and risky behaviour of children and youth are treated explicitly.

Raboteg-Šarić, Sakoman and Brajša-Žganec [108] examined whether parental child-rearing practices are related to different styles of children's leisure-time activities and, moreover, they aimed to find out which aspects of parental behaviour and after school activities are related to children's school achievement and substance use. They were interested in examining "to what extent parental educational procedures are related to the styles of spending free time of their children and which aspects of parental behaviour and activities of young people during free time are related to their school achievement and alcohol consumption and drug" [108; p.243]. Specifically, they wanted to see how child gender and style of leisure time influence connection relation between behaviours of parents and children. They surveyed 2 832 secondary school students, attending gymnasium and vocational schools, from every Croatian county. Altogether 86 % of respondents live with both parents and 14 % with one parent [108; p.243]. Respondents were asked about their parents' behaviour, activities they conduct in free time and about themselves. According to data collected: mothers significantly more supervise their daughters; girls feel less support from parents than boys; boys and girls similarly participate in the activity going out and having fun, while there are statistically significant differences in participation in all other 18 activities included in the survey; finally, boys' and girls' behaviours

are statistically significantly different [108; pp.246-247]. The authors present detailed analysis of contribution of socio-demographic and other characteristics onto overall and especially onto risky leisure time activities of respondents. The authors "pointed out the importance of parenting practices, especially parental supervision and support in the period of adolescence, for the successful psychosocial adaptation of young people" [108; p.258]. Their factorisation of types of parent's behaviour is to be compared with that of Blažević [47].

Cavenago Morović et al. [109] focus onto risky behaviour of adolescents. Using anonymous surveys, in 2005 they collected data from 848 youth from 8th grade of primary school and all grades of secondary schools in Zadar county. They present detailed data about the respondents' free time, risky habits and depression. The authors conclude that adolescents do not have enough acceptable and recognizable content for adequate leisure time, and that inadequate spending of free time increases the occurrence of risky behaviours and habits. They consider that the formation multidisciplinary youth centres could contribute to better use of free time and prevention of all forms of risky behaviour.

Nazor [110] starts with results of surveys conducted in 1995 and 2000 in Split, both devoted to young people aged 15 to 29. Both surveys had 996 respondents, but generally different people. Moreover, surveys significantly overlap in questions, but not totally. Regarding the use of drugs, the author divides the respondents into three groups: the abstainers, the tasters and the consumers. There are some general characteristics of how persons within some group use their free time, as shown by analysing data collected in 1995 survey. In particular, the abstainers most often watch television program in their free time. Tasters most often enrol in sport activities, while consumers prevalently go to bars. Based on the data analysis, the author states that there is significant connection between the contacts with drugs and the two activities; the extreme sports and alternative courses [110; pp.64-65]. Additional observation is that all young people often spend their free time in a rather passive way [110; p.65].

CONCLUSIONS

Since 1990 a large number of studies dealt with notion of free time for school-aged children and youth in Croatia. The studies differ in the age groups of the respondents from elementary school age students all the way up to the student population. They include differences in the place of residence as well as the place of education, which are usually reduced to differences between the countryside and the city. The studies are focused on a wide range of topics that include the criterion of the structure of free time, the connection of the contribution of free time with regard to the general development context and the preventive-intervention aspect. Structure of free time is the most represented topic in studies. Some of the studies have equivalent groups of respondents and their results can be mutually compared, what was done in several cases. Other studies cannot be directly compared, but their results can serve in forming a unified picture of dynamics of free time of children and youth during different intervals. Moreover, data collected, presented and analysed in existing articles represent solid basis for comparison with results of possible, future studies.

We extract two results, among many presented in literature. First, average quantity of free time is considerable. That is a valuable resource and it requires longer-term, correlated action of schools, parents, youth centres and other subjects to structure it. Secondly, improper approaches can degrade that potential: too intensive broadening of formal education can reduce the potential for creativity and self-development during free time; too weak approach will enable further raise of manipulative influences that, unintentionally or not, eventually also brings about ceasing of creativity and development of children and youth.

These facts go along with the general approach to a leisure time. Although leisure time as a term was recognized in pedagogy in the 1920s, lately it has been gaining more relevance,

especially in the context of creating education for leisure time of children and youth. Leisure time, in addition to being important for the overall development and wellbeing of an individual, at the same time enables the recognition of talents of an individual. Therefore, it is necessary to offer students a chance to independently organize leisure time with structured activities. In doing so, it is important to bear in mind that organizing leisure time is influenced by modernisation and globalisation. This influence can be observed in the context of systems theory, because leisure time can be understood as a system constructed from different elements, such as activities, motives, values, aims, preferences, resources, limitations, influences and outcomes. These elements interact and create a dynamic structure which reflects an individual's personality, needs and interests, and also affects their development, health, wellbeing and quality of life. Leisure time as a system is connected to other systems, such as family, school, work, culture, society and environment, and they also have an influence on its formation and function. Leisure time pedagogy is an interdisciplinary field of pedagogical science and is closely connected to other sciences. Because of that, it is necessary to devise an integrated questionnaire that fosters creative problem solving, enables a holistic approach in the development of children and youth and different forms of prevention. The aim of the integrated questionnaire is to enable an individual to learn actively, creatively and critically in line with their needs, interests and capabilities and to prepare them for a life in a complex and dynamic world. An example of an integrated questionnaire applicable in all areas would be a problem solving questionnaire. The dynamic structure of the occurrence of leisure time creates space for further research which would contribute to increased development quality of an individual but also the prevention of unwanted behaviors.

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DEEP LEARNING IN SCIENCE: IS THERE A REASON FOR (PHILOSOPHICAL) PESSIMISM?

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ABSTRACT

In this article, I will review existing arguments for and against this philosophical pessimism about using deep learning models in science. Despite the remarkable results achieved by deep learning models networks in various scientific fields, some philosophers worry that because of their opacity, using these systems cannot improve our understanding of the phenomena studied. First, some terminological and conceptual clarification is provided. Then, I present a case for optimism, arguing that using opaque models does not hinder the possibility of gaining new understanding. After that, I present a critique of this argument. Finally, I present a case for pessimism, concluding that there are reasons to be pessimistic about the ability of deep learning models to provide us with new understanding of phenomena, studied by scientists.

KEY WORDS

CLASSIFICATION

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INTRODUCTION

In the last decade, artificial neural networks (ANNs) using deep learning (DL) achieved some remarkable results when used in for scientific research. AlphaFold a model developed by DeepMind learned to accurately predict possible novel protein structures [1]. DL models are used to successfully predict the presence of breast cancer [2] and the one-, two- and three-year risk of lung cancer [3] from images. DL has proven useful in helping researchers to identify the correlations between the structure and properties of materials in the field of materials science [4]. In neuroscience, such models perform much better than the previously existing ones to model neural single-unit and population responses in higher visual cortical areas [5].

The success of deep learning models is due in large part to their increased complexity [6]. Buckner [7] compares the difference between older, "shallow", ANNs and DL models to the difference between a small team of engineers assembling a car and doing it on a mass-production assembly line. Although the process is in principle the same, the assembly line is exponentially more efficient and reliable. The same goes for deeper neural networks. Bucker writes: "Similar gains in the efficiency and complexity of representational schemes and decision-making policies are afforded by additional depth in neural networks. Specifically, deeper networks can solve certain types of classification and decision problems exponentially more efficiently than shallower networks" [7; p.3].

But increased complexity also means that human users have less understanding of how these models work. As stated in a recent survey of literature on explainable artificial intelligence (XAI): "Though they appear powerful in terms of results and predictions, AI algorithms suffer from opacity," meaning "that it is difficult to get insight into their internal mechanism of work" [8; p.52138]. Given this, some philosophers worry that despite their predictive accuracy, using these systems cannot improve our understanding of the phenomena studied. In other words, they ask whether the fact that we cannot understand highly complex models means that we cannot use them to gain new understanding of the phenomena they predict[1].

In this article, I will review existing arguments for and against this philosophical pessimism about using DL models in science. In what follows, I will first provide some clarification on the terms like artificial intelligence, neural networks, machine learning, the black box problem, explanation, and understanding. In section 3, I will review an argument, presented by Sullivan [9], that opaque ANNs can provide us with understanding. In section 4, I will present some critiques of her argument. In section 5, I will present a positive argument for pessimism about the ability of ANNs to provide us with understanding Finally, I will conclude by stating that the argument for pessimism is convincing, albeit with some qualifications.

SETTING THE SCENE

ARTIFICIAL NEURAL NETWORKS AND DEEP LEARNING

In this section, I will present some terminological and conceptual clarifications that will be important for the discussion in the later parts of the article. Artificial neural networks or ANNs represent one approach in AI research [10]. Unlike AI systems based on deductive logic and probabilistic reasoning, artificial neural networks "are based on formalisms that can be broadly termed 'neurocomputational' " [10]. The idea is that the structure of ANNs was inspired by the structure of organic neural networks, abstracted to the level of a mathematical formalism. ANNs are thus composed of what are called "neurons", which are "simple, unintelligent units that are interconnected by weighted nodes" [11; p.42]. "Neurons" or units are usually layered into a multi-layer net, with each unit being connected to some or all units in the next layer. Each unit also has a so-called activation value. This value is calculated in two steps. First, the

input function calculates the weighted sum of all input values, i.e., the values of the weighted nodes connecting the unit to the previous layer. Then, the activation function converts this value into the activation level, i.e., the output, of the unit [10].

Such networks are "almost exclusively used for building learning systems" [10]. In other words, they are used to build systems that "adapt to the environment through learning, which takes place according to a chosen learning rule. Using the learning rule, the system gradually changes the strength of the connections between units" [11; p.45]. Artificial neural networks thus play an important role in the research field of machine learning that "building systems that improve their performance by solving tasks" [10]. It is important to notice here that some machine learning algorithms do not employ ANNs, meaning that machine learning is not a subfield of neurocomputational artificial intelligence. However, one of the biggest recent advances in the design of artificial neural networks has come in the form of the development of deep learning models, i.e., models with increased depth.

BLACK BOX PROBLEM

Let us now turn to the problem of opacity or the so-called black box problem. As already mentioned in the introduction, researchers in the field of XAI have pointed out that "predictive accuracy [of machine learning systems] has often been achieved through increased model complexity" [6; p.1]. This increased complexity, "combined with the fact that vast amounts of data are used to train and develop such complex systems," has inherently reduced researchers' ability to "explain the inner workings and mechanisms" of these systems. As a result, "the rationale behind decisions [of these systems] becomes quite hard to understand and, therefore, their predictions hard to interpret". Therefore, they say that "there is clear trade-off between the performance of a machine learning model and its ability to produce explainable and interpretable predictions" [6, p. 1]. Adadi and Berrada [8] have reached a similar conclusion. They state that "there are algorithms that are more interpretable than others are, and there is often a trade-off between accuracy and interpretability: the most accurate AI/ML models usually are not very explainable (for example, deep neural nets, boosted trees, random forests, and support vector machines), and the most interpretable models usually are less accurate (for example, linear or logistic regression)" [8; p.52145].

Linardatos, Papastefanopoulos, and Kotsiantis [6] thus distinguish between "black-box" models, which have state-of-the-art performance but are opaque, and "white-box" or "glass-box" models, which are more easily interpretable, but not as powerful. Chirimuuta [12] also specifies which aspects of deep neural networks suffer from opaqueness. She argues that scientists know the activation values of the units, the learning rule, the depth of the network, and the connectivity between the layers. But they do not know exactly how an already trained network arrives at a prediction or classification.

EXPLAINABILITY, INTERPRETABILITY, AND UNDERSTANDING

The problem of opacity has encouraged researchers to search for ways of making ANNs and especially DL models more understandable to human users. But one salient feature of the literature on explainable AI is the imprecise or even interchangeable use of the concepts of explainability, intelligibility, and interpretability [13]. This is also recognized by the researchers themselves. For example, Linardatos, Papastefanopoulos, and Kotsiantis observe that there is "not a concrete mathematical definition of explainability and interpretability" [6; p.2]. Nevertheless, they make a conceptual distinction between these two terms. Interpretability, on the one hand, is understood in connection to the ability of researchers to intuitively understand the relationship between the inputs and outputs of a system. Explainability, on the other hand, is understood in relation to understanding the inner workings of a system. In contrast, Gilpin

et al. [14] define explainability as the possibility to provide a satisfactory answer to the "w-questions" regarding the functioning of a system. They also make a difference between two levels of explanation, connected to two different questions scientists can ask about a system. A question about the relationship between inputs and outputs, i.e., "why does this particular input lead to that particular output?" And a question about the internal workings of a system, i.e., "what information does the network contain?"

Definitions of these terms are similarly contested in philosophy. Nevertheless, I think there are at least two distinctions that are important for our discussion. First is a distinction between explainability and interpretability, i.e., between being able to provide an explanation of a given model and being able to understand it. Not everyone accepts this distinction. For example, Beisbart and Räz [15] argue that we should understand interpretability and explainability as synonyms. Nevertheless, there is a long tradition in the philosophy of science of separating the two terms [16] that I think should not be so easily dismissed. Thus, to examine this distinction in a bit more detail, I will present an argument, offered by Erasmus, Brunet, and Fisher [17], that the increased complexity of DL systems affects their understandability or interpretability but not their explainability.

In essence, Erasmus, Brunet, and Fisher [17] argue that (1) the possibility of explaining a given phenomenon P is independent of the complexity of P, while (2) the increased complexity of P hinders our ability to understand it. To argue for (1), they rely on the analysis of explanation which holds that it consists of three elements: (a) the *explanandum*, i.e., what we want to explain, (b) the *explanans*, i.e., with what we are explaining, and (c) the *process of explanation*. Different models of explanations differ in one or more of these elements. Erasmus, Brunet, and Fisher [17] present four such models which feature prominently in the literature. (I) The Deductive Nomological model, in which the explanans includes empirical content plus a law-like preposition, and the process of explanation takes the form of deductive reasoning. (II) The Inductive Statistical model, in which the explanans includes a statistical law about the behavior of the variables, and the process of explanation takes the form of inductive or probabilistic reasoning. (III) The Causal Mechanical model with which scientists aim to show "how the explanandum fits into the causal structure of the world" [17; p.838] and thus involves giving information about the causal process and the causal interaction that leads to the emergence of the explanandum. (IV) The New Mechanist model, in which the explanans includes the entities and their activities that are responsible for the emergence of the explanandum[2].

Then they argue that under all four models of explanation, complexity and explainability are independent[3]. Let us take the Deductive Nomological explanation as an example. According to the above definition, it requires only that the explanans contains a law, and that the process of explanation takes the form of deductive reasoning. It does not matter how complex the two elements are. Thus, an explanation that contains a more complex explanans and requires more complex reasoning may be less desirable, but it is no less an explanation. This also holds, *mutatis mutandis*, for other models of explanation. Consequently, the fact that DL models are increasingly more complex should not, at least principally, affect our ability to explain them.

What about understanding? Erasmus, Brunet, and Fisher [17] point out that authors who study understanding disagree about its exact nature. Nevertheless, they commonly observe that, while an explanation is necessary for understanding, it is not sufficient for it. So, to gain understanding of a phenomenon, some other conditions besides having an explanation must be met. There are several candidates for these additional conditions in the literature, but, as Erasmus et al. argue, they all have in common that they are some "subjective features of the individual who is trying to understand the phenomenon in question" [17; p.848]. One such condition is the criterion of intelligibility. It states that a theory T is intelligible to a scientist in

context C if the scientist is able to recognize the qualitatively distinct consequences of T without doing the exact calculations [18]. Given this, it is obvious that the increased complexity of an explanation or a phenomenon makes it less intelligible and thus less understandable. Thus, it can be concluded that complexity affects the ability to understand a phenomenon.

The other distinction that I think is important is a distinction between understanding the models *themselves* and the understanding *provided by* the models. There is an intuitive distinction between having a grasp on how a model works and learning something about the target phenomenon by using the model. This distinction also captures the essence of the disagreement between pessimists and optimists about using DL in science. The optimists, like Sullivan [9], argue that we do not need to understand the models themselves for them to provide us with at least some understanding of the target phenomena. The pessimists, like Chirimuuta [12] or Räz and Beisbart [19], on the other hand, argue that one is a necessary condition for the other.

A CASE FOR OPTIMISM

At face value, there seems to be an intuitive connection between our ability to understand a given model and the possibility that this model provides us with understanding of the target phenomenon. But not all philosophers agree with this line of reasoning. In this section, I will thus present Sullivan's [9] argument that model complexity does not necessarily prohibit understanding.

Her argument can be presented in two parts. First, she argues that having an understanding of a given model is not sufficient for gaining new understanding using this model. Consider, for example, the controversial Schelling's model of segregation. This model is simple and completely transparent. As she describes it: "It is a simulation that consists of a grid with two types of actors, A and B, where both types act on one simple preference—that at least 30 % of their neighbours are the same type. The simulation follows a simple algorithm: if more than 70 % of the actors adjacent to a particular actor are of a different kind, move that actor to the closest unoccupied space" [9]. The equilibrium result of this model is a segregated board which suggests that simple personal preferences, and not systemic discrimination, can cause segregation. But as Sullivan [9] points out, this model does not explain how segregation actually happens, but only how it can possibly happen[4]. Thus, although Schelling's model provides us with an intelligible explanation of the target phenomenon, it does not provide an understanding of it.

What is missing, according to Sullivan [9], is empirical evidence showing that the model accurately represents a real situation. She describes the process of obtaining that evidence as reducing the "link uncertainty", that is, reducing the uncertainty that we can link the behaviour of the model to the behaviour of the target phenomenon. If this is so, having an intelligible explanation is not sufficient for understanding; we need to also consider the empirical evidence connecting the model to the real world. In other words, "the focus should not be unduly placed on how the model works, but instead consider the explanatory question we ask of the model, the role that the algorithm or model plays in the explanation, and the amount, quality, and kind of scientific evidence needed in order to connect the model to the target phenomenon."

In the second part of her argument, Sullivan [9] argues that understanding a given model is also not necessary for gaining any understanding by using this model. The main point here is that "black boxiness" is not a discrete property but that it comes in degrees. She argues that the issue of opacity is an issue of implementation – different parts of the implementation of a given model can be opaque to its builders. But this in principle does not impact the potential of models to provide understanding of phenomena. Consider the following example. Imagine I try to recreate Schelling's simulation on my computer. I might have some knowledge of a

programming language, let us say Python, but maybe I am not all that skilled at programming. So, I start building the simulation. I quickly notice that I do not know how to program the function that will tell me whether, for a given actor, at least 30 % of the surrounding actors are of the same type. I go online and, luckily, I find a library containing a function that does exactly that. The documentation says that the function takes a 2-dimensional array (representing the grid with the actors) and the indexes of a given actor as arguments and returns *True* if at least 30 % of the surrounding actors are of the same type as the given actor and *False* if this is not the case. Thus, I do not understand *how* the function works, but I know *what* it does. Happy with my finding, I import the library and implement the function. The simulation works and although one of its main components of it remains opaque to me, I can still plausibly claim that I understand the model as a whole.

These kinds of implementational black boxes are ubiquitous in science. It thus seems reasonable to conclude that they do not hinder understanding. But what about if a given model is opaque at the highest level of implementation, meaning that we only know the inputs and outputs of the system but nothing about what it does and how? Sullivan [9] concedes this kind of opacity would indeed hinder understanding. But she argues that DL models are not opaque in this way. First, as I already mentioned above, we know quite a lot about how DL models work. In addition, Sullivan mentions methods such as salience maps that can help us understand, for example, which features of the input data are the most relevant in the decision-making process of the model. She concludes that "it should be clear from the above discussion that DNNs [deep neural networks] are not black boxed at the highest level either during the modelling process, or in the resulting model" [9].

In the last part of her paper, Sullivan [9] gives some examples of the explanatory value of DL models. She argues that such models can provide us with how-possibly explanations. One example she uses is Deep Patient, a DL model that can accurately predict future health complications based solely on the medical records of patients. Sullivan [9] argues that Deep Patient can provide how-possibly explanations: it shows that it is possible to diagnose patents based only on their medical records. In addition, using salience maps we can determine which parts of the records were especially important for the model's decisions. This way the model could "point to possible correlations that are worthy of future scientific and empirical research" [9]. Given all this, Sullivan [9] argues that we should focus more on testing these correlations and thus reducing the link uncertainty between the model and the real-world phenomena. "The stronger the link, the greater possible understanding the model can provide" [9]. Pessimism about the use of DL models in science is thus unwarranted.

A CASE AGAINST OPTIMISM

In the previous section, I summarized Sullivan's case for optimism about using DL models in science. In this section, I will present some arguments against her case. First, I will present Räz and Beisbart's [19] argument that Sullivan's thesis is tangible only under a very weak notion of understanding. Then, I will use Boge's [20] distinction between two levels of opacity in DL to argue that DL models are not implementational black boxes.

Räz and Beisbart [19] examine three key epistemic insights that Sullivan [9] claims are offered by DL models, and they assess whether these insights indeed enhance understanding. These three insights are: predictive success, how-possibly explanations, and playing a heuristic role in guiding future scientific research. They argue that all of these are necessary conditions for understanding "but that they do not lead to a high degree of explanatory understanding, because they are too far from actual explanations" [19]. As I showed previously, understanding can be analysed as an intelligible explanation. But under Sullivan's [9] account, DL models provide

as neither with actual explanation nor are they highly intelligible to us. In the best case, we have a how-possibly explanation and some degree of intelligibility which rests on the possibility to examine the models with post hoc techniques such as salience maps.

In addition, Räz and Beisbart [19] question whether DL models provide us with how-possibly explanations in the same way as more traditional simulations. As we saw, Schelling's model shows one possible way how segregation could happen. Can we say something similar about the Deep Patient model Sullivan mentions? Sullivan writes: "The model can also be used to explain how it is possible to predict schizophrenia (or any of the other seventy-seventy medical problems) through past medical records alone. Simply having a highly predictive model, and knowing the high-level emerging properties of the model, uncovers that it is possible to use a machine learning representation for disease prediction" [9]. But as Räz and Beisbart [19] point out, there seems to be a fundamental disanalogy between the cases. Instead of providing a how-possibly explanation of the target phenomenon, i.e., the relation between schizophrenia (or any of the other problems) and existing medical history, Deep Patient answers "a question about the possibility of predictive modeling itself" [19]. In other words, it answers a methodological rather than substantive question.

Another problematic aspect of Sullivan's argument is her assertion DL models are opaque in essentially the same way as other kinds of models used in science. This ignores one important distinction in the XAI literature mentioned above. Namely, the distinction between answering the question "Why does this particular input lead to that particular output?" in contrast to answering the question "What information does the network contain?" [14].

This distinction is further explicated by Boge [20]. He begins his exposition of the two aspects of opacity by defining opacity. He uses Humphreys's definition of epistemic opacity which states that: "a process is epistemically opaque relative to a cognitive agent X at time t just in case X does not know at t all of the epistemically relevant elements of the process" [21; p.618]. Boge [20] then distinguishes between two aspects of the opacity of deep neural networks. First, he describes h-opacity. This kind of opacity concerns the workings of a system: a system is h-opaque if it is the process of its operation that is not intelligible to its human users. This is the kind of opacity that results from the complexity of deep neural networks and hinders the understanding of the connection between input and output data. But as Boge [20] notes, this type of opacity is not qualitatively different from, say, the opacity of other complex computational simulations, e.g., climate simulations. In other words, this is what Sullivan calls an implementational black box. But Boge [20] identifies another aspect of opacity that is specific to deep neural networks. He calls is w-opacity. W-opacity concerns the representational content of the system (what was learned). According to Boge, in DL models, not only the process that takes a neural network from an input to an output, but also the properties of the input data that guide this process are opaque.

This distinction is important from the point of view of gaining understanding via DL models. H-opacity only hinders the understanding of the computational model itself, as it prevents researchers from seeing how it gets from input to output data. In contrast to this, w-opacity reduces the potential of deep neural networks to bring new understanding of the target phenomena. Even in the case where promising results would suggest that a DL model "discovered" an important feature of input data that was previously missed by researchers, w-opacity would make this discovery incomprehensible to scientists. It could happen, for example, that the Deep Patient model would discover an important new correlation between some aspect of a given patient's medical history and risk for schizophrenia. But since this model is w opaque, scientists must depend on methods, such as salience maps[5], to try to extract this information. This, together with the above argument about the weak reading of understanding, in my view, defeats Sullivan's argument for optimism about using DL in science.

