TEHNOLOŠKI VIDIK BELEŽENJA BARV PRI DOKUMENTIRANJU IN VREDNOTENJU ARHITEKTURNE DEDIŠČINE

TECHNOLOGICAL ASPECTS OF RECORDING COLORS IN DOCUMENTATION AND EVALUATION OF THE ARCHITECTURAL HERITAGE

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Ključne besede
arhitekturna dediščina; barva; senzorji

Izvleček

V članku je predstavljen odnos družbe do barve kot elementa arhitekturne kulturne dediščine v okviru zakonskih določil, s stališča prakse in z vidika mednarodnih dokumentov. Izpostavljeno je vprašanje vrednotenja dokumentacije kot sestavine dediščine ter pomen njenega hranjenja in nadgrajevanja med vso življenjsko dobo dediščine. V nadaljevanju je predstavljeno merjenje barv, tehnološko ozadje digitalne fotografije, fotografiranje z velikim dinamičnim razponom in lasersko skeniranje. Ugotovljeno je bilo, da ni tehnoloških ovir za beleženje podatkov o barvah. Obstajajo sicer nekatere omejitve pri interpretaciji in nadaljnji reprodukciji zapisanih informacij, še pomembnejša pa je vrzel med splošnim razumevanjem in upoštevanjem pomena in deklarirano vrednostjo dediščine z njeno barvno komponento na eni strani ter vsebino shranjenih dokumentov o barvi na drugi strani. Razprava je zatem razširjena na mednarodna načela in prakso dokumentiranja dediščine v širšem smislu in v povezavi z barvno komponento dediščine. Ta je obravnavana z vidika točnosti, natančnosti in enoznačnosti zabeležene informacije in z vidika vpliva načrtovanja na ustreznost in uporabnost podatkov o njej. Članek se zaključi z razmislekom o lastnikovi vlogi pri ohranjanju arhitekturne kulturne dediščine in dokumentacije o njej.

Key words
architectural heritage; color; sensors

Abstract

This article presents the attitude towards color as an element of architectural cultural heritage in the context of the legislative requirements, from the standpoint of practice, and in the perspective of international charters, conventions and other doctrinal texts. It highlights the questions of the valuation of documentation as a component of heritage, and the importance of its conservation and upgrading during the entire lifetime of heritage. Next, the measurement of color, the technological background of digital photography, high dynamic range imaging and laser scanning for recording the color information on heritage are presented. It was established that there is no technological barrier for recording information on colors. There are certain limitations in the interpretation and further reproduction of the recorded information. However, the gap between the common understanding of and regard for the importance and the declared value of heritage with its color component on the one hand and the contents of stored documents about color on the other hand is more important. The debate is thus extended to the international principles and practice of documenting the heritage in the broad sense and in connection with its color component. This is discussed in terms of accuracy, precision and singularity of the recorded color information and the impact of planning on the relevance and usefulness of the data about it. The article concludes with a reflection on the owner's role in preserving the architectural and cultural heritage and its documentation.

1. Uvod

Eno izmed osrednjih opravil pri celovitem ohranjanju kulturne dediščine je dokumentiranje. Gre za proces, na osnovi katerega se lahko prepoznata pomen in vrednost dediščine. Vrednotenje dediščine pa se odraža v dokumentaciji o njej. Pogojeno je s trenutkom, ko je bila vrednost dediščine prepoznana, s ponavljanjem beleženja pa se spremljajo njene lastnosti skozi čas.

V praksi pri pripravi na posege na dediščini na eni strani nastajajo novi dokumenti, na drugi pa se odpira vprašanje dostopnosti in uporabnosti obstoječega gradiva. Beleženje stanja (kaj, kako natančno beležiti/spremljati ...) je odvisno od razpoložljivih virov, izbor metode pa vsak s svojega vidika pogojujejo lastnik, konservator in projektant. Odločitev ni nujno vezana na vrednotenje ali pomen dediščine. Ne glede na izbrano metodo morajo rezultati izpolniti tri ključne zahteve: dolgoročna berljivost izdelanega gradiva, možnost nadgradnje in ponovne interpretacije izvornih podatkov ter preprosto upravljanje izdelkov za končnega uporabnika.

V članku se preverjata pomen in vrednost barvnega tona gradbenih površin v procesu ohranjanja dediščine. Z vidika zakonodaje, mednarodnih dokumentov, dokumentiranja in s tem povezanega tehnološkega razvoja, ohranjanja enoznačnosti informacije skozi čas ter drugih dejavnikov je bil z različnih zornih kotov raziskan odnos družbe do barve.

Glavni namen članka je opozoriti na vrzel v razumevanju in upoštevanju vzročno-posledične povezave med vrednotenjem dediščine in vsebino dokumentacije o njej. Namen članka je tudi okvirno prikazati merjenje barv, tehnološko ozadje digitalne fotografije, fotografiranje z velikim dinamičnim razponom in možnosti zapisa tako merske informacije kot informacije o barvi z metodo laserskega skeniranja. Rezultati dokumentiranja, pridobljeni s temi metodami, so za nadaljnjo uporabo, nadgrajevanje, dopolnjevanje, vključevanje v druge zbirke podatkov, analiziranje in raziskovanje primernejši kot rezultati, pridobljeni z drugimi metodami. Z njihovo uporabo se zmanjša možnost napačne interpretacije.

1. Introduction

One of the key tasks in the overall preservation of the cultural heritage is cultural heritage documentation. It is a process, on the basis of which the importance and the value of heritage are recognized. In addition, the value of heritage is reflected in the documentation relating to it. It depends on the moment when the value was recognized. Its properties are monitored over time by repetitive recording.

In practice, in preparations for heritage interventions on one hand new documents are created and on the other there appears the question of their accessibility and usability. Recording (what to record, how precisely it has to be done ...) depends on the available resources; the owner, conservator and design engineers influence the selection of the method, each from their own point of view. The decision is not necessarily tied to the meaning and value of heritage. Irrespective of the method, the results must meet three key requirements: a long-term readability of the produced documents, the possibility of upgrading and re-interpretation of the original data, and easy management of the results for the end user.

In the article the significance and the value of the color tone of building surfaces in the process of heritage conservation have been checked. The attitude towards color was verified from different angles – in terms of legislation, international documents, documentation and recording with the related technology development, and the conservation of the singularity of information over time.

The main purpose of this article is to draw attention to the existence of gaps in understanding and considering the importance of the cause and effect relationship between the heritage value and the contents of the documentation relating to it. The purpose of this article is also indicative display of color measurement, technological background of digital photography, high dynamic range imaging and the possibility of recording dimension and color information with the laser scanning method. The recorded data obtained with the listed methods are more suitable for further use, upgrading, updating, integration with other databases and for analysis and research than those obtained by other methods. With their use the possibility of future misinterpretation is reduced.

1.1. Attitude towards Colors

When reviewing local publications in the field of conservation it can be established that Slovenian authors take no specific stance towards color. Studies revolve around composition, iconography, contrasts between light and dark, with the emphasis on painting. In the past, professionals believed that the architectural history and monumental value of an object are always revealed best during renovation. The method of research was to a large extent invasive and loss of the original substance was common. Color tones of unpainted facades were not at the top of the list of values to be protected on a particular monument. In the past conservation profession or perhaps the whole society placed no special emphasis on the color layers. The opus of the architect Le Corbusier has not yet been entered on the World Heritage List, despite efforts to do so, due to lack of "evidence of the original exterior colors in many buildings, such as the Villa Savoye" [ICOMOS, 2009: p. 137]. In 2011 evaluators assessed that the "conditions of integrity and authenticity for the series have not been fully justified and for individual sites, the conditions of authenticity and integrity have only been partly met" [Ibid.].

Colors play a certain role in architecture. Current standpoints of the profession and the public can be deduced by monitoring the media, in particular related to the issues of spatial planning and the economic crisis. The trend of return to existing condition can be noticed. Systematic professional regulation is obviously needed and will have a positive impact on the management of the architectural heritage (hereinafter: heritage). International experience shows that to a large extent the heritage protection (approximately thirty thousand units in the Slovenian registry) is regulated very well by spatial planning legislation. Current legal protection mechanisms already allow conservator supervision over planning and interventions. Of

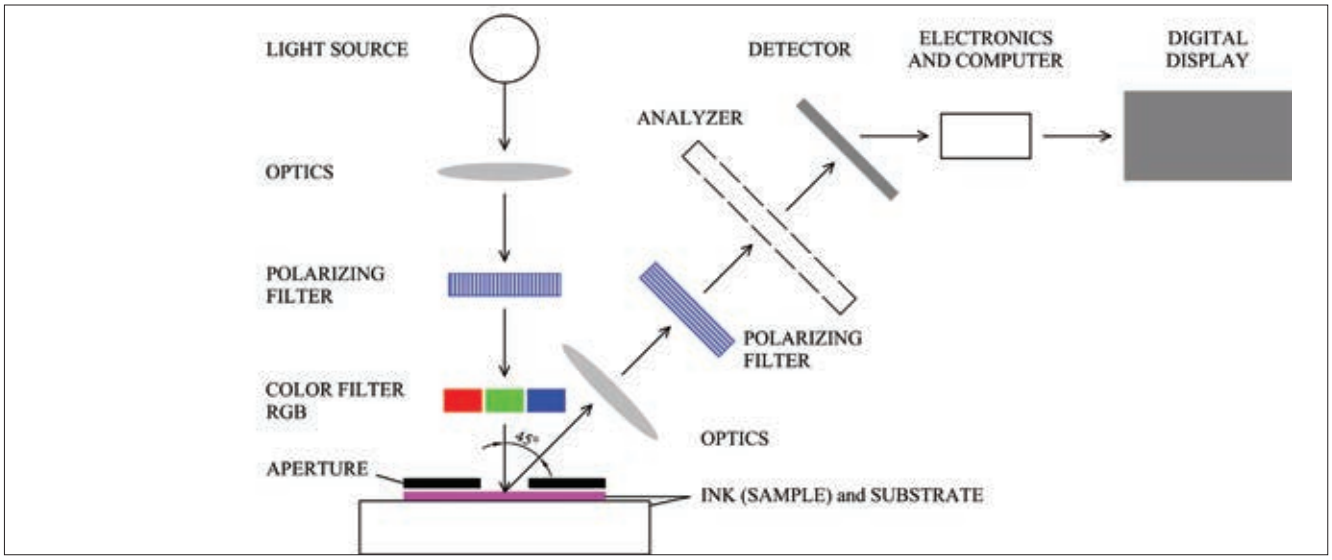
1.1. Odnos do barve

Pri pregledu domačih publikacij s področja konservatorstva je mogoče ugotoviti, da se slovenski avtorji do barve ne opredeljujejo. Študije se sučejo okoli kompozicije, ikonografije, kontrastov med svetlim in temnim, večji poudarek je na slikarstvu. V preteklosti je veljalo, da se stavbna zgodovina in spomeniška vrednost objekta vedno najbolje razodeneta ob obnovi. Način raziskav je bil pretežno invaziven in ni bilo redko, da se je prvotna substanca izgubila. Barvni toni neposlikanih fasad niso bili na vrhu lestvice vrednot, ki bi jih pri posameznem spomeniku najbolj varovali. Tudi drugje stroka ali celo vsa družba v preteklosti ni namenila posebnega poudarka barvnim slojem. Opus arhitekta Le Corbusiera zaradi manjkajočih dokazov o prvotnih barvah pri številnih stavbah, med njimi pri vili Savoye, kljub prizadevanjem še vedno ni vpisan na seznam svetovne dediščine. Ocenjevalci so v letu 2011 presodili, da ni popolnoma zagotovljena in izkazana avtentičnost nekaterih stavb [ICOMOS, 2009: str. 137].

