

INFRAREDESIGN® KAO ELEMENT IDENTITETA GRUPE

INFRAREDESIGN® AS AN ELEMENT OF GROUP IDENTITY

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SAŽETAK

Iz perspektive socijalne psihologije i teorije socijalnog identiteta, interesnu grupu možemo definirati kao dinamičku supkulturu koju čine više ljudi u međusobno zavisnosti i interakciji koji dijele zajednički cilj. Navedena grupna obilježja grade i održavaju grupnu kohezivnost među njezinim članovima – ovisno o vrsti interesa, a pripadanje grupi omogućava pojedincima izgradnju vlastitog identiteta kroz identitet grupe te zadovoljenje određenih potreba. Ono što čini interesne grupe različitim jesu specifična obilježja koja stvaraju grupni identitet pojedine grupe kao što je vrsta aktivnosti, vrsta i stil odjeće, verbalni i neverbalni stil komuniciranja, stavovi i vrijednosti grupe, njihova vizija i misija, te grafička obilježja kao što su dizajn, logo i slogan. Ogleđavajući grupni identitet grupe i pripadanje toj grupi, grafička obilježja su ujedno i sredstvo kojim interesne grupe jačaju i šire svoju vidljivost u javnosti. Stoga sve više grupa ima potrebu zaštititi svoja grafička obilježja, a time i svoj grupni identitet, u čemu infrared dizajn može imati značajnu ulogu.

Ključne riječi: *infrared dizajn, grupni identitet, obilježja grupe, interes, logo*

ABSTRACT

From the perspective of social psychology and social identity theory, an interest group can be defined as a dynamic subculture made up of several people in mutual dependence and interaction who share a common goal. The aforementioned group characteristics build and

maintain group cohesiveness among its members - depending on the type of interest, and belonging to a group enables individuals to build their own identity through the group's identity and satisfy certain needs. What makes interest groups different are the specific features that create the group identity of each group, such as the type of activity, type and style of clothing, verbal and non-verbal communication style, attitudes and values of the group, their vision and mission, and graphic features such as design, logo and slogan. Reflecting the group's group identity and belonging to that group, graphic features are also a means by which interest groups strengthen and expand their visibility in the public. Therefore, more and more groups have the need to protect their graphic features, and thus their group identity, in which infrared design can play a significant role.

Keywords: *infrared design, group identity, group characteristics, interest, logo*

1. UVOD

1. INTRODUCTION

*„And God saw the light, and it was good; and God divided the light from the darkness.”
Genesis 1,4*

Let this passage from the Genesis be an appropriate and intelligible starting point for what we call Infraredesign®. Even though Infraredesign® is not a phenomenon, it can be viewed as a reflection or a consequence of a phenomenon. Because light is a phenomenon. For were there no light, there would be no colours! And in the Infraredesign®

technology, colour is the most important. As made clear by Genesis 1,2 where it says “and darkness was over the surface of the deep” – the deep and the darkness are the full meaning of the lack of light, thus of colour as well.

Still, is Infraredesign® a phenomenon? If going by the definition: phenomenon (Greek: Φαινόμενον) that which is seen, that which appears, appearance) (<https://www.enciklopedija.hr/natuknica.aspx?id=19236>), then it certainly is. Why?

Because in products prepared using Infraredesign® technology, things can be both visible and invisible, but they undoubtedly emerge. Under specific conditions, of course. From the titles of works about Infraredesign®, one can notice the frequent mention of the term “hidden”, even though it needn’t be deliberately hidden. It is, in fact a matter of pragmatic needs for making such diverse products.

What kinds of products? The core of Infraredesign® technology is the use of specially prepared colours that conceal the possibility of showing/appearing images that are visible or invisible to the naked eye. So, all the wisdom is contained in the phenomenon known as “light.” Let there be light (Genesis 1:3)!