A CASE FOR PESSIMISM

In In this final section, I will present Chirimuuta's [12] case for pessimism about using DL in science. In her paper, she focuses on using ANNs in computational neuroscience, but I think that with some qualifications, her main points can be generalized to other areas of scientific research.

Chirimuuta defines computational neuroscience as "a tradition of research that builds mathematical models of neurons' response profiles, aiming both at predictive accuracy and at theoretical understanding of the computations performed by classes of neurons" [12; p.771]. It is based on the assumption that information about the external world is "encoded" in the electrical and chemical signals of the neurons. Researchers in the field thus attempt to solve the so-called "decoding problem", i.e., to find a mathematical function that could successfully link neuron spikes to outside information. Specifically, according to Chirimuuta [12], they try to devise a theory of how neurons encode information about the outside world and then write a program, called an encoder, that performs the translation operation between the stimuli and the neural activity.

Thus, as Chirimuuta [12] points out, computational neuroscience pursues two separate epistemic goals. On the one hand, it aims at accurately predicting the relations between neural activity and external stimuli (e.g., to predict how neurons will fire if we show a picture of a square to a primate). On the other hand, it tries to understand how this translation takes place. Chirimuuta [12] thus argues that in the past, when even very simple linear models have proved surprisingly accurate in certain contexts, there has been a convergence between these two goals. However, with the development of deep neural networks, which are much more accurate but w-opaque, these two goals started to diverge.

Chirimuuta [12] presents two examples of such divergence, one from modeling the functioning of the motor cortex and another from modelling the visual perception system. I will limit my presentation to the former, i.e., to her comparison between two studies that tried to model motor cortex activity, Georgopoulos et al. [22] and Sussillo et al. [23]. In both experiments, researchers measured the activity of individual neurons in non-human primates while the primates were performing given tasks. Georgopoulos et al. [22] present an experiment in which a monkey was surrounded by eight buttons, with the ninth button in front of her. In the experiment, first, the button in front of the monkey lit up. After the monkey held it for one second, one of the other eight buttons lit up, and the monkey had to press it with the same hand. Meanwhile, the scientists measured the activity of a population of neurons in her motor cortex and tried to establish a correlation between this activity and the direction of her arm movement. They did this by simply converting the activity of a neuron into a vector in three-dimensional space according to a formula they devised, and then summing the vectors of the individual neuronal cells to obtain one vector that represented the whole neuron population. They found out that the direction of this vector quite closely matched the direction of arm movement. Because of the fairly simple math they used, their model was completely intelligible. In addition, the researchers themselves determined which information about the neural activity is important and should be used to calculate the movement vector. The accuracy achieved by the model can thus be seen as a partial confirmation that these features of neural activity are indeed important for directing arm movement.

The experiment reported by Sussillo et al. [23] is a bit different. They also had non-human primates, this time two, implanted with electrodes that measured the activity of individual neurons in their motor cortex. But the monkeys did not press buttons; rather, they had to move a cursor on a screen from a central position to a marked position in one of the corners of the screen. Each monkey performed three series of experiments. First, they moved the cursor by

moving their hand. Then, they moved the cursor using a brain-machine interface (BMI) that used an encoder, based on a mathematical model, similar to the one described in the previous example. In the last series, they used a BMI that encoded information using a trained neural network. Each monkey performed each of the three experiments hundreds of times. The researchers found that using this ANN-based encoder significantly improved the monkeys' performance vis-à-vis the older model. This suggests that the BMI with an ANN was more successful in translating between neuronal activation and information about the outside world. We can thus assume that the ANN either has approximated the mathematical function linking neuronal activation and external stimuli more accurately or it has "discovered" new features of the input data that play an important role in the translation. But the ANN used was both h-opaque and w-opaque so despite its improved performance, it did not provide scientists with a better understanding of how the motor cortex works.

It should now be clear what Chirimuuta [12] is getting at when she says that the use of complex ANNs creates a divergence between the goals of predictive accuracy and understanding of neurological processes. It should be noted again that researchers can use post hoc methods such as salience maps to extract at least some information from the models [9, 24, 25]. Nevertheless, there is a clear sense in which the opacity of DL models used affects the ability of scientists to gain new understanding black boxes.

CONCLUSION

Some philosophers worry that because of their opacity, deep learning systems cannot improve our understanding of the phenomena studied. In this article, I tried to establish whether there are good reasons for this philosophical pessimism about using deep learning models in scientific research. First, I clarified the main concepts used in the article. Next, I presented a case for optimism about using DL in science, as found in Sullivan [9]. After that, I presented a critique of her arguments, relying mostly on Räz and Beibart's [19] and Boge's [20] discussion of the opacity of DL models. Finally, I summarized a case for pessimism, as presented in Chirmuuta [12]. The article concludes that despite the predictive success of DL models, there are reasons to be pessimistic about the ability of DL models to provide us with new understanding of phenomena, studied by scientists.

REMARKS

[1]There is also a huge body of literature on the ethical issues of using opaque technologies in decision-making processes. These issues are especially pronounced in domains where such decisions affect individuals' well-being, e.g., in medicine or the justice system. For a review of this literature, cf. Mittelstadt et al. [26]; Jobin, Ienca, and Vayena [27]. I will not consider this problem here.

[2]Woodward and Ross [28] present a slightly different typology. In particular, they add Salmon's statistical relevance model and pragmatic models of explanation.

[3]Prasetya [29] points out that Erasmus, Brunet, and Fisher [17] left out one important model of explanation, i.e., the unificationist model of explanation, which consists in providing a pattern of inference that can be used to describe and thus explain many different phenomena. Prasetya [29] argues, pace the general thesis in Erasmus, Brunet, and Fisher [17], that this kind of explanation is sensitive to the complexity of both the explanandum and the explanans. In a response, Erasmus and Brunet argue that the unificationist model of explanation is dissimilar to the other four models in that it is "about whether a theory is 'explanatory,' while the other familiar accounts of explanation are about whether a given act/argument is an explanation" [30; p.42]. Since in the original paper, they admit that a more complex

explanation might be less desirable or less "explanatory", Prasetya's [29] point about the unificationist model does not defeat their general thesis.

[4]For a more detailed discussion on the distinction between how-possibly and how-actually explanations, cf. Reutlinger, Hangleiter, and Hartmann [31].

[5]It is questionable how reliable such methods actually are. Räz and Beibart for example write: "Saliency maps can indeed be useful. However, there is no guarantee that if a saliency map looks fine, the model is fine. Saliency maps are heuristic tools; they do not provide general understanding of a model" [19]. This is supported by literature in XAI: Linardatos et al. for example write that "one of the issues with saliency maps is that concepts in an image, such as the 'human' concept or the 'animal' concept, cannot be expressed as pixels and are not in the input features either and therefore cannot be captured by saliency maps" [6; p.9].

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EDUCATION AGAINST DISINFORMATION

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ABSTRACT

In the contemporary world, disinformation has serious consequences, including undermining democracy, the economy and public health. They influence electoral processes, undermine trust in companies, encourage divisions and divert attention from key issues. Social networks play a key role in spreading disinformation and lack of transparency. Prevention of disinformation requires the cooperation of different sectors and the application of effective detection, removal and education strategies. Artificial intelligence is playing an increasingly important role in spreading and combating disinformation.

Psychological factors such as confirmation bias, cognitive dissonance, and social influence contribute to the spread of disinformation. Education, media literacy and critical thinking are key to overcoming these factors. Software tools such as InVID & WeVerify, Google Fact-Check Explorer and others help debunk disinformation by verifying sources and analysing content.

Exploratory research conducted at the University of Applied Sciences in Criminal Investigation and Public Security in Zagreb studied attitudes and behaviours related to disinformation. Participants recognized the importance of checking sources and content analysis, but fewer of them felt that they were sufficiently informed about ways to recognize disinformation. Critical thinking and media literacy play a key role in understanding and combating disinformation.

KEY WORDS

CLASSIFICATION

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INTRODUCTION

In today's world, information and communication technologies play a key role, but they also form the basis for various hybrid threats such as hacktivism, cyber terrorism, espionage, warfare and disinformation campaigns. These activities use technology to achieve goals that can seriously threaten the security of individuals, organizations, and entire nations. Cooperation between governments, companies and individuals is necessary to develop effective strategies to counter these threats.

Hacktivism uses hacking and computer activities to advance social or political goals, including disrupting government operations and leaking information. Terrorism in cyberspace relies on digital tools to spread propaganda, recruit and plan attacks. Espionage involves unauthorized access to sensitive data, while cyber warfare uses technology to attack and defend military targets. Disinformation campaigns manipulate public opinion by spreading false or distorted information, often via social media, clickbait headlines and deepfakes. Disinformation can originate from rumours, but also from fiction, governments and politicians, and vested interests. Moreover, changes in the media environment, including the advent of the Internet, have significantly affected the ways in which information is communicated and disinformation spread [1]. Stakeholders in crime prevention face major challenges due to the volume, speed and increasing sophistication of disinformation on the Internet [2]. In Europe, units have been created that are dedicated to identifying, collecting and reviewing disinformation and fake news, warning the media and the public about them (e.g. EU East StratCom Task Force) [3]. At the UN level, the problem of disinformation is also recognized and, for example, in the UNHCR guide on protection on social media, "types of misinformation and disinformation" are presented [4]. Disinformation and fake news spread on social media platforms and mainstream and non-mainstream media. Automated bot accounts assist in this effort by disseminating information at a faster and more frequent pace than individual users can. Disinformation and bot supporters also amplify disinformation and fake news on the Internet [5]. Disinformation can take many forms, including fake news, propaganda and conspiracy theories.

Disinformation campaigns manipulate public opinion by spreading false or distorted information. Declining levels of trust in government have contributed to the rapid spread and consumption of fake news by the public [6]. Disinformation spread through social media, clickbait headlines, deepfakes and other techniques. Perception of disinformation and its effects requires education about the differences between disinformation (inaccurate information without the intent to mislead) and disinformation (deliberately false information for manipulation).

Disinformation has serious consequences, including undermining democracy, the economy and public health. They influence electoral processes, undermine trust in companies, encourage divisions and divert attention from key issues. Social networks play a key role in spreading disinformation, encouraging sensationalism and lack of transparency. Disinformation also serves to recruit extremists through Twitter, which requires efforts to detect and remove extremist content and education to build resilience to extremist tactics. ISIL recruiters used a variety of tactics on Twitter to attract potential recruits. ISIL developed an application *The Dawn of Glad Tidings* that members and supporters would download to their mobile devices; the application is among other things, designed to access the user's Twitter account and tweet on behalf of the user [7].

Prevention of disinformation requires cooperation between different sectors and the application of effective detection, removal and education strategies.

PSYCHOLOGICAL TRIGGERS

There are several psychological triggers that lead individuals to accept and spread disinformation and resist correcting these misconceptions even when presented with evidence [8].

Confirmation bias is the tendency to look for information that confirms existing beliefs, ignore contradictory information, and thus cause biased judgments. Cognitive dissonance is an uncomfortable state when we are faced with information that contradicts our beliefs, prompting us to reject the new information and remain consistent.

Overconfidence and the illusion of knowledge make people less open to new information and able to overestimate their knowledge.

Social influence plays a role in the spread of disinformation because people often accept information that is consistent with the social groups they belong to.

Emotional thinking is based on emotion instead of evidence and often leads to accepting false information.

Fact-fighting occurs when conflicting information is rejected due to identity threats or embarrassment.

More generally, the two strategies are preventive intervention (prebunking) and reactive intervention (debunking). Prebunking aims to help people recognize and resist disinformation they later encounter, even if it is new. Debunking emphasizes responding to certain disinformation after exposure to show why it is false [8]. The common fallacies are divided into three categories: Fallacies of Relevance, Fallacies of Unacceptable Premises, and Formal Fallacies [9].

To overcome these psychological triggers, strategies such as encouraging critical thinking, promoting media literacy, exposing people to different perspectives, and educating people about the mechanisms of disinformation are useful. Governments, technology companies and individuals have a role to play in combating disinformation through regulation, education and promoting accountability. Media literacy is key to identifying and countering disinformation, while critical thinking encourages questioning and impartial evaluation of information. Similar to digital citizenship, a key premise for defining media literacy is that literacy includes the ability to interact intelligently with media and information sources [10]. In line with the growing amount of fake news and disinformation on the Internet, there are numerous platforms on the web for authenticating, analysing and/or fact-checking news [11]. Exposure to different perspectives develops tolerance and broadens understanding. Hearing about someone else's experience can shed light on a life different from your own and give you a new perspective.

We need new ideas, views, and practices to encourage and inspire us, to show us how others eat, celebrate and love! Therefore, it is important to recognize that diversity is critical to our survival, but it is also critical to our progress. Bringing together people from different backgrounds with different life experiences can generate ideas or perspectives that others may have never considered or been aware of, which can directly affect productivity [12]. Overall, education and awareness play a key role in combating disinformation.

DEBUNKING OF DISINFORMATION

Debunking false information is a key method that can contribute to better informing and educating the public. It is important to thoroughly check information sources, analyse content and circumstances, and apply critical thinking and software tools. It is also important to educate people on how to recognize and challenge false claims, especially in professional policing where professionalism and integrity are crucial. There are variety of software tools for debunking disinformation, depending on the type of information being verified. Some of these tools are:

- InVID & WeVerify Chrome Extension – this technology enables reverse image and video searches to find the original source and authenticity. It also enables keyframe extraction from videos and metadata analysis,

- Google Fact-Check Explorer – this database allows you to search for claims and sources based on keywords, languages, and countries,
- Google Earth – this tool provides a 3D view of parts of the planet and provides additional information about different places,
- SunCalc – this technology makes it possible to determine the position of the sun at a certain time and place.

It is important to invest time, research and critical thinking in debunking false information. It is necessary to check sources, seek confirmation from independent sources, analyse content, recognize illogicalities and manipulative techniques, and share only verified information. Education on debunking of disinformation should be available in order to perform quality police work and become a responsible consumer of information.

CHECKING THE SOURCE OF INFORMATION

The first step is to carefully examine the source of the information. It is necessary to determine whether the source is known, reliable and has a good reputation for providing accurate information. It is also important to ensure that other reliable sources confirm the same information. Regardless of your role (journalist, researcher, and professional), identifying accurate information and using it correctly are key challenges in the 21st century [13]. The contribution to contemporary scientific discussions on journalism therefore lies in the definition of different journalistic strategies related to the exposure, that is, the public exposure of false information that is marketed in order to influence or rather manipulate the whole society or at least its larger parts [14].

There are several criteria you can apply to assess the credibility of a source:

- check who is the author of the information.
- research his credentials, professional experience and reputation in the relevant field.
- compare the information with other reliable sources to confirm accuracy.
- check the relevance of the information to your topic and needs.
- make sure the information is up-to-date, especially with rapid changes.
- look for independent sources that confirm or dispute the information.
- analyse content to identify illogicalities and manipulative techniques.
- using guidelines like the "5 W" questions (Who, What, Where, Why, How), smart checks, and the CRAAP test, you can better assess the reliability of sources [15].
- additional sources.

Finding independent sources is key to verifying information. Use search engines, news browsers and fact-checking platforms as additional sources of information. Fact-checking organizations and journalistic teams often check claims and evaluate their veracity.

ARTIFICAL INTELLIGENCE AND DISINFORMATION

Artificial Intelligence (AI) can be used to create and spread disinformation, and at the same time to detect and suppress it. Here are a few ways artificial intelligence is influencing disinformation: generation of disinformation, disinformation detection, social network analysis, information verification, content personalization, automating fact-checking.

Generative models like GPT-3 have the capability to produce highly realistic and coherent text that can mimic human writing. Advances in generative models such as GPT-3 make it possible to create convincing false information. The ability of these models to generate authentic-sounding text can be abused to create disinformation.

While these models have numerous positive applications, they can also be exploited to generate disinformation, misleading content, and fake news. The generation of disinformation using AI models can have serious consequences, as it becomes increasingly difficult for people to distinguish between authentic information and fabricated content. This can further erode trust in media, institutions, and even online interactions. Addressing this challenge involves a combination of technological, social, and educational measures. Some of these strategies include: algorithmic accountability, content verification tools, media literacy, transparency in AI-generated content, human review, collaboration with AI, public awareness campaigns, regulation and policy. It is a complex issue that requires a multi-pronged approach involving technology, education, policy, and public awareness to effectively address the challenges posed by AI-generated disinformation.

It is important to note that although artificial intelligence has a significant role to play in the fight against disinformation, it is not perfect. Detection algorithms can have false positives or false negatives, and the technology itself can be misused to create sophisticated disinformation. Therefore, it is important to use diverse approaches, including human verification and collaboration, to effectively counter disinformation.

A SYSTEMATIC APPROACH TO DISINFORMATION RESEARCH

There are numerous reasons that point to the need for a coordinated strategy to combat all forms of disinformation, because it is not possible to expect all social groups to take a critical approach on their own initiative, recognize the intention and verify the veracity of the content. However, considering that disinformation represents a great threat to democracy, it is necessary to create adequate educational content. This claim can be supported by numerous previous studies that have confirmed the seriousness of threats, especially in relation to young people. For example, authors in [16] point out that disinformation spread by human action, bots and paid organized groups, so-called troll factories operate maliciously to gain political influence and financial gain, approval of ideas and popularity. Special attention should be paid to social networks and platforms with the role of spreading disinformation, and the issue of regulating these platforms is raised. Self-regulation and encouraging greater accountability of the platforms on which disinformation is spread are becoming increasingly important.

In view of the aforementioned, in this article a research question was asked about the perception, attitudes and habits of the younger population with greater digital and media literacy, related to disinformation on the Internet, with the basic aim of determining the level of recognition and information about disinformation, as well as habits that contribute to less the possibility of manipulating disinformation and determining differences with regard to the level of education in order to coordinate the most appropriate education program with the necessary learning outcomes in international institutional cooperation. This specifically emphasizes the importance and ways of dealing with the problem of disinformation in the digital age.

The specific research questions are: is there a connection between the perception of the frequency of disinformation and checking the truth of information, is there a connection between the frequency of using social networks and checking the truth of information, and are there differences in the perception of two different groups of respondents (university students and high school students, including students course) with regard to experiences with cyber threats and with regard to the perception of the strength of the influence of disinformation. In doing so, survey, comparative and descriptive methods and correlation analysis were used.

The methods used are: survey method, comparative method, descriptive method and correlation analysis, and the data were processed with the statistical package SPSS ver. 25.0.

It was hypothesized that there is a statistically significant connection between the perception of the frequency of disinformation and the verification of the truth of information, and a statistically significant difference between the high school and high school groups of respondents with regard to the experiences of cyber threats and the perception of the impact of disinformation.

METHODOLOGY

PROCEDURE

The research was conducted at the University of Applied Sciences in Criminal Investigation and Public Security in Zagreb during March and April 2023. The research was part of the Erasmus+ project entitled "Collaboration on the development of a common curriculum on combating hybrid threats – HYBRIDC". The Ethics Committee of the University of Applied Sciences in Criminal Investigation and Public Security previously gave a positive opinion on the implementation of the research. The participants were informed about the purpose of the study and gave their consent before participating.

Data were collected through an online survey, and statistical analysis was performed using the SPSS program. General statistical data are presented using means (M) and standard deviations (SD).

PARTICIPANTS

The research participants included 278 persons (63,3 % men and 36,7 % women) with an average age of 29,29 years (standard deviation 6,36 years). All participants are students of the University of Applied Sciences in Criminal Investigation and Public Security, of which 71,9% are studying professional studies in criminology, and 28,1% are specialized graduate studies. Among the participants, 74,8% are employees of the Ministry of the Interior. The average length of service of the police officers in the sample was 6,23 years (standard deviation 5,37 years). The participants performed various jobs within the police, where 23,4% worked in basic police work, 18% in criminal work, 15,1% at the border, 8,6% in traffic and smaller percentages in other specialized units.

RESEARCH INSTRUMENTS

The research used three survey questionnaires: Questionnaire of sociodemographic data, Questionnaire of attitudes and beliefs about disinformation, Questionnaire of behaviour on the Internet.

The sociodemographic data questionnaire contained 11 questions that explored various aspects of the participant's characteristics such as age, gender, occupation, work experience, level of education, grade point average, place of residence, and level of English proficiency.

The questionnaire of attitudes and beliefs about disinformation consisted of 42 items divided into 4 subscales: the impact of disinformation, the purpose of creating and disseminating disinformation, the recognition of disinformation and the frequency of disinformation in the media. Participants responded to these items using a 5-point scale. The reliability of these subscales is acceptable, and the Cronbach α coefficients for each subscale are 0,854 for the influence of disinformation, 0,723 for the purpose of creating and spreading disinformation, 0,660 for recognizing disinformation and 0,938 for the frequency of disinformation in the media.

The Internet behaviour questionnaire consisted of 38 items that were divided into 4 subscales: security protection, protection from disinformation, negative experiences on the Internet, use of social networks and Internet portals. Participants responded to these items using a 5-point scale.

On the security protection and disinformation protection scales, participants answered questions using a 5-point scale (1 – never, …, 5 – almost always), and the particles consisted of recommended behaviours/methods for security protection (e.g. "I regularly change passwords and passwords") and protection against disinformation on the Internet (e.g. "When I come across some information, news, content on the Internet: I check the credibility of the author of the content"). The scale of negative experiences on the Internet consisted of a list of items corresponding to different methods of cyberattacks (e.g. "Have you been the target (victim) of a cyberattack via: virus, identity theft, card fraud", etc.) to which participants answered using a scale of 4 degrees (1 – never, …, 4 – often). The use of social networks and Internet portals scale consisted of multiple-choice questions that examine the use of different social networks and Internet portals, the frequency of using them using a 5-point scale (1 – I do not use every day, …, 5 – more than 10 times a day) and the time spent on them daily using a scale of 5 degrees (1 – up to 15 minutes, …, 5 – more than 2 hours). The calculated reliability of all subscales is acceptable and for the scale protection of security is Cronbach α = 0,825, for the scale protection from disinformation Cronbach α = 0,861, for the scale negative experiences on the Internet Cronbach α = 0,865, for the scale use of social networks and Internet portals Cronbach α = 0,735.

FINDINGS

The participants recognized that disinformation has the greatest influence on people's political attitudes, social events and the perception of events. As the purposes of creating and disseminating disinformation, the participants rated the distraction from social problems and the manipulation of people's opinion and behaviour the most.

Regarding the impact of disinformation and the purpose of creating and spreading disinformation, the participants believe that disinformation has the greatest impact on people's political attitudes ($M = 4,26$), then on social events ($M = 4,15$) and social perception of an event, person or group ($M = 4,14$) while they have the least influence on the perception of the population's health condition ($M = 3,89$) and the course of the war in Ukraine ($M = 3,53$).

Regarding the purpose of creating and disseminating disinformation, the participants gave the highest rating to divert attention from important social problems ($M = 4,25$) and the manipulation of people's opinions and behaviour ($M = 3,24$), while the lowest rating rated entertainment ($M = 3,06$) as the purpose of disinformation.

In the part of the questionnaire on recognizing disinformation and being informed about disinformation, the first three questions refer to the respondent himself, while the other three questions refer to the respondent's perception of other people. The majority of respondents (66,9%) believe that they are sufficiently informed about the dangers of disinformation, and that they can easily distinguish disinformation from the truth (55,4%), while less than half of them (48,9%) believe that they are sufficiently informed about ways to distinguish disinformation. On the other hand, only 9% of respondents believe that people easily recognize disinformation from true information, 6,9% of them believe that people easily recognize disinformation from disinformation, while 67,7% of them disagree with the thesis that people on the Internet/social networks do not share the news for which they know is disinformation.

Regarding the frequency of disinformation in the media, the participants believe that the highest percentage of disinformation is present on social networks (70,79%) and internet portals (66,87%), while printed newspapers (46,55%) and radio (41,01%) are rated with a lower percentage of disinformation.

Regarding media areas, the participants believe that the highest percentage of disinformation is found in the area of the topic of COVID 19 (67,45%) and politics and marketing (63,02%), while the least amount of disinformation is found in the area of sports (33,85%).