Barve imajo v arhitekturi svojo vlogo. O tem, kakšno je danes stališče stroke in javnosti, je govora v medijih v povezavi s problematiko urejanja prostora in ekonomske krize. Opazen je trend vračanja k obstoječemu. Sistemska strokovna ureditev je potrebna in bo v primeru ustreznega pristopa pozitivno vplivala na ravnanje z arhitekturno dediščino (v nadaljevanju dediščina). Praksa v tujini kaže, da je velik del varovanja dediščine (v slovenskem registru je približno trideset tisoč enot) zelo dobro urejen že s prostorsko zakonodajo. Naša današnja ureditev pravnih mehanizmov zaščite, ki jih uporablja tudi konservatorska stroka, omogoča nadzor nad potekom načrtovanja in posegov. Vse rešitve in orodja je seveda iz finančnih in pravnih razlogov pogosto težko izkoristiti. Obenem se pojavlja kritika, ki je pogosto zasnovana na napačnih predpostavkah ali je subjektivna. Do trdno teoretično in strokovno utemeljene kritike je sicer treba zavzeti stališče in prevzeti odgovornost. A v današnji poplavi informacij, pripomočkov, orodij in svetovalcev je največja težava, kako ju objektivno razločevati. In ena izmed nalog strokovnjaka je prav ta, da sogovorniku pomaga – da mu jasno predstavi, kaj vidi, dela in zaznava. In morda je tu del odgovora. Na strani stroke je, da podpira, nagrajuje, promovira dobro urejanje prostora, primerno ravnanje z dediščino in v detajlu tudi paleto ustreznih barvnih tonov. Tu pa nastopi veščina retorike in komuniciranja, na osnovi katere bo nepoučena kritika izgubila svojo moč.

1.2. Dediščina, podatki in vrednotenje

Za oblikovanje/nastanek arhiva so potrebni rezultati pomembnega sklopa opravil, dejavnosti, ukrepov in jasno izražena volja do njihovega izvajanja [Letellier, Schmid, & LeBlanc, 2007]. Dokumentacija kot rezultat beleženja in dokumentiranja pa je še vedno prepuščena posameznikom, in to kljub temu, da gre za eno izmed poglavitnih opravil



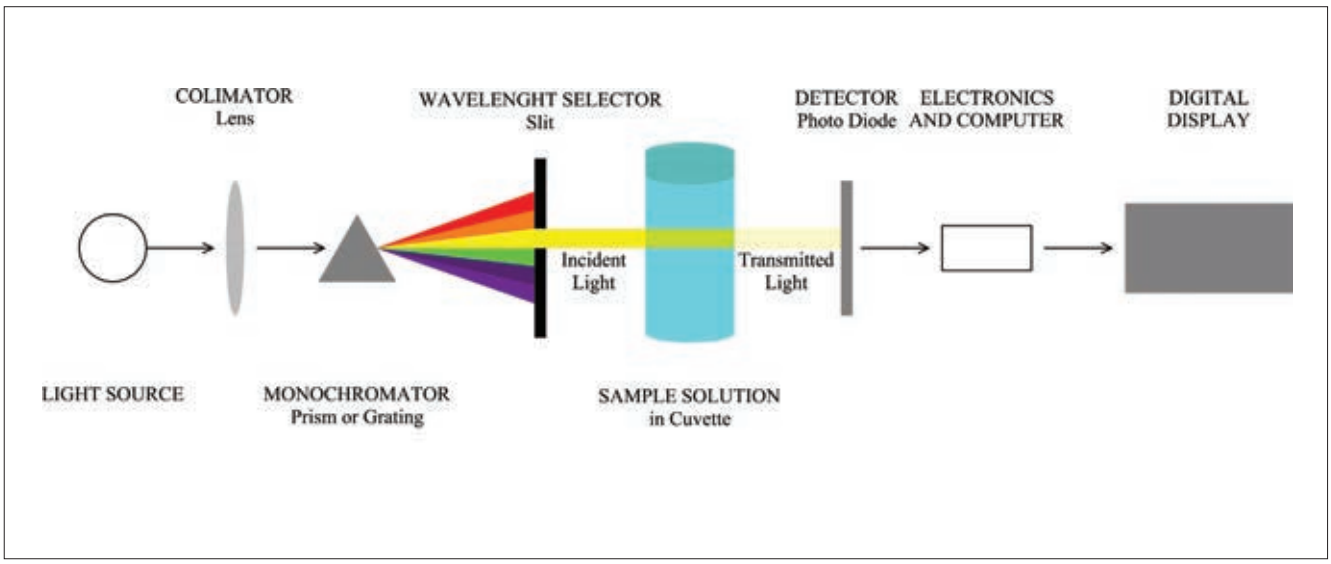
Slika 1: Shema refleksijskega denzitometra. Rezultat je debelina plasti barve, enaka optična gostota ne pomeni nujno enake barve (ilustracija: Potočnik, I., 2015).
Figure 1: Scheme of a reflection densitometer. The result is the thickness of paint layers, the same optical density does not necessarily mean the same color (Illustration: Potočnik, I., 2015).

course, all solutions and tools are difficult to exploit, often due to economic and financial reasons. At the same time, criticisms are subjective and sometimes based on false assumptions, although it is necessary to take a stand towards and responsibility for well-founded criticism. Nowadays, in the flood of information, utilities and consultants, the biggest problem is how to separate them. One of the tasks of the experts is to help the interlocutor: they need to present clearly what they see, perceive and do. Perhaps a part of the answer lies herein. The task of the profession is to support, reward, and promote good spatial planning, appropriate management of cultural heritage and the range of appropriate color tones in the detail. This is where the art of rhetoric and communication comes into play. With this skill, any uneducated criticism will lose its power.

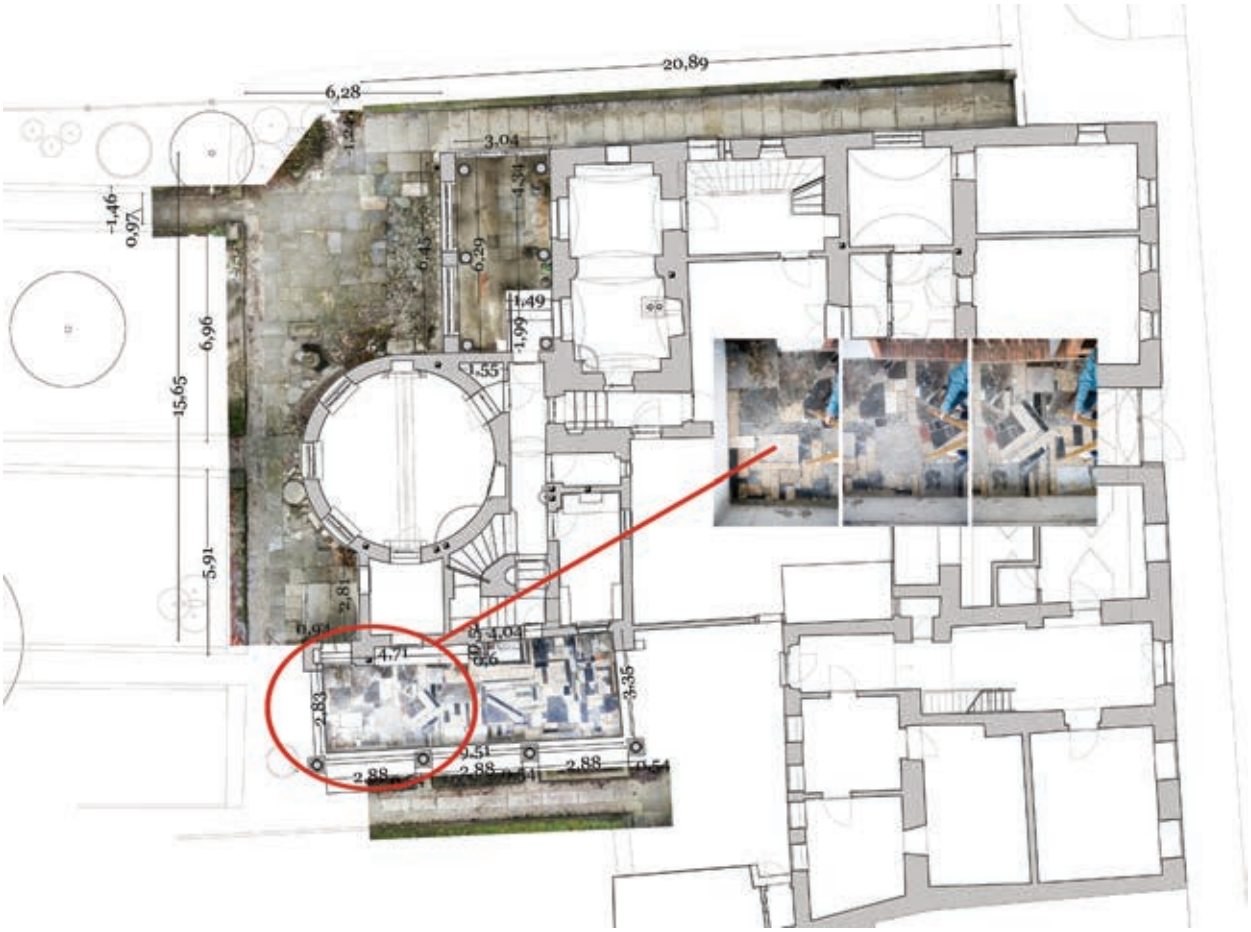
1.2. Heritage, Data and Evaluation

In order to create an archive results from an important set of tasks, activities, actions and a clearly expressed will to implement them are needed [Letellier, Schmid, & LeBlanc, 2007]. Heritage documentation as a result of recording and documenting is still left to individuals, despite the fact that documenting is one of the key tasks in the process of heritage conservation. The significance and the value of heritage are recognized in the process of documenting. By using the obtained data it is possible to adopt a professional decision, and check and analyze it using scientific methods [Ibid.], since recording is "one of the principal ways available to give meaning, understanding, definition and recognition of the values of the cultural heritage" [ICOMOS, 2014: p. 71]. Operational practice in the protection and conservation of cultural heritage reveals a different story. Often, it is based more on the available resources than on careful consideration. With today's technological support, there are numerous methods available. In addition to the sampling and recording, there are geo-radar, thermographic imaging with analysis of the results, laboratory researches and analyses of samples, tests on new and old materials, monitoring of the situation using different devices and in different scales; there is also the possibility to synthesize all of the above methods and their presentation in writing or otherwise.

In Slovenia, the process of documenting is enacted. In addition to the Cultural Heritage Protection Act, documentation is prescribed also by the Rules on Conservation Plans (CP). Their content and form are set out, and the documentation is placed in the chapter on understanding the site and its values. The Rules [2009: Annex 1, 01-6.8] lay down that the records about the current condition of a building are "extracts from the cadastres, surveying and architectural imagery /…/ basic photo documentation sheets /and/ a list of other documents." Documentation is, as stated in the Cultural Heritage Protection Act [2008: 3rd Art.], "the collection, compilation and storage of



Slika 2: Shema merjenja faktorja odboja po principu monokromatorja. Izmerjena vrednost je količina svetlobe, ki jo objekt odbija pri izbranih intervalih. Rezultati se izrazijo kot triobmočne vrednosti X, Y, Z in kot kromatične koordinate x, y, Y (ilustracija: Potočnik, I., 2015).
Figure 2: Scheme of measuring the reflection factor according to the principle of the monochromator. The measured value is the amount of light reflected by an object at selected intervals. The results are expressed as tristimulus values X, Y, Z, and as chromaticity coordinates x, y, Y (Illustration: Potočnik, I., 2015).