Now, about light and Infraredesign®. There is another concept to consider: the concept of colour and dye, in the sense of the physical realization of a substance that creates the impression of colour as perceived by the human eye. Therefore, colour and dye are different things. Dye is a physical realisation, while colour is the perception of a form of light under the given circumstances[1]. And that is the essence!

Let us reiterate: without light, there would be no colours—excluding physiological and anatomical deficiencies in living beings, not just humans, that might limit such perceptions.

The ability to create two images in the “same” place is precisely what leaves great application potential for Infraredesign® technology. By simply following the titles of works dealing with this phenomenon, one can see the various fields where Infraredesign® can be applied or utilized.

This paper aimed to demonstrate that

Infraredesign® design, as an innovative technology in the field of visual communication, can have significant applications in researching group identity and the sense of belonging within social psychology and group sociology. In the conducted pilot study, efforts were made to protect the privacy of both individuals (GDPR) and the group as a whole by abstracting the fundamental reason for the group's formation.

Specific features that create the group identity of a particular group are, in order: type of activity, type and style of clothing, verbal and non-verbal communication style, group attitudes and values, vision and mission. From the perspective of this work, additional features include the graphical characteristics of the group, such as design, logo/emblem, and group slogan. This paper aimed to demonstrate that the possibilities offered by Infraredesign® technology can influence the integrity of the group.

A simple question arises: if a group has its own characteristics by which it identifies/expresses/communicates itself to its environment, and these features can be created or manufactured with Infraredesign® technology, what benefit does the group have?

Specifically: if a group has a symbol, trademark, logo, or uniform, using Infraredesign® technology these features can be printed in a way that they cannot be replicated. New features can be made, but only in the same unique manner.

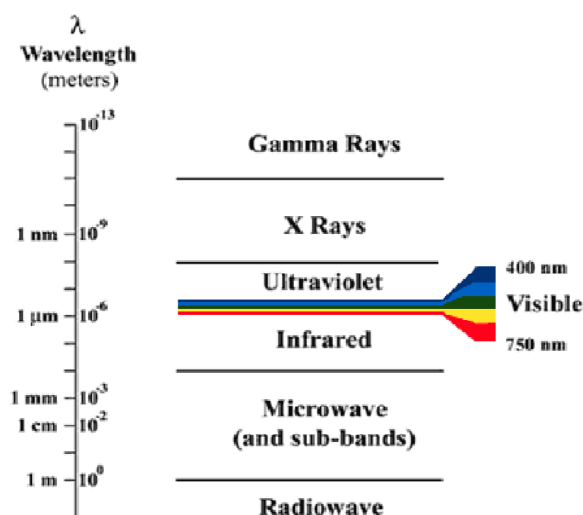
1.1. INFRAREDESIGN® – JOŠ MALO UVODNO!

1.1. INFRAREDESIGN® – JUST A LITTLE MORE INTRODUCTION!

From a scientific perspective, especially physics, the concept of light can be observed through the electromagnetic spectrum of radiation. The electromagnetic spectrum encompasses the entire range of electromagnetic radiation, including radio waves, infrared rays, visible light, X-rays, and gamma rays. Specifically, according to the wavelength of radiation, the spectrum covers the range from 10-13 meters for gamma radiation to 1 meter for radio waves (Figure 1). What the human eye can see under normal conditions is

only a segment of the spectrum that includes the aforementioned forms of electromagnetic radiation. This is the range from 400 nm to 750 nm [2].

The part of the spectrum interesting for Infraredesign® is the section from 700 nm to 1000 nm, which is the borderline area of visibility to the naked eye.



Slika 1 Elektromagnetski spektar

Figure 1 Electromagnetic spectrum

Infraredesign® is essentially a printing technique that uses special colour models. The RGB colour model consists of three primary colours: Red, Green, and Blue. By mixing these three colours, all other secondary and tertiary colours are obtained. RGB is an additive light colour mixing model. When the intensities of red, green, and blue are maximized, white colour is produced, while black is produced by minimizing the intensities. This is similar to sunlight, where all colours of the spectrum combine to form white, and when the sun is absent, it is dark.