The Internet behaviour the results show that the majority of participants use all of the listed security and privacy protection methods. Using private profile settings on the Internet is the most frequently used method of privacy protection, which is often or always used by 81,7% of participants, while 64,7% of them declare that they are often or always careful about the way they publish text and image content. Strict privacy settings on the Internet are often or always used by 64,8% of participants, while only 1,8% of participants declare that they never use such settings. Creating complex passwords is often or always used by 53,6% of participants, while only 25,9% of them change their passwords regularly.

On the scale of behaviour on the Internet related to disinformation, which represents the central interest of this research, of the seven offered activities (I think before sharing content, I check the veracity of the content, I check the date of the event, I check the credibility of the author of the content, I check the credibility of images and videos, I check the source of the URL address, I ask the experts for their opinion), most participants state that they simply think before sharing content on the Internet, which is often or always 68,4% of them, while 12,6% of participants state that they never or rarely think before sharing some content they come across on the Internet. Only 42,4% of participants often or always check the veracity of the content (the central part of this scale) with 15,8% of them doing it rarely or never. Checking the date of the event, the credibility of the author and content, image and video, and the source of the URL address is done even less often by the participants, while the smallest number of participants ask for an opinion from an expert – 35,6% of them never do this.

A comparison of the different groups from which the research sample was composed, using the t-test for independent samples, shows that there is a statistically significant difference in checking the truth of information with regard to gender (M, F), in such a way that men use methods to check the truth and credibility of information more often than women (MM = 3,13, SdM = 0,759; MF = 2,87, SdF = 0,817; $t = 2,674$, $p = 0,008$) with a small to medium effect size (Cohen d equals 0,329). The participants did not differ in the frequency of checking the veracity of information with regard to employment or level of study.

The use of methods for verifying the truth of information (protection against disinformation) is most closely related to security protection ($r = 0,736$) and to being informed about disinformation ($r = 0,354$). People who think they are more informed about ways to recognize disinformation and people who more often use methods to protect security and privacy on the Internet also more often use methods to verify the truth and credibility of information. Low but significant positive correlations were also obtained between protection against disinformation and the perceived amount of disinformation on the Internet ($r = 0,253$) and the perceived impact of disinformation ($r = 0,206$), which indicates that those who believe that there is more disinformation on the Internet and those who believe that disinformation has a more significant impact on individuals and social changes also more often use methods to verify the truth and credibility of information. The frequency of using social networks is not related to protection against disinformation ($r = 0,074$), nor is it the year of study ($r = 0,01$), the grade point average ($r = 0,049$) or age ($–0,055$).

In order to examine the predictors of protection against disinformation, a regression analysis was performed and out of a total of 4 predictors used in the regression model, 2 predictors were found to be significant in relation to protection against disinformation as a criterion - security protection and recognition of disinformation. According to the beta standardized coefficients, it is evident that security protection is the best predictor of protection against disinformation ($\beta = 0,696$), which means that with the increase in the use of methods for security protection on the Internet, the use of methods for verifying the truth of information also increases. Another significant predictor, with a much lower beta coefficient ($\beta = 0,109$), is the recognition of disinformation – with the increase in information about the dangers of disinformation and ways

to recognize it, the probability of using methods to verify the truth of information also increases. The regression model significantly explains 54,5% of the total variance of protection against disinformation.

DISCUSSION OF FINDINGS

This article presents the results of an exploratory study aimed at collecting preliminary data on the attitudes, beliefs and behaviour habits related to disinformation on the Internet among students of the University of Applied Sciences in Criminal Investigation and Public Security and examining potential predictors of these behaviours.

The results show that the majority of respondents (66,9%) believe that they are sufficiently informed about the dangers of disinformation, and that they easily distinguish disinformation from the truth (55,4%), while less than half of them (48,9%) believe that they are sufficiently informed about the ways to distinguish disinformation.

Furthermore, men use methods to verify the truth of information significantly more often than women ($t = 2,674$, df $= 276$, $p = 0,008$), while the regression model resulted in the two most significant predictors: individuals who are more likely to use methods to protect their privacy and security on the Internet ($\beta = 0,696$, $p < 0,01$) and individuals who believe that they are better informed about the dangers and ways to recognize disinformation ($\beta = 0,109$, $p < 0,05$) more often use methods to verify the truth of information ($R^2 = 0,545$, F $= 84,021$, $p < 0,01$).

Further analysis of the correlations suggests that those individuals who believe that disinformation has a more significant impact on society and that disinformation is more frequent in the media also use methods to verify the veracity of information more often.

EDUCATIONAL POTENTIAL

These results provide valuable insight into participants' attitudes, beliefs and behaviours regarding disinformation. They can serve as a basis for the development of educational content and interventions aimed at raising awareness and promoting proper behaviour in relation to disinformation on the Internet.

Different aspects of disinformation and hybrid threats in the digital world, as well as psychological factors that support their spread are clearly recognized and investigated in the paper. The key points highlighted are as follows.

Information and communication technologies and the threats that are realized through them represent a major security challenge today. For example, the effectiveness of countering hybrid threats really requires cooperation between different sectors, including governments, technology companies and ordinary users. These threats, such as hacktivism, cyber terrorism, espionage and disinformation, all rely on technology to achieve their goals.

Analysis of the relationship between disinformation and social networks shows that the role of social networks in the spread of disinformation is crucial. These platforms enable the rapid spread of information, but also disinformation. It is important to make people aware of the differences between true and false information and to encourage media literacy so that users are better equipped to recognize manipulation.

Analysis of psychological factors that support the spread of disinformation indicates that: confirmation bias, cognitive dissonance, overconfidence and social influence are factors that can contribute to the spread of disinformation and make it difficult for people to accept corrections even when they are presented with the facts.

An integral part of the strategy to combat disinformation must be education and the promotion of media literacy play a key role in this fight. It is also important that governments and tech companies take responsibility in regulating and curbing the spread of disinformation on their platforms.

In accordance with the introductory considerations of this paper and the results of research related to the debunking of disinformation, we could divide the educational approach to this issue into three types of learning outcomes, namely: those that check information sources, content analysis and context checking.

LEARNING OUTCOMES: CHECKING INFORMATION SOURCES

After studying this part, the student will be able to:

- recognize the importance of checking information sources in order to determine their credibility,
- identify key steps for verifying sources, including analysis of authorship, author expertise, comparison with other sources, and relevance and timeliness of information,
- understand the role of fact-finding organizations and reviews of other reliable sources in verifying information,
- develop a critical approach when checking sources, recognizing possible biases, (manipulations or deficiencies in information.

Content analysis is a key step in verifying information and identifying manipulative techniques, so it is important to know how to analyse content. There are numerous definitions of content analysis, such as:

- Definition 1 – "Any technique for drawing conclusions by systematically and objectively identifying particular characteristics of messages" [17].
- Definition 2 – "Interpretive and naturalistic approach. It is both observational and narrative in nature and relies less on experimental elements that are normally associated with scientific research (reliability, validity, and generalizability)" [18].
- Definition 3 – "A research technique for the objective, systematic and quantitative description of the apparent content of communication" [19].

In general, there are two types of content analysis: conceptual analysis and relational analysis. Conceptual analysis determines the existence and frequency of terms in the text, while relational analysis further develops conceptual analysis by examining the relationships between terms in the text [20].

LEARNING OUTCOMES: CONTENT ANALYSIS

After studying this part, the student will be able to:

- recognize the importance of content analysis in evaluating information and recognizing manipulative techniques,
- identify key steps in content analysis, including careful reading, identifying sensationalism, looking for inconsistencies and manipulations, and checking sources and evidence,
- understand the different definitions of content analysis and how they apply to information evaluation,
- develop critical thinking skills when analysing content, recognizing author's motives, verifying factual claims, and recognizing and understanding manipulative techniques.

LEARNING OUTCOMES: CHECK THE CONTEXT

After studying this part, the student will be able to:
- recognize the importance of understanding context when interpreting information,
- identify the steps in properly interpreting the context, including carefully reading the entire content, looking for additional sources for the bigger picture, and identifying hidden motives or interests,
- understand how different sources of information provide different perspectives and contextual information.

Develop the ability to think critically when interpreting the context, recognizing potential biases, ambiguities or incompleteness of information.

These learning outcomes provide guidance for understanding and applying key steps in the processes of information verification, content analysis, and context interpretation. Through their application, students will develop critical thinking skills and better prepare for understanding, interpretation and evaluation of various information.

By implementing these types of learning outcomes in teaching courses at the University of Applied Sciences in Criminal Investigation and Public Security, a significant step forward will be achieved in the field of prevention of misuse of information and communication technologies from the point of view of the creation and spread of disinformation.

The analysis carried out in the paper clearly shows that countering disinformation and hybrid threats is a complex process that requires comprehensive strategies, cooperation of various actors, and education and awareness in order to train people to recognize and face these challenges.

These studies are exploratory in nature, so further research could deepen these results and analyse other variables that could influence participants' attitudes and behavior regarding disinformation.

CONCLUSION

Countering disinformation requires comprehensive and collaborative strategies that include education, regulation, cooperation between sectors, and the application of technological tools to verify and analyse information. It is important to note that although artificial intelligence has a significant role to play in the fight against disinformation.

This research provides a valuable insight into the perception and behaviour of the participants regarding disinformation on the Internet and points to the importance of education and information in order to fight against the spread of disinformation.

The hypothesis that there is a statistically significant connection between the perception of the frequency of disinformation and the verification of the truth of information and a statistically significant difference between the high school and high school groups of respondents with regard to the experiences of cyber threats and the perception of the impact of disinformation was confirmed by this research.

Namely, checking the truth of information is positively and significantly related to the perception of the frequency of disinformation in the media ($r = 0,181$, $p < 0,01$) and on social networks ($r = 0,253$, $p < 0,01$), and it was also shown that students, who believe that in the media and there is more disinformation on social networks, they use more methods of verifying the truth of information. It was also shown that the perception of the frequency of disinformation in the media and on social networks is positively significantly related ($r = 0,547$, $p < 0,01$).

A statistically significant difference was also confirmed in the sample groups regarding the experiences of cyberattacks on the Internet ($t = -3,470$, $p = 0,001$), and the group of students experienced more cyberattacks compared to the group of high school and course participants. In the context of the previously presented research results, it can be concluded that it is a moderating effect of the participant's age. There is also a statistically significant difference between the sample groups with regard to the perception of the strength of the influence of disinformation ($t = -3,947$, $p = 0,000$), which shows that the group of students attributes to disinformation a more significant impact on the individual and social events than the group of high school and course participants.

In today's digital age, the ability to recognize false information is important for making informed decisions. In professional policing, this becomes crucial to ensure safety and public

confidence. Critical thinking, using fact-checking tools and being educated about various disinformation techniques will help maintain the integrity and effectiveness of police work.

The digital landscape is constantly evolving, and addressing these challenges requires a multi-pronged approach involving governments, tech companies, civil society, and individuals. Balancing the regulation of ICT and addressing disinformation with the principles of free speech, privacy, and open communication is a complex endeavour. Effective regulation and response strategies need to be carefully crafted to address the challenges posed by the rapid evolution of technology and the dissemination of information. Striking the right balance between regulating ICT, safeguarding privacy, and addressing disinformation is essential for creating a safe, inclusive, and informed digital environment.

In conclusion, the work emphasizes the importance of dealing with the problem of disinformation in the modern digital age, and through different teaching methods for different age groups opens up space for further research regarding the selection of the most appropriate approaches and teaching methods. It is certainly a research challenge to investigate the breadth and depth of content related to disinformation and the fight against it in the educational space in accordance with the level of education and the expected learning outcomes when creating the curriculum.

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COMPARING TWO METHODS FOR EXPLORING CONSCIOUSNESS: DESCRIPTIVE EXPERIENCE SAMPLING AND MICRO-PHENOMENOLOGICAL INTERVIEWS

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ABSTRACT

Methods are arising in first-person research aimed for deeper understanding of lived experience. Here we compare two of the most frequently used methods – Descriptive Experience Sampling and the micro-phenomenological interview. Both look at short episodes of experience. Both have safeguards to limit biases and distortions from first-person reporting. But these methods are still different in terms of how they deal with memory, questioning, and analysis.

We report on an exploratory study that used both methods in the context of a common task. Four participants were interviewed about their experience of a mental imagery task using both methods. Descriptive Experience Sampling results focused more on fine-grained details of visual experiences. micro-phenomenological interview results focused more on how experience extended over time, and how participants engaged with the task. These differences in results demonstrate how the applied methods differ in their focus and scope, and present a direction for future comparison, investigation and potential integration of first-person methods.

KEY WORDS

CLASSIFICATION

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INTRODUCTION

It is possible that as you are reading this you feel an itch somewhere on your body. Or you start to form a sensory impression – say, of a white sandy beach, with clear blue water, the smell of salt, and the gentle chirping of birds in the background. Even if you have resisted these suggestions, chances are that you are still having some kind of conscious experience. To give a pragmatic definition, for a conscious person, there is *something that it is like* to be that person [1].

In recent decades, new methods have been developed that aim at providing scientifically admissible descriptions of subjective experience[1] [2]. In this article, we will look at two of the most wide-spread: Descriptive Experience Sampling (DES) and the micro-phenomenological interview (MPI). DES was pioneered by Russell Hurlburt in the late 70s and refined over the course of subsequent decades [3]. It uses random beeps to direct participants towards specific, concrete episodes of experience. The micro-phenomenological interview (MPI) was adapted by Claire Petitmengin from Pierre Vermersch's explicitation interview [4]. The MPI aims to guide participants to a state in which memory becomes immediate and lived [5], taking into account the biases and errors frequent in unguided recall of experience. Both methods seek detailed descriptions of lived experience. And both want to recentralize consciousness as a worthy topic of research.

First-person research has had a rocky history [6, 7]. In the early 20th century, first-person research was a major pillar of psychology. But this was marred by a prolonged disagreement between two rival 'introspectionist' camps [4, 8]. One side argued for the possibility of thoughts without any imagery (visual, auditory, etc). The other side held this was impossible. Other disagreements compounded and eventually the domain of psychology moved on, leaving introspection behind.

Throughout the 20th century, behavioural, neural, and computational approaches to studying the human mind rose in prominence. When consciousness was investigated, this was mostly done *from the outside* – through its traces on the world – rather than *from within* – how it was experienced. An influential paper by Nisbett and Wilson [9] further kicked first-person research when it was down. It solidified the notion that first-person data is flawed and distorted by heuristics, overgeneralizations, and memory problems. People simply do not know what is in their consciousness.

You might expect us to lash back at Nisbett and Wilson but we actually do not disagree! Biases of memory and attention get in the way of accurately describing consciousness. In fact, the founding authors of both DES and MPI have directly addressed Nisbett and Wilson's critiques.

Hurlburt and Heavey [10] point out that the DES method actually complies with oft-overlooked prescriptions that Nisbett and Wilson give for how first-person research can be done right. These include: 1) interrupting a process at the moment it was occurring, 2) alerting subjects to pay careful attention to their cognitive process, and 3) coaching them in introspective procedures. Random beeps in participants' everyday life are meant to attune them to the moment directly preceding the beep.

As for the MPI, Petitmengin and colleagues [11] sought to replicate a study inspired by Nisbett and Wilson's critiques. Participants were given a choice and then tricked to believe they made the opposite choice. In the original study [12], participants were largely unable to detect this manipulation. However, in the conceptual replication, with an MPI conducted immediately after the participant made the choice, participants' ability to detect the manipulation significantly improved [11].

Both methods have guidelines to narrow in on specific moments of experience and to limit biases. They aim to guide participants away from generalisation and towards concrete lived

instances. Experience described in the abstract is an amalgamation of warped memory, self-perception, conceptual frames, and fleeting impressions. 'This morning I had breakfast and felt sleepy'. However, specific experience manifests itself as a flow of vivid *nows*. '*Now* I'm watching the cream dissolve in my coffee. *Now* I'm picturing what would happen if gravity reversed overnight and I had to rearrange my furniture on the ceiling'. These *nows*, so vivid when lived, can dissolve in memory like cream in coffee, so that we might forget their original colour. Methods of first-person research and empirical phenomenology [13] aim for that colour.

Despite similar intentions, there has been some contention between methods. Hurlburt and Akhter [14] have questioned the validity of the MPI. Petitmengin has argued about DES that "the beeper is not suitable for observing very brief or very fine subjective events" [5; p.253]. What is the nature of this disagreement? Does it imply that 'empirical phenomenology' doomed to the same fate as introspection, with unresolved differences once again disqualifying it?

Let us not be so dramatic. The founders and practitioners of each method have come to embrace a more reflective and even collaborative approach. The point of this study is to use the two methods with a common task to see which aspects of experience they reveal. The questions then are: What similarities do they reveal? What differences? And in the case of differences, how can we explain them? Might one method give valid results and the other flawed ones? Or do methods simply have different scopes, revealing different aspects [15]? Just because a thermometer and a barometer tell us different things about the air around us does not mean that any one of them is 'wrong'. But in this case, we need to precisely understand our methods and which aspects of experience they reveal. Then we will know how to apply methods and refine them.

The protocol for the comparison of the two methods involved using each method with a mental imagery task. Participants listened to audio-recorded verbal prompts like "A child holds an ice cream cone with three scoops. The ice cream falls onto the hot pavement". They were given time during which they could imagine the prompt. They were then interviewed about what was in their experience – half starting with DES and half with MPIs. After the interviews and a buffer period, the methods were switched between groups. The MPI group moved on to the task with DES interviews and vice versa.

In order to compare methods, we tried to bring them as close together as possible. Each method can itself be used in very different ways. For example, an MPI can look at experience shortly before the interview – such as feelings of surprise after viewing a series of images [16]. Or it can look at experience in the distant past – like an experience of intuition that may have occurred years before [17].

DES is less flexible in terms of how far back the target experience is. But it is still flexible in terms of research design. Typical sampling occurs as participants go about their everyday life, be it going to college classes or watching TV. But sampling can also occur during a pre-determined task, for example reading chosen book passages [18] or golfing [19].

As it was not possible to include all this variety in a single research design, we decided to adopt a task-based approach which allowed us to reduce the differences between the two conditions, minimise retrospection, and examine experiences of similar durations. By bringing the methods as close together as possible, the goal was to better see the nuances of how they differ.

In the following, we provide an outline of the interview methods we sought to compare. We then highlight the main *a priori* differences between the two methods and describe what measures were taken to facilitate comparison in the context of this study.

DESCRIPTIVE EXPERIENCE SAMPLING

DES uses random beeps throughout the day to help participants better grasp their own experience [10]. This can involve a specialised beeper or a smartphone. The participant must

have an earpiece directly in their ear throughout the procedure. The beeps are delivered at random intervals ranging between five minutes to one hour. Six beeps are delivered a day. This usually takes around three or four hours. In most studies, in service of ecological validity, they occur during the participant's daily life, not in a lab. So, a participant might be going about their day, hanging their laundry, cooking – only punctuated by random beeps.

After each beep, the participant jots down notes on their inner experience right before the beep. So not inner experience during the beep (e.g. that's annoying!) but right before. The goal is to describe the last uninterrupted moment before the beep. Usually, this moment is much shorter than what participants first have in mind, and can last a fraction of a second.

At the end of each day of sampling, participants are interviewed about the six beeps they collected. The interviews last an hour and any samples not discussed within that time are discarded [10]. Here is an example of a DES sample from the DES training period of our research:

> Eva Day 3 Sample 3
>
> Eva was talking with her brother about theatre spotlights. She was wondering how theatre spotlights can be automatic. She was unsure if this thought had words to it or not [*Demarcating uncertainty is important for DES*].
>
> What is certain is that Eva simultaneously had a mental image of her brother operating a spotlight. It was a moving image. Her brother was moving the spotlight to follow two actors. The point of view was from above and behind him, so that you could see him and the actors in one image. The image didn't have borders. It was as if she was in the scene.

Questioning and training is needed in order to apprehend DES moments. This was the third day of Eva's DES training. Often participants' samples on day 1 are much more vague. They might for instance say, "I was having a conversation with my brother. It was about theatre lighting". It can take multiple days to uncover details like if inner speaking or mental images are present. Or how these mental images appear.

Guidelines for questioning are extensive. For those who want to learn more, you can turn to a book on guidelines [10] or a useful interactive website [20]. The general premise of DES interviewing is pushing for greater specificity and evaluating the validity of any added details. For example, practitioners are wary of any generalizations ("I always have some kind of mental image"). They want to know, was a mental image definitively present at the exact moment right before the beep. If participants do confirm, then interviewers seek greater detail. Did the mental image have borders or no? Colours? Was it moving or still? Interviewers must be careful not to introduce biases. A typical question might be: "Did the mental image have colours, or no, or you are not sure?". Numerous opportunities are given for the participant to 'change the story' if they become uncertain (e.g. maybe there really was no mental image).

During this entire process, interviewers monitor for hesitation, filler words, overgeneralizing, changing narratives, and other potential markers of fabrication. The goal is to work together with the participant, both with open curiosity and skepticism, hewing to reality as faithfully as possible.

MICRO-PHENOMENOLOGICAL INTERVIEWS

MPIs aim to guide the participants towards vividly reliving and precisely describing a past conscious episode [5]. This episode is of underdetermined length, ranging from a few minutes to a few seconds. The episode can be in the recent past or have occurred many years ago. For

the sake of bringing our methods as close as possible to compare them, here we will apply MPIs to short episodes (around 10 seconds) in the recent past.

Memories can be indistinct, so the MPI method aims to guide the participant to an 'evocation state' where past experience is 're-lived' [5]. Participants have direct contact with what they saw, heard, or felt at the time of the target experience. Questions, as well as repetitions of what the participant has reported so far, aim to 'stabilise' this evocation state and maintain the participant's contact with their experience. For example, participants are periodically asked to return to the beginning of the episode. If the participant digresses, the interviewer can repeat the participant's earlier descriptions.

These repetitions serve an additional purpose, too; they give participants a chance to correct, modify, or add to their earlier description of the experience. Participants are encouraged to interrupt if the interviewer's description does not match their experience. They are also asked before starting the interview to report on their experience as faithfully as they can, without adding to it, or distorting it. Repeating participant's experience by the interviewer thus also provides an accuracy test of sorts.

To maintain a stable evocation state, MPIs also make use of 'direct reference' [21]. Participants are encouraged to use pointers – these might be generic terms like 'this thing,' gestures, or any other kind of (non-)verbal symbol – to refer to processes or experiences that are still vague or not fully stabilised. These pointers can then also be used by the interviewer to help the interviewee become conscious of, or attend to the referred-to process or experience.

Once participants are in a stable evocation state, interviewers can ask about the unfolding of the experience and how different elements change over time. Individual elements can then be examined in turn. As in DES, participants are asked for greater specificity about the elements they reveal; attention is directed from what appears in the participant's experience to how it appears. For example, if a participant has a mental image, an interviewer might ask, "Is it in colour or in black and white? Is it detailed or fuzzy? Is it dark or light?" [5; p.251]. These questions serve to direct the participant's attention inwards, to the processes they are describing, in order to obtain a deeper understanding of the described experience.

The MPI method aims for nuance. Questioning can often focus on subtle emotional shifts of even shifts in body or posture that contribute to experience. There are no firm guidelines for how long an MPI should last. However, it is not uncommon for short segments of experience to elicit hour-long interviews. The aim of MPIs is to uncover the complexity and nuance of the experiential episode both at a particular moment (synchronic dimension) and its development over time (diachronic dimension), with the focus of the interview depending on the research question of the particular study.

MAIN DIFFERENCES BETWEEN THE METHODS

In what follows, we will look at the main differences between DES and the MPI with regard to their typical target experiences (their duration and the timing of their occurrence), as well as their attitude in dealing with retrospection, directing the participant's attention and focus, and validity issues.

Time

MPIs typically deal with longer periods of time. Researchers observe how experiential elements change. Petitmengin writes, "To enter into contact with one's experience, it is necessary to respect its fluid and dynamic character" [21; p.59]. Exact length of target experience can vary. For example one study looked at experience for the 20 minutes after the

administration of the drug DMT [23]. Another study looked at experience while listening to sound samples lasting just a few seconds [24]. So, the length of the target experience depends on research goals.

DES always deals with the moment right before the beep. This length depends on the particularities of the participant's experience. For example, say during that moment, the participant was innerly speaking "I need to call mom". They may define the moment as comprising this entire sentence rather than just "mom". However DES is agnostic if this division represents any real division in the participant's experience. The use of 'moments' is a tool to reach greater specificity. To give a rough idea of how long moments typically last, Hurlburt and Heavey at one point speculate around 2 seconds [25].