Slika 3: Arhitekturni posnetek stanja pritličja Plečnikove hiše v Ljubljani, dvodimenzionalni vektorski načrt z rastrskim mozaikom – načrtom zunanjih tlakov (ni v merilu). Mozaik je izdelan z obdelavo večjega števila posameznih fotografij (načrti: Potočnik, I., Bulc, J., Dobrina, D., 2010; Potočnik, I., Sušnik, E., 2014, ZVKDS, Center za konservatorstvo, Restavratorski center; ilustracija: Potočnik, I., 2015).

Figure 3: Ground floor of Plečnik's house in Ljubljana. Two-dimensional vector plan with raster mosaics – disposition of stone pavement (not to scale). The mosaics are made from a large number of single photos (plans: Potočnik, I., Bulc, J., Dobrina, D., 2010; Potočnik, I., Sušnik, E., 2014, ZVKDS, Conservation centre, Restoration centre; illustration: Potočnik, I., 2015).

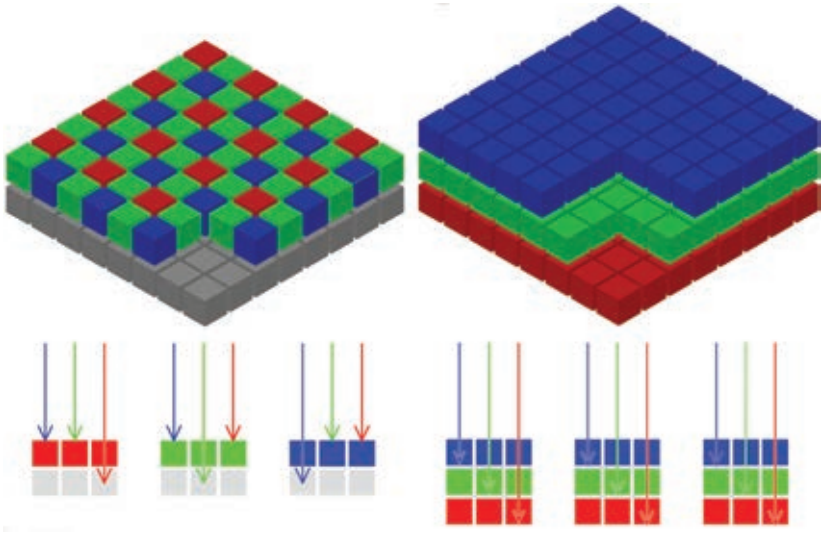
pri ohranjanju dediščine. V procesu dokumentiranja se prepoznata pomen in vrednost dediščine, s pomočjo pridobljenih podatkov se sprejemajo strokovne odločitve, ki so preverljive z znanstvenimi metodami [prav tam], saj je to "eden od glavnih razpoložljivih načinov osmišljanja, razumevanja, definiranja in priznavanja vrednot kulturne dediščine" [ICOMOS, 2014: str. 71]. Operativna praksa varovanja in ohranjanja nepremične kulturne dediščine kaže drugačno sliko. Prepogosto je bolj vezana na razpoložljive vire kot na tehten premislek. A tehnologija danes podpira in omogoča izbiro različnih metod. Poleg vzorčenja in zapisovanja so tu georadar, termografske kamere z utečeno obliko analize rezultatov, laboratorijske preiskave in analize vzorcev, testiranje novih in starih materialov, spremljanje stanja z različnimi napravami in v različnem obsegu (monitoring): vse našteto je mogoče združiti ter rezultat pisno ali drugače predstaviti.

V Sloveniji je dokumentiranje uzakonjeno. Poleg zakona o varstvu kulturne dediščine ga predpisuje tudi pravilnik o konservatorskem načrtu. Njegova vsebina in oblika sta določeni, dokumentacija pa je umeščena v poglavje o razumevanju spomenika in njegovih vrednot. V pravilniku [priloga 1, 01-6.8] je navedeno, da je dokumentacija stanja "izvleček iz katastrov, izvleček iz geodetskega in arhitekturnega posnetka, /.../ osnovna fotodokumentacija stanja, /.../ seznam druge dokumentacije in drugo". Dokumentiranje pa je, kot piše v zakonu o varstvu kulturne dediščine [2008, 3. čl.], "zbiranje, urejanje in hranjenje podatkov o dediščini, njenih vrednotah, stanju, lokaciji". Zakonski podlagi za izdelavo konservatorskega načrta in dokumentacije o dediščini kot njegovega sestavnega dela dajejo še večjo težo zaveze in spodbude v mednarodnih listinah, kot sta Beneška listina iz leta 1964 [ICOMOS, 2003] in Načela beleženja spomenikov, skupin objektov in območij iz leta 1996 [ICOMOS, 2014]. In čeprav je dokumentiranje opredeljeno kot obvezen postopek pri ohranjanju dediščine, je še vedno opazna vrzel. Védenje o dediščini kljub teoretični

data on heritage, its values, condition and location." Commitments and incentives in international instruments, such as the Venice Charter [ICOMOS, 2003] and the Principles for the recording of monuments, groups of buildings and sites [ICOMOS, 2014], only emphasize the legal basis for the production of CP. However, although the documenting is mandatory component in the procedure of preservation of cultural heritage, a gap is still noticeable. Knowledge about heritage is not always an integral part of all conservation activities, regardless of theoretical awareness. In the given situation, and without understanding the real needs, the strategy for the preparation of documents and their evaluation will not be soon approved or widely accepted. The same outcome can be expected for the systematic complementarity of the missing records. It happens too often that some photos, architectural sketches, or orthogonal architectural plans without any details are the only results of recording the actual condition. These records are used in the planning process as a basis for further work, without any upgrade. The mere proclamation of a monument or expert identification of elements that are worthy of protection and preservation for future generations are not an adequate basis either in basic maintenance, preservation and restoration of buildings and their parts, let alone in the preservation of authentic substances, including color and narrative value of heritage.

In view of all the open tasks, it might be a good first step to become aware that good documentation and records are a precious heritage for the future. "Preparing a plan for long-term consistent and systematic work on the heritage, important for the collective memory, is a necessity." [Pirkovič, 1993: p. 110] The second step is the acceptance and the awareness of the fact that the heritage recording is not and cannot be final as long as it exists. Upgrading and updating is necessary and inevitable, since the condition has to be recorded before, during, and after any minor and major interventions. Therefore, it is necessary to be adequately prepared in advance, especially as far as digital data are concerned. Because of the technological development there is an increasing number of different tools available, allowing the acquisition of previously hidden information.

One must not forget the management of all the records acquired: without suitable storage, adequate links between the data, data and software updates and accessibility, primarily the cultural heritage and as a consequence the whole society are damaged. Digital documents present a major problem; their loss or destruction will, if no action is taken, leave a great void in historical memory about present time. In practice, there is no single solution, because this field is still relatively unexplored. Commitments have been taken up on the conservation of cultural heritage. It is imperative to continue the collection, recording and storing of all the information about it. Depending on the circumstances, the tasks must be done as comprehensively as possible. When the documentation of the heritage is comprehensive, complete, and consistent, it becomes its inseparable part and thus heritage in itself; therefore, in all respects, something that we should treat with care.



Slika 4: Shemi zajema barvne informacije v slikovnih (optoelektronskih) senzorjih. V običajnih sistemih (levo) so rdeči, zeleni in modri barvni filtri na enem sloju foto detektorjev (fotodiode) razporejeni v mozaičnem vzorcu. V vsaki točki se zabeleži le ena barva. Ti senzorji zabeležijo 50 % zelene in po 25 % rdeče in modre svetlobe. Senzorji na osnovi tehnologije Foveon X3 imajo v silikon vstavljene tri vrste fotodiod. Ker silikon v različnih globinah absorbira različno valovno dolžino svetlobe, vsaka vrsta zabeleži drugo barvo. Ti senzorji v vsaki točki zabeležijo vse tri barve (ilustracija: Potočnik, I., 2015).
Figure 4: Schemes of capturing the color information in the image (optoelectronic) sensors. In conventional systems (left), the red, green and blue color filters are arranged in a single layer of photo detectors (photodiodes) in a titled mosaic pattern. The filters let only one wavelength of light trough, so each pixel records only one color. These types of sensors capture 50% of green and only 25% of red and blue light. Sensors based on Foveon X3 technology have three layers of photodiodes inserted into the silicone. Since silicone absorbs different wavelengths of light at various depths, each layer of photodiodes records a different color. These types of sensors can capture red, green and blue light at every pixel (illustration: Potočnik, I., 2015).

2. Methods

2.1. Color Measurement

While the beginnings of the numerical description of colors reach back to the first quarter of the 19th century, "it was only in the 1980s that the computer technology enabled the development of three-area photometers and spectrophotometers for describing

ozaveščenosti ni vedno integralni del vseh dejavnosti ohranjanja dediščine. V teh razmerah in brez razumevanja dejanskih potreb tudi strategija za pripravo dokumentov in njihovo vrednotenje ne bo kmalu potrjena ali širše sprejeta. Enak izid je mogoče pričakovati glede sistematičnega dopolnjevanja gradiva. Še prepogosto pri beleženju stanja nastane le nekaj fotografij, arhitekturna skica stanja ali ortogonalni arhitekturni načrt brez vseh detajlov in podobno. Ti dokumenti se iz različnih vzrokov nikoli ne nadgradijo, a se pri pripravi potrebne projektne dokumentacije uporabijo kot osnova za nadaljnje delo. Zgolj razglasitev za spomenik ali strokovno prepoznanje elementov, ki jih je vredno varovati in ohranjati za prihodnje rodove, ni ustrezna podlaga niti za osnovno vzdrževanje, ohranjanje in obnavljanje stavb in njihovih delov, kaj šele za ohranitev/ohranjanje avtentične substance, vključno z barvo in pričevalnostjo dediščine.

Ob vseh odprtih nalogah je morda prvi korak zavedanje, da je dobra dokumentacija dragocena dediščina za prihodnost in da je nujno izdelati načrt dolgoročnega doslednega in sistematičnega dela na dediščini, ki je pomembna "za kolektivni spomin" [Pirkovič, 1993: str. 110]. Drugi korak je sprejetje in ponotranjenje dejstva, da dokumentacija o stanju dediščine, dokler ta obstaja, ne more biti dokončna. Nujno in neizbežno jo je treba nadgrajevati, saj je treba stanje zabeležiti pred in med manjšimi in večjimi posegi ter po njih, na kar je treba biti posebno pri digitalnih podatkih ustrezno pripravljen. Tu je še tehnološki razvoj, zaradi katerega je na razpolago vedno več različnih orodij, s katerim je mogoče pridobiti informacije, ki so v preteklosti ostale skrite.

Nedopustno je pozabiti na ravnanje z vsemi pridobljenimi podatki: brez primerne hrambe, povezave med njimi, posodabljanja in dostopa je v prvi vrsti oškodovana dediščina in z njo vsa družba. Največja težava so digitalni podatki, njihova izguba ali uničenje bo brez ustreznih ukrepov v zgodovinskem spominu pustilo veliko praznino o našem času. V praksi enoznačne rešitve ni, saj je tudi v svetu to področje še dokaj neraziskano.