The CMYK colour model consists of four primary colours: Cyan, Magenta, Yellow, and Key plate (black). This model is used in printing. CMYK is a subtractive colour mixing model, meaning that by adding all CMYK colours, black is obtained. This involves mixing colours by subtracting light, starting from white light (paper) and subtracting light through the addition of CMYK colours which absorb light. The three CMY colours when mixed are imperfectly surrounded by black, so black ink is added to the print.

Infraredesign® is based on the idea of combining graphics of two groups of colours with the same colour tone – V colours (visual) and Z colours (near-infrared). It is important to emphasize the concept of twin colours introduced through the same colour in the visual spectrum within the RGB colour filling system (red, green, blue). Twin colours differently absorb the wavelength of near-infrared (NIR) light. Twin colours differ only in the level of NIR light absorption at 1000 nm [3].

2. OSJEĆAJ PRIPADNOSTI I IDENTITET GRUPE U KONTEKSTU SOCIJALNE PSIHOLOGIJE I SOCIOLOGIJE GRUPE

2. THE SENSE OF BELONGING AND GROUP IDENTITY IN THE CONTEXT OF SOCIAL PSYCHOLOGY AND GROUP SOCIOLOGY

Next, we will review the use of symbols in various social groups, as well as the possibilities of their protection in the modern era, contemporary society, and the ubiquitous digital age.

By definition, a group is two or more people who interact with each other and depend on one another, meaning that they influence each other due to their needs and goals [4].

A group is also described as a social community of two or more individuals who, through interaction and possessing a certain structure, norms, and awareness of their belonging to the group, work toward achieving common goals [5]. Brown considers a group as a set of people bound by a common experience or goal, whose connection is based on microsocial structure or mutual interaction and who share a concept of themselves as members of the same social unit [6].

The social identity theory was developed by theorists Tajfel and Turner to explain how and why people form social identities and how they behave in intergroup relations. According to this theory, individuals derive much of their personal value and identity from membership in certain social groups, wherein group symbols become important as they visually and conceptually

embody boundaries between us and them, enabling social comparison and fostering group cohesion [7].

Group identity and group belonging are topics that engage theorists from various fields—social psychologists, sociologists, philosophers, and others. Social psychologists have conducted and continue to conduct research that has led to the establishment of several theories about group identity and group belonging. Baumeister and Leary proposed the need to belong theory as a fundamental human motivation, that is, the innate human need to establish and maintain interpersonal relationships as inherently social beings. The need to belong is the reason why people join various groups in which they share specific values and norms that contribute to a sense of community and security (family/friend circles, sports teams, professional communities, and subcultural groups such as motorcycle/cycling/hiking/alpinism/fishing clubs, fan groups, hiking societies, etc.) [8].

Belonging to a group among its members fosters the feeling of sharing common values and goals (facilitating positive identification with groups that share common beliefs and interests), performing joint activities (strengthening bonds and the sense of community), and symbolic belonging (wearing clothing with group symbols/trademarks, using specific jargon, etc.).

Aronson, Wilson, and Sommers emphasize several advantages of belonging to a particular group—groups are an important part of an individual's identity, helping define who we are and serving as a source of social norms, explicit or implicit rules that define what is (un)acceptable behaviour. Likewise, groups help individuals achieve goals they could not accomplish alone [9].

The sense of belonging to a group develops through various psychological and social processes: norms and values (regulating behaviour and ensuring cohesion), rituals and symbols (collective/group identity and differentiation from other groups), and social support (intra-group support particularly important in challenging or stressful situations). The awareness of belonging to a group, although not always clearly or equally intense, exists among members of all groups and

is rightfully considered one of the constitutive elements of a group in the narrower sense [5].