As mentioned, for this study we brought the methods close together to invite more nuanced comparison. DES looked at the moment before the beep as it always does. MPIs looked at experience during the 10 seconds after a prompt was given. This interval maintains the temporal unfolding crucial to the MPI method but keeps it relatively constrained to allow comparison with DES. The question then is: even with temporal intervals quite close, what differences in methods can we observe?

Retrospection

MPIs, in general, involve substantially more retrospection. The target experience could be years before the interview [22]. In DES, the target experience is a few seconds before the note-taking and less than 24 hours before the interview. There are still memory demands but they are fewer. However, as mentioned, MPIs can also be used to investigate a target experience that occurred shortly before the interview [16]. This is the case for our comparison study.

Directing attention

The MPI aims for an evocation state in which participants re-live the original experience. DES takes a more sceptical approach. DES questions encourage the participant to doubt if reported elements were really part of their direct experience. DES acknowledges that this scepticism might lead it to miss out on elements of experience, but holds this as preferable to reporting elements that were not there [10]. The MPI method prefers having as full an impression of experience as possible. It offers participants opportunities to revise and clarify their reports, but in service of maintaining an evocation state, does not 'grill' participants to the extent that DES does. For our study, we stuck to method guidelines, and the DES portion did indeed involve more skepticism. More on this in the results section.

Questioning

MPI questioning is "non-inducive but directive" [5; p.252]. DES questioning is non-inducive and non-directive. For example, in MPIs the specific sensory modalities may be asked about in turn, i.e. 'Do you hear anything?' It holds that this is often necessary to elicit greater detail since participants may not know where to direct their attention. DES would instead ask, 'Was there anything else in your experience?'.

In general, the MPI method is more trusting of participant reports. DES places a greater emphasis on skepticism, training participants in order to get greater fidelity. For example, the first day of training is always discarded with DES. This is not the case with MPIs. Training interviews are occasionally used but optional.

Validity

There is agreement between methods about how to judge validity. Both acknowledge that rules and explanations of the method make their own case for validity. A successful

sample/interview then depends on these guidelines being followed, and questions being suitably content-neutral and non-leading.

Other points of agreement include situating methods in a net of third-person observables – for example, can first-person data link with behavioural data? Can correlations be found with neuroimaging? Studies have been done with DES and fMRI [25, 26] and with MPIs and EEG [22, 27]. No one correlation can address validity but networks of connections can help lead to first- and third- person methods informing each other through 'mutual constraints' [28].

Differences in validity criteria include differing methods for judging veracity. Both methods rely on both verbal and non-verbal cues. But DES leans more heavily on verbal cues, like subjunctification [10]. Is the participant saying "umm", "I think", "kind of", "maybe", "sort of", "I guess"? Then it's likely they're not describing direct experience. The MPI method, compared to DES, relies more on non-verbal cues – for example a participant's gaze defocusing or their speech slowing down might indicate that they are in an evocation state.

Petitmengin also advocates checking a participant's reported experience against the researcher's own experience, calling this the "kingpin of all validation" [5; p.255]. Is it similar or at least plausible? Hurlburt and Akhter [14] see this as harmful – a participant's experience may be radically different from the researcher's and so should be 'bracketed' as much as possible.

METHODS

PARTICIPANTS

This study involved four participants – a small sample size aimed at highlighting and comparing certain method contours rather than generalising or making claims of statistical significance. All four were female students studying at the University of Ljubljana, aged 23 to 26. All participants gave informed consent and are referred to here using pseudonyms. They received course credit in exchange for their participation in the study.

DESIGN

Each participant underwent both the DES and the MPI procedure. However, two started with MPIs and two started with DES, to limit biassing. There was a break of at least six days before switching methods. Participants were divided into two groups. Figure 1 gives a rough overview of the procedure, before we launch into the specifics.

MATERIALS

The task slightly differed between the DES and MPI portions. However, the prompts remained of the same format. Each prompt consisted of two recorded sentences, played back on headphones for participants. They were recorded by an English native speaker trained in performing arts. The full list of 34 prompts can be found in the Appendix. After each prompt, participants were given 10 seconds during which they could imagine what was described.

Only seven prompts were followed by DES beeps and interviews or MPIs. This was to give greater latitude for comparisons. None of the participants heard the same prompt twice. The seven prompts followed by interviews were:

1) A child holds an ice cream cone with three scoops. The ice cream falls onto the hot pavement.
2) A candle flickers in a dark room. A person sits down in front of it.
3) Three children skate on a frozen pond. Birds chirp in the trees.
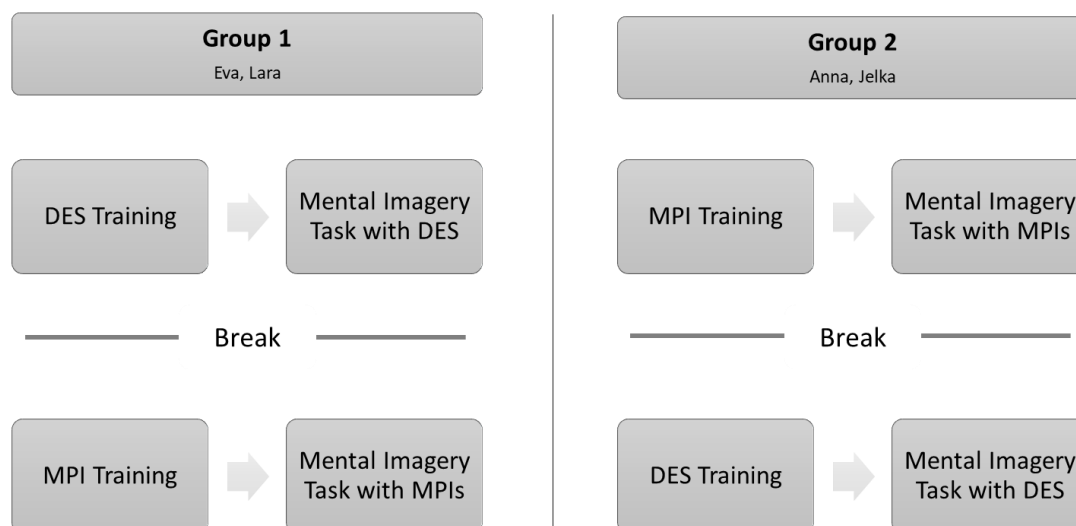
Figure 1. Outline of the procedure for each group.

4) A cat sits outside a shop window. It stares at its reflection.
5) A storm cloud gathers over a city. A lightning bolt strikes.
6) A family gathers around the dinner table. The father starts serving food.
7) A girl sits on the bus. She takes out her headphones

PROCEDURE

The DES training and interviews were led by J.L. Bass-Krueger. The MPIs were conducted by E. Wiedemann. E. Demšar led a workshop teaching the basics of both methods and further assisted E. Wiedemann with training in conducting MPIs. There was no communication between the researchers concerning their respective results until after the analysis was complete.
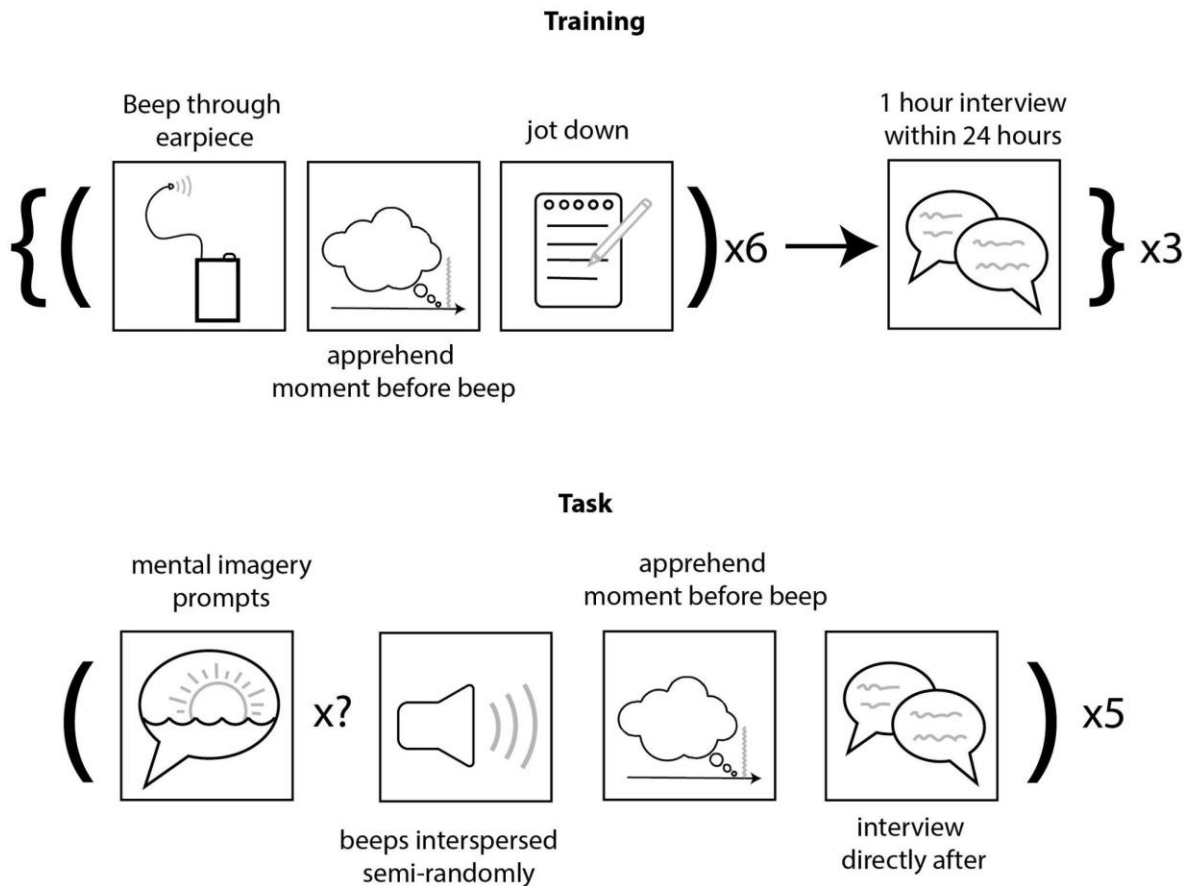
DES Procedure

Before the task came training. For DES, this involved three days of DES sampling during the participants' everyday life – going to class, work, cafés, etc. Participants received six beeps a day. After each beep they jotted down their inner experience in the moment before the beep. They received hour-long interviews within 24 hours of sample collection. Any beeps not discussed in that hour were omitted. Quality over quantity was key for training and it could take up to 25 minutes to discuss one beep (although sometimes as short as 5 minutes). This collection and interview process was repeated for three days. Interviews followed guidelines as described above (and in referred literature). They were instructed that any beep they do not want to discuss they should omit entirely.

Figure 2 shows the procedure. For the mental imagery task, the DES portion involved 32 pre-recorded prompts. 10 seconds followed each prompt, allowing for mental imagery formation. Five beeps were semi-randomly interspersed throughout the task, ranging between 1-10 seconds after the prompt concluded. This length was chosen with a random number generator. The beeps were edited directly into the audio track with the prompts. There was a DES interview after each beep, conducted by J.L. Bass-Krueger. Interviews were recorded with an audio device.

MPI Procedure

For the MPIs, participant training was much shorter. Participants received an overview of the procedure and an oral communication contract telling them no statements would be associated with them and that they were free to refrain from answering any questions. They were then interviewed about a simple task to give them some practice and familiarity with the MPI method

Training

Task

Figure 2. DES training and task.

and the interview procedure. The task consisted of closing their eyes and spelling the word octopus in their mind. Interviews lasted up to 15 minutes. They followed guidelines as outlined previously in this subsection and in the referred literature.

The MPI task involved two prompts. These were given on separate days, Figure 3. Participants had 10 seconds after each prompt to form mental images, then they were interviewed about their experience following the MPI guidelines. The experience that was explored during the interview was defined as starting at the moment when participants first began to imagine what was described. This was either while the prompt was still being played or after it was finished. The target experience ended 10 seconds after the prompt. Interviews were recorded using either audio or video recording devices, depending on availability and participants' consent. They lasted 23 minutes to one hour.
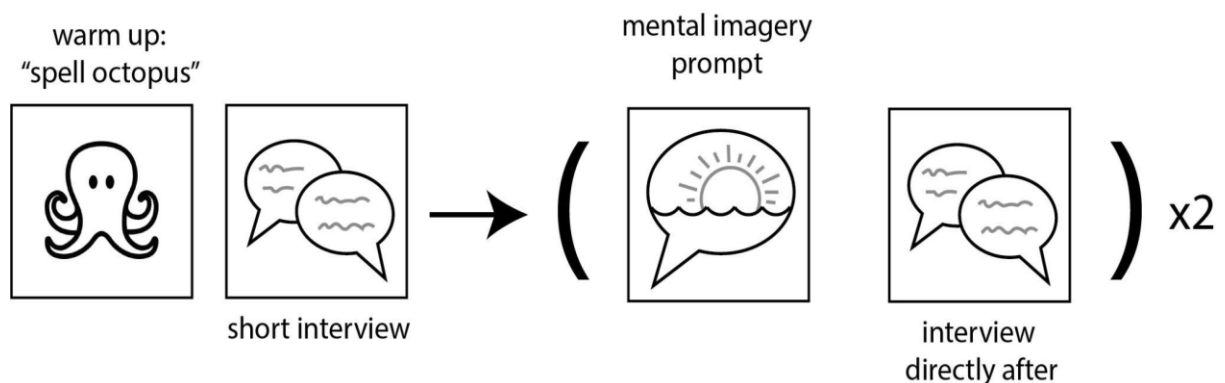
Figure 3. MPI training and task.

DATA TREATMENT

DES Analysis

J.L. Bass-Krueger carried out DES sample analysis. Salient features were extracted from DES audio recordings. Each sample was then analysed, and a summary drafted, denoting which features were certain and which were speculative. Samples were also coded. DES analysis is idiographic and follows the contours of each individual's experience. Often no clear code can be found. However, at other times codes can be applied that recur throughout DES research. For example, inner speaking, images, and feelings are common [30]. Percentages of codes were calculated, for both the training period and the task. Training period codes were not used, since we had no analogue from the MPI portion to compare them to. Codes from the task were occasionally used in our analysis, although as a supplement to qualitative analysis which offered the clearest comparisons with MPI results.

MPI Analysis

Interviews were transcribed and anonymized. Transcripts were used to extract participants' descriptive statements, which were then reordered to follow the chronology of the experience. In this, we followed the guidelines put forward by Petitmengin and colleagues [31]. The analysis remained close to these reports and followed the general guideline of qualitative analysis [32]. Participants' experiences were summarised to make them comparable to the results of the DES part of this study. The MPI analysis was conducted by E. Wiedemann.

RESULTS

This section presents the main findings of the study. We were interested both in the findings about participants' experience during the mental imagery task, and, more centrally, in how these findings might converge or diverge across the two methods. In what follows, we first look at the similarities in the findings – i.e., which features of the target experience were revealed by both methods. Then we turn to the differences – i.e., findings about experience that were revealed or emphasised by only one method, but not the other.

SIMILARITIES IN FINDINGS

Image Characteristics

Both methods uncovered common visual phenomena. One example of this was the GIF-like repetition found in both MPIs with Anna (prompts 1 and 2), but also in her DES samples. Think short moving mental images that loop from the beginning every few seconds. You may have seen some scrolling on social media sites.

Other commonalities between method findings include visual elements changing over time. Different elements could be added to mental scenes, or scenes could be switched entirely. Sometimes new visual elements entered all at once. For example, in an MPI about prompt 5, Lara described an abstract mental image of a Z-shaped lightning bolt which appeared "from nothing but altogether" – immediately fully formed.

Sometimes new visual elements formed gradually. For example, in an experience examined with an MPI, Anna first formed the image of a floating ice-cream cone before adding it to a child's hand (prompt 1). In an experience examined with DES, she formed images of children's faces before adding them to three children skating on a frozen pond.

The findings that we got with DES showed that not only can images not arise fully formed but the visual space of the image, itself may take time to form. For example, in some DES samples,

Lara described being in the process of forming a 3D screen overlaid on the actual room she was in. Her prompt-inspired visuals then appeared on this 3D screen.

Both methods revealed that images could either be moving or static. For DES, sometimes the image subject was moving. And sometimes the visual space itself – for example zooming in. In MPIs most elements changed over time. One exception was Jelka's image of a bookstore (prompt 4). It stayed static, unchanging.

With both methods, mental images were described as having differing levels of detail. Images were sometimes clear. Sometimes they were fuzzy, indistinct, ghostly, or blurry. Visual elements were sometimes realistic and sometimes cartoonish.

Interactions with Other Modalities

Mental images were the primary components of experience for all participants and for both methods. But these images were often concomitant in experience with other elements. For instance, both methods revealed the experience of words and images interacting. MPIs revealed participants sometimes innerly repeating words from the prompt. For Eva, these repetitions seemed to mark a change in the scene (a new figure entering in prompt 6; a new perspective in prompt 7). To give one example from DES, for one prompt, Eva misheard the word 'chirp' as 'gerb.' At the moment of the beep, she was innerly repeating it, wondering what it meant.

Images could also interact with feelings – experiences with emotional valence. DES found that one fifth of samples involved feelings. These were sometimes positive in valence ('calm') or sometimes negative ('dislike'). Certain prompts were more frequently related to feelings – like the prompt "A family gathers around the dinner table. The father starts serving food". Anna had a feeling of antipathy, from not liking the father in the image. Lara had a feeling of cynical amusement, since her father would never serve food.

The MPIs also found feelings. For prompt 3, about two children skating on a pond, Jelka added a mother to the scene and described projecting feelings of worry onto her. Lara had a feeling of nervousness in her chest, present throughout the session with this prompt, but not elicited by it. Some positive feelings were reported as well. Anna described feeling relaxed (prompt 1). Eva felt happy (prompt 6) and a "good feeling" (prompt 7).

DIFFERENCES IN FINDINGS

Differences between the two methods' findings spanned various dimensions. Here, we focus primarily on differences in describing visual experience (typically more detailed descriptions with DES), describing how experience evolved in time (typically more detailed descriptions with MPI), as well as describing participants' feelings or attitudes towards the mental image or the activity of forming it (typically more detailed descriptions with MPI).

Particularities of DES Results

DES findings were able to provide more details on the nuances of the visual experience. With DES, for Jelka, all five prompt samples involved imagery with a dual vantage point. She described both looking at the image from a distance but at the same time having another vantage point of being surrounded by the scene. Think of simultaneously watching a movie on a screen and being in the movie as the main character.

DES findings focused more on characteristics of mental images. MPI findings also dealt with these characteristics, but for DES, differences in mental visual space between participants were the driving salient findings:

- Images can have borders, no borders, or focus can be on the centre so the participant is unsure of whether or not the image has edges.
- Images can be experienced in a separate mental space or as positioned over the real world, for instance on a "3D screen".
- Two simultaneous visual spaces can be present at the same time. For example, Anna had one visual space of children skating on a frozen pond, and a separate space where she was creating a face to add to the children.
- Visual aspects can be sensed without yet being visually present. For example, areas can have some visual attributes (brightness) without colours yet being present (seen in samples by both Anna and Eva). Eva also sensed some attributes of the word "gerb" (misheard from "chirp") like length and a large size. But she was not yet clearly innerly seeing anything.

Particularities of MPI Results

The MPIs revealed more information on how experience evolved over time. The findings showed changes of imagery over time and showed the broader experience of the task including how participants interacted with prompts, referring back to them, and playing with them.

MPIs revealed that while some mental images (or elements of them) were experienced as coming naturally, others required some effort. Elements that came easily include an image of a candle for Anna (prompt 2), the pond with three children and their mom for Jelka (prompt 3), or the headphones for Eva (prompt 7). An example of an element requiring effort was Jelka's image of a tree with birds in it – "my mind didn't do that for me" (prompt 3). Lara also reported having to invest effort to form mental images for this prompt – "I really tried to imagine it".

Some findings from MPIs further differentiated elements of the mental image that would either "fit" or be disproportionate with the scene. For example, Jelka imagined a tree with birds that did not fit with the rest of the scene (prompt 3). It was too big, and a different colour. Another example, for the same prompt, is Lara's image of a skate flashing over an image of a pond. The skate did not fit with the pond at all. It was too big. It had different colours and was in a different visual style. Both the pond and the skate were cartoonish, but the skate was more 'retro'.

MPI findings also suggested that mental imagery tasks could involve constrained freedom or constraint. Jelka felt constrained at times. She had to imagine things she was not interested in. Anna felt freedom (prompt 2). She could imagine whatever she wanted. Anna also played with the prompts. For example, given a prompt about a boy with three scoops of ice-cream, Anna imagined three ice-cream scoop tools (prompt 1). She engaged with the task, testing how far she could push the prompts.

DISCUSSION

In this section, we consider different aspects of this comparison study in turn. First, we will discuss some of the reported findings, aiming to put them in context. Next, we discuss how experience with one of the two methods affected participants' approach towards the other. We then touch on some more general considerations related to our research design, before discussing how best to deal with discrepancies between the findings with these two methods, and finally broadening our perspective to consider future directions in this field of research.

The GIF-like repetitions uncovered by both methods present an interesting finding in their own right. This characteristic of mental images might not sound too exciting, as we are used to seeing these in our daily lives, but such phenomena have not been described (or at least rarely) in the DES or MPI literature so far. This may be because this kind of experience is specific to our current digital age. There are other examples in the literature of age-specific technologies

potentially shaping our perception and perceptual cognition. For example, many older people in DES sampling have mental images in black and white [33]. This may present further evidence that the technologies of our age shape our perception and perceptual cognition.

Another interesting finding, particular to the DES results, was Jelka's dual vantage point, which was present throughout her DES samples during the mental imagery task. This vantage point is impossible in real physical space. However, past DES research indicates that 'impossible' vantage points should be taken as seriously as possible in consciousness [6]. Since this dual vantage point was found in all of Jelka's samples, one might expect it to be a generalizable feature of her mental images.

Yet, interestingly, the MPIs did not find it. The MPI about prompt 3 may have included hints of this, however. Jelka described seeing children skating on a pond as if on a TV screen (with no borders) from about a 10m distance ("it looked like if I would want to walk in there I would have to […] do some steps not like walk for 2 km"). She was visually focused on the children but emotionally she was more focused on their mother's worry – "I kind of felt it for her". After the MPI, she said she did not feel like her description was complete, as some details were left unexplored. This might suggest that the dual vantage point was present but not explored. It may also have been present but not yet apprehended. Or it might only have been present in the DES task. As there was no communication between researchers until after the analysis was complete, we did not ask Jelka about this in any of the interviews.

Some noteworthy findings, particular to the MPIs, are the experiences of elements being proportionate or not, and the experiences of freedom and constraint. These dimensions came up in several of the MPIs but were not described in any of the DES samples. This may be because experiencing an added element to be (dis-)proportionate presumably involves comparison with previous elements. Differences in temporal scope between the two methods may make these elements easier to uncover in MPIs than in DES samples.

Similarly, Anna's testing out different versions of the prompt (imagining different visual components) was only possible due to the greater temporal scope of the MPI method. While DES could not have revealed this entire sequence, it is interesting to note that feelings of freedom or constraint in participants' engagement with the task were not featured in any DES samples. This may be because the beeps happened to fall onto moments when these feelings were simply not part of their experience. But this might also be due to MPIs allowing for more in-depth descriptions of participants' experiences.

It is also interesting to point out that there were some commonalities among the experiences elicited by certain prompts. For instance, prompt 6, the family at dinner, elicited feelings in three of our participants. Similarly, prompt 3, the children skating, was associated with negative feelings for both Lara and Jelka. They also both reported on *trying* to imagine certain elements of the prompt (i.e., having to invest effort to imagine what was described, with varying success), and they both formed mental images with disproportionate elements in response to this prompt.

The difficulties both Lara and Jelka had in imagining what was described in prompt 3 may be related to a switch in modalities in the prompt itself. The first sentence reads, "Three children skate on a frozen pond". This part of the prompt came naturally for Jelka, it describes a (visual) scene. However, the second part of the prompt, "Birds chirp in the trees", refers to something occurring in a different modality – auditory, not visual. Jelka picks up on this, saying that "the sound came more naturally than the actual birds".

