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THE WORLD OF PHOTOGRAPHY – TRANSLATION OF CHOSEN TEXTS WITH COMMENTARY AND GLOSSARY

Barbora Svejkovská

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THE WORLD OF PHOTOGRAPHY – TRANSLATION OF CHOSEN TEXTS WITH COMMENTARY AND GLOSSARY

Barbora Svejkovská

Vedoucí práce:

Mgr. et Mgr. Jana Kašparová
Katedra anglického jazyka a literatury
Fakulta filozofická Západočeské univerzity v Plzni

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Prohlašuji, že jsem práci vypracoval(a) samostatně s použitím uvedené literatury a zdrojů informací.

Plzeň, duben 2016 ……………………………..

Děkuji Mgr. et Mgr. Janě Kašparové za užitečné rady, za vstřícný přístup při zpracovávání mé bakalářské práce a za její čas, který mi věnovala.

Table of Content

1. INTRODUCTION 1

2. THEORETICAL PART 2

2.1. TRANSLATION 2

2.1.1. FUNCTION OF TRANSLATION 2

2.1.2. SOURCE TEXT AND TARGET TEXT 2

2.1.3. CHARACTERISTIC OF TRANSLATION 3

2.1.4. ROLE OF A TRANSLATOR 4

2.1.5. VOCABULARY 4

2.1.6. FACTORS INFLUENCING TRANSLATION 5

2.1.7. LANGUAGE OF TRANSLATION 5

2.2. PHOTOGRAPHY 6

2.2.1. EVOLUTION OF PHOTOGRAPHY 6

2.2.1.1. ANCIENT ERA 6

2.2.1.2. MIDDLE AGES 7

2.2.1.3. EARLY MODERN PERIOD 8

2.2.1.4. LATE MODERN PERIOD 8

2.2.1.5. INTERWAR PERIOD 10

2.2.1.6. POST-MODERN 11

3. PRACTICAL PART 12

3.1. ENGLISH-CZECH TRANSLATION 13

3.1.1. TARGET TEXT I 13

3.1.2. GLOSSARY 19

3.1.3. TARGET TEXT II 21

3.1.4. GLOSSARY 24

3.1.5. COMMENTARY 25

3.1.5.1. MACRO APPROACH 25

3.1.5.2. MICRO APPROACH 29

3.2. CZECH-ENGLISH TRANSLATION 35

3.2.1. TARGET TEXT III 35

3.2.2. GLOSSARY 37

3.2.3. TARGET TEXT IV 38

3.2.4. GLOSSARY 39

3.2.5. TARGET TEXT V 39

3.2.6. GLOSSARY *43*

3.2.7. COMMENTARY *44*

3.2.7.1. MACRO APPROACH *44*

3.2.7.2. MICRO APPROACH *46*

4. CONCLUSION *50*

5. ENDNOTES *52*

6. BIBLIOGRAPHY *60*

7. ABSTRACT *66*

8. RESUMÉ *67*

9. APPENDICES *68*

1. INTRODUCTION

The aim of this Bachelor thesis is to translate English and Czech texts related to both historical and modern photography, completed by commentary and glossary.

The thesis is divided into two main parts. The first part is the theoretical part which consists of the theory of translation including terms occurring in the field of translation, its function or characteristic and factors influencing the process of translation. The second part of the thesis is the practical part that comprises five translated texts. Two of the texts are translated from English to Czech and three of them are translated from Czech to English; these two groups of translations are followed by a commentary. All of the texts are accompanied by their own glossaries. The English source texts are articles from the *Communications of the ACM* journal, namely the articles *Computational Photography Comes into Focus* and *Open Platforms for Computational Photography* and both are popular scientific texts. These two texts discuss the modern techniques in photography. The Czech texts are extracted from the online blog of Czech company *Analogue*, namely *Od camery obscury až po Dirkomu, Pinhole camera 4M – skládačka a radost v jednom balení* and *Analogový serial na Protišedi.cz* which are all popular scientific texts, aimed rather at lay people. These three texts focus on the historical photography. It is expected that the translation of the technical texts will be more demanding than the translation of the non-technical texts, even though they are all specialized in photography. All source texts are found in Appendices.

The glossaries are divided into several sections by lexical fields of the entries. They include terms from the field of photography, painting and others. The commentaries include analysis of the source and target texts. Every commentary is divided into two subparts – macro approach and micro approach. Macro approach consists of analysis of the source texts, namely the topic, the author, the style, etc. Micro approach includes grammatical and lexical phenomena of both the source texts and the target texts. The practical part is followed by the summary of the thesis, bibliography, abstract, résumé and appendices.