One of the strongest ways to express group belonging is through the use of visual symbols, such as wearing uniforms, clothing items, and objects with group emblems or symbols, which strengthens the feeling of unity, belonging to something greater than oneself, and mutual connection within groups [10]. Geertz (1973) and Mach (1993) also noted that most groups use some form of symbol or common mark of identity, attributes, values, and history of the group. Symbols represent an important element of the group, and their use conveys desired impressions to others, especially when group members are in a competitive context. Even when certain content is associated with specific symbols, it can influence not only the attitudes and behaviour of group members but also shape impressions of other individuals [11, 12, 13].

Wearing specific clothing or visual accessories can serve several key functions: visual identification and differentiation (e.g., wearing sports jerseys, motorcycle jackets/vests, hiking shirts for easier mutual recognition and distinguishing from members of other groups) [14], increased sense of unity and connection (uniformity in dressing), emotional and symbolic value (wearing items with the group's logo/symbol/trademark, fan scarves, motorcycle jackets/vests with club insignia, hiking society keychains), and fostering group cohesion (wearing the same symbols serves as a reminder of shared values and goals). By adopting clothing styles, individuals within a group demonstrate loyalty and connection to the group. Diverse stylistic choices (clothing, fashion accessories, hairstyles, use of cosmetics, tattoos, and piercings) function as visual markers for evaluating members within the group, including influence and hierarchy within the group. Members who adhere to norms of dress, behaviour, and communication tend to be more influential and more likely to attain leadership positions within the group. Conversely, members who deviate from group norms often become subjects of conversation or marginalization [15].

Volkan [16] argues that members strive to strengthen, protect, and maintain group identity through two principles: maintaining dissimilarity

and creating boundaries, gaps, or tangible spaces between groups. By maintaining dissimilarity, a system is established where one group must not be the same or even approximately similar to another. Boundary creation, from a historical perspective, has always been present and significant, but Volkan believes that a psychological boundary must also exist, which is far more important than a physical boundary.

Historically, symbols have played a key role in shaping collective identities and expressing belonging to specific social, political, religious, and ethnic groups. Their function was not limited to visual representation of communities but also acted as means of communication, differentiation, and legitimization of power within societies. Early forms of symbolism and identity are well-known, such as the use of petroglyphs, totems, and other visual depictions in Palaeolithic and Neolithic communities dating back as far as 17,000 years; symbolism in ancient civilizations [hieroglyphs (Egypt), seals (Mesopotamia), heraldic motifs (Greece), and flags/vexilla (Roman Empire)]; medieval heraldry (coats of arms) and religious symbols used to identify (genealogy) noble families and military orders; national and ideological symbols in the modern era (flags, coats of arms, and national anthems); and symbols in contemporary society and the digital age (corporate logos, political slogans, and digital emojis).

Throughout history, symbols served as powerful means of identification, differentiation, and social cohesion. Their role in shaping group identities has evolved in accordance with technological, social, and political changes. However, their fundamental function has remained unchanged—the creation of a sense of belonging and unity within a particular group or community.

Given the importance of the sense of belonging, visual symbols and emblems also play a crucial role in maintaining group identity and ensuring membership exclusivity. Consequently, it is important to emphasize that group members are sensitive to forgeries/fakes or unauthorized use of their signs/symbols. Group members perceive symbols as marks of belonging that must be earned (particularly among motorcyclists/bikers). This sensitivity arises from factors such as the violation of the group's authenticity and

exclusivity, ignorance of group norms and values, which can lead to negative perceptions of the group within the community and, consequently, the risk of damaging the group's reputation.

To protect themselves from forgery and unauthorized use of their symbols, groups have at their disposal various legal and social mechanisms as well as technical methods of protection.

Legal options include: registration of a trademark, copyright protection, industrial design rights, legal sanctions against counterfeiting, and international protection (particularly for globally recognized groups/organizations) [17].