Finally, before turning to some broader considerations about our design, it should be noted that the reported results were the outcome of analyses that did not perfectly follow the guidelines for either method. The deviations were minimal for the DES part, but more substantial for the

MPI analysis. The MPIs were not analysed in terms of their synchronic and diachronic structure as proposed in [31], and no codebook was created. The findings also were not graphically visualised, and the entire analysis conducted E. Wiedemann. This limits our ability to generalise based on the outcome of this comparison. Future studies could aim to follow the proposed analysis procedures more closely in order to conduct a more faithful comparison.

TRAINING EFFECTS

Reporting experiences with one method seemed to influence the later reports with the other method. For instance, participants who started with DES and then moved on to the MPIs were more cautious and skeptical in these MPIs than participants with no DES training. Guiding these participants into an evocation state was more challenging for E. Wiedemann, compared to the group that started with the MPIs, as these two participants were both hesitant to explore aspects of their experience that they were not immediately aware of. However, these two participants were also more confident about what was in their experience and what was not, and they were more definitive in accepting or rejecting additions or modifications of their descriptions that came up at later points during the interview. E. Wiedemann therefore relied more heavily on repetition to stabilise these two participants' attention and to test the accuracy of their reports.

Although both participants, having completed the DES training with J.L. Bass-Krueger, were not new to reporting on their experience, the practice interviews proved useful in familiarising them with the new method. Lara commented after the first MPI session that "I was like ok what [laughs] what are you asking me" but ultimately said she found two types of interviews "quite similar" (after the second MPI session). Eva felt similar but expressed that she was happy to have completed the DES training first, as the MPIs felt "deeper" to her.

Conversely, Anna who started with the MPIs and then moved on to DES was at first exasperated by the scepticism of DES. This was a sample on the first day of DES training: Anna had been watching a video of a neuroscientist presenting her textbook, and was trying to discern if she (the neuroscientist) was drunk or high. Anna described paying attention to her words, movements, pauses, and blinks. J.L. Bass-Krueger's questions were geared towards figuring out if all these elements of focus were really present at this exact moment. Or perhaps at this exact moment, one or a few of them were more prominent. Anna became somewhat frustrated and insisted they were all present. Of course, she may have been correct but the point of DES training, especially the first day, is to render participants more sensitive to the possibilities of their experience. Interestingly, no other DES participants in this research or in J.L. Bass-Krueger's other research have become this frustrated. So potentially coming from MPIs made Anna more sensitive to having her reports questioned. Note however, that in the end, no participants including Anna were disgruntled by the DES method, since its questioning is based not on adversarial denial of experience but on collaborative investigation.

Both participants who started with MPIs required at least as much training as participants with no prior experience with first-person reporting. So MPI experience did not make DES training any easier. But did it impair results? J.L. Bass-Krueger thinks not. After the DES training period (three days), all participants had enough skill with the process to give faithful reports.

RESEARCH DESIGN

Without exaggerating, there exist an infinite number of research designs for comparing our two methods. We decided on a mental (visual) imagery formation task. This choice was somewhat arbitrary, although it had some motivations. We thought that vivid prompts would induce vivid and varied experiences, but that this variety would be constrained mostly to one modality

(visual) to simplify comparisons. Other modalities were present, for example auditory or affective. This did not impede our analysis. However, for those wishing to make more emotionally neutral prompts, perhaps steer clear of mentioning 'fathers'.

Any task could be used to compare methods so long as it remains the same or similar for both conditions. We also considered canonical tasks like a mental rotation task [34]. In general this task would be interesting for first-person research, since so far the literature on mental rotation is a prime example of studies that infer experience from behaviour (like reaction times). Other widely used tasks like the rubber hand illusion [35] could be interesting as well. The many iterations of this paradigm, at its core, consist of participants feeling sensation on a rubber hand as if on their own. Experiential reports are usually elicited in the form of questionnaires determining if the illusion was effective [35, 36]. But first-person methods like DES and MPIs could give more in-depth views on the experience during this task.

With various tasks we could build up a repository of how methods compare regarding feelings, regarding mental images, inner speaking, or a number of other modalities.

One difficulty of our study was getting the task for each interview condition as close as possible. The prompts themselves remained of the same format. But The DES task involved 32 prompts with beeps spread between them. The MPI task involved just one prompt at a time followed by an interview. It would have been possible to use a number of prompts and then only interview participants about one of them. This is not how MPIs are typically conducted however. It increases retrospection and usually in MPI studies involving increased retrospection, the participant gets to choose an especially salient moment to discuss [15, 16]. Less salient experiences may be quickly forgotten. So there are trade-offs with any research design. Should the tasks between conditions be as similar as possible? Or should methods be as close as possible to their original intent? We challenge other researchers to come up with other designs balancing this trade-off.

DEALING WITH DIFFERENCES

We saw a good deal of similarities in method results; both involved reports of new visual elements sometimes arising gradually, and reports of some images repeating in a loop, like GIFs. Despite similarities, DES and MPIs have different scopes and reveal different results.

MPIs revealed more temporal dynamics. We saw how images evolved over time and how participants interacted with the prompts. The analysis also involved a greater focus on participant's attitudes towards their mental imagery – for example if added elements "fit" a scene or were disproportionate. Reasons for this (among others) could be the MPI's greater attunement to valence and feeling. Or that just by chance participants had more of these experiences during MPIs, and none before the random beeps. Or that analysis of MPI results involves a greater pool of experiences to select from, and different conclusions to be drawn.

DES revealed more nuances of visual characteristics of images. This is contrary to Petitmengin's comment concerning DES's limited experiential detail: "I doubt whether the beep enables the interviewee to direct his attention from 'what' to 'how', unless by chance" [5; p.253]. It also goes against claims from Froese, Seth, and Gould that DES adheres only to a 'shallow' conception of consciousness [35].

Note that methods differed in revealing some fine-grained details. DES revealed dual aspect imagery and MPIs did not. Recall that with DES, all of Jelka's images had two simultaneous vantage points – as if she was looking at the image, and as if she was inside of it. The MPIs did not find this in Jelka's experiences. Perhaps Jelka's experience really was different on different interview days. Perhaps her reporting improved with practice and training. Or perhaps one or the other method was more accurate.

Methods that distort experience may lead to disagreements and stall progression of the study of consciousness. For this reason, issues regarding retrospection, memory distortion, presuppositions, and biases need to be handled carefully. Practitioners of any method need to question what its intent is, whether its guidelines are coherent, and what research questions it can and cannot answer.

It would be fruitful here to bring in different opinions on results presented, and more broadly on the utility of each method.

J.L. Bass-Krueger thinks that DES was more faithful to experience here. The fact that all five of Jelka's mental images presented with a dual vantage point showed that this was a common feature of her mental images. And MPI results hinted at this dual vantage point without making it explicit. In DES interviewing it took Jelka some time with questioning to sort through and assert her experience. This is often the case when experience goes against participant's preconceptions of physical reality.

One of the benefits of the DES beep and interview training is that participants are able to voice experiences that they previously considered impossible. J.L. Bass-Krueger noticed this for example with Eva. By the third training day she had already had multiple samples of thought with clear content but no associated words / inner speaking. Eva's third sample from her third training day partially involved her wondering how theatre spotlights can be automatic (described in p.4). Eva first described there being words to this thought. But when the researcher sought further details, Eva could not provide any. Eventually she said "Maybe it could have been a thought without words. Maybe I just was not thinking that could exist". This is an example of how misconceptions can influence experience reports and how it can take multiple days of training to sort through them. The ambiguity in that sample in question was never resolved, but the goal was to make Eva more careful on subsequent sampling days.

J.L. Bass-Krueger sees this careful, iterative as the only way to reveal certain kinds of experience. He sees MPIs as more prone to error and is especially wary of MPIs of target experience in the distant past. That being said, he is open to MPIs revealing types of experience missed by DES, and to new fruitful methods that mix components from each method.

For E. Wiedemann, it is interesting that some dimensions, such as the felt freedom or constraint, and elements appearing naturally or with effort, were only revealed in the MPIs. While it is possible that these dimensions simply were not present in the DES samples, it could also be the case that the MPIs allowed participants to access dimensions of their experience that they were not previously aware of. If the latter is true, this would suggest that the MPIs enabled a more in-depth exploration of participants' experience during the mental imagery task than DES.

Finding that the MPIs provided a more nuanced, or 'deeper' exploration of experience than DES is not particularly surprising though, given the two methods' differences in emphasis. Yet, the fact that the MPIs did not identify Jelka's dual vantage point is somewhat puzzling. Some possible explanations for this are entertained above (it might not have been present during the MPIs, Jelka might not have apprehended it, or she might not have been able to articulate it). However, if this feature was present during her experience that was explored in the MPIs (e.g., for prompt 3), the fact that it was not uncovered could also be linked to a lack of expertise on the interviewer's part – a key limitation to our study.

While only Jelka has the answers that would resolve this debate, E. Wiedemann thinks that this discussion points to a broader issue regarding differences in the application of these two methods. Whereas DES advocates training of participants, the MPI method places a stronger emphasis on interviewer expertise – the interviewer is responsible for guiding the participant into a stable evocation state, in order to then assist them in exploring and faithfully reporting on their experience. The results reported here may point towards the benefits of training both interviewers and participants to foster faithful descriptions of subjective experience.

E. Demšar thinks that a bigger study with an improved research design (e.g. relying on various common tasks, and/or focus on a task-independent phenomenon) would be needed for more conclusive findings about the differences between the two methods. This exploratory research, however, highlighted some candidate features of mental imagery experience on which the two methods either converged or diverged (including elements that were articulated or accentuated by only one of the methods). (There might have been other experiential aspects that remained unarticulated in both conditions.) She sees the project of expanding on this and similar studies as an important step forward in the maturation of the field of first person research and empirical phenomenology.

Further, she'd argue that dealing with first-person methods and their problems is not entirely different from dealing with scientific methods in general. As in any research, different research questions in consciousness studies call for different methodological approaches. With first-person methods, however, we're in the unenviable situation where participants' experience is at the same time the object as well as the instrument of research, where we have no external, third-person tool to genuinely access or "verify" anyone's experience or the accuracy of its description, and where we cannot even claim that we can measure the same "object" twice. As a result, achieving intersubjective agreement - the foundation of scientific objectivity – is less straightforward than in most third-person research fields. But that does not mean that it is impossible. A critical investigation and optimization of methods, enabled by comparing and combining different methods, is a necessary step in this process.

Comparing methods, however, is only possible if enough researchers know how to use them. Carrying out interviews about experience with either one of the methods explored here is a skill, and learning it requires researchers to have access to learning resources. For our two methods, researcher training is increasingly available for micro-phenomenology, and DES provides a large collection of training videos on the DES process and research skills on a freely available interactive website [20].

It's interesting to bring in these perspectives to show that even with set results to a study, there may be different interpretations. Comparison studies like this certainly will not give cut and dried answers. There is not yet any outside method to validate an interpretation. Any result must be integrated in different frameworks and interpreted. And those from a DES background may very well do so differently than MPI practitioners.

By bringing in different perspectives, we hope to have demonstrated the utility of a collaborative approach, engaging researchers from different backgrounds. We do not have to agree on everything in order to test, compare, and learn from other methods.

And we all believe that not every difference in results denotes issues in validity. Methods have different scopes. DES looks at more fine-grained slices of time. MPIs look at experience unfolding over longer intervals. The scope of methods can shape acquired data as much as experience itself. In this way, observation becomes a co-construction between method and target phenomenon [36, 37].

FUTURE OF EMPIRICAL PHENOMENOLOGY

Horizons are open for methods to be refined and for experimentation to conjure up new methods. Emerging research is even combining elements from MPIs and DES. Oblak, for example, combined influences from both methods for interviews investigating experience during a visual-spatial memory task [41]. Springinsfeld conducted interviews inspired by the MPI method shortly after a target experience–aiming for interviews on the same day as a bulimic individual's vomiting episodes, to minimise retrospection demands [42]. Caporusso used DES-style beeps with an interview method hewing more closely to the MPI in order to

better understand sense of self and boundaries in daily life and compare this to experiences of boundary dissolution [43]. Co-author J.L. Bass-Krueger, adapted DES to a slightly wider temporal scope to investigate what is really meant by a 'moment' of experience [44]. Co-author E. Demšar currently integrates MPI with sampling of sleep-related experience according to the best-practice guidelines for dream reporting, as suggested in [45]. Critical methodological pluralism is important going forward. We must acknowledge different avenues of exploring lived experience, while questioning where exactly these avenues lead us.

We discussed previously how first-person research was missing from psychology. Headlines and funding centre on the neuroscientific and the behavioural. But we must remember that conscious experience is still central to this field. In clinical psychology, it is still paramount. And in research, it is usually inferred or assumed. As it becomes increasingly trendy to offer neuroscientific explanations, we cannot forget the importance of experience. For example much new research seeks neurological and biochemical biomarkers for psychiatric illnesses. Researchers hope to find brain scan results that are capable of making diagnoses. While this research is useful and some correlations have been found, there are not yet any clear biomarkers for diagnosing any psychiatric illness [41, 42]. Diagnosis still depends on questionnaires and conversations that focus on experience. Advances in first-person research then have much to add to the field.

So consciousness research needs to start staking its claim to validity. Within this context, different methods giving different results could still be an issue. There is not yet a fixed outside observable that can settle differences. Comparison studies are then needed to determine if differences come from differences in scope or in validity. Results then depend not only on observables but also interpretation, theory, and argument.

This is a bit of a knock in a field that's coming to favour the quantitative over the qualitative. But we must remember not only that quantitative analysis can be flawed (regarding the replication crisis and disciplines distorted by publication bias for instance [48]), but that it often relies on theory and argument that becomes implicit. We take for granted how much theoretical scaffolding lies behind the tools we trust.

For example H. Chang gives a book-length account of the development of the thermometer [49]. We trust these things enough that if we see 35 °C, we know it is time to put on that bathing suit and head to the pool. But to get to that point, we had to first rely on rough tools with no clear theory. Then set fixed points at boiling and freezing. Then form a theory of what exactly it was that we were measuring. Then go to great lengths to ensure this definition was not circular. Then test our instruments without relying on that very same type of instruments, and so on. Theory and measurement were developed hand in hand, often with one side lagging behind the other. Once a tool is established and trusted we forget how much 'qualitative' framework goes behind our trust of its 'quantitative results'.

Tools of empirical phenomenology are new, and still have a lot of work to do to gain trust. We should continue comparing them with common tasks to see which aspects they reveal. And each method needs to work on making its own claims to validity. Partnership with behavioural and neural-level third-person approaches can help. We can also follow what Petitmengin calls the "pragmatic validity criterion" [5; p.256] if results from these methods can help people. Methods can also be combined, and new methods created.

And importantly we need to stay skeptical yet open minded. Every new method or development should be questioned, but none rejected offhand. And any practitioner must admit the limitations of their methods. It's not yet possible, and may never be possible, to uncover every nuance of consciousness. But with the right attitude towards developing and refining methods, hopefully research on consciousness from within can become as central to the scientific project as it is to our own lives.

REMARK

[1]We use various terms here like lived experience, subjective experience, inner experience, and consciousness. These can have different meanings depending on context and some are preferred in certain discourse communities. In general, though, they aim at the same underlying phenomenon – that 'something that it is like' quality.

ACKNOWLEDGMENTS

APPENDIX

The full list of prompts used in this study:

1) A child holds an ice cream cone with three scoops. The ice cream falls onto the hot pavement.
2) A train moves through the countryside, past mountains. The sun shines through clouds.
3) A large fish chases a smaller one. The small one escapes.
4) A business woman rides an elevator. She checks her watch.
5) A candle flickers in a dark room. A person sits down in front of it.
6) A construction crew knocks down a building with a wrecking ball. It collapses.
7) An old lady in a wheelchair watches TV. A cat jumps onto her lap.
8) A man cooks onions in a pan. They sizzle.
9) Children run around a playground. A girl stumbles and falls on the grass.
10) Three children skate on a frozen pond. Birds chirp in the trees.
11) A boat sails over water. It rocks back and forth with the waves.
12) A waiter in a café walks up to a lady. He takes her order.
13) A group of friends cook a meal together. One of them tells a joke.
14) A woman puts a glass on the edge of a table. She puts down her bag.
15) A cat sits outside a shop window. It stares at its reflection.
16) Two friends meet in a park. They sit on a bench and start talking.
17) A whale swims to the water's surface. Its head bobs out of the ocean to breathe.
18) A flower blooms in spring. A bee lands on it.
19) A kettle full of water boils. A person takes it off the stove to make some tea.
20) A family gathers around the dinner table. The father starts serving food.
21) A girl sits on the bus. She takes out her headphones.
22) A scuba diver swims through clear water. He looks at bright coral.
23) A baby sleeps. It wakes up and starts crying.
24) A man looks at jewellery in a shop. He picks up a pair of diamond earrings.
25) A group of dancers performs. They are completely in synch.
26) A singer walks on stage. She grabs the microphone.
27) A boy checks his phone. There are no new messages.
28) A mother deer and her baby wander through the woods. They eat leaves.
29) A novelist sits in a bar. She orders some whisky.
30) Two cars drive down an empty highway. One pulls to the side of the road.
31) A photographer holds a camera. He presses the shutter.
32) An old man watches TV. He picks up the newspaper.
33) A storm cloud gathers over a city. A lightning bolt strikes.
34) A marching band marches through a town. The trombonist bumps into the drummer.

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BRIDGING THE GAP BETWEEN
THE NORMATIVE AND THE DESCRIPTIVE:
BOUNDED EPISTEMIC RATIONALITY

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ABSTRACT

The aim of the article is to propose bounded epistemic rationality as a concept that blurs the divide between normative and descriptive approaches to the study of rationality. I illustrate the contrast between philosophy as a normative discipline and psychology as the empirical study of cognition and show that unattainable standards and the arbitration problem pose a challenge for normative theories of rationality. I then outline three possible types of relations between normative and descriptive theories of rationality, the third being the proposal for hybrid concepts, such as bounded epistemic rationality, that include both normative and descriptive elements. I continue by describing Herbert Simon's notion of bounded rationality and Gerd Gigerenzer's ecological rationality, and consider the role of bounded rationality in epistemology. I reflect on the relationship between norms of epistemic and bounded rationality and finally, drawing on the work of David Thorstad, I suggest some features that I believe should be included in an account of bounded epistemic rationality. I aim to show that an understanding of epistemic rationality that is compatible with bounded rationality can help to avoid overly strict, idealized, as-if theories of rationality, narrow the gap between the normative and the descriptive, and bring us closer to a comprehensive understanding of epistemic rationality.

KEY WORDS

CLASSIFICATION

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INTRODUCTION

What it means to be rational is one of the core questions of epistemology. Epistemic rationality concerns epistemic attitudes, states, and processes [1], with a focus on beliefs [2]. It is distinguished from other kinds of rationality in terms of pursuing a strictly epistemic goal [3], for example truth, knowledge, or understanding [4-6]. It stands at the intersection of epistemology and investigation of rationality, and as such is closely connected with core concepts in epistemology, especially justification [7]. Although epistemic rationality and epistemic justification are often used interchangeably, I will distinguish between them, as I agree with Foley's [7] claim that this allows us to investigate epistemic rationality in a similar way to rationality of other phenomena, for example decisions or actions, and frees it from the preoccupations of traditional epistemology, such as inquiries about the connection between rationality and knowledge.

It is often said that there is a division of labour between philosophy and psychology [8, 9]. Philosophy, including epistemology, is considered a normative discipline which is primarily concerned with how people should reason, inquire, form and update beliefs, and make judgments in order to be rational. Rationality is often defined as adherence to a particular normative system, such as following the rules of logic or probability theory. Stein calls such a view "a standard picture of rationality", and he writes that "to say that someone is rational is roughly to say that she reasons in the way she ought to" [10; p.17]. Rationality thus has a strong evaluative component and can be understood as a normative concept. On the other hand, empirical disciplines such as psychology study how reasoning, judgement, decision making, belief formation and updating actually occur and aim to provide processing of cognition and describe the underlying mechanisms. Although they often refrain from making evaluative judgments about rationality, they are still closely related to normative theories, as they usually employ a specific normative system (e.g., reasoning according to the rules of logic or probability theory) as a yardstick for evaluating the (ir)rationality of beliefs, judgments or decisions [11].

With normative philosophical theories on the one hand and descriptive, empirical research on the other, one is faced with the question of what is the appropriate relationship between the two approaches. Normative theories are often criticized for not considering empirical insights about the limitations of human abilities and consequentially proposing norms of rationality that are too demanding and unachievable for real human cognizers [12]. It seems that norms of rationality should be informed in some way by empirical data about human cognition, but evaluative judgments about how we should think and reason to be rational cannot be derived from descriptive, empirical premises without committing the "is-ought" fallacy [13]. This leaves us with a question of how to define epistemic rationality in a way that would consider what psychology and other disciplines can tell us about human cognition, but still keep the normative element and guidance for epistemically good reasoning without succumbing to the abovementioned fallacy.

The aim of this article is to propose bounded epistemic rationality as a hybrid concept that blurs the divide between the normative and the descriptive. Bounded rationality is a term first proposed by Herbert A. Simon in the 1950, and it emphasizes that the notion of rationality should consider the limitations of human cognition and the environment in which we operate. An account of bounded epistemic rationality recognises that we are bounded agents, proposes norms that are empirically grounded and attainable, and as such can provide good epistemic guidance. I begin by describing how the concept of rationality is intertwined with the notion of normativity and highlight two challenges for normative theories of rationality. I summarize some possible ways of relating normative and descriptive theories of rationality, and then move on to a description of Herbert A. Simon's concept of bounded rationality and Gerd Gigerenzer's

ecological rationality, which is based on Simon's work. In the last part, I reflect on the role of bounded rationality in epistemology, drawing on David Thorstad's work, and – relying on the abovementioned concepts – suggest some features that I believe are crucial for an account of bounded epistemic rationality that includes both normative and descriptive elements.

RATIONALITY AND NORMATIVITY

The connection of rationality and normativity is a much debated issue in epistemology [14, 15]. Normative theories of rationality involve some sense of "ought", but Knauff and Spohn [1] argue that the terms "ought" and "norms" are ambiguous when they apply to rationality and point to the difference between empirical and genuine normativity. Empirical normativity consists of the norms that are established in a particular community, but cannot help us answer the question of genuine normativity; if there is a rule to stop at the red light when driving a car, this does not answer the question of whether we should really stop at the red light. What one really should believe and what should be the case cannot be determined by empirical observation, but by normative deliberation and accepting a particular normative stance [1]. Knauff and Spohn [1] emphasize that the goal of normative theorizing is not the search for normative truth but for normative agreement, and that normative theories of rationality are merely hypotheses about how one should achieve rational beliefs. In contrast to empirical theories, that are based on experimental or other empirical data, the starting points of normative theories are intuitions or assessments of various normative claims. In a similar way as empirical theories are meant to explain and predict data, normative theories are meant to justify these intuitions or assessments and arrive at a reflective equilibrium. However, using intuitions as a starting point for defining rationality has also been problematized [9].

Normative theories of rationality are faced with various challenges. One of the much-discussed criticisms is that they place unrealistic, impractical or even impossible demands on agents [16-18]. Normative theories of rational reasoning or decision making often require optimization – employing the best possible solution to a given class of problems. However, problems in the real world are often so complex that optimal solutions are computationally intractable even for hypothetical machines with infinite time and computational power. If we want to establish optimization as a norm of rationality, hardly any human in the real world could ever be rational [12]. Humans operating in the real world are far from ideal cognizers equipped with computational capacities and relevant information from the environment that would enable them to search for optimal solutions – regardless of whether we are talking about belief formation, reasoning, decision making or behaviour [19, 20].