Sprejete so bile zaveze o ohranjanju dediščine. Obvezno je treba nadaljevati zbiranje, izdelavo in hranjenje informacij o njej. To pa mora biti glede na okoliščine izvedeno kar se da celovito. Ko je dokumentacija o dediščini celovita, popolna in skladna, postane njen neločljivi del in s tem tudi sama dediščina. Z dediščino pa naj bi v vseh pogledih ravnali skrbno.

2. Metode

2.1. Merjenje barv

Medtem ko segajo začetki numeričnega opisovanja barv v prvo četrtino 19. stoletja, je "šele v osemdesetih letih 20. stoletja računalniška tehnologija omogočila razvoj triobmočnih fotometrov in spektrofotometrov za opisovanje barvnih učinkov" [Kumar, 2008: str. 91]. Denzitometer je naprava za merjenje optične gostote, uporablja se v grafični pripravi in v tisku. Optična gostota je logaritemska (nelinearna) vrednost brez enote. Vrednost je definirana na osnovi razlike v moči barvnega dražljaja med vpadno in prepuščeno oziroma z vzorca odbito svetlobo, zato je z napravo posredno izmerjena samo njegova svetlost. Kolorimeter ali triobmočni fotometer analizira barvni dražljaj podobno kot človeško oko, običajno ima le en fotoelement (fotodiodo), vendar po en barvni filter za modri, zeleni in rdeči del spektra. Meri svetlobno energijo, ki jo objekt odbija, prepušča ali absorbira. Spektrofotometer pri izbranem koraku analizira spektralno sestavo svetlobe (barvnega dražljaja). S tem nastane spektrofotometrična krivulja, ki je uporabna za vsakršne barvnometrične preračune, in se navezuje na barvni model CIE. Ker se vrednosti ne pridobijo s filtri, marveč iz vsega spektra, je absolutna natančnost spektrofotometrov zelo visoka [Kumar, 2008].

2.2. Tehnološko ozadje digitalne fotografije

Ne glede na okoliščine in na zadrego pri nadaljnji uporabi ali reprodukciji gradiva, je za dokumentiranje dediščine že iz preteklosti poznana fotografija. Z razvojem novih tehnologij se njena uporabna vrednost tako za upodobitve kot za pridobivanje merskih podatkov z rektificirano fotografijo, stereofotogrametrijo, fotomozaiki in drugimi tehnikami samo povečuje.

O zgodovinskem razvoju fotografije je bilo veliko napisanega že drugod. V tem članku je zanimiva predvsem njena zmožnost ohranjanja in prenosa podatkov in informacij o barvi. V obdobju črno-belih slik je bilo to izključeno. Na črno-belih fotografijah, filmih ali steklenih ploščah so motivi le v akromatičnih tonih. Če pa je poleg fotografije ohranjen tudi natančen opis in morda še vzorec, se ugibanja o barvni podobi nagnejo v območje védenja. Obstoj, ohranjenost in dostopnost analognih arhivskih dokumentov in sistematika nastajanja se od primera do primera razlikujejo. Pri digitaliziranju obstoječih kot tudi pri nastajanju in hranjenju novih dokumentov le v digitalni obliki pa umanjka splošna zavest o njihovi minljivosti. "Redki dokumentacijski centri sledijo izzivom ohranjanja elektronskih zapisov, čeprav je večina danes izdelane dokumentacije o dediščini v digitalni obliki." [Letellier, Schmid, & LeBlanc, 2007: str. 46]

Analogna fotografija je rezultat fizikalno-kemijske reakcije svetlobno občutljivega sloja na nosilcu (filmu) s svetlobo. Izdelava barvne fotografije je precej bolj zapletena in tehnološko zahtevnejša kot izdelava črno-bele. V obeh primerih so najmanjši fizični delci zapisa naključno porazdeljena fotografska zrna, in zapisana vsebina tudi pri velikih povečavah daje vtis zveznosti. Tehnologija digitalne fotografije pa je bistveno drugačna. Tu gre za diskretizacijo in kvantizacijo zveznega signala – svetlobe. Diskretizacija pomeni, da zvezni signal spremenimo v diskretne vrednosti, kvantizacija pa je določitev konkretnih vrednosti signala v diskretnih točkah. Pri tem je treba upoštevati teorijo vzorčenja oziroma Nyquist-Shannonov teorem [Luhman, Robson, Kyle, & Boehm, 2014: str. 131–134; Triglav, Crosilla, & Kosmatin Fras, 2010: str. 403–416], ki pravi, da mora biti frekvenca vzorčenja (digitalizacije) signala najmanj dvakratnik najvišje frekvence originalnega (analognega) signala, da lahko iz vzorčenega gradiva zadovoljivo rekonstruiramo izvirni zapis. Ta teorem je bil v osnovi namenjen digitalizaciji zvočnih (avdio) signalov, a je uporaben tudi pri digitalnih slikah, saj imajo v

color effects" [Kumar, 2008: p. 91]. Densitometer is a device for measuring optical density used in the graphic preparation and in the press. Optical density is a logarithmic (non-linear) value without unit. It is defined only based on the difference in the power of a color stimulus between the incident and reflected light from the sample, so it is used indirectly to measure the brightness of a sample. Three-area photometer or colorimeter analyses the color stimulus much like the human eye, and it usually has one photodiode, but three color filters, i.e. for blue, green, and red part of the spectrum. It measures the light energy reflected, transmitted, or absorbed by an object. Spectrophotometer analyses the spectral composition of light (color stimulus) in the selected step. This forms a spectrophotometric curve, which is useful for any colorimetric calculations and refers to the CIE color model. The value is not obtained by means of filters but from the entire spectrum; therefore, the absolute precision of spectrophotometers is very high [Kumar, 2008].

2.2. Technological Background of Digital Photography

Regardless of the circumstances and the predicament about the future use or reproduction of materials, photography is well known already from the past for recording heritage places and objects. With the development of new technologies, its value for depictions and for the acquisition of measurement data with rectified photography, stereo photogrammetry, photo mosaics and other techniques is only increasing.

Many writers have already written profusely about the historical development of photography. What is particularly interesting in this article is the emphasized ability of photographs to preserve and transfer data and information on color. During the black-and-white picture period, this was ruled out. In the black-and-white photographs, films or glass panes, the motives are only in achromatic tones. If, beside photos, an accurate description and perhaps even a sample are stored and preserved in the archive, speculations about the color are inclined towards the area of knowledge. The existence, preservation and availability of analogue archival documents and systematic formation differ from case to case. In the digitization of existing, as well as in the creation and storage of new documents only in digital form, there is a general lack of awareness of their transience. "Few documentation centers are prepared to meet the new challenge of preserving electronic records, although digital files have become the main format in which heritage documentation is delivered today" [Letellier, Schmid, & LeBlanc, 2007: p. 46].

Analog photography is the result of physicochemical reaction of

Slika 5: Multispektralno slikanje: radiografija (RTG), ultravijolična fluorescenca (UVF), vidna svetloba (VIS) in infrardeča fluorescenca (IRF) na primeru slike Marija s sv. Avguštinom in sv. Filipom Benizijem iz nekdanje cerkve servitskega samostana v Kopru. Tovrstno snemanje omogoči vpogled v avtorjev način slikanja, določa obseg obstoječih preslikav in preteklih konservatorsko – restavratorskih posegov (fotografije: Hirci, A., UVF, VIS, IRF, Narodna galerija; Fister, S., RTG, ZVKDS Center za konservatorstvo, Restavratorski center, dokumentacija Oddelka za štafelajno slikarstvo, ZVKDS CK RC).
Figure 5: Multispectral imaging: radiography (RTG), ultraviolet fluorescence (UVF), visible light (VIS) and infrared fluorescence (IRF) in the case of the painting St. Mary with St. Augustine and St. Filip Benizi from the former church of the Servite convent in Koper. Such recording enables an insight into the artist's way of painting, determines the range of existing repaintings and historical conservation - restoration procedures (photographs: Hirci, A., UVF, VIS, IRF, National Gallery; Fister, S., RTG, IPCHS, Conservation Centre, Restoration Centre, 2007. Easel Painting Department Archive, IPCHS, Conservation Centre, Restoration Centre, Ljubljana).

Slika 6: Fotografiranje z razširjenim tonskim razponom na primeru trga Navona v Rimu. Na združeni fotografiji so podrobnosti o prostoru in barvah jasnejše kot na posameznih fotografijah. Zaradi dolgih ekspozicij pri prvotnih posnetkih trga (22 s, 42 s, 194 s) so na združeni fotografiji tudi sence ljudi in avtomobilov (Potočnik, I., 2009, 2015).

Figure 6: Expanded tonal range imaging of Piazza Navona in Rome. In merged photograph, the details about the location and colors become clearer than in individual photos. Because of the long exposition in the original footages of the market (22 s, 42 s, and 194 s) shadows of people and cars are present on the merged photo (Potočnik, I., 2009, 2015).

a light-sensitive layer on the film (medium) with the light. Making of color photography is much more complex and technologically challenging than making black-and-white photos. In both cases, the smallest physical particles are photographic grains, which are randomly distributed, and the recorded content gives the impression of continuity even at high magnification. The technology of digital photography is fundamentally different. Above all, it is a discretization and quantization of the continuous signal – light. Discretization is the process of transferring continuous signals into discrete values. Quantization is determining the actual value of the signal at discrete points. The sampling Nyquist-Shannon theorem [Luhman, Robson, Kyle, & Boehm, 2014; Triglav, Crosilla, & Kosmatin Fras, 2010], which says that the sampling (digitizing) signal should be at least twice the highest frequency of the original (analog) signal in order to satisfactorily reconstruct the original record from the sample, should be taken into account. This theorem was intended primarily for the digitization of sound (audio) signal, but it can also be used with digital images, which have a raster format and pre-set pixel size. Simplified, this means that for 1 mm large details the calculated size of a pixel should be at least 0.5 mm to avoid, due to the analog-to-digital conversion, losing the details. Quantization is the process of identifying radiometric range of digital values - it is a process of reducing the number of different colors used in the image. The most common is an 8-bit format for one spectral channel, which allows separation of only 256 different values (28). Powerful devices today are capable of much higher values, up to 216.

In relation to digital photographic technology, at least the basic operation of image sensors should be understood [Luhman, Robson, Kyle, & Boehm, 2014: pp. 169–181]. Image sensors consist of a large number of light-sensitive detectors (photodiodes) in the form of a line or matrix a semiconductor module (microchip). Each detector (sensor element) generates an electrical charge, which is proportional to the amount of incident light thereon. The sensor is constructed so that the electric charge of each individual element can be transferred, processed and digitized. Electric charge has no color information; color results from placing a corresponding color filter that transmits only light of certain wavelength in front of a photodiode. For practical reasons, the entire spectrum of visible light is distributed and recorded in three regions: red, green and blue (RGB). Techniques of capturing color information in the image sensor are different. The most common is the use of a filter mask (for example the Bayer pattern) where each photodiode records only one color at a time. With the special prism mounted in front of the sensor, it is possible to deflect the incident light in three directions and three separate sensors, so that each records the entire image in a given region of the spectrum. Professional and expensive devices mainly use this mode. There is also a technology known as the Foveon X3 technology, where one sensor simultaneously records all three-color values. Details of the functioning of this technology are a trade secret, but some cameras already use it.

In addition to the visible part of the spectrum of electromagnetic waves it is possible with appropriate equipment to take advantage of the X-rays (0.01-10 nm), ultraviolet (UV-A, UV-B, UV-C, 200 to 380 nm) and near infrared (IR-A; 0.7–1.4 nm) radiation. In these photos, spectral signature analysis techniques can be used to obtain certain information invisible to the naked eye, e.g. layers beneath the surface, hidden defects, etc.