Possible social mechanisms for protecting group symbols include: establishing strict internal rules and codes of conduct (defining who and under what conditions certain symbols can be worn, initiation processes to fulfil specific requirements, e.g., permission to wear club emblem vests), authenticity checks within the community (specific methods for recognizing authentic markings), social pressure and condemnation, preserving exclusivity through events (organized exclusively for verified members), and credibility marks (special versions of symbols, limited editions of clothing/badges for members with specific status) [18].

Technical protection methods offer additional ways to safeguard group symbols beyond the aforementioned legal options and social mechanisms. Technical protection methods may include the use of the following advanced technologies [2, 19, 20]:

- Infrared (IR) design – marks containing infrared elements that can be verified only using specialized devices;
- Holographic and UV rays – technologies that are difficult to copy and enable quick authenticity verification;
- RFID chips and digital authentication – radio frequency identification enables fast verification of ownership of the symbol;
- Blockchain protection – each authentic emblem can have a unique digital record that makes counterfeiting difficult;
- QR codes – allow digital authenticity

verification by scanning with various devices (e.g., smartphones).

The use of infrared (IR) design as a method of technical protection for visual group emblems/symbols is a topic that will be further explained in the continuation of this paper.

3. KORIŠTENJE INFRARED (IR) DIZAJNA KAO TEHNIČKE METODE ZA ZAŠTITU IDENTITETA GRUPE

3. THE USAGE OF INFRARED (IR) DESIGN AS A TECHNICAL METHOD OF GROUP IDENTITY PROTECTION

Group identity is crucial for defining belonging to a particular organization, community, or institution. Symbols and emblems that visually represent the group can be subject to misuse. Infrared (IR) technology enables the integration of security visual elements invisible/hidden to the naked eye, which are visible only under specific infrared light using specialized devices, thereby increasing security and making counterfeiting more difficult. Infrared design (IR) represents an innovative and effective method of technical protection for the visual characteristics of a group (symbols/trademarks), and thus the identity of its members.

Infrared radiation encompasses electromagnetic radiation with wavelengths longer than those of visible red light (570 nm–770 nm, near IR) but shorter than radio waves. It ranges approximately from 770 nm to 1000 nm.

Infrared design uses special dyes and inks that react to infrared light. Such elements may be invisible to the naked eye but are clearly recognizable when viewed through specialized IR cameras and/or sensors. This technology has already found application in the protection of official documents, banknotes [21], and product authenticity, and its potential use in the context of group identification is increasingly being researched.

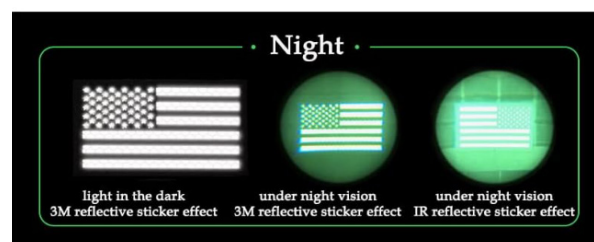
The application of Infrared (IR) technology provides multiple benefits to users – protection against counterfeiting (impossibility of simple

copying with standard printing techniques), discreet authentication (using IR scanners does not compromise the aesthetic appearance of the symbol), and the possibility of integration with other technical protection technologies for group symbols (combining with RFID chips, holographic elements, and QR codes to achieve multilayer protection).

Practical applications of Infrared (IR) technology are numerous – protection of official emblems and insignia of police, military, and government organizations (Figure 2), identification of organization members, branding and protection of commercial/corporate products and interests, ...

Reflective Effect

3M Reflective Stickers/IR Reflective Stickers



Slika 2 Efekt IR reflektirajućih naljepnica

Figure 2 IR Reflective stickers effect

The application of Infrared (IR) technology can significantly reduce the risk of misuse and counterfeiting, especially in cases where it is crucial to preserve the authenticity of the visual identity of (in)formal groups, as well as official documents, securities, banknotes, packaging, products, and brands. Further research and technological development will enable broader application and increased accessibility of this method across various sectors.