2. THEORETICAL PART

2.1. Translation

Translation is a conversion of words/thoughts from one language into another one. Languages differ from each other in different aspects such as grammatical and lexical structure or origin and evolution of language and culture in relevant to country, context, culture, experience, etc. Lately, interpreting became more than a substitution of words. The primary purpose of translation is a message which legacy should not be altered by the translator.

2.1.1. Function of translation

Nowadays in the age of globalisation, the world is getting more and more connected and translation is portrayed as one of the main actors in the accomplishment of a reciprocal communication. However, interpreting was instrumental also earlier in communication in both written and spoken form (interpretation). The written form of translation has several indisputable advantages in comparison with interpreting. An interpreter has a chance to work on a translation without time pressure or to revise some parts of the final interpreting without anyone noticing his previous faults.

With the aid of translation the society can gain a view of another culture, not only of syntax or lexicology of a foreign language but also of a psyche; what the societal and behaviour norms are, how they act in different situations, what went down in their history and so forth.

“As a general rule, texts are not produced just in order to be translated but to fulfil certain communicative purposes for a specified source language (further only SL) audience,” [1] Nord claims in her book. Basically it means that the target language audience should get an equal piece of information provided by the translator as the source language audience gets from the author of the source text.

2.1.2. Source text and target text

In translatology it is important to term both texts a translator works with. An original text that a translator is given to interpret into another language is called *the source text*. Source text may be formulated in translator's mother tongue or in a foreign language.

The final or in other words the resultant text is called *the target text*. "Target text is the translation of the source text" [2] and may be translated into translator's mother tongue or into a foreign language.

2.1.3. Characteristic of translation

"Translation is a message," [3] Levý describes in his book. Such kind of message is based on a conception of language as a code. This code is a "system of units and the rules of their combinations". [4] In principle, the system is based on deciphering of a source text written in a certain language and follow-up enciphering into another language. The resultant translation, which is basically foreign information converted into a code is once more deciphered by the reader of the translation. [5]

The process of translation begins with the order by an initiator, who purchases the services of a translator in order to get the target text for various purposes. One of the purposes might be initiator's personal demand or need of comprehension of certain source text written in a source language and translated into the language he/she understands (target language) or to provide the translation to a larger group of people for the purpose of getting some piece of information. Despite the fact that being a translator is a profession, translation of a source text can be initiated without anyone asking and paying for it. [6]

Before even beginning with a translation, a comprehensive analysis is recommended. It prevents misreading and misunderstanding of the source text. [7] An interpreter is expected to read the whole text ahead of forming a text in another language. It is a supportive method to sort terminology contained in the source text and prepare potential notation. A translator also gets the chance to think the procedure, methods and technique of his translation through and to get him/herself necessary tools such as glossary and additional literature.

The final result of translation comes in the force at the moment of perception by the reader. This process results according to Levý in three concepts of the work: "author's conception of reality, translator's conception of the original work and reader's conception of the translation". [8]

The resultant interpreting reaches the reader in the form of a written text as "an objective material". [9] "A reader's concretization" [10] comes into existence as the perceiver affects the objectivity with his/her own subjectivity by reading the target text. [11]

According to Nord, all participants in the process of translation "can be represented by one and the same individual". [12] This individual may hold the post of the producer, provider and receiver of the source text as well as the initiator, translator and receiver of the target text. [13]

2.1.4. Role of a translator

A translator is expected to comply with several aspects in the process of deciphering. Under these aspects fall sufficient knowledge of the foreign language, in which the source text is interpreted as well as to have a good grasp of the language, in which the target text is expected to be written.

"A good translator should be primarily a good reader." [14] One of the aspects a comprehension of the original text requires is philological understanding. An interpreter is expected to reach a certain level of the source language, which is necessary to be able not only to read through the original text but also to understand artistic elements, characters and their relationships, plot and the author's ideological intention. [15]

An interpreter is otherwise asked to decide, which element should stay unchanged, because it would alter the meaning, and which one should be replaced. In most cases a translator transforms the text into his/her mother tongue. This kind of translation enables the translator to create a text comprehensible for the reader. [16]

2.1.5. Vocabulary

A translator should also master a passive vocabulary and improve an active one to be able to precisely express all the situations quoted in the source text. The difference between a passive and an active vocabulary is that an active vocabulary changes in the course of time as we learn something new or forget something we do not use in speaking or writing anymore. [17] Vocabulary is specific and subjective and differs from translator to translator. The acquired set of words depends on the milieu in which he/she grew up or just occurred for some time, on age, the level of education and so forth.