2.3. High Dynamic Range Imaging

In analog color images, it is possible to confirm without additional research that colors have changed over time. This applies to the negatives, positives, as well as slides. In digital images, there is another issue. Various sensors detect the color, brightness and other settings differently, independently of whether they are recorded in raw format (RAW) or have already been algorithmically modified. All this affects the quality of each photograph. Notwithstanding this, it is possible to upgrade pictures. Yan et al are exploring this area [Yan & Rajan, 2008; Yan, Behera, & Rajan, 2010]. They are interested in the digital photograph's capability to store large amounts of information about the color and brightness of the architectural heritage. Their goal is to develop an affordable and effective method that will help record and document information about colors of interiors and exteriors. "With sampling, characterization and comparison of the color information, regardless of lighting effects, which is an essential characteristic of the final layer of the surfaces in the interior and exterior, we can accurately document only small sample areas, not the entire range of architectural surfaces" [Yan & Rajan, 2008: p. 238]. The method presented here has the advantage of being able to record color data of the entire surface. With the help of the spectrometer any part of the picture and the color of individual pixels can be defined in the color model CIELUV (CIE L*u*v*) and thus uniquely determined.

The method is based on High Dynamic Range Imaging (HDRI). HDR is a term from digital video processing, computer graphics and photography and generally relates to techniques for providing the extended tonal range that goes beyond tonal range achievable with a single exposure. This method is suitable in case of large differences in lighting (sun – shade); it is difficult to record the details detected by the human eye (which is more sensitive than today's digital sensors) in a single exposure. The basis is multiple shooting of the motive with different settings, while further processing and assembling of the footage can store more details through the entire tonal range.

2.4. Laser Scanner and Color

For simultaneous recording of both measurement data [Triglav, Crosilla, & Kosmatin Fras, 2010: pp. 403–416] as well as information on the color tone, a combination of camera and laser scanner is suitable. The processing of the data then requires powerful hardware, corresponding software, and a trained operator. The very term "laser scanner" is generic and usually refers to "a set of instruments that work on different bases in different environments and with different precision and accuracy" [Mills, Barber, & Andrews, 2011: p. 3]. The result

osnovi rastrsko obliko in določeno velikost slikovne točke (piksla). Poenostavljeno to pomeni, da mora biti na primer pri detajlih, ki so veliki 1 mm, velikost piksla v naravi 0,5 mm, da se zaradi analogno-digitalne pretvorbe ne izgubijo podrobnosti. Kvantizacija je proces za opredelitev radiometričnega razpona digitalnih vrednosti – gre za postopek zmanjševanja števila različnih barv, uporabljenih v sliki. Najbolj običajen je 8-bitni zapis za en spektralni kanal, ki omogoča ločevanje 256 različnih vrednosti (28). Zmogljivejše naprave danes zmorejo že precej višje vrednosti, tudi do 216.

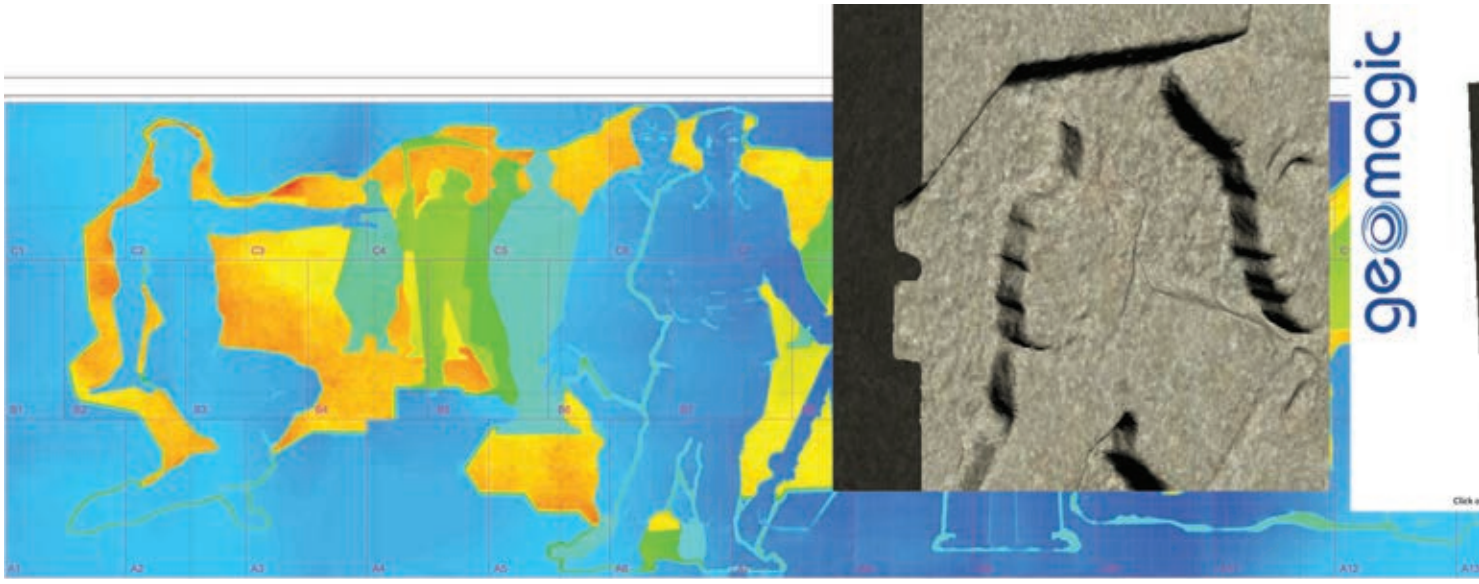
Pri digitalni fotografski tehnologiji je dobro razumeti vsaj osnove delovanja slikovnih senzorjev [Luhman, Robson, Kyle, & Boehm, 2014: str. 169–181]. Sestavljeni so iz večjega števila na svetlobo občutljivih detektorjev (fotodiod), razporejenih v linije ali matriko na polprevodniškem modulu (mikročipu). Vsak detektor (element senzorja) ustvarja električni naboj, ki je sorazmeren s količino vpadne svetlobe. Senzor je zgrajen tako, da se lahko električni naboj vsakega posameznega elementa prenese, obdela in digitalizira. Električni naboj nima informacije o barvi; ustvari jo barvni filter pred fotodiodo, ki prepušča samo svetlobo določene valovne dolžine. Iz praktičnih razlogov se ves razpon vidne svetlobe razdeli in zajame le v treh območjih: rdečem, zelenem in modrem (RGB, iz angleških imen za barve: red, green, blue). Tehnike zajema barvne informacije v slikovnih senzorjih pa so različne. Najpogosteje se uporabi filtrirna maska (na primer Bayerjev vzorec), kjer vsaka fotodioda naenkrat zabeleži le eno barvo. S posebnimi prizmami, nameščenimi pred senzorjem, se vpadna svetloba lahko preusmeri v tri smeri in na tri ločene senzorje, vsak pa zabeleži vso sliko v posameznem delu spektra. Ta način v glavnem uporabljajo profesionalne in drage naprave. Obstaja pa tudi tehnologija Foveon X3, kjer se v enem senzorju hkrati zabeležijo vse tri barvne vrednosti. Podrobnosti delovanja te tehnologije so poslovna skrivnost, se pa že uporablja v nekaterih fotoaparatih.

Poleg vidnega dela spektra elektromagnetnega valovanja je mogoče z ustrezno opremo izkoristiti tudi rentgenske žarke (0.01–10 μm) ter ultravijolično (UV-A, UV-B, UV-C; 200–380 μm) in bližnjeinfrardeče (IR-A) sevanje (0.7–1.4 μm). Pri takšnih fotografijah je mogoče uporabiti tehnike analize spektralnega podpisa za pridobitev nekaterih informacij, ki očem niso vidne, na primer o materialih, slojih pod površjem, prekritih poškodbah in podobno.

2.3. Fotografiranje z velikim dinamičnim razponom

Pri arhivskih analognih barvnih fotografijah je mogoče brez večjega raziskovanja ugotoviti, da so se barve skozi čas spremenile. To velja za negative, pozitive, tudi za diapozitive. Pri digitalnih posnetkih je vprašanje še drugje. Različni senzorji različno zaznavajo barvo, osvetlitev in ostale nastavitve, in to neodvisno od tega, ali so posnete v golem (surovem) formatu zapisa fotografije (RAW) ali pa so že algoritemsko spremenjene. Vse to vpliva na kakovost posamezne fotografije. Ne glede na to, je mogoče fotografije nadgraditi. To področje raziskuje Yan s sodelavci [Yan & Rajan, 2008; Yan, Behera, & Rajan, 2010]. Zanima jih, kako je mogoče s pomočjo digitalne fotografije shraniti večjo količino informacij o barvi in osvetlitvi arhitekturne dediščine. Njihov cilj je razviti cenovno ugodno in učinkovito metodo, ki bo v pomoč pri evidentiranju in dokumentiranju informacij o barvah interjerjev in eksterjerjev. "Z vzorčenjem, opisovanjem in primerjavami barvno informacijo, ne glede na svetlobne učinke, kar je bistvena lastnost zaključnega sloja površin v notranjosti in zunanjosti, natančno dokumentiramo samo na manjših vzorčnih območjih, na celotnem obsegu gradbenih površin pa ne." [Yan & Rajan, 2008: str. 238] Ravno tu je predstavljena metoda v prednosti, z njo je namreč mogoče zabeležiti podatke o barvi s celotnih površin, barve posameznih slikovnih točk (pikslov) na vsakem delu fotografije pa se s spektrometrom definirajo in enoznačno določijo v barvnem modelu CIELUV (CIE L*u*v*).

Postopek temelji na fotografiranju z velikim dinamičnim razponom (HDR ali HDRI – High Dynamic Range Imaging). Izraz se uporablja pri digitalni obdelavi videa, računalniške grafike in v fotografiji



of the scan is comprised of a set of points with three spatial coordinates in a chosen coordinate system where the points describe the surface of the object. In most of these instruments, point clouds are a raw product of measurement, but they may also include additional information such as the intensity of the reflected light and the order of reflection (in case of multiple reflections). The laser beam, which is used to measure the distances to different parts of the surface, is essentially monochromatic. However, with simultaneous shooting it is possible to attribute color value to every point in the cloud by knowing the mutual geometrical relationship between the camera and the laser scanner. This makes it possible to display the scanned object not only in the tree-dimensional view, but also in color. In this case, it comes to colored cloud points. The spectrometer also allows defining unambiguously the color tone. The proper recording, storing and preparation of the information are the basis that make it suitable for the use in different circumstances and that allow the interested public better access to it.