Another challenge for normative theories is the question of what makes a particular normative system the right one. The idea that rational reasoning follows the rules of logic and probability seems intuitively plausible, but this alone cannot provide sufficient justification for it. Sometimes called "a problem of arbitration", the issue consists of the lack of clear criteria for choosing one particular normative system over another [17]. An example is Wason selection task [21] in which the participants are presented with four cards that have a colour on one side and a number on the other. The fronts of the cards show the numbers 3 and 8 and the colours brown and red. Participants have to decide which cards to turn over to test the rule: "If there is an even number on one side of the card, the opposite side is red". According to the rules of deductive logic, which were the predominant normative system for evaluating responses to the task, participants should turn over a card with the number 8 to test the modus ponens and a brown card to test the modus tollens. The majority of participants in different studies and different variations of the tasks answered that they had to turn over a card with the number 8 and the red colour, the latter being a logical fallacy (affirming the consequent). However, these answers are only wrong if they are interpreted as violating the rules of deductive logic, and

various authors have proposed alternative normative systems for evaluating the correctness of the answers. One example is Oaksford and Chater's rational analysis [22], according to which participants choose the cards that are expected to yield the greatest information gain, and such answers are considered rational. This shows that the evaluation of a particular type of answer on a reasoning task as correct or incorrect depends on which normative system is used as a benchmark. Normative theories must therefore address the question of how the preference for one normative system over another can be justified.

RELATIONSHIP BETWEEN NORMATIVE AND DESCRIPTIVE THEOIRES OF RATIONALITY

The question about the relationship between the normative and the descriptive can be traced back to Hume and the well-known "is-ought" fallacy. According to the dominant interpretation, Hume [13] states in the Treatise that no evaluative conclusions can be drawn from descriptive premises [23]. Whenever we want to infer "ought" from "is", or, in other words, whenever we want to infer from what is the case to what ought to be the case, we are committing a logical fallacy. The same applies to inferences in the other direction: it is not valid to infer from "ought" to "is". The debate applies not only to ethics and moral reasoning, but is also highly relevant for research of reasoning and rationality. In order to avoid is-ought fallacy, some authors [24] suggest that theories of rationality shoud adopt another principle of normativity: ought implies can. According to this principle we can only require an agent to perform a certain action if she is able to do so. This means that epistemic norms we propose should be attainable, and if agents cannot execute a demanding cognitive operation or conduct a complex inquiry, they should not be expected to do so.

Due to human receptivity for norms, there are many defeasible connections between normative and descriptive theories of rationality, but Knauff and Spohn [1] are critical of the types of relations proposed in the literature so far and do not consider any of them satisfactory. I believe that we have three different possibilities. The first is to keep normative and descriptive theories completely separate – let philosophical disciplines, like epistemology, to determine how we should think and act in order to be rational, and leave psychologists to work on processing accounts of human reasoning, judgement, decision making and other cognitive processes. This is the position advocated by Elqayam and Evans [17]: To avoid is-ought fallacy, descriptive research should dispense with the notion of normativity and focus exclusively on providing processing accounts of cognition. They do not argue for excluding normativism from scientific research completely and they acknowledge its importance in various domains, but claim that psychological research on cognition would do better without normativism. However, other authors argue that normative perspective is indispensable in rationality research [1], but nevertheless urge to consider the option that normative and descriptive approaches are at least logically independent, since both is-ought and ought-is inferences are considered unacceptable [1].

The second option is to continue what we are already doing: we keep conducting empirical research on human cognition with some degree of normativism involved and keep engaging with philosophical theories of rationality, but this means that somewhere along the way we should address the arbitration problem and argue why empirical data on human cognition is not relevant to norms of rationality. At this point, it is worth considering the possibility that the term rationality has a different meaning in normative theories than in descriptive ones; an example of this would be Evans and Over's [25] rationality$_1$ and rationality$_2$. They define rationality$_1$ as a personal and instrumental kind of rationality that is evaluated in terms of achieving one's goals, while rationality$_2$ or impersonal rationality refers to following the rules of logic and probability in one's reasoning and decision making. In their words, rationality$_1$ is "thinking, speaking, reasoning, making a decision, or acting in a way that is generally reliable

and efficient for achieving one's goals", while rationality$_2$ is "thinking, speaking, reasoning, making a decision, or acting when one has a reason for what one does sanctioned by a normative theory" [25, p.8]. This means that an individual can at the same time be rational in one sense but not in the other. This distinction suggests that, in addition to views that equate rationality with reasoning in accordance with a normative system, another possibility is to understand rationality instrumentally, i.e. in terms of achieving one's behavioural goals, whatever they may be.

If we prefer the second option, the question arises as to what to do when empirical findings about human cognition deviate from the norms of rationality. One possibility is to stick to the chosen normative standard and interpret the deviations as irrationality; another is to modify the normative standard in order to reduce the discrepancy (e.g. provide alternative explanations of the answers to the Wason selection task in terms of optimal data selection [22] instead of deductive logic or falsification); and the third is to take it as a starting point for criticising normative systems, which might lead us to the third possible relationship between the normative and the descriptive.

The third option is to propose some kind of hybrid concepts or models of rationality that contain both normative and descriptive elements [26]. Such theories should be informed by empirical research on human cognition, but should not dispose of the normative and evaluative questions of what is good reasoning, what is rationality, and how should we conduct inquiries. Gigerenzer and Sturm [8], for example, argue for such a naturalized account of rationality. They believe that it is – to some extent – possible to determine norms of rationality on the basis of empirical research, but not in all domains of reasoning; the normative-descriptive divide cannot be bridged everywhere. Their naturalized view of rationality is based on Gigerenzer's work on fast and frugal heuristics, which I will describe in more detail in the section on ecological rationality. According to them, rationality should be assessed in terms of fit between a strategy and the environment, and they aim to replace an instrumental understanding of rationality with an ecological one. Their naturalism about rationality is, in their words, "normative, ecological, and limited" [8, p. 245].

Schurz and Hertwig [9] also urge philosophers and psychologists to work together to find a new definition of rational cognition. They argue that rationality should not be measured against specific, "universal" benchmarks, such as consistency, coherence, deductive logic or Bayes' rule, but should be understood in terms of cognitive success in the real world. They propose a consequentialist approach to rational cognition, in which normative standards are justified by the success of their outcomes. They problematize the inevitably subjective nature of intuitions and argue that intuition-based account of rationality is prone to strong cognitive relativism. Instead of intuitions, they propose basing epistemic normativity on cognitive success, which is defined in terms of successful prediction. They claim that in their consequentialist account, empirical data gain normative weight and normative claims guide new empirical questions, and argue that such an approach could help to overcome the division of labour between philosophy and psychology.

BOUNDED RATIONALITY

One of the most prominent critics of normative views on rationality was a political scientist Herbert A. Simon, who introduced the concept of bounded rationality. He criticized the way in which traditional economic theory, e.g. expected utility theory [27] viewed agents: this "economic man" has information about all relevant aspects of the environment, has complete and stable preferences, and is equipped with a cognitive apparatus that enables him to perform complex calculations that determine which of the possible alternatives in a decision situation yields the highest expected utility. In real life, however, we usually act under uncertainty and

practically never know all possible alternatives, have only partial knowledge of the consequences and imperfect estimations of the values [28]. Simon urged that global rationality postulated by economic theories should be replaced by a concept of rationality that is compatible with both the computational capacities of the agents and the structure of the environment in which they operate. Due to the limits of human cognitive processing, particularly in terms of computational and predictive capacity, "actual human rationality can at best be extremely crude and simplified approximation to the kind of global rationality that is implied, for example, by game-theoretical models" [29, p.101]. He urged to replace the requirement of optimization – the search for solutions that would maximize the payoff – with the notion of satisficing, i.e. the search for solutions that are good enough, but not necessarily the best [29, 30]. He emphasized that to understand human rationality, we must take into account both the limitations of human cognition and the characteristics of the environment in which humans operate [30]. To illustrate his point, he used a metaphor of a scissors: "Human rational behaviour (and the rational behaviour of all physical symbol systems) is shaped by a scissors whose two blades are the structure of task environments and the computational capabilities of the actor" [31, p.7]. In order to understand human rationality, we have to take into account both blades. The answer to the question of how to behave rationally differs depending on whether we look at it from the perspective of global, economic theories of rationality or from the perspective of theories that consider the limitations of human cognition and environment [30]. Another important feature of bounded rationality is its procedural character. In contrast to substantive rationality, according to which a behaviour is rational if it helps us to achieve our goals, procedural rationality also considers the process; a behaviour is procedurally rational if it is the consequence of an appropriate process of deliberation [32].

It is worth noting that the term "bounded rationality" is nowadays used in different disciplines and not necessarily in exactly the same sense as Simon described it; according to Gigerenzer [18], some authors understand bounded rationality as optimization under constraints [33] or as irrationality. In the first case, bounded rationality is often used in economic models as a kind of optimization under constraints, in part because such models are mathematically much less complex than non-optimizing ones. In the second case, bounded rationality is interpreted as a deviation from rational choice theory, which is considered normatively correct, and thus equated with irrationality [18]. In the article, however, I intend to use the term bounded rationality in Simon's terms.

ECOLOGICAL RATIONALITY

Simon's bounded rationality has gained considerable recognition in various fields, particularly in psychology and economics, and has greatly influenced the way we think about rationality. One of the concepts widely used in psychology of reasoning and decision making that stems from Simon's bounded rationality is ecological rationality, investigated by Gerd Gigerenzer & ABC research group. They argue that a particular strategy of reasoning, problem solving or decision making is ecologically rational to the extent that it is adapted to the structure of the task; (ir)rationality of a strategy should not be judged according to a priori normative criteria, but by its degree of fit with the environment [34, 35].

Gigerenzer has established a research programme of fast and frugal heuristics. As the name suggests, his focus is the investigation of heuristics: strategies that ignore part of the information and are not computationally demanding, which can lead to faster, frugal and more accurate judgments. Heuristics and the core capacities on which they rely (working memory, attention, object tracking, etc.) are part of what Gigerenzer calls the mind's adaptive toolbox. The function of an organism's adaptive toolbox is defined in evolutionary terms: to reach proximal goals, such as finding food, avoiding predators, finding a mate, etc. Adaptiveness is therefore an important component of Gigerenzer's understanding of rationality [34, 35].

Our intuition often tells us that more information and computation will always lead to better results than less information and computation. The idea that more information is always better and that one should always use as much evidence as possible is deeply rooted in our notions of rationality, Carnap's [36] principle of total evidence being just one example. In contrast to our intuitions, Gigerenzer's research has shown the so-called less-is-more effect. Under conditions of uncertainty, when not all alternatives, values and probability distributions are known, heuristics often provide more accurate predictions than more complex or optimizing strategies that use and weigh all available information. This means that heuristics are computationally less demanding, but not at the expense of accuracy. In other words, there is often no trade-off between frugality and accuracy [34, 35].

If we use a strategy that gives us more accurate predictions than other available strategies, we are ecologically rational. The question of fit between the strategy and the environment is, according to Gigerenzer, an empirical one, and one of the main goals of his research is to explain the characteristics of the environment that are relevant for determining the ecologically rational strategy: degree of uncertainty, number of possible alternatives, the size of a learning sample and so on [34, 35].

Ecological rationality is not defined by adherence to certain norms and emphasizes that no strategy is a priori rational. The idea of ecological rationality is therefore to suggest that problem-solving strategies should be evaluated in relation to the environment in which they are used, and that such an approach is a better starting point for addressing the normative questions than evaluating a strategy against a normative yardstick from the standard picture. Ecological rationality refers to the success of cognitive strategies, while success is defined in terms of accuracy and frugality. Ecological rationality is therefore intertwined with the notion of success and is instrumental in this sense, but still keeps the standard epistemic goals by emphasizing the importance of truth or accuracy [34, 35].

The normative claim of Gigerenzer's research programme is that in cases where heuristics lead to more accurate judgments than other strategies, people should use them – but this implies that it is crucial to recognise when to use a particular strategy. Classical logic may be a perfectly justified normative system, but it would hardly be rational to apply it in all situations of everyday reasoning. However, the fact that a particular rule should not be used in all situations does not mean that it is inadequate; no formal system such as logic or Bayes' theorem – or heuristics – can be the best solution in all situations. There is no general rule of reasoning and rationality that is a priori superior. As Gigerenzer and Sturm say, "mind and environment hang together, and a theory of rationality should respect and explicitly deal with both blades of Simon's scissors" [8, p.264].

BOUNDED RATIONALITY IN EPISTEMOLOGY

Sturm [37] finds it surprising that only a few philosophers have drawn on bounded rationality, since it is an empirically grounded approach which aims to encompass not only descriptive but also normative dimensions. Consequently, the philosophical aspects of bounded rationality have not been systematically explored. He explicates the goals of a systematic, comprehensive study of the philosophical dimensions of bounded rationality: to clarify and analyse in detail the assumptions of the concept of bounded rationality and its differences from non-bounded rationality; to assess in which domains of philosophy bounded rationality can be useful; and to investigate its theoretical and methodological foundations in various disciplines such as psychology, economics and political science [37].

Similarly, Thorstad [24] argues that bounded rationality is not as strongly represented in epistemology as it should be. He views it not as a theory but as a paradigm and describes it in

terms of five normative claims, the first being that bounds are important. In practical philosophy, it is generally accepted that physical limitations must be taken into account when we think about norms for rational action – for example, we cannot be required to lift an object that weighs a tonne. However, this is often not the case with rational beliefs, and norms of epistemic rationality frequently place unachievable demands on agents. Thorstad claims that bounds should also be considered when thinking about rational cognition: if we are unable to perform a complex cognitive operation, we should not be required to do so. The second claim is that we should focus not only on the final doxastic states, but also on the processes that led to them. This procedural outlook on rationality derives directly from Simon's work and shifts the focus away from norms of belief to norms of inquiry. The third and fourth claims relate to ecological rationality and the use of heuristics: rationality is not bound only by internal cognitive factors, but also by the environment, and is therefore ecological. Moreover, the use of heuristics can be rational in many cases – either because non-heuristic processes are too demanding or even impossible or because heuristics provide more accurate predictions than other, more complex strategies. The final claim is that bounded rationality is consistent with the programme of vindicatory epistemology, which regards alleged violations of norms of rationality as the consequence of boundedly rational deliberation. We cannot comply with requirements such as coherence of beliefs because of our cognitive limitations, and we often inquire in the most rational way we can, considering our bounds [24].

NORMS OF BOUNDED EPISTEMIC RATIONALITY

If we want to understand epistemic rationality as bounded, we need to address the question of the relationship between traditional epistemic norms and norms of bounded rationality, which has already been raised in the literature [24, 37, 38]. Sturm [37] points out that we cannot simply map the norms of the standard picture into recommendations for rational reasoning in everyday life. One example is the rule of non-contradiction, which is elementary in classical logic, but is not easily translated into the requirement of a coherent set of beliefs. The belief sets we hold in real life are large and complex, and it seems impossible for us to check for possible contradiction every time we obtain new belief and adjust the set so it would satisfy the law of non-contradiction. According to other views, the norms of the standard picture and bounded rationality are not necessarily incompatible, quite the contrary. Gigerenzer and Sturm [8], for example, argue that their naturalized account of rationality does not undermine the standard picture. Sturm [38] also says that rules of formal logic are embedded in the formulation of Gigerenzer's heuristics, such as the recognition heuristic, which presupposes the basic understanding of if-then conditional: "If one of two alternatives is recognized, infer that it has the higher value on the criterion" [39, p.130]. Bounded rationality is thus inevitably based on the concepts of logic [37].

I believe we have several possible types of relationship between the norms of the standard picture and bounded rationality:

1.) We can keep norms of epistemic rationality (e.g. forming true beliefs and avoiding false ones) and use the notion of bounded rationality as a framework for justifying the lowering of the threshold for epistemic rationality. This means that the norms should be empirically grounded – we should know what the limitations of our computational power and speed, working memory, attention, etc. are in order to propose feasible norms. In this case, we can apply ought-implies-can principle of normativity. In such a view, "bounded" in bounded epistemic rationality only serves as a justification for lowering the bar for traditional norms.

2.) We can use the framework of bounded rationality to put an emphasis on the procedural dimension of epistemic rationality, especially on the role of pragmatic factors. According to Simon [32], rationality of behaviour is judged not only by its final outcome, but also by the process that led to it. Shifting the focus from the final doxastic attitudes to the process is

already pursued by inquiry epistemology [40, 41], but bounded rationality might help us to consider how to put more emphasis on the costs of the process. For example, if a particular process is highly reliable (i.e. leads to a high ratio of true to false beliefs), but has a large computational cost, is very time consuming, and interferes with other important activities in life, it would hardly be considered rational – at least from the perspective of bounded rationality. If we do not evaluate the rationality of cognitive processes or inquiries only according to epistemic factors, such as reliability, but also consider the influence of pragmatic factors such as costs in terms of cognitive resources, effort and time, norms of rationality become more flexible and can be better applied to real, limited human agents. In a similar line, Bishop and Trout [42, 43] proposed a theory they call strategic reliabilism. They argue that epistemically good reasoning is connected to reliability, but one can still spend a lot of time reasoning about trivial matters, such as memorising the product descriptions in an online store or forming true beliefs about the number of bricks in a pavement. For this reason, they include pragmatic criteria for rational reasoning: it must be efficient in terms of time, energy and effort, and it must relate to topics that are relevant to the agent. According to them, "rational reasoning is reliable, cost-effective and focused on significant problems" [43, p.106]. Such an approach treats rationality as a function of factors that are usually considered purely epistemic (reliability) and factors that are considered purely practical (cost-effectiveness and relevance of issues to the agent). Bishop and Trout argue that strategic reliabilism has just the right mix of epistemic and practical elements to be used as a tool for ameliorative epistemologists who want to make recommendations for improving people's reasoning. Because strategic reliabilism takes into account the limitations of human cognitive processing and the individual differences of reasoners, it is, as Bishop and Trout put it, an epistemological theory for real people. I believe that using the bounded rationality framework is consistent with Bishop and Trout's approach and could help us to further explore the idea of incorporating practical factors into our procedural understanding of epistemic rationality.

3.) In notions of bounded and ecological rationality, the emphasis is on adaptiveness: rationality is defined in terms of fit between the strategy and the environment, there is no single set of rules of rationality that can be applied in all contexts, and heuristics are domain-specific. Perhaps it is possible to include adaptiveness as one of the norms of bounded epistemic rationality: for a process to be boundedly epistemically rational, it must lead to some epistemic goal and serve as an adaptive response to the environment. These two goals – the attainment of true beliefs and adaptiveness – often coincide, but there are many situations in which they come apart. If we have true beliefs about which food is poisonous and we therefore do not eat it, we have achieved both the epistemic and adaptive goals. However, we can think of many situations where one of the two goals may take precedence or even conflict with each other. If we devote enormous amounts of time and resources to gaining true beliefs about a particular trivial matter while neglecting other important activities, this will hardly be adaptive. We should know when to stop reasoning or inquiring, or, in other words, when the costs of reasoning outweigh its benefits. If we include adaptiveness as a norm, we must determine its relation to strictly epistemic goals. When we speak of bounded epistemic rationality, epistemic goals should always be present, but the question arises as to what role adaptiveness plays in evaluating the rationality of inquiry or belief.

BOUNDED EPISTEMIC RATIONALITY

It is not my aim to propose a comprehensive account of bounded epistemic rationality, but merely to describe some of the features that I think such an account should contain, drawing on the concepts and approaches described previously in the article.

I propose that bounded epistemic rationality means inquiring in a way that leads to good enough results: good enough accuracy, understanding, or prediction. In determining what is good enough – e.g., what is a belief that is sufficiently accurate or close to the truth – we must apply a form of ought-implies-can principle of normativity. Bounds that we need to consider are cognitive, practical, and environmental. The standard for how accurate beliefs we are expected to form, and in what way we should inquire, must be attainable by limited cognizers. In other words, we cannot be expected to have fully coherent belief systems about a complex issue; we cannot be expected to find an optimal solution to a complex decision problem; and we cannot be expected to perform perfect Bayesian conditionalization. Moreover, the norms of bounded epistemic rationality should take into account practical considerations. We are not bounded only by our cognitive abilities, but also by time. When we inquire, reason, and form beliefs, we do not do so in a bubble that isolates us from the practical considerations of our daily lives. Every day we have to decide (even if we do so automatically and implicitly) how much time and cognitive resources we want to devote to a particular task. Prioritising, allocating our resources, and knowing when to stop inquiring and move on to another task is a skill that bounded agents need to manage their daily lives. Bounded epistemic rationality should not require from us to reason and inquire in a way that interferes with other important activities in life [42]. Finally, the content of our beliefs and the process of our inquiry depend on the characteristics of the environment in which we operate: the access to information, the prevalence of misinformation and so on. If we inquire in an epistemically polluted environment, where we do not know which sources are reliable and there is a large amount of inaccurate or incomplete information, the formation of false beliefs should not be considered a sign or a consequence of irrationality – this view has already been put forward by Levy [44]. Another feature of our epistemic environment is uncertainty; we can hardly be expected to perform expected utility maximizations if we do not have a complete knowledge of alternatives and probability distributions. Bounded epistemic rationality must therefore apply to conditions of uncertainty, not just to conditions of risk, which are rare in everyday situations.

Another feature of bounded epistemic rationality is that it is not defined by adherence to a priori normative criteria, but by the fit between the strategy and the environment. Bounded epistemic rationality is therefore ecological (in Gigerenzer's sense) and does not strive for a rigid, all-encompassing set of rules of rationality, but allows the question of which strategies give the best results in certain tasks to be investigated empirically. In this sense, bounded epistemic rationality is consequentialist – it cares about cognitive success in the sense of Schurz and Hertwig [9] – and as such it allows for different strategies, from complex reasoning to simple heuristics, to be rational.

Such an account of bounded epistemic rationality is compatible with moderate epistemic naturalism [16]: cognitive psychology and other disciplines can help us understand how human belief formation, inquiry, and other cognitive processes work and that can serve as a baseline for detemining what can be expected from us. However, defining what is good enough – enough knowledge, enough understanding, close enough to the truth – is still a philosophical question. Bounded epistemic rationality does not collapse into adaptiveness or fitness, as it emphasizes the notion of epistemic goals and still asks the question of how to arrive at the most accurate beliefs possible and what constitutes good inquiry, so it encompasses descriptive, normative and ameliorative aspects. Such a view of epistemic rationality can encourage us to think about what Bishop and Trout [43] call epistemology for real people and help us move away from idealized theories to notions of rationality that are psychologically realistic and applicable to real human cognizers in the world in which they live. If we assume that one of the tasks of epistemology is to provide guidance on how to conduct better inquiries and achieve our epistemic goals, it must be based on non-ideal, empirically grounded models of human cognizers and the environment [42, 43, 45].

QUESTIONS FOR FUTURE RESEARCH

Numerous aspects of bounded epistemic rationality require further investigation. One of these is how to determine which characteristics of human cognition should be considered a factor in lowering the rationality threshold; in other words, which limitations matter. This question has already been raised by Carr [46], and Thorstad suggested that the bounds that should lower the bar are those imposed by the agents' cognitive architecture (e.g. limitations of working memory capacity, computational power, or processing speed), but not the processes implemented within it. However, he points out that his aim is not to provide a detailed account of which bounds matter, but to stimulate further discussion on the topic [24].

Another question relates to the practical limitations for inquiries that we face in everyday life. If a concept of bounded epistemic rationality states that we should prioritize and decide which tasks are worth our time and resources, should it not also specify how we do so? The problem with bounded epistemic rationality is that it does not provide an account of which problems are important enough to merit long and careful inquiry. Bishop and Trout [42] have already pointed out that an epistemological theory should determine which problems are relevant. In their theory of strategic reliabilism, they attempted to describe significant problems in terms of so-called objective reasons, and a similar account may be adopted in a theory of bounded epistemic rationality.

Another need for further research lies in the social aspects of bounded epistemic rationality. In this article I have focused on the cognitive limitations of individual agents, but belief formation, knowledge acquisition, and inquiry are of course strongly influenced by factors that have long been neglected by traditional analytic epistemology. The emergence of the field of social epistemology has emphasised the study of the epistemic properties of social interactions, social systems, and groups, for example the role of social institutions in knowledge production and dissemination and the epistemic effects of agents' social roles and identities [45, 47]. I believe that the nature of social institutions, social interaction between agents, and other epistemically relevant aspects of our social situatedness should be taken into account when we think about bounded epistemic rationality.

Another question is how to determine what is accurate enough, true enough or explained enough. The question of which strategy in which environment leads to more accurate predictions than others is an empirical one, but determining the threshold for acceptable accuracy is not. An account of bounded epistemic rationality should specify how to determine this threshold. For example, if we are going to act on the basis of a belief and the consequences of acting on the basis of an inaccurate belief are severe, we can set the threshold for accuracy higher; this has already been proposed under the notion of pragmatic encroachment [48]. The question of what is true enough, especially in scientific research that relies heavily on models and idealizations, has been thoroughly explored by Catherine Elgin [6, 49]. I believe that the connection between bounded epistemic rationality and the concept of "true enough" is worthy of further research.