2.1.6. Factors influencing translation

When implementing translation, translator has to take into consideration historical period in which the source text was written or stylized. Different era requires different style of speech. However, the age the author lives in has to a considerable extent an influence on the target text. The contemporary style of literature and political issues penetrate into the resultant. Translation is primarily perceiver-oriented. The generation of the reader influences the perception and understanding of the interpreting. Values and norms related to the reader's generation acquire special intensity. [18]

An author of a source text expresses his/her subjectivity or somehow puts his/her beliefs and ideas into the text which makes the source text so specific. One of the main tasks of a translator is not to throw the original ideas into disarray, to maintain the identity of an author coded in the text and not to leave a trace of his/her own subjectivity. A translator is expected to translate primarily the ideological content, which refers to the intended meaning of a source text. The interpreter might not be able to translate the source text literally, as languages differ from each other in both semantics and structure. Language form dwindles in importance, because of the existence of various phenomena of language such as idiomatic expressions. [19]

The meaning of particular words differs from the final meaning of the whole unit. The composition of words in an idiomatic expression may vary in different languages; therefore the meaning is given big importance. The only exception is a translation of literature, of which interpreting requires equality of content and form.

2.1.7. Language of translation

According to Levý, translator's creativity is limited to the field of language; not only because of creating new expressions but also because of foreign expressions becoming naturalized in domestic setting. A translator is allowed and expected to make use of his/her translating skills in the situation of interpreting of stylistic figures, which possess no equivalent counterpart in the language of the target text. The target language is quite often incapable of interpreting such broad or polysemous expressions mentioned in the original text; the translator is set a task to specify the meaning and to understand the reality hidden in the source text. [20]

When constructing new expressions, interpreter has a chance to realize his/her potential. However, it requires sufficient knowledge of both source and target language and a great deal of creativity.

2.2. Photography

Photography serves in communication and expression of people and has a great value to aesthetics. The quickness of getting a picture has greatly improved since the first types of cameras were invented. Capturing a picture by a camera is a unique method not only because of the immediacy but also because of other characteristics. [21]

The picture is formed by a lens inside of a camera. In case of classical film cameras the image is imprinted in the sensitive material called *negative*. The negative is a reversed image which colours' development takes time and with the help of *sodium thiosulfate* it gets fixed. [22]

Photos captured by a camera are considered as authentic and accurate. Photography was sometimes judged as a "mechanical art" because it uses technology. This statement is not necessarily correct as the use of the camera and the methods of taking pictures are individual and creative. The only limitation caused by the technology of cameras is the actuality of the depicted image rather than fantasy. The selection of scene, the moment of exposure, perspective and composition are up to the author of the picture. [23]

Photography has been called "the most important invention since the printing press" because of the merit to "recording the visible world", immortalizing of people, objects and nature and "extending human knowledge and understanding". [24]

2.2.1. Evolution of Photography

The word Photography was first used in the 1830s is derived from the Greek words *photos*, meaning "light" and *graphein*, meaning "to draw". [25]

2.2.1.1. Ancient era

The principle of obtaining an image by the method of passing the light through a hole dates back to the 5th century BC. A Chinese philosopher Mo Ti was aware of the ability of the objects reflecting the light in all directions. He also mentioned the fact that the light reflected from the upper part of an object portrays the lower part of an image. [26]

In the 4th Century BC Aristotle asked himself a question “why sunlight passing through quadrilaterals does not create an angled image, but a round one instead” [27] [1] and he made use of the forerunner of camera obscura by projecting a partial solar eclipse on the ground in the form of a crescent using gaps between leaves of a tree or crossed fingers or letting the light of the sun passing through a sieve. [28] [29]

2.2.1.2. Middle Ages

In the 11th Century AD Ibn al-Haytham, an Arabian mathematician and physicist, known as Alhazen, applied his idea to the refraction and reflection of light and also lenses. During his research, he used a board with a pinhole. In front of this board Alhazen lined up flaming candles picture of which was projected onto the other side of the board. He deduced that the light spreads straightforwardly from noticing of precisely mirrored projection. Alhazen alternately covered the candles and found out that the projected picture of the candle situated on the right turns to the left side. [30] [31]

In the 13th Century Roger Bacon, an English monk, a significant philosopher and a scientist, called *Doctor Mirabilis*, concerned himself with physical experiments like the reflection and quarry of light. He describes the camera obscura as a safe tool to observe the sun. [32]

In 1420s one of the first illustrations came in existence appearing in the book written by Johannes de Fontana. The image shows a person holding a cylinder-shaped object, which can be mistaken as a lantern, with an image projected on the inside of it. The difference between a lantern and camera obscura is that a lantern projects the image and a camera obscura hides the projected image inside. Siegfried Zielinski claimed that the person holding the apparatus is a feminine, originated in orient, which could symbolise the inventors of the magic lantern. [33]

Leonardo Da Vinci, an Italian artist and inventor, wrote the manuscript *Codex Atlanticus* in year 1485, in which he introduced the principle of the pinhole camera that he used to study perspective. One of his drawings was a sketch of a magic lantern from 1515. In his works, Da Vinci introduced a lot of

[1] Translated by the author of this bachelor thesis from the Czech original to English.

optics from which the magic lantern and the camera obscura are considered as the less important. Once he mentioned the appearance of the image of a sunny landscape on the inside wall of a dark room with a pinhole. [34] [35] More about the characteristic and development of camera obscura is described in the Appendix 1.