3. Results

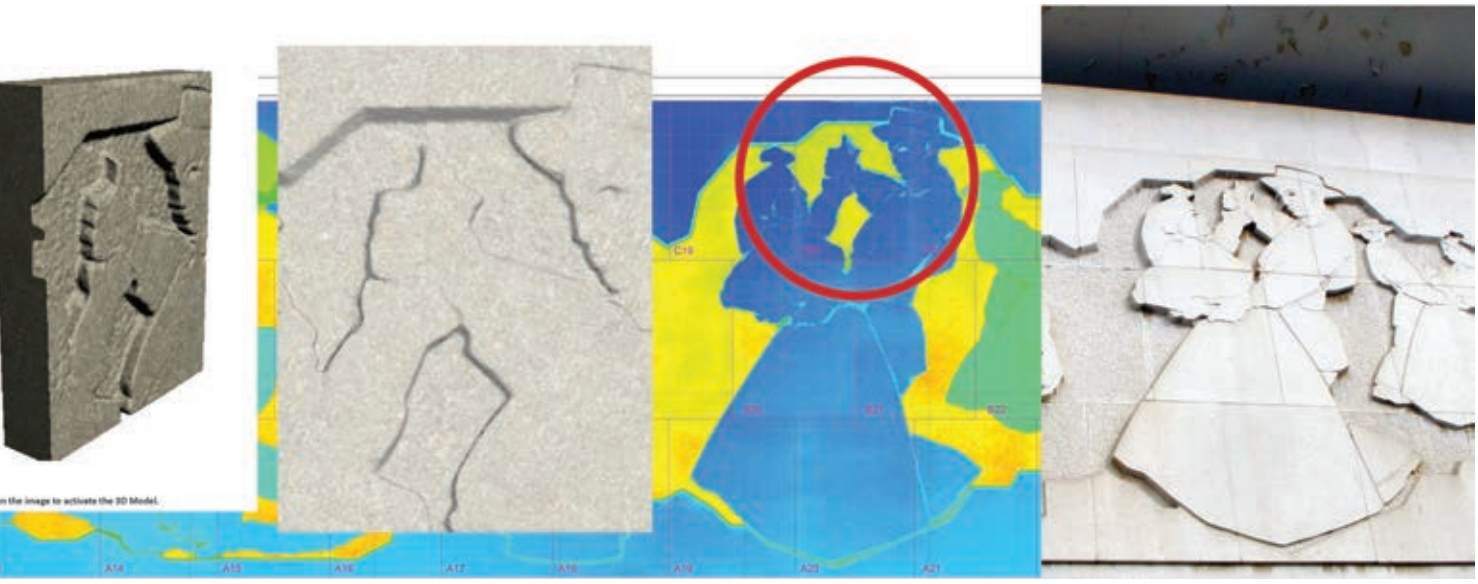
Today technology has advanced to such level that it is possible to select an appropriate device to obtain the required information on the color. The choice of tools and the precision of the result depend on the significance and the value of heritage and the available resources. This includes trained professionals, available equipment, time and financial resources. They must be handled with care and used to their full extent.

Textual records, sampling, and the use of color charts for a comprehensive and accurate recording of colors are only a part of the story about recording and documenting the color components of heritage. In some cases, it is necessary to find and use different methods. These are perhaps more expensive or require more time, work and knowledge, but can offer more leeway in interpretation and repeatability. Before deciding to implement them, it is important to make a proper plan, which includes both research and knowledge of the widest possible range of options to achieve the desired objectives. In addition to the complexity and other things defining the object, the criteria for planning should also include its legal status and evaluation – sampling of works of art such as Leonardo Da Vinci's Mona Lisa [National Geographic Society, 2013] for investigation and research is inadmissible. For this purpose, there are other tools.

Today color measurements are used on objects where accuracy and precision are essential, such as paintings, but the measuring methods and instruments differ. Spectrometer is a general term, which refers to several types of devices capable of measuring a wide part of the electromagnetic spectrum. Some of them are used in science

Slika 7: Hipsografski prikaz prostorskega modela kamnitega reliefa Jakoba Savinška na pročelju Kulturnega doma v Črnomlju s prostorskim in barvnim prikazom modela ene kamnite plošče (ni v merilu). Rezultati so narejeni iz barvnega oblaka točk in shranjeni v prostorski format PDF (načrti: Gvozdanovič, T., Anžur, A., Novaković, G., 2012, ZVKDS, Center za konservatorstvo, Restavratorski center; ilustracija: Potočnik, I., 2015).

Figure 7: The hypsographic display of the model of Jakob Savinšek's stone relief on the facade of the Cultural center in Črnomelj with spatial and colored model of one stone slab (not to scale). Results are made from colored point cloud and stored in a three-dimensional PDF format (plans: Gvozdanovič, T., Anžur, A., Novaković, G., 2012, IPCHS, Conservation Centre, Restoration Centre; illustration: Potočnik, I., 2015).



ter se na splošno nanaša na tehnike za zagotavljanje razširjenega tonskega razpona, tako da se preseže tonski razpon, dosegljiv z enkratno ekspozicijo. Ta metoda je primerna pri velikih razlikah v osvetlitvi motiva (sonce – senca); podrobnosti, ki jih zazna človeško oko (sicer bolj občutljivo od današnjih digitalnih senzorjev), je namreč z enkratno osvetlitvijo težko zabeležiti. Osnova je večkratno fotografiranje motiva z različnimi nastavitvami, z nadaljnjo obdelavo in združevanjem posnetkov pa shranimo več podrobnosti v celotnem tonskem razponu.

2.4. Laserski skener in barva

Za hkratno beleženje merskih podatkov [Triglav, Crosilla, & Kosmatin Fras, 2010: str. 403–416] in informacij o barvnem tonu je primerna kombinacija laserskega skenerja (optičnega čitalnika) in fotoaparata. Za obdelavo podatkov so potrebni še zmogljiva strojna in ustrezna programska oprema ter ustrezno usposobljen operater. Splošni izraz 'laserski skener' se navadno nanaša na "niz instrumentov, ki delujejo na različnih osnovah, v različnih okoljih ter z različno natančnostjo in točnostjo" [Mills, Barber, & Andrews, 2011: str. 3]. Rezultat skeniranja je množica točk s tremi prostorskimi koordinatami v izbranem koordinatnem sistemu, kjer točke opisujejo površino objekta. Pri večini tovrstnih instrumentov je surovi produkt merjenja oblak točk, ki pa lahko vsebuje tudi dodatne informacije, kot je intenziteta odbite svetlobe in red odboja (če pride do več odbojev). Laserski žarek, ki se uporablja za merjenje razdalj do posameznih delov površja, je v osnovi monokromatski. Če pa se sočasno izvede tudi fotografiranje, je mogoče ob poznavanju medsebojnih geometrijskih odnosov med fotoaparatom in laserskim skenerjem vsaki točki v oblaku pripisati tudi barvno vrednost. To omogoča, da objekt skeniranja ni prikazan le prostorsko, temveč tudi v barvah. V tem primeru je govora o barvnem oblaku točk.

S spektrometrom je mogoče tudi tu barvni ton enoznačno definirati, podatek je treba le še primerno zabeležiti, shraniti ter pripraviti v takšni obliki, da bo primeren za uporabo v različnih okoliščinah in da bo imela do njega dostop čim širša zainteresirana javnost.

3. Rezultati

Danes je tehnologija tako napredovala, da je mogoče z ustrezno izbrano napravo pridobiti tudi informacijo o barvi. Izbira orodja in natančnost rezultata sta odvisna od pomena in vrednosti dediščine ter od razpoložljivih sredstev. Sem sodijo usposobljeni strokovnjaki, razpoložljiva oprema, čas ter finančni viri. Z njimi je treba ravnati skrbno, obenem pa jih je treba kar najbolj izkoristiti.

Besedilni zapisi, vzorčenje in uporaba barvnih kart za celovito in čim natančnejše beleženje barv so le del zgodbe o dokumentiranju barvne komponente dediščine. V nekaterih primerih je treba poiskati in uporabiti še druge metode. Te so danes morda dražje ali zahtevajo več časa, dela in znanja, a omogočajo več manevrskega prostora pri interpretaciji in so ponovljive. Pred odločitvijo o izvedbi je nujno ustrezno načrtovanje, ki vključuje tako raziskave kot poznavanje čim širšega nabora možnosti za doseganje zastavljenih ciljev. Poleg kompleksnosti in stanja objekta bi morala biti pri načrtovanju upoštevana tudi njegov pravni status in vrednotenje – na umetniškem delu, kot je da Vincijeva Mona Lisa [National Geographic Society, 2013], je odvzem materialnih vzorcev za preiskave in raziskave nedopusten. Za ta namen so na voljo druga orodja.

Barve se dandanes merijo pri predmetih, kjer sta nujni točnost in natančnost, na primer pri slikah, načini merjenja in instrumenti pa se razlikujejo. Naprave, ki omogočajo merjenje v širokem delu spektra elektromagnetnega valovanja, se splošno imenujejo spektrofotometri. Nekateri med njimi se uporabljajo pri naravoslovnih preiskavah za identifikacijo organskih komponent predmetov kulturne dediščine (veziv, lakov, vlaken), identificirati pa je mogoče tudi nekatere anorganske snovi (pigmente, minerale). Spektrometer je lahko povezan z mikroskopom, kar omogoča analizo zelo majhnih vzorcev, vse to pa omogoča celovit pristop pri vrednotenju predmetov kulturne dediščine. Uporaba spektrometra je mogoča tudi na gradbenih površinah, in to tako na zadnjem sloju kot po odvzemu vzorcev na vseh zgodovinskih plasteh, kar je z raziskovalnega vidika vsekakor zanimivo.

V praksi je s fotografiranjem in fotografiranjem HDR še vedno največ težav pri napravah za zajem slik. Pri tovrstnem fotografiranju je večina opreme namenjena profesionalni rabi. S splošno dostopnimi napravami je mogoče uporabiti le tehniko več zaporednih posnetkov v različnem tonskem razponu. Fotografije HDR, pridobljene z navadnimi kamerami, je treba nato s programsko in strojno opremo šele izdelati. To je zamudno in zahteva precejšnje strokovno znanje. Pri tem načinu dela na rezultat zelo vpliva časovna neusklajenost: med posnetki se motiv lahko zaradi vetra, gibanja ljudi ali avtomobilov spremeni. Podobne posledice ima premik naprave pri pritisku na sprožilec – z vsako motnjo upade kakovost. In čeprav se je mogoče izogniti tehničnim težavam, rezultat porabi ogromno shranjevalnega prostora. Pričakovati je (seveda), da bo tehnološki razvoj tovrstne težave rešil. Letos je Wagner [2015] vložil patentno prijavo za "časovno usklajeno kadriranje /stopnjevalno snemanje/ za fotografiranje HDR", kar bi utegnilo biti alternativa dosedanjemu načinu fotografiranja HDR. Ker gre za patentno prijavo, splošne uporabe ne moremo napovedati.

4. Razprava

V mednarodnem prostoru se je na osnovi številnih izkušenj izoblikovalo ogrodje dokumentiranja arhitekturne dediščine in njene digitalne rekonstrukcije, ki vključuje geodetsko izmero, raziskave in analizo arhivskega gradiva ter trirazsežnostno (3R) prostorsko modeliranje stavb z večpredstavnim vmesnikom [Yan, Behera, & Rajan, 2010]. Ta okvir dela se dopolnjuje, krči ali spreminja glede na okolje in razmere. V Sloveniji prostorsko modeliranje in nadaljnje delo v smislu raziskovanja ali predstavitev ni v splošni uporabi, a arhitekti, gradbeniki in geodeti vseeno zapišejo velik del prostorskih merskih informacij. Beleženje lege, dimenzij in/ali oblike je vendarle nujna sestavina vsakega projekta obnove, saj gre za "pomemben element dokumentacije in raziskovalnega

investigations to identify the organic components of cultural objects (binders, paints, fibers). It is also possible to identify some inorganic materials (pigments, minerals). The spectrometer can be coupled with a microscope, which enables the analysis of very small samples. All this allows for an integral approach in the evaluation of cultural heritage objects. Spectrometer can also be used on building surfaces, both on the last layer and on all the historical layers, which is certainly interesting from the research point of view.