Another important feature of bounded epistemic rationality is strategy selection – to be boundedly epistemically rational, cognizers should know when to use a particular strategy. This is a question of both descriptive and normative importance, as the empirical study of metacognition is crucial when determining what can be expected of cognizers and when we think about what is good or bad metacognition.

CONCLUSION

In the article, I aimed to show that combining epistemic and bounded rationality in a hybrid concept could be a way of narrowing the gap between descriptive and normative approaches

to the study of rationality. I pointed out that I distinguish epistemic justification from epistemic rationality, and defined the latter as a type of rationality aimed at pursuing epistemic goals. I described the division of labour between philosophy and psychology, with the former providing normative theories of rationality and the latter proposing descriptive, processing accounts of cognition based on empirical data. I described how investigations of rationality are intertwined with the notion of normativity and pointed out the unattainable norms and the arbitration problem as the challenges for normative theories. I then proposed three possible types of relationships between normative and descriptive theories of rationality, pointing out the importance of avoiding is-ought fallacy and contrasting it with an acceptable ought-implies-can principle of normativity. I then described Herbert Simon's concept of bounded rationality and Gigerenzer's notion of ecological rationality as examples of non-ideal accounts of rationality that aim to overcome the problems of normative theories mentioned above. I pointed out that the notions of bounded or ecological rationality are rarely used in the philosophical literature, and summarized David Thorstad's arguments for a greater emphasis on bounded rationality in epistemology. I reflected on the relationship between the norms of bounded rationality and the norms of epistemic rationality in traditional analytic epistemology. Finally, I outlined some features that I think should be included in the hybrid concept of bounded epistemic rationality: satisficing instead of optimizing; the consideration of cognitive, environmental, and practical limitations; its ecological nature; and its compatibility with moderate epistemic naturalism.

A definition of epistemic rationality that is compatible with bounded rationality might help us avoid overly strict, idealized, *as-if* theories of rationality and bring us closer to understanding rationality through the interaction of our cognitive faculties and the structure of the environment. If we allow that rationality of a particular strategy should be understood as the degree of fit between the strategy and the environment, and assume that this is an empirical question, then bounded epistemic rationality blurs the divide between the normative and the descriptive. In this way, we can construct a theory that is not detached from the real world, but can provide good epistemic advice and guidelines for epistemically good inquiring and belief formation. Linking bounded and epistemic rationality can therefore provide a more comprehensive understanding of rationality that is applicable to real human subjects in the world in which they live.

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NAVIGATING ENVIRONMENTAL ETHICS AND GEOGRAPHY IN THE CLIMATE CRISIS ERA

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ABSTRACT

This study explores the moral dimensions of the planet's challenges by examining the intersection of environmental ethics, metaphorical expressions, and geography in the context of the escalating climate crisis. The study employs the jellyfish metaphor and geographical ethics to link theoretical ethical issues with real-world societal behaviours. The study emphasizes the need to contextualize metaphors like climate change and jellyfish resilience to make them more relevant in real-world situations. This approach represents a shift in societal attitudes toward sustainable coexistence, emphasizing the use of metaphors to promote environmental consciousness and ethical action. The study aims to strongly promote ethical behaviour and environmental awareness.

KEY WORDS

CLASSIFICATION

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INTRODUCTION

The escalating climate crisis, which is rooted in human activities, poses an unparalleled threat to the delicate balance of our planet. As societies urgently seek sustainable solutions, the ethical dimensions of environmental challenges require careful exploration. This study explores environmental ethics using metaphorical expressions and a geographical perspective. In doing so, we navigate the current environmental discourse to understand the problem and surpass existing limitations in our approach [1].

Climate change, pollution, and environmental degradation pose an existential threat, challenging the interconnected fabric of our world. The issue is not just scientific; it is also deeply ethical, involving human behaviours, choices, and their impact on the environment. Existing solutions address specific aspects but do not comprehensively connect ethical implications with tangible geographical spaces, places, and human mobility [2].

Current solutions mainly focus on policy measures, technological innovations, and behavioural change campaigns. While these efforts are important, they often fail to promote a deep understanding of the moral imperatives behind sustainable practices. The limitations are in the abstract nature of ethical considerations and the gap between global environmental issues and their local impacts [3]. Our approach argues that the most effective solution is to translate abstract ethical concepts into tangible narratives that resonate with individuals and communities. Metaphors bridge complex environmental ethics with people's lived experiences. Introducing a geographical dimension ground these metaphors in specific contexts, emphasizing the diverse ethical responsibilities dictated by spaces, places, and human mobility [4].

This study aims to redefine environmental ethics by using metaphors to communicate moral imperatives and geographical considerations. It aims to bridge the gap between theory and practice, fostering a deeper understanding of ethical responsibilities toward the planet. The synthesis aims to inspire a shift toward sustainable coexistence with the environment.

This essay is based on fundamental metaphor theories. Our approach is in line with the evolving field of geographical ethics, recognizing the spatial dimensions of environmental responsibilities. As we explore the following sections, the interconnected themes of morality, geography, and metaphor will intertwine, providing a new perspective on environmental ethics and fostering a deeper connection between humanity and our planet.

THEORETICAL BACKGROUND

This theoretical background explores the relationship between metaphorical expressions and moral dimensions in the context of environmental challenges. It focuses on societal behaviours, environmentally friendly business practices, climate justice, and religious teachings. Drawing on influential works and theories, the goal is to establish a theoretical foundation for understanding the intricate relationship between humanity and the environment.

Metaphor studies, a field within cognitive science and linguistics, has significantly contributed to understanding societal behaviours and environmental issues. George Lakoff and Mark Johnson's book "Metaphors We Live By" suggests that metaphors shape our perceptions and influence our actions [5]. This approach examines metaphors associated with consumerism, ecological responsibility, and human impact on the planet, uncovering ethical aspects in everyday language. Aldo Leopold's "A Sand County Almanac & Other Writings on Conservation and Ecology" introduces the concept of a land ethic, emphasizing the interconnectedness of ecosystem components [6]. This perspective contributes to understanding businesses' moral responsibilities toward the environment, reflecting themes of stewardship and sustainable practices, and contributes to the theoretical foundation for eco-friendly business practices.

Climate justice, based on political philosophers like John Rawls, emphasizes fairness and equality in addressing the ethical aspects of climate change [7]. Mary Robinson's book "Climate Justice: Hope, Resilience, and the Fight for a Sustainable Future" promotes fair and inclusive decision-making to address the unequal impacts of climate change, emphasizing the moral imperative of rectifying climate consequences for different communities [8].

Religious teachings have a significant impact on environmental stewardship. In his essay, "The Historical Roots of Our Ecologic Crisis," Lynn White Jr. examines Christianity's historical influence on the environment and advocates for a reassessment of religious viewpoints [9]. The concept of believers as earth stewards in Islam and Buddhism's emphasis on sustainable living align with eco-theological perspectives, enriching the understanding of moral dimensions in these religious teachings [10].

Rachel Carson's "The Sea Around Us" provides a theoretical framework for comprehending the significant influence of human activities on ocean ecosystems, emphasizing the symbolic representation of the ocean in connection to environmental issues such as the Great Pacific Garbage Patch [11, 12]. The metaphor of jellyfish as the ocean's next ruler provides a unique perspective on resilience and adaptability in the midst of environmental disruptions. Drawing on ecological theories and biodiversity literature, this metaphor explores the dynamic nature of marine ecosystems. It contributes to discussions on adaptation, survival, and the consequences of human actions.

CASE STUDY: JELLYFISH RESILIENCE AS A METAPHOR

INTERCONNECTED THREADS OF SOCIETY AND ENVIRONMENT

As human activities intensify the climate crisis, our planet faces unprecedented challenges. This case study uses the jellyfish metaphor to explore environmental issues and emphasize the ethical dimensions within human societies. By integrating perspectives from environmental philosophy, religious teachings, and various academic disciplines, the study sheds light on the complex nature of the climate challenge. This exploration goes beyond immediate environmental concerns to examine societal behaviours and the changing moral fabric that influences our collective response.

Examining ethical implications through various philosophical perspectives highlights the need for a change in human values. Deep ecology emphasizes the intrinsic value of non-human life and is reflected in global trends favouring biodiversity conservation. Environmental ethics focuses on our moral responsibilities, seen in eco-friendly business practices and ethical policymaking [13]. Ecofeminism, which intertwines gender and environmental concerns, is reflected in movements for gender equality and environmental justice. Climate justice principles emphasize global awareness, as seen in youth-led climate strikes [14, 15].

Major world religions are committed to environmental stewardship. Islam views believers as earth stewards and promotes sustainable practices and eco-friendly initiatives. Christianity's "creation care" philosophy is reflected in Green Church initiatives and Pope Francis's environmental encyclical [16]. Buddhism aligns with sustainable living trends, and Hinduism's reverence for nature is reflected in initiatives such as the Hindu Declaration on Climate Change [17].

Human activities lead to pollution, air quality problems, soil degradation, and water scarcity. Events such as Mexico City's health crises due to air pollution and global struggles to combat air quality problems highlight the urgent need for comprehensive measures. [18] The connection between soil degradation, hydroponics, and the sinking of villages in the Sahara underscores the complex relationship among climate change, soil degradation, and water

scarcity. Water scarcity in regions like the Sahara emphasizes the need for responsible water management practices [19].

The jellyfish metaphor represents resilience in the face of declining larger ocean species. Trends such as overfishing, and the Great Pacific Garbage Patch highlight ecological imbalance [20]. The metaphor reflects climate change-induced events, leading to global climate strikes and a push for renewable energy sources. Examples such as the circular economy demonstrate an increasing dedication to environmentally responsible practices [21].

Seemingly unrelated issues such as consumerism, health crises, and the societal impacts of lust and pornography are interconnected. Black Friday and global health crises exemplify the environmental impact of consumerism. Lifestyle choices affecting health crises are similar to the acidification of oceans [22]. Understanding these interconnected threads is essential for comprehensive environmental stewardship.

ALIGNING WITH GEOGRAPHIES

Geographical analysis shows how environmental challenges affect different regions. The implementation of religious teachings varies geographically and requires culturally sensitive approaches. Human actions display specific spatial patterns, highlighting the necessity for location-based policies. The geographical analysis of jellyfish resilience offers insights into ecosystems undergoing transformation. Interconnected societal threads, when understood geographically, enable targeted interventions that recognize diverse landscapes. The global impact of human mobility highlights the necessity for coordinated international efforts from a geographic perspective [23, 24].

Considering geography is crucial in analysing trends and morality. Space, place, and human mobility are crucial factors that shape the ethical dimensions of environmental challenges [25]. Crafting sustainable solutions requires a nuanced understanding of geographic contexts to create tailored interventions that resonate with diverse landscapes and communities worldwide.

DISCUSSION

The aforementioned case study examines the jellyfish metaphor, emphasizing the moral importance of understanding and addressing the intricate relationship between humanity and the environment. The theoretical framework and case study highlight the significance of geography, including space, place, environment, and mobility, in addressing climate and environmental issues. This interconnected concept emphasizes the moral obligation to address this complex relationship.

As we shifted to the jellyfish metaphor in the case study, this perspective was refined to capture the core of environmental resilience and adaptability. The metaphor acts as a bridge between theoretical concepts and real-world environmental challenges, subtly transforming abstract ideas into relatable narratives. The oceanic metaphors and the symbolism of jellyfish as the next rulers of the ocean align with the theoretical framework, emphasizing the need for a moral awakening in response to environmental disruptions [26].

Geography plays a crucial role in this discourse. Theoretical perspectives, such as those based on deep ecology, climate justice, and environmental ethics, have a unique spatial dimension. The unequal impacts of climate change are not random; they disproportionately affect specific regions in a spatially patterned manner. Religious perspectives gain geographic relevance as the implementation of earth stewardship and creation care varies across diverse landscapes.

Moreover, human actions have distinct spatial patterns, leading to consequences such as pollution hotspots and water scarcity. The metaphor of jellyfish resilience reflects geographical nuances, thriving in areas where larger species struggle. By anchoring the discussion in

geography, the case study enhances our understanding of the spatial aspects of moral responsibilities concerning the environment [27].

The case study transforms the metaphor of jellyfish resilience into a conceptual framework for understanding environmental challenges. Through a metaphorical lens, the interconnected threads of societal choices and their contribution to environmental degradation become clear and relatable. This shift from metaphor to concept enables a more predictable and practical structure. Metaphors are used to convey complex ideas in a way that is understandable and meaningful to diverse audiences. The theoretical foundation introduces the power of metaphorical expressions, emphasizing their potential to go beyond linguistic devices and become catalysts for deeper understanding and meaningful action.

The study explores the relationship between metaphorical expressions and the jellyfish metaphor to change societal understanding and promote environmental stewardship. It emphasizes the importance of contextualizing environmental challenges within specific spaces to foster a deeper understanding. The study uses theory and a case study on the jellyfish metaphor to provide a framework for understanding environmental ethical aspects. It aims to prompt a moral awakening by promoting practical steps towards sustainable and morally responsible coexistence with the planet.

CONCLUSION

This examination of environmental ethics, viewed through metaphorical expressions and enhanced by a geographical perspective, represents a significant advancement in the discourse on morality concerning climate and the environment. The combination of theoretical foundation and the insightful case study using the jellyfish metaphor advances our understanding beyond the current state of knowledge.

The case study examined how metaphors can help understand complex environmental issues. The text integrated metaphorical expressions with geographical considerations to provide a nuanced perspective on societal behaviors, eco-friendly practices, climate justice, and religious stewardship. This work aimed to address the intersection of morality, metaphors, and geography, highlighting the real-world impact of human actions.

The findings of this study have implications for a wide range of stakeholders. Academically, this contributes to environmental philosophy, ethics, and geography by showing how metaphorical expressions can be used to shape moral narratives. Practically, it provides a tool for policymakers, educators, and environmental advocates to communicate complex concepts in accessible ways. The metaphorical approach helps a wider audience understand the moral imperatives of environmental stewardship.

Future research should explore metaphorical expressions that resonate with diverse cultures, expand moral narrative applicability, and investigate the effectiveness of metaphorical communication in driving behavioural change and fostering environmental consciousness. It should also explore the role of geography in shaping environmental perceptions and responsibilities through interdisciplinary collaborations.

This study highlights the global moral obligation humans have toward the environment, transcending geographical boundaries. It calls for a global approach to environmental challenges, while recognizing the necessity of context-specific strategies to tackle the ethical aspects of these issues.

This study contributes to the understanding of morality in climate and environmental contexts, laying the groundwork for future research in metaphor theory and geography. It connects abstract ethical concepts with tangible geographical spaces, aiming to inspire meaningful action and contribute to a sustainable, morally conscious coexistence with our planet.

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SELECTING A SUITABLE FRAMEWORK
FOR MODELLING THE SPREAD
OF THE HUNGARIAN EID CARD

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ABSTRACT

The aim of this article is to select an applicable framework for modelling the spread of the Hungarian eID card, as an innovation, among the Hungarian population. Using the concepts of the selected theory, a basic model is also outlined, which can serve as a foundation for further research.

Keeping the characteristics of the Hungarian eID card in mind, this article compares the various technology acceptance theories. Considering the specialties of the identity document, the Diffusion of Innovations is the most suitable framework for examining the spread of the Hungarian eID card and its electronic functions in Hungary.

Through the outlined model, the factors preventing the spread can be identified, and new research directions can also be determined. With the further development of the model, a diffusion plan can be created that would greatly facilitate the spread of the examined electronic identification document.

KEY WORDS

electronic ID document, technology acceptance, diffusion research, electronic signature, information security

CLASSIFICATION

ACM: J.1, J.4, K.4.m

JEL: L86, O33, O52

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INTRODUCTION

The eIDAS regulation [1] defines a uniform model for the application of electronic ID cards in the European Union. Governed by the Hungarian Government Decree 414/2015. (XII. 23.) the so-called 'eSzemélyi' ID card (in the following: Hungarian eID card) is the Hungarian equivalent of the eIDAS-defined ID card [2].

Among other things, the eID card is suitable for storing personal digital certificates and identification numbers. Several use cases can be mentioned like electronic signature of documents (e.g. motor vehicle or real estate sales contracts), authentication in e-government services and so on. To take full advantage of the benefits of the card, one needs a computer and a card reader device connected to it (can be replaced with a smartphone and the 'eSzémélyiM' mobile application) [3].

Somogyi and Nagy [4] state that the Hungarian Act CLXVI of 2012, in conformity with EU Council Directive 2008/114/EC, defines the following financial services as critical infrastructure: Commerce, payment and clearing of monetary assets and liabilities, Security of banks and credit institutions and Cash management.

Over time and with the increasing number of use cases citizens will probably depend on electronic trust services and electronic signature services to a similar extent as they do on various financial services (e.g. bank card use) today. However, this would require electronic trust services and electronic signature services to be considered as critical infrastructures in Hungary, which unfortunately is currently not the case according to the Act CLXVI of 2012 [5].

Nowadays, electronic information systems have a growing presence in the Hungarian public administration increasing the expected digital and computer literacy skills from all citizens. The situation however can easily seem complicated to users, since the use of the eID card has many technical requirements. As a result, basic computer usage skills are not enough, but further knowledge is necessary, e.g., the basics of electronic signature.

Nyári [6] shows in previous research on the topic that Hungarian citizens seriously suffer from a lack of information related to the eID card and its possibilities. This may be because they do not receive the necessary informative materials and information, even though such materials are abundantly available on the information portal about the identification document.

The purpose of this article is to find a suitable framework for modelling the phenomenon of the Hungarian eID card. The selected framework can be used in further research in order to explore the factors hindering the spread of the usage of the eID card and to develop solutions that facilitate the broadening of its use.

The framework for modelling the examined phenomenon must have the following properties:

- the phenomenon must be modelled among an entire social group not only in a scope of an organisation,
- the model must take into account the way of communication related to the phenomenon,
- the focus of the model must be on a technological novelty,
- the time course of the phenomenon must be considered as well.

In the recent decades, researchers have used several different methodologies to measure the acceptance of various technologies. In the following literature review section, the basic properties, similarities and differences of these methodologies are presented as well as the pieces of research conducted with them.

LITERATURE REVIEW

Hungarian eID cards with a chip are suitable for storing various data, for example: digital certificate for electronic signature, ICE (In Case of Emergency) telephone numbers, address data, identification numbers like social security number, fingerprint, etc [3].

The main areas of use of the eID card are electronic identification, public transportation, receipt of mail, travel document (within the EU) and electronic signature (e-signature). Regarding this study, however, the most important use case is the electronic signature. According to the edict governing the Hungarian eID card only private individuals can use the eID card for personal matters, i.e. it cannot be used for corporate affairs [2].

Nyári [6] conducted focus group interviews about the aspects of trust towards the electronic signature technology. Members of the 18-30 age group were represented in the first group, and members of the 31-65 age group in the second one. Grounded Theory analysis was performed on the collected data using the open coding approach. The resulting codes were then grouped into categories using axial coding, and finally a core category was created to combine the categories.

The analysis pointed out that lack of trust is not the main obstacle to the spread of electronic signatures in Hungary. Although it appears as an inhibiting factor, but the fundamental problem is caused by the fact that citizens are not aware of the possibilities of the Hungarian eID card, which is due to the lack of communication, lack of information and lack of use cases related to the identity card. So, the problem is seemingly a question of communication [6].

Several frameworks can be used to examine the acceptance of technology. According to Oliveria and Martins [7] the most used theories include Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB), Technology Acceptance Model (TAM), Technology-Organization-Environment (TOE), Unified Theory of Acceptance and Use of Technology (UTAUT) and Diffusion of Innovation (DOI).

Some of these frameworks place focus on organizational rather than individual level. Awa, Ojiabo and Orokor [8] state that TPB and TAM are more suitable for understanding technology adoption among individuals. According to Oliveria and Martins [7] TPB, TAM and UTAUT are at individual level, as opposed to TOE, furthermore DOI can be applied on organization and individual level as well.

For this research topic, the frameworks that examine the willingness of individuals to accept technology are most suitable, since the organizational level cannot be interpreted in the use-cases of the electronic identity card of Hungarian citizens due to the national legal context mentioned above. Given the nature of this research, those frameworks that are not suitable for examining the individual level will be excluded.

In the Theory of Reasoned Action (TRA) behavioural intention is the main motivator behind behaviours, and it is a function of attitudes and subjective norms toward the behaviour in question. Analysing attitudes and subjective norms can lead to an understanding as to whether the tested person will perform the intended action [9, 10].

Theory of Planned Behavior (TPB) was created in 1985 by Ajzen [11] based on Theory of Reasoned Action (TRA) by Ajzen and Fishbein [9]. According to Ajzen [12] TRA can be looked at as a special case of TPB. TRA does not consider that certain tasks may be beyond the ability (unanticipated events, insufficient time, money, or resources; lack of requisite skills and so on) of the tested subjects, so TPB is extended with control which expresses the extent to which the examined person has influence over undesirable events. Madden, Ellen and Ajzen [10] state that, practically speaking, perceived behavioural control is the level of confidence of being able to perform the behaviour. It influences both behaviour intention and the behaviour itself.

According to Ajzen [12] TPB is formulated on a very general level whereas Technology Acceptance Model (TAM) is an extension of TPB focusing on acceptance of technology. As a result, the TPB and the TRA methods are no longer dealt with, as they may be too general for the purpose of this research.

TAM was created by Davis [13] in 1986 stemming from the TRA. It models the degree to which users of an information system accept and utilize the technology in question. According to Davis [13] perceived usefulness (U) and perceived ease of use (EOU) are the two primary impressions that influence users' attitude towards using a computer system.

Practically speaking a user decides whether to accept a technology based on two questions:

- Does it enhance my job performance (Perceived usefulness)?
- Is it easy enough for me to use (Perceived ease of use)?

The TAM methodology has been continuously developed and supplemented over the past decades by researchers. TAM2 was created by Venkatesh and Davis [14] in 2000. The extended model refines the original U and EOU from the perspective of social influence and cognitive instrumental process [15].

According to Venkatesh and Davis [14] the additional aspects are the following:

- subjective norm – this is kept consistent with TRA, basically, it is the user's impression as to whether his/her acquaintance would perform the same task,
- voluntariness – practically, the potential adopter's judgment of the extent to which an innovation is adopted out of their free will,
- image – defined by Moore and Benbasat [16] based on research on Diffusion of Innovation, image is the perception of the degree to which performing a task will influence the potential adopter's status in his/her social system,
- job relevance – 'an individual's perception regarding the degree to which the target system is applicable to his or her job',
- output quality – a subjective perception how well the system is able to perform specific tasks,
- result demonstrability – also defined by Moore and Benbasat [16] it is the extent to which the system produces concrete and relevant results for the individual's job.

According to the TAM focused literature review by Marangunić and Granić [15] the framework is rather popular in many fields including information systems, health care information systems, clinical information systems, digital libraries, Internet-based information systems and e-learning systems.

Ward [17] states that many studies prove the connection between U, EOU and system use. Since the creation of TAM research indicate that U is 50% more influential than the other factor. Imposing new technologies by corporate management or organizations though affect the users' attitude towards innovations negatively.

Lovosova [18] used TAM to examine the usage of the national Electronic Health Record system among the healthcare professionals of Estonia finding that in that particular case the key motivator was imposing the usage of the system by law, but TAM variables Perceived Ease of Use and Perceived Usefulness had a correlation on user behaviour.

Venkatesh, Morris, Davis and Davis [19] formulated the Unified Theory of Acceptance and Use of Technology (UTAUT) model in 2003 based on the empirical evaluation and comparison of eight existing models (Theory of Reasoned Action, Technology Acceptance Model, Motivational Model, Theory of Planned Behavior, Combined TAM and TPB, Model of PC Utilization, Innovation Diffusion Theory and Social Cognitive Theory).