3.1. ISTRAŽIVANJE

3.1. RESEARCH

What primarily interested us was whether members of different groups recognize the possibilities/potentials of applying Infrared (IR) technology in protecting visual features that are important both for their sense of belonging and for the identity of the group to which they belong.

To obtain an answer to the question of whether members of various subcultural groups would choose to use Infrared (IR) protective technology in creating the group's visual features, data were collected through a completely anonymous pilot survey.

The aim of the pilot study was to examine the role of visual and symbolic features in forming, strengthening, and maintaining identity within different subcultural groups, as well as their connection with individual and collective value systems. The pilot study analysed the perception of group members regarding the importance of visual identity elements, such as logos, slogans, trademarks, colours, clothing, and equipment, in the context of creating a sense of belonging and mutual connection. Additionally, the study aimed to determine the extent to which individuals' personal values correlate with group values and the influence of perceived opinions within the group on identification with it. Special emphasis was placed on the possibility of implementing innovative technologies, such as Infrared (IR) design, in creating visual features, analysing respondents' readiness to adopt new design and technological approaches to protect the group's visual features, thereby enhancing influence on group identity.

A structured online questionnaire was used as the measurement instrument. The target group consisted of members of various subcultural groups/associations (members of motorcycle, cycling, hiking/alpinism, fishing clubs; hiking societies; choirs; fan groups; carnival and other groups/associations, etc.)

The online survey questionnaire was distributed to potential participants via email. Along with the link to the online questionnaire, all potential participants were sent written instructions requesting them to complete the survey and forward it to their acquaintances, colleagues, and people they thought might be interested. This technique, often called the snowball sampling method, relies on initial participants recruiting additional participants, thereby enabling faster access to a larger population of respondents.

Since we were uncertain how well members of different subcultural groups were informed about the possibilities of Infrared (IR) design technology, the written instructions included additional information and possible sources of information (links to two articles) about Infrared (IR) design.

The questionnaire consisted of 16 closed-ended questions. For some questions, a Likert scale with (usually) 6 levels was used (1 – lowest to 5 – highest rating; respondents were also given the option to choose No answer). Two questions related to socio-demographic status (age and gender).

The pilot study included responses from $N = 42$ respondents ($F = 25$; $M = 17$) aged over 18 years. The largest number of respondents, 13, indicated they belonged to a group of hikers/alpinists, followed by 10 respondents affiliated with a fan group, 7 cyclists, 6 motorcyclists, 3 respondents belonging to a church group, and 3 belonging to a carnival group.

Respondents were also asked to state their status within the group. Five respondents identified as group leaders, 10 were part of the group organization, 19 participated in activities, and 8 were sympathizers of the group.

Respondents were asked to identify which of the listed features (logo, slogan, trademark, special

colours, clothing/uniform, equipment, vision, mission) are used by their group.

Respondents belonging to the motorcycle group stated that their features are: logo, trademark, clothing, equipment, and vision. The most important feature for them is clothing (uniform), while the least important is the slogan. The features that build the connection between members are the trademark, special colours, and clothing (uniform), while clothing (uniform) also represents a feature that strongly reflects group belonging.

Cyclists stated that their features are: logo, slogan, clothing (uniform), and equipment. They consider equipment their most important feature, and vision the least important feature. The features that build the connection between members are equipment, special colours, and clothing (uniform). At the same time, equipment represents a feature that strongly reflects group belonging.

Respondents belonging to the hikers/alpinists group consider the logo the most important feature, and vision and mission the least important features. They state that their features are: logo, slogan, trademark, special colours, clothing (uniform), equipment, vision, and mission. The features that build connection among group members are clothing (uniform) and equipment, while the logo represents a feature that strongly reflects group belonging.