In practice, the image capturing devices present the biggest problem in photography and in HDR imaging. Most of the equipment is intended to professional use. The widely available devices can only use the technique of successive shots in different tonal ranges; after that, it is necessary to create the HDR images with the help of software and hardware. This is time-consuming and requires considerable expertise. Using this work method, timing has great impact on the results, since wind, movement of people or cars can change the motive. Moving the device by pressing the shutter button can have similar consequences – any such disturbance decreases the quality. In addition, even though it is possible to avoid technical problems, the result still takes up a lot of space on the storage media. It is expected (of course) that the technological development will solve these problems. This year Wagner [2015] filed a patent application "for temporally aligned exposure bracketing for high dynamic range imaging," which will offer an alternative to the current way of creating HDR images. Since it is a patent application, we cannot predict the general use.

4. Discussion

The framework for heritage recording and historic reconstruction that involves "surveying, historic investigation, three-dimensional (3D) digital modelling of buildings and an enabling (multimedia) interface" [Yan, Behera, & Rajan, 2010] has formed on numerous international experiences. This framework is supplemented, contracted or changed in relation to the environment and circumstances. In Slovenia, spatial modeling and further work in terms of research or presentation is not in general use, although the architectural, civil engineering and surveying professionals record a large share of spatial metric information. The recording of position, dimensions, and/or shape is an essential part of every project related to the conservation of cultural heritage and forms "an important element of the documentation and analysis process" [Mills, Barber, & Andrews, 2011: p. 3]. Recording is "the graphic and/or photographic capturing of information" which describes the heritage place "at known points in time" [Letellier, Schmid, & LeBlanc, 2007: p. 35] – this important task must be executed first and repeated when appropriate. How extensive the recording of data will be, depends on the "needs assessment, the cultural significance of a heritage place, and the interaction between available resources and relevant constraints" [Ibid: p. 36]. In Slovenia, the work in the field of heritage conservation is facing some restrictions. Architectural documentation collected, stored or created by the Service for the Protection of Cultural Heritage is frequently still not spatial. Perhaps the reason is that 3D records are seen as a supplement and a sort of upgrade. "The focus of 3D visualization of historical structures is not 3D modeling or creating stunning images, but conducting an in-depth, systematic study of the sources, correlating and assessing them, deriving the most probable hypotheses, documenting this interpretation process in a well-structured way and finally visualizing them according to the requirements of the context in which these visualization results are used." [Pletinckx, 2008: pp. 91–92]

There is a variety of techniques available to generate three-dimensional survey information. "These techniques can be characterized in a number of ways, but a useful method is by the scale at which they might be used (which is related to the size of the object to be measured), and by the number of measurements acquired by it (which is related to the complexity of the object). While hand measurements can provide dimensions and positions of objects and scenes of a few meters in size, it is impractical to extend this to larger objects; and collecting many measurements would be a laborious process. Close-range photogrammetry and terrestrial laser scanning could be used to provide a greater number of measurements for similar object sizes, which makes them suitable for more complex objects" [Mills, Barber, & Andrews, 2011: p. 3].

Conservation does not deal with color description on a regular basis. One of important tasks is documenting the state of heritage and monuments. In addition to the already mentioned, there are other tools, accessible to a wide range of users. This fact is a big advantage, but also an obstacle. It can be stated that the reproduction of photos –Kumar [2008: p. 121] writes extensively on this – or HDR images is today already a common knowledge but without any deeper understanding. Correct footprint of colors, especially in professional environments tied to the graphic design, printing or related fields requires color management of all devices involved in the production process. Many of them use the RGB color space. Before printing photos should be converted to a suitable format, e.g. for printers with four basic CMYK colors. Formulae, which convert RGB to CMYK, where the conversion occurs through the CIE model, are not simple and the CMYK actually has no true standard. Therefore, the outputs of the same document on different devices and with the help of a variety of software may differ; and are affected by the color gamut, which is limited in the CMYK color space.

What can be said about the preview of photos? Technically even the most sophisticated monitor is of no use if it depicts distorted color effects as a result of factory settings. In addition to the screen, hardware and software has to be taken into account. Before the work, the screen should be adjusted to fully exploit the color space it is able to depict, and to make the best possible simulation of other standardized color models (sRGB, Adobe RGB ...). "This can only be achieved with the instrumental calibration. Different software tools, based on visual observation, give us unreliable and unrepeatable results. This also applies to color profiles, supplied by manufacturers with the monitor; in particular, in these cases

procesa" [Mills, Barber, & Andrews, 2011: str. 3]. Beleženje je grafično in/ali fotografsko zapisovanje merskih in drugih podatkov o zunanji podobi. Z njim se ohrani védenje o "razvoju in stanju arhitekturne dediščine v danem trenutku" [Letellier, Schmid & LeBlanc, 2007: str. 35] – to pomembno nalogo je treba opraviti prvo in jo redno ponavljati. Koliko obsežno bo beleženje zastavljeno, je odvisno od "nujnosti, kulturnega pomena območja, ciljev, virov ter drugih omejitev" [prav tam: str. 36]. V Sloveniji je pri delu na področju ohranjanja dediščine kar nekaj omejitev, zato arhitekturna dokumentacija, ki jo služba za varstvo kulturne dediščine zbira, hrani in tudi izdela, še vedno velikokrat nima prostorske komponente. Morda tudi zato, ker je to razumljeno zgolj kot dodatek in nadgradnja. A "žarišče 3R-vizualizacije zgodovinskih objektov ni v 3R-modeliranju ali oblikovanju osupljivih fotografij, temveč v poglobljenem, sistematičnem študiju ter povezovanju in ocenjevanju virov, izpeljavi najverjetnejše hipoteze, dokumentiranju dobro strukturiranega procesa interpretacije in naposled vizualizacije vsega tega v skladu z zahtevami in glede na namen uporabe rezultatov." [Pletinckx, 2008: str. 91–92]

Na razpolago so različne tehnike in orodja, s katerimi je mogoče ustvariti mersko informacijo o prostoru. Izbrati jih je mogoče na več načinov a "uporaben kriterij je na primer merilo, v katerem je orodje uporabno (glede na velikost in obseg merjenega objekta), in število z njim dobljenih mer (glede na kompleksnost objekta). Ročne meritve so primerne za izmero objektov in prizorišč v obsegu nekaj metrov, širjenje območja je nepraktično. Tudi izmera večjega števila dimenzij, na primer tisoč ali več, je težavna naloga, ki zahteva veliko časa. Za to sta primernejša bližnjeslikovna fotogrametrija ali terestrično lasersko skeniranje, saj je z njima pri podobno velikih in kompleksnih objektih mogoče izmeriti veliko večje število dimenzij" [Mills, Barber, & Andrews, 2011: str. 3] in to v razmeroma kratkem času.

Konservatorstvo se z opisovanjem barv ne ukvarja redno. Za zapis informacije o njih so poleg omenjenih orodij na voljo še druga, ki so dostopna širokemu krogu uporabnikov. To je velika prednost, a hkrati tudi ovira. Mogoče je posplošiti, da se z reprodukcijo fotografij – o tem obširno piše Kumar [2008: str. 121] – ali slik HDR danes sreča že vsakdo, a brez dobrega poznavanja ozadja. Pravilen odtis barv, predvsem v profesionalnih okoljih, ki so vezana na grafično oblikovanje, tisk ali sorodna področja, zahteva barvno upravljanje (color management) vseh uporabljenih naprav, saj večinoma uporabljajo barvni prostor RGB. Pri tisku pa je treba fotografije pretvoriti v barvni prostor, ki ga uporablja izhodna naprava, na primer tiskalnik s štirimi osnovnimi barvami CMYK. Enačbe, ki pretvorijo RGB v CMYK (pri čemer pretvorba večinoma poteka preko modela CIE), niso preproste in CMYK pravzaprav nima standarda. Zato utegnejo biti izpisi istega dokumenta na različnih napravah in z različno programsko opremo različni, na rezultat pa vpliva tudi razpon barv, ki je pri barvnem prostoru CMYK omejen.

Kaj pa predogled fotografije? Še tako tehnično izpopolnjen zaslon je brez koristi, če zaradi tovarniških nastavitev upodablja popačene barvne učinke. Poleg zaslona je treba upoštevati še strojno in programsko opremo. Pred delom ga je treba nastaviti tako, da popolnoma izrabi barvni prostor, ki ga je zmožen prikazati, in da lahko najbolje simulira kar največ drugih standardiziranih barvnih modelov (sRGB, Adobe RGB...). "To je mogoče doseči le z instrumentalno kalibracijo/merjanjem. Različna programska orodja, ki temeljijo na vizualnem opazovanju, dajejo nezanesljive in neponovljive rezultate. To velja tudi za barvne profile, ki jih z monitorji dobavljajo proizvajalci, še zlasti pa je treba v teh primerih pozabiti na simulacijo tiska v barvnih prostorih CMYK. Rezultati niso natančni in ponovljivi niti primerljivi." [Kumar, 2008: str. 256]

Pri razmisleku, kako informacijo o barvi zabeležiti, je treba razumeti, da pretvorbe tako poškodujejo barvno natančnost in podrobnosti, da ton ne ustreza več temu, kar je videlo oko. Upoštevati je treba tudi, da se z ročno obdelavo in omejenim obsegom barv, ki jih je mogoče prikazati (gamut) ali natisniti na razpoložljivi opremi, poškodba samo povečuje. Škodo je s profesionalno strojno in programsko opremo mogoče zmanjšati, a za povprečnega uporabnika razlika do trenutka, ko informacijo o barvi rabi, ni relevantna.

Pri dejanski obnovi, restavriranju spomenikov ali dediščine ter pri rekonstrukciji stavb se lahko zaplete zaradi neznanja ali napačne interpretacije shranjenih podatkov. V teoriji morajo posegi zagotavljati skladnost s prvotno obliko, barvo, odtenkom, sestavom, obsegom ter omogočiti ohranitev čim večje količine zgodovinskega materiala [Feilden & Jokilehto, 1998], s tem se zagotovi avtentičnost. Razumevanje avtentičnosti je namreč podlaga za vrednotenje. Že restavriranje je visoko strokoven postopek, ki mora ostati nekaj izjemnega: "ustaviti se mora tam, kjer se začenjajo domneve." [ICOMOS, 2003, 9. čl.] Mednarodno sprejeta načela svarijo pred invazivnimi posegi v spomenike celo pri dovolj informacijah in ko naj bi bilo soglasje možno ter strokovno utemeljeno. Kako pa je s posegi na že zelo poškodovani dobrini, o kateri so na voljo morda le dokumenti, katerih problematika je nakazana v tem besedilu? V takšnih primerih je obnova seveda na mestu, a strokovno vprašljiva. Spomenik naj ne bi propadel do take mere, a propadlih elementov brez popolne in natančne informacije tudi ne bi smeli rekonstruirati – niti barve ne. Temu se je mogoče izogniti le z rednim vzdrževanjem in izdelavo ustrezne dokumentacije.

5. Zaključek

Barve ni mogoče zabeležiti samo na en način ali z eno metodo. Zelo pomemben je sistematičen pristop in povezovanje podatkov iz vseh razpoložljivih virov. Enako sistematičen pristop mora veljati pri hrambi rezultatov, sicer so lahko vsa prizadevanja za zapis podatkov zaman. Dokumentacija je smiselna, če se nepretrgano gradi, dopolnjuje in povezuje, način dokumentiranja pa se med procesom lahko celo spremeni ali izboljša. Mednarodna skupnost vse od zapisa Atenske in Beneške listine do Konvencije o svetovni dediščini in drugih listin v novejšem času postavlja, razvija in zapisuje načela delovanja in ohranjanja kulturne dediščine ter poglablja razumevanje,

we can forget about the simulation of the press in CMYK color space. The results are imprecise, unrepeatable, and incomparable." [Kumar, 2008: p. 256]

In considering, how to record information about color, it should be understood that color accuracy and detail could get damaged in the process of conversion in such way that it no longer corresponds to what the eye sees. It should be also taken into account that together with manual processing and the color range, which can be displayed (gamut) or printed on the available equipment, the damage only increases. With the use of professional hardware and software, the damage may be decreased, but for the average user this difference, up to the moment the information on the color is needed, is irrelevant.