There are eight key concepts in UTAUT, four core determinants of intention and usage, and four moderators of key relationships. The main concepts and their relations are shown in Figure 1.
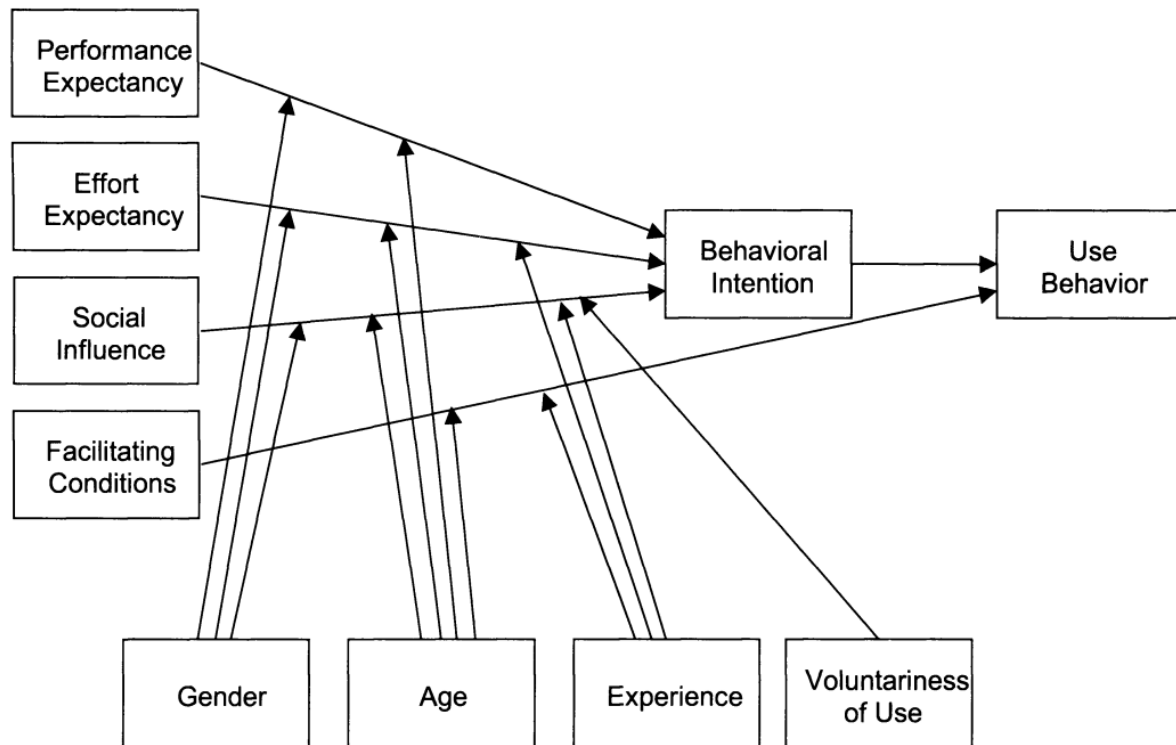
Figure 1. UTAUT [19].

According to Venkatesh, Morris, Davis and Davis [19] the four core determinants are the following:

- Performance Expectancy – basically, the same as the Perceived Usefulness in TAM, the degree to which an individual believes that a system is helpful regarding his/her job;
- Effort Expectancy – very similar concept to the Perceived Ease of Use in TAM, it expresses the degree of ease of the system usage;
- Social Influence – it stems from the Subjective Norm concept of TRA expressing the degree to which a user of a system believes that his/her acquaintances would use the same system;
- Facilitating Conditions – rooting in the Perceived Behavioural Control concept of TPB it expresses the degree to which individuals believe that the necessary technological and organization infrastructure is in place for the system in question.

As Figure 1 shows the first three core determinants (Performance Expectancy, Effort Expectancy and Social Influence) have a direct effect on Behavioural Intention and through that an indirect effect on Use Behaviour. The fourth, Facilitating Conditions has a direct effect on Use Behaviour. And the four moderating factors influence the effects of the core determinants on the Behavioural Intention or the Use Behaviour [19].

In 1962 Rogers [20] published the 1st version of 'Diffusion of Innovation' theory (DOI or Innovation Diffusion Theory – IDT) aiming to model the spread of new ideas and technologies. In this context diffusion is a process of communicating an innovation to the members of a social group. The key factors of the diffusion are Innovation (the innovation itself), Communication Channels, Time and Social System (including the potential adopters).

According to Rogers [20] the innovation can be anything that is considered new by the potential adopters (an idea, a practice and so on). The perceived characteristics of the innovation under consideration by potential adopters greatly influence the rate of the spread. It is important to emphasize that the following properties should always be interpreted in the context of what is perceived by potential users. The main characteristics of innovation are:

- relative Advantage is meant to express the extent to which the innovation is more advantageous compared to the currently used, usual practice,

- compatibility refers to the extent to which the innovation is similar to the already known and regularly used practices of potential adopters,
- complexity expresses the extent to which potential adopters consider the innovation in question to be complicated and difficult to understand,
- trialability is the extent to which the examined innovation can be tested without consequences,
- observability expresses the extent to which the results of the application of the innovation are visible to other potential adopters [20].

In order to diffuse, the Innovation must be transferred between potential adopters, Communication Channels are the media for that. Mass media channels such as TV, radio and the Internet can reach many people, but interpersonal communication channels can be much more effective in spreading innovations. The greatest challenge is the diversity of people in terms of knowledge, beliefs, education, socioeconomic status etc. [20].

Obviously, Time is needed for any new technology to be adopted, so time is also a part of the model. Every potential adopter needs to go through a so-called 'Innovation Decision Process', in which he/she decides whether to adopt the innovation in question. This goes from the first knowledge of the innovation to the adoption or rejection of it. According to Rogers, the spread of an innovation always follows the pattern of the so-called S-shaped curve [20].
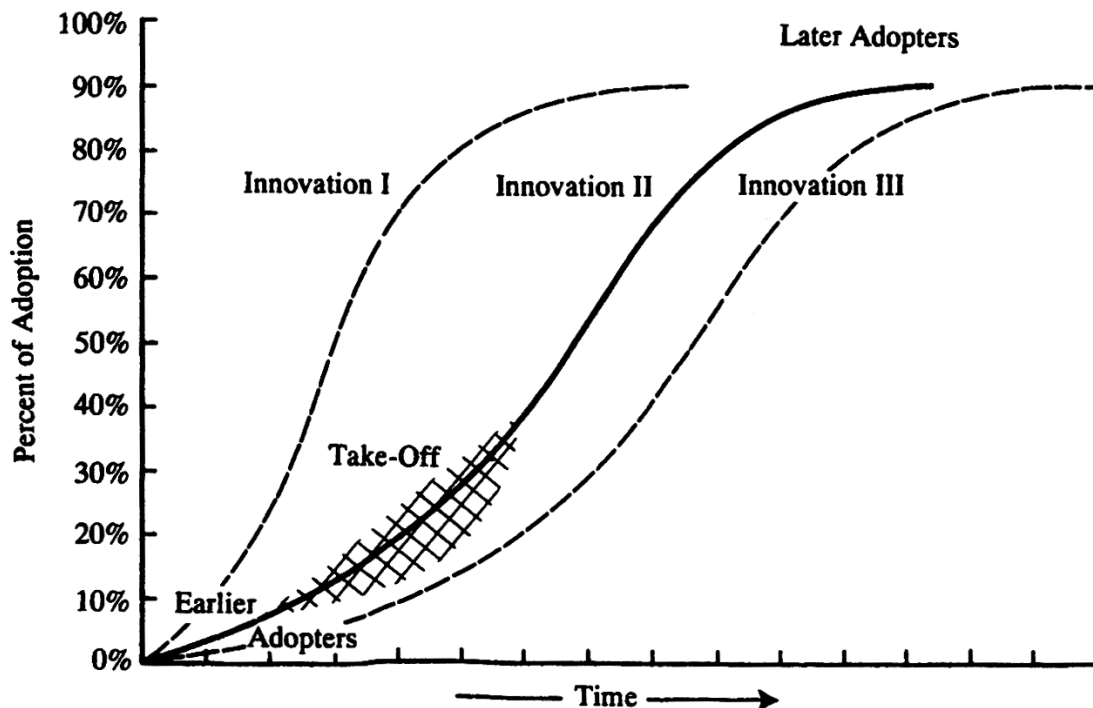
Figure 2. Diffusion process, source [20].

Finally, Social System is 'a set of interrelated units that are engaged in joint problem solving to accomplish a common goal' whose members include potential adopters as well. Adopters can be individuals or organizations depending on the nature of the innovation in question. Adopters can be categorized by the willingness of adoption (from the most to the least willing) as follows: innovators, early adopters, early majority, late majority and laggards [20].

According to Rogers [20] a 'Change Agency' is an organization that is somehow interested in the spreading of the innovation under investigation, and 'Change Agents' are the people who actively participate in promoting the innovation.

Opinion Leaders are those members of the Social System who can influence the opinions of other individuals to a large extent [20].

If the adoption rate of the innovation in question reaches the so-called 'Critical Mass', the diffusion process becomes self-sustaining, and there will be less and less need for the contribution of change agents [20].
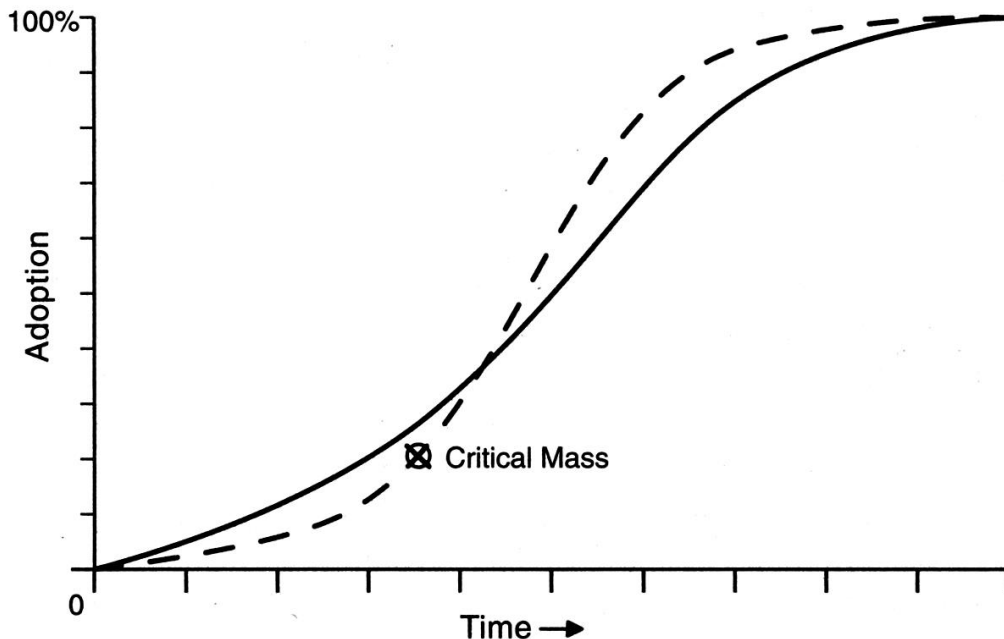

Figure 3. Critical Mass, source : [20].

Oliveria and Martins [7] state that DOI can be applied on organization and individual level as well. The theory has been applied in various fields like e-business and e-procurement so far.

Rogers [20] also states that diffusion research programs were conducted in many fields like agricultural science, healthcare, marketing etc.

SELECTING A SUITABLE FRAMEWORK

As stated earlier, the aim of this paper is to find an applicable framework for modelling the spread of the Hungarian eID card. A suitable model can provide a solid basis for further research on the factors hindering the spread of the electronic functions of the Hungarian eID card, among others.

Considering the characteristics of the Hungarian eID card, a framework with the following properties must be selected:

- can be applied on individual level,
- it focuses on technology or innovation,
- it considers the time factor and the communication aspects of the topic.

TRA and TPB are essentially psychological behaviour models with a long history but are not specifically designed to examine the acceptance or spread of technologies. Although the foundations of the first two theories are used by several other models, like TAM, on their own these frameworks are too generally formalized in order to efficiently use them in further research on this topic.

TAM as its name suggests, focuses on the acceptance of a technology that is available to and known by the users. But acceptance cannot be measured in cases where the technology was not spread to its potential users. Considering that Hungarian citizens do not have enough information regarding the possibilities of the national eID card, a framework with capabilities of modelling the communication aspects is needed.

Although UTAUT combines the best attributes of eight other models, but Communication Channels are not taken into consideration as opposed to DOI.

Based on the requirements above the suitable frameworks can be narrowed down to one framework, Diffusion of Innovations, so in the following this methodology will be in focus.

See the reasons of excluding other frameworks summarized in Table 1.

Table 1. Excluding frameworks from the current research.

Framework	Reason of exclusion
Technology-Organization-Environment (TOE)	Cannot be applied only on individual level
Theory of Reasoned Action (TRA)	Formulated on a too general level
Theory of Planned Behavior (TPB)	Formulated on a too general level
Technology Acceptance Model (TAM)	Does not take 'Communication Channels' into consideration
Unified Theory of Acceptance and Use of Technology (UTAUT)	Does not take 'Communication Channels' into consideration

The Hungarian eID card phenomenon can be best modelled as a diffusion research problem by applying the concepts of the Diffusion of Innovations framework.

APPLYING THE CONCEPTS OF THE DIFFUSION OF INNOVATIONS FRAMEWORK TO THE HUNGARIAN EID CARD PHENOMENON

As stated above, the DOI framework basically divides diffusion into four main elements: Innovation, Time, Communication Channels and Social System. In the next section, it will be discussed how the Hungarian identity document can fit in the concepts of the DOI.

INNOVATION

According to Rogers [20] even a relatively old technology can be considered as an innovation in the scope of a Social System, when it is new to the members. The Hungarian eID has been available to citizens since January 1, 2016, but the chip has only been mandatory since August 2021 [3].

Based on the statistics provided by the Hungarian Ministry of Interior Deputy State Secretariat for Data Registers, only a very small percentage of those entitled have requested the electronic signature functionality of the document over the years, so the ID document and its electronic functions can be considered as an Innovation [21].

The eID card as an Innovation may seem somewhat complex, since several software and a card reader (or an NFC-capable mobile device to replace it) are required for its use. In terms of its Compatibility, it is quite different from the paper-based signature solution used by citizens as a daily routine.

Unfortunately, citizens do not have the opportunity to try out or observe the solution without consequences before applying for it, so the situation is not very favourable in terms of Trialability and Observability.

As an advantage of its use, it can be highlighted that time and paper can be saved by using electronic signatures, but it depends on the individual judgment of the citizens as to what degree of Relative Advantage this represents for them compared to the usual solution.

SOCIAL SYSTEM, ADOPTERS AND CHANGE AGENTS

The concept Social System requires the least explanation. In this diffusion research, Social system means the entire Hungarian society.

All Hungarian citizens are required to have a photo identification card (however, this can also be a driver's license or passport) and citizens from the age of 14 are entitled to apply for an eID card with an electronic signature function. Essentially, the set of citizens defined above corresponds to the concept of Potential Adopters in this case [2].

In further research Opinion Leaders should be identified regarding the eID card in order to actively and effectively facilitate the spread of the benefits of the card.

The main Change Agency is the Hungarian Government itself; Citizens' Administrative Bureaus can also be considered as Change Agencies. The main Change Agents are Government Customer Service Representatives who help citizens with the application for the eID card.

Nyári [6] pointed out that improvements could be made in this area, and that Government Customer Service Representatives should make a greater effort to promote the electronic document during the application process.

According to Somogyi and Nagy [4], great emphasis should be placed on education and training to increase the IT security awareness of employees in the financial sector. Similarly, the use of electronic identification documents and electronic signatures also require sufficient awareness and training on the part of citizens.

TIME

The timeframe of this innovation starts on January 1, 2016. The identity document in question has gone through some alterations over the years. At first the chip was optional, but since August 2021 it is mandatory. In the spring of 2022, the 'eSzemélyiM' mobile application was released making it possible to replace hardware card readers utilizing NFC and WIFI capable mobile devices [3].

The innovation and its use cases continue to develop, since January 2023, a new role-based authentication solution has been available in connection with the electronic signature function of the Hungarian eID card, which allows users to supplement electronically signed documents with an attribute certificate that includes their position in an organization. This is however only available for governmental employees for now [22].

As a result of the amendment of Act C of 2021 [23], a further important development is expected in 2024, when it will be mandatory for citizens to use electronic signatures in real estate transactions. However, it is feared that the prerequisites for this will not be available neither on the technical nor the human side. The preparation of citizens for this change should have already started with the publication of advertisements and educational materials, but currently there is no information whatsoever on the eszemelyi.hu portal [3] referring to this new use case.

With the introduction of newer and newer use cases, society will increasingly rely on the services provided by electronic trust providers and electronic signatures. Taking the electronic signature service to the appropriate security level will become important, so including it to the critical infrastructures in Hungary would be necessary.

Unfortunately, according to the aforementioned statistics by the Hungarian Ministry of Interior, the number of citizens applying for the electronic signature functionality has not increased significantly over the years, as shown Table 2 below.

The data available on the website present the annual number of new eID documents broken down according to the various services that can be requested (e.g., electronic signature function). For the sake of simplicity, we considered the requests as completely new claims (rather than replacing lost/damaged documents). The cumulative amount of the new requests

is also shown in Table 2. However, this is a maximum estimate, meaning that this is the maximum number of valid cards with an electronic signature function. Data also show that there were 11 016 399 eID card requests among the full population of 9 689 010 during the years. This is normal as it covers requests to replace lost/damaged/expired cards [21, 24].

Table 2. New eID cards per year [19].

	2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**July 2023**
New eID cards with eSignature	67 348	122 520	37 523	25 509	20 743	16 246	27 980	17 313
Sum of eID cards with eSignatrue	67 348	189 868	227 391	252 900	273 643	289 889	317 869	335 182

The rate of adoption is very low, even with the aforementioned simplification applied, what's more the annual increase has fallen compared to the initial values (2016 and 2017). In order to reach the Take-off stage and the Critical Mass on the S-shaped curve the annual increase should drastically boost up in the next three to four years. The Critical Mass would be at around 1.5-2 million eID cards with electronic signature function.
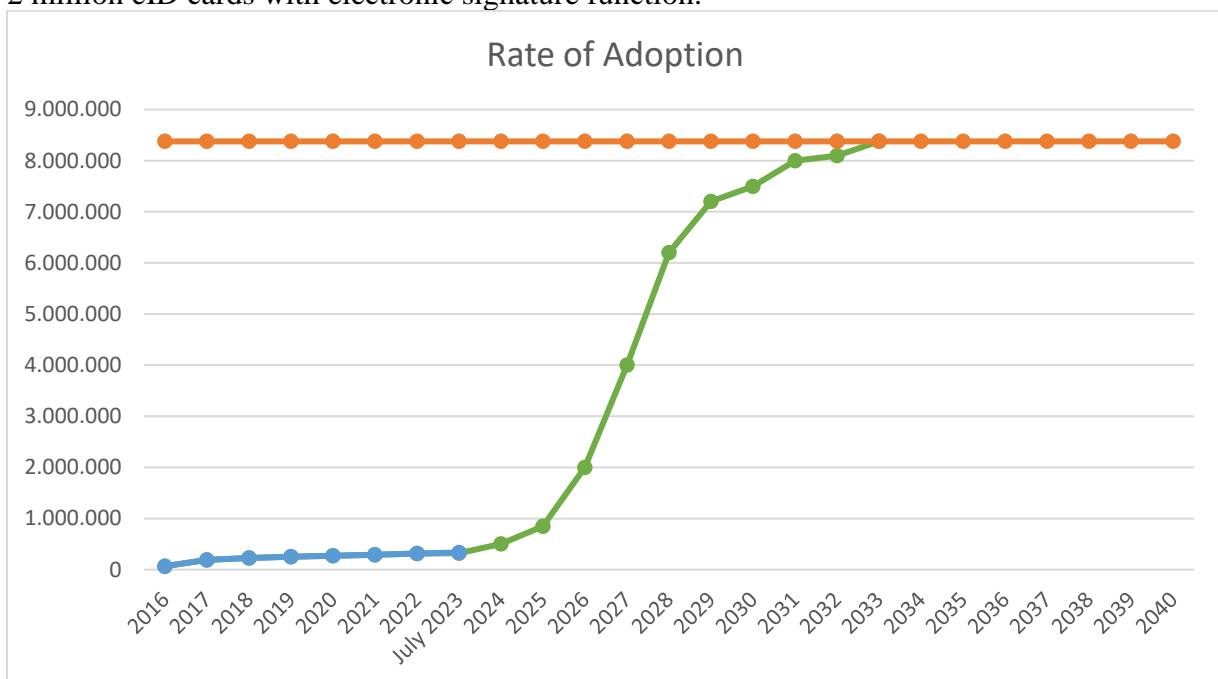
Figure 4. Hungarian eID card Rate of Adoption.

In Figure 4 the blue line shows the requests from previous years until the end of July 2023, the orange line shows the number of eligible citizens (calculated from Hungarian population data for 2022 [24], considered constant 8 377 302 for the entire period), and finally the green shows the S-shaped curve of diffusion estimated based on the data so far.

COMMUNICATION CHANNELS

On one hand there are no TV, radio or internet commercials promoting the Hungarian eID card whatsoever. On the other hand, the eSzemelyi.hu information portal contains all the information necessary to learn about the capabilities and use of the document. It also presents the possible use cases of the document in sufficient detail, except for the soon-to-be-compulsory use case of real estate sales [3].

However, Nyári [6] in 2022 stated that citizens do not have enough information about the document, nor are they aware of the above-mentioned information portal. The participants in the research also highlighted that the use of the document could be embedded in the story of TV series and movies in order to further promote it.

SUMMARY

As more and more use cases appear for electronic signatures, electronic trust service providers and electronic signatures should be considered as critical infrastructure, and this should be reflected in the Hungarian legal environment as well. Defining best practices and security measures for the protection of the infrastructure in sectoral recommendations would be highly advisable like the case of the financial sector as Somogyi and Nagy [4] point out.

The risk analysis of the Hungarian electronic identity card and the electronic signature – as a further research direction – would be vital for the development of adequate infrastructure protection.

There are many theories to examine the adoption of technologies, which utilize different criteria. However, we can only examine the acceptance of technologies if they are already available to potential users. The phenomenon of the eIDAS compliant Hungarian eID card needs a different approach, since its electronic functions are not well known among citizens. It should be considered as a diffusion research problem utilizing the Diffusion of Innovation framework.

The Innovation in question is somewhat complex and less compatible with the solutions currently used by Hungarian citizens. The diffusion process is still in the early phase, since the number of eID cards has not reached the Critical Mass yet.

Based on the annual increase so far, the number of the new e-signature requests should grow drastically for the S-shaped curve to form. In order to start on the S-shaped curve, the electronic functions and benefits of the eID card should be promoted through educational and advertising campaigns. These are absolutely necessary so that the innovation can reach citizens as soon as possible and that they can use it with confidence. Furthermore, gradual introduction of additional use cases would also speed up the spread of the innovation.

The Diffusion of Innovations theory is fully suitable for modelling the Hungarian eID card phenomenon. The basic model outlined in this article needs to be further refined in order to facilitate the wide spread of the eID card. A diffusion plan must be developed to achieve the most efficient and fastest spread keeping the importance of education and IT security awareness in mind.

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ABSTRACT Concisely and clearly written, approx. 250 words.

KEY WORDS Not more than 5 key words, as accurate and precise as possible.

CLASSIFICATION Suggest at least one classification using documented schemes, e.g., ACM, APA, JEL.

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Include figures and tables in the preferred position in text. Alternatively, put them in different locations, but state where a particular figure or table should be included. Enumerate them separately using Arabic numerals, strictly following the order they are introduced in the text. Reference figures and tables completely, e.g., "as is shown in Figure 1, y depends on x …", or in shortened form using parentheses, e.g., "the y dependence on x shows (Fig. 1) that…", or "… shows (Figs. 1-3) that …".

Enumerate formulas consecutively using Arabic numerals. In text, refer to a formula by noting its number in parentheses, e.g. expression (1). Use regular font to write names of functions, particular symbols and indices (i.e. sin and not *sin*, differential as d not as *d*, imaginary unit as i and not as *i*, base of natural logarithms as e and not as *e*, x_n and not x_n). Use italics for symbols introduced, e.g. *f(x)*. Use brackets and parentheses, e.g. {[( )]}. Use bold letters for vectors and matrices. Put 3pt of space above and below the formulas.

Symbols, abbreviations and other notation that requires explanation should be described in the text, close to the place of first use. Avoid separate lists for that purpose.

Denote footnotes in the text by using Arabic numerals as superscripts. Provide their description in separate section after the concluding section.

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