The same features are noted by respondents belonging to the church group, for whom the most important features are: slogan, trademark, clothing (uniform), and equipment, while the logo is the least important. The features that build connection among group members are the logo and clothing (uniform). At the same time, clothing (uniform) represents a feature that strongly reflects group belonging.

Respondents belonging to the fan group have the same features as the hikers/alpinists group, with the most important features being the slogan and clothing (uniform), and the least important being the mission. The features that build connection among group members are the slogan and clothing (uniform), while the trademark represents a feature that strongly reflects group belonging.

Regarding the question about using Infrared design to protect the group's visual features, the majority of respondents indicated that they would agree to use it if there was a purpose or if most group members also agreed to the use of this technology. In terms of the importance of marking the group's visual identity with Infrared design, they considered the most important elements to highlight (in order): logo, trademark, equipment, slogan, and clothing.

When asked to rank the colours they would use in creating visual symbols visible under infrared light, respondents chose the following order of colours: red, purple, white, yellow, indigo, green, and blue.

4. ZAKLJUČAK 4. CONCLUSION

The results of the pilot study indicate a high level of awareness among respondents regarding the importance of visual features in the context of group identity and sense of belonging. The most frequently emphasized features among different subcultural groups include the logo, trademark, and clothing (uniform), with respondents perceiving these features as key elements for identification as well as connection within the group.

The pilot study also showed that there is potential for the application of Infrared (IR) technology in protecting the visual features of groups, with respondents expressing willingness to use it if there was a clear purpose and/or if it was accepted by the majority of group members. When selecting colours to be used for visual symbols visible under infrared light, respondents preferred red, purple, and white.

These findings suggest the possibility of further development and implementation of Infrared (IR) technology in protecting the visual identities of various subcultural groups. However, the results also highlight the need for additional information and education about the advantages and possibilities of applying this technology to increase its acceptance level within the targeted populations.

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• **Irena Miletić** - MS Computer Science - She studied at the Polytechnic of Rijeka and earned the title of Specialist in Business Information Systems. She completed the CARNET e-Learning Academy (program: e-Learning Management). She works at the Department of Psychology at the Faculty of Humanities and Social Sciences, University of Rijeka, as an IT advisor. She is the faculty coordinator/administrator of various information systems. She is the graphic editor of the journal *Psihologijske teme/Psychological Topics*. Within the Centre for Applied Psychology, as an IT expert/collaborator, she is involved in research within scientific/professional projects related to e-Learning and the use of IT in education (funded by: CARNET; University of Rijeka). As a co-author, she has published several scientific/professional papers and a chapter in a book (published in a monograph). She is also the editor and graphic editor of various publications published in print and/or digital editions of the Faculty of Humanities and Social Sciences at the University of Rijeka and the Croatian Psychological Society. She is a recipient of the State Award for the Popularization and Promotion of Science (in the field of Social Sciences) for 2013 (as a team member).

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• **Nataša Peteh** - MA Psych. - Professor - She completed her psychology studies at the Faculty of Humanities and Social Sciences in Rijeka and earned the title of graduate psychologist and psychology teacher. She was doing an internship at the Center for Social Welfare (CZSS) in Pula, where she familiarizes herself with social welfare institutions and various issues concerning children and parents. Since 2014, she has been employed in the primary education system as a professional associate, and since 2022, she holds the title of mentor. At school, she is involved in various Erasmus projects and trainings. As a lecturer, she has participated in numerous county and inter-county professional councils of psychologists and many other subject meetings. As an external associate, she cooperates with several elementary schools in Pula. She has participated in projects such as “Community Support Trip B” and worked on the resocialization of homeless people; “Love your heart” as a co-author of the manual, lecturer, and advisor for visiting nurses in preparing workshops for obese patients. In collaboration with Naklada Slap and four co-author psychologists, she is working on publishing the school readiness test "TestOŠ," which is expected to be realized by the end of April 2025.

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