In actual reconstruction, restoration of monuments or heritage, and the reconstruction of buildings complications may appear due to lack of knowledge or misinterpretation of the stored data. In theory, interventions must ensure compliance with the original shape, color, shade, assembly, scale and be able to retain the greatest possible amount of historical material [Feilden & Jokilehto, 1998], ensuring authenticity. Understanding authenticity is the basis for valuation. Restoration is a highly professional process, and must remain something exceptional. "It must stop at the point where conjecture begins." [ICOMOS, 2003: Art. 9] Internationally accepted principles warn against invasive interventions even when there is enough information, the interventions are professionally justified, and an expert consensus is possible. So, how to handle interventions on the quite damaged buildings and with only few documents available? In such cases, the restoration is, of course, necessary, but questionable from the professional point of view. The monument should not be ruined to such an extent and the failed components without complete and accurate information should not be reconstructed – not even colors. Only by regular maintenance and proper documentation can this be avoided.

5. Conclusion

It is not possible to record color in only one way or using only one method. Great importance should be attributed to systematic approach and integration of results from different sources. We must apply the same systematic approach in archiving the records; otherwise, all efforts in data recording are in vain. Documentation makes sense if it is built, complemented, and linked, while recording techniques can be changed or improved during the process. The international community has set up (the Athens Charter, Venice Charter, World Heritage Convention and other documents), developed, and wrote down the operating principles for the preservation of cultural heritage and the very understanding of what is the immovable cultural heritage. Thus, many contributed to these texts of declarations; they are optional, but professionally justified. Recommendations are loosely binding and the most binding among them are the conventions. They morally bind signatory states as well as those that have not ratified the document, and their content is expected to be adopted in the local legislature. They have a common point – "every text is concise, and to the point, thus ensuring its acceptability for the widest array of users in various countries with different cultural environments and systems of protection" [Grobovšek, 2014, p. 9]. Colors are indirectly included in these texts in the sense of authenticity and originality of materials, documents, techniques, and recommendations and in incitement to recording, storing information about the monuments and all of the components, as well as in planning interventions.

Conservation aims at safeguarding the quality and values of the assets, protecting its material substance and ensuring its integrity for future generations [Feilden & Jokilehto, 1998], and must respect "the valid contributions of all periods" [ICOMOS, 2003: Art. 11]. Stylistic harmony should not be our goal; on the other hand, the presentation of all periods simultaneously is probably not an appropriate approach either. Recording, interpretation of data, their storage and use for the purpose of presentation with the help of already available technologies and tools, such as computer-aided visualization, and not the in-situ presentation, is a methodology that we can recommend. When speaking about the in-situ presentation, we cannot ignore the warning about the loss of substance, which occurs during the disclosure of individual elements. We cannot avoid external factors. At the same time, we must not forget that despite the attractiveness of the newer tools that provide a strong technological support, exploration and understanding of the heritage should come first. "A computer-based visualization method should normally be used only when it is the most appropriate available method for that purpose" [Beacham, Denard, & Niccolucci, 2009: Principle 2]. Whatever the approach - scope, accuracy, precision and singularity are the result of the knowledge, skills, experience of the person that records the information, the one that stores it, the person who searches for information, and the one who uses it. Decision, on what the information that we want to preserve should be, depends on knowledge. Larger amount of data does not always offer a better basis for decision-making and conservation of resources. Too much information can be an obstacle. Project planning, well-done records and their proper storing can save us time and enables a rational use of increasingly scarce resources. Setting priorities is appropriate; it reduces the possibility of duplication or the execution of unnecessary works. The result is sufficiently detailed information, which will not deviate from the purpose for which it was recorded, thus avoiding any substantial deviation between its inception and its exploit. It must contain measurement data, material composition and argumentation of the accepted decisions, because otherwise subsequently the mind flow cannot be followed. We can re-read the stories hidden in the building fabric (without good records and archive) about how the heritage was built, used and modified only if we preserve the heritage itself.

The main question is no longer how to record something, but how to arm the owner, the central influential person, with knowledge. We have to convince him to preserve heritage

kaj nepremična kulturna dediščina sploh je. Tako so nastala besedila deklaracij, ki so neobvezne, a strokovno utemeljene, zapisana so bila mehko obvezujoča priporočila in najbolj zavezujoča besedila med njimi, konvencije. Slednje moralno zavezujejo tako države podpisnice kot tudi tiste, ki teh dokumentov niso ratificirale, vsebine pa naj bi bile privzete v nacionalno zakonodajo. Imajo skupno točko – "vsako od besedil je zato, da bi bilo sprejemljivo za različna kulturna okolja in sisteme varstva v državah, le toliko obširno, da je sprejemljivo najširšemu krogu uporabnikov" [Grobovšek, 2014: str. 9]. Barve so v ta besedila posredno vključene: kjer je govora o avtentičnosti in izvirnosti materialov, gradiv, tehnik ter priporočil in spodbujanja k dokumentiranju, hranjenju informacij o spomenikih in seveda vseh sestavnih delov kot tudi o načrtovanju posegov.

Cilj ohranjanja je varovanje kakovosti in vrednot dobrine, zaščita njegove materialne substance in zagotavljanje njene neokrnjenosti za prihodnje rodove [Feilden & Jokilehto, 1998], ob tem pa je treba "spoštovati kakovostne prispevke vseh obdobij" [ICOMOS, 2003, 11. čl.]. Cilj ne sme biti slogovna enotnost, na drugi strani pa sočasna predstavitev vseh obdobij tudi ni ustrezen pristop. Zagovarjati pa je mogoče metodologijo z beleženjem, interpretacijo pridobljenih podatkov, njihovim hranjenjem in uporabo z namenom predstavitve, pri čemer se uporabijo že danes dostopne tehnologije in orodja, kot je računalniško podprta vizualizacija (ne s predstavitvijo in situ). Pri predstavitvi in situ je treba opozoriti na izgubo materije, čemur se pri razkrivanju posameznih elementov zunanjim dejavnikom ni mogoče izogniti. Hkrati se je treba zavedati, da je kljub privlačnosti novejših orodij, ki nudijo močno tehnološko podporo, na prvem mestu raziskovanje in razumevanje dediščine. "Računalniško predstavitev naj bi običajno uporabili le, če je najustreznejša za ta namen." [Beacham, 2009] Ne glede na pristop so obseg, točnost, natančnost in enoznačnost rezultat znanja, spretnosti, izkušenj tistega, ki informacijo zabeleži, tistega, ki jo hrani, tistega, ki jo poišče, in tistega, ki jo uporabi. Od vsega tega je odvisna tudi odločitev, kakšna naj bo ohranjena informacija. Večja količina podatkov ni vedno boljša osnova za odločanje in ohranjanje dobrin, zato pravilno načrtovanje in dobro izdelana in shranjena dokumentacija prihranita čas in omogočita racionalno izrabo vedno skopo odmerjenih virov. Ustreznejša je postavitev prioritet – tako se zmanjša možnost podvajanja ali izvedbe neustreznih del. Rezultat bo informacija, ki bo podana dovolj natančno, da se pri njeni uporabi ne bo odstopalo od namena, s katerim je bila zabeležena, in da se od nastanka do uporabe njena vsebina ne bo bistveno spremenila. Vsebovati mora merske podatke, materialno sestavo in argumentacijo za sprejete odločitve, saj sicer kasneje ne bo mogoče slediti miselnemu toku ob dokumentiranju. V stavbno tkivo skrite zgodbe – kako je bila dediščina zgrajena, uporabljana, spremenjena – bodo v prihodnje še berljive, a le, če bo stavba ohranjena.

Odnos do barve je subjektiven, vendar se da njena objektivna vrednost dokazati in utemeljiti. Razpoložljivost virov seveda narekuje odgovornost tehtnega premisleka, kako in kaj zabeležiti: predstavljene metode so bile izbrane zato, ker se že uporabljajo in jih je mogoče združevati in nadgrajevati. Laserski skener objekt izmeri, fotografija dopolni podobo z merljivo barvo in informacija je tako zaokrožena. Če se dediščina iz katerega koli vzroka izgubi, je ves postopek ponovljiv (če so podatki ustrezno shranjeni). Tako nastali dokumenti so neločljivi del dediščine in v prihodnje se jim bodo pridružili še novi. Glavno vprašanje danes ni več, kako stanje dediščine in s tem tudi barvo zabeležiti, marveč kako osrednjo vplivno osebo, lastnika, oborožiti z védenjem o tem, kaj ima. Prepričevanje, utemeljevanje in dokazovanje, da ima nekaj vrednega in naj to ohrani najprej zaradi sebe, je nujnost. Le s postopnim pridobivanjem zaupanja bo mogoče sodelovanje, vlaganje v fizično ohranjanje dediščine in beleženje ter spremljanje njenega stanja. Vzporedno s tem bo poiskan tudi primeren način hranjenja zbranega gradiva. Lastnik namreč za ohranjanje dediščine navadno ne skrbi sam, zato zapisano velja za vse soudeležene.

for his sake and gradually gain confidence, based on which he will be ready to invest in the preservation of heritage, understand the need to use specific methods of recording its condition and allow appropriate storage and archiving of records and other documentation.

The attitude toward color is subjective, but its fair value is demonstrable and justifiable. Of course, the availability of resources dictates the responsibility for careful consideration of how and what to record: the presented methods are selected because they can be combined and upgraded. Laser scanner measures the objects, photographs supplement the image with measurable color and information is rounded. If for whatever reason the heritage is lost, the entire process is repeatable (if the data is properly stored). The resulting documents are an inseparable part of heritage; in the future, new ones will join them. The main question is no longer how to record the current state of heritage and hence the color, but how to arm the key influential person, the owner, with knowledge of what he possesses. Persuasion, argumentation and proving that he has something valuable and should keep it first for himself, are a necessity. Only a gradual increase of confidence will lead toward cooperation, monitoring, investments in heritage conservation and recording. Parallel to this, appropriate storage of the collected material will be located. Owners generally do not care about heritage or a building in general by themselves; therefore, the above applies to all participants.

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Recenzije / Review

Problematika beleženja barv pri dokumentiranju in vrednotenju objektov arhitekturne dediščine ima v širšem kontekstu ohranjanja le-te pomembno vlogo, saj močno vpliva na verodostojnost prikaza zgodovinskih interierov in zunanjosti. V tem pogledu predstavlja članek pomemben in dobrodošel strokovni prispevek, v katerem avtor podrobno informira strokovno pa tudi laično javnost o možnih načinih beleženja barve v kontekstu objektov arhitekturne dediščine. Z vsemi prednostmi in pomanjkljivostmi, ki jih tudi opiše. V času, ko je presoja o ohranjanju ali odstranjevanju objektov arhitekturne dediščine velikokrat na strani kapitala, je objektivna informacija o možnostih njene zaščite in obnove toliko bolj na mestu. V besedilu je na začetku ustrezno prikazano problemsko ozadje. Metode beleženja so v jedru članka ustrezno razložene, besedilo pa je razumljivo strukturirano, da se bralec, ki še nima podrobnega vpogleda v obravnavano problematiko, ne izgubi. V zaključku članka so ponovno poudarjeni cilji članka ter kako jih članek dosega.

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