2.2.1.3. Early modern period

New smaller size of the camera and roller-wheels attached underneath the apparatus made the transfer easier. Another great invention Zahn showed interest in was *the magic lantern* which he used for anatomical lectures and solar observations employing mirrors and lenses. “Zahn also suggested the presentation of images under water and proceeded to explain, and stressed the importance of hiding the magic lantern out of sight of the audience.” [36] The image under water was projected on glass primarily as a clock and its main advantage over the camera obscura is the ability to provide the view of the image to more than one viewer. [37]

The use of camera obscura to create images was replaced by more advanced devices in a bid to develop a device which would capture images completely mechanically. [38] Further information about camera obscura is found in Appendix 1.

2.2.1.4. Late modern period

In the first half of the 19th century a French amateur inventor Nicéphore Niépce, interested in lithography[2], came up with a method of using light to get a picture. Niépce used oiled engravings to make it transparent which he put on a plate coated with a light-sensitive material and lavender oil which he exposed to light. This process of copying of an engraving Niépce called heliography[3]. The light-sensitive material he used was a form of asphalt which loses its solubility in some solvents. [41] Even though his images were underexposed and didn’t last long, his ideas helped others to develop more successful devices. [42]

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[2] Litography is a process in which drawings are copied or drawn by hand onto lithographic stone and then printed in ink. [39]

[3] Heliography is an early type of photoengraving made on a metal plate coated with sensitized asphalt. [40]

Niépce's colleague and a professional scene painter for the theatre Louis Jacques Mandé Daguerre also experimented with the tracing of pictures by both camera obscura and *camera lucida*. His goal was to shorten the exposure time needed to obtain an image. After few attempts which did not lead to great results, Daguerre reduced the exposure time from eight hours to 30 minutes and developed a new apparatus using a silvered copper plate called after his inventor *the daguerreotype*. [43] [44]

In 1835 a scientist at the University of Cambridge William Henry Fox Talbot successfully tried to use chemicals to obtain a picture. Using silver chloride he invented a technique which allowed to copy easily captured pictures. [45]

A Slovakian mathematician Jozef Maxmilián Petzval invented an advanced lens working 20 times faster than the lens in existing Daguerre's cameras. At the same time a German mechanic Petr Voigtländer reduced the size of the wooden box to be easily transported. [46] [47]

In 1835 Talbot improved the negative process by reproducing the image on paper instead of metal, still with the help of chemicals. He named his invention *the calotype* in Greek meaning "beautiful picture". The calotype was used in the 1850s to exceptionally capture architectural monuments. [48]

Another significant experimental camera in the 1850 was *the stereograph* capturing two pictures of the same subject by two lenses apart to simulate the position of the human eyes. Firstly it was developed by Sir David Brewster who also invented a stereoscope through which the complete scene could be viewed by bringing both images together with the help of the human brain which ensures the illusion of three-dimensionality. The most popular purpose of the stereograph was to view "landscapes, monuments or composed narrative scenes". Also during the second half of the 19^{th} century was this apparatus used for the education and recreation of the public. During the Crystal Palace Exposition of 1851 Queen Victoria showed her interest in this sensational invention. [49]

In the same year *wet collodion process* was developed by Frederick Scott Archer, an English sculptor. The new method was faster and free from patent restrictions. However, its main disadvantage was a high sensibility of a plate onto which the image was captured to light. Nevertheless, the wet collodion process made the photography itself more popular than daguerreotype because of its exactness of details. [50]

Many other techniques followed like *the ambrotype*, positive images produced on glass with the help of the wet collodion process; *the tinytype*, a cheap variation of the ambrotype, popular among soldiers in the Civil War or *the dry plate*, developed by Richard Leach Maddox, regarded as “the beginning of the modern era of photography” which leaded to the invention of the Kodak camera in 1888 by George Eastman. Instead of the glass plates was put into the camera a roll of *flexible negative material* for up to a hundred pictures. The images were printed from the negative in one of the Eastman factories. The slogan of Kodak was “You Press the Button, We Do the Rest.” which is also the name of the song composed in 1892. [51] [52]

2.2.1.5. Interwar period

All of these innovative techniques led to a wider range of photographic products. After the World War I a method called *photojournalism* was quite popular because of the large number of newspapers and magazines published around the world. Ernst Leitz began in 1925 the production of so called *Leica* camera, which was *a* “German miniature-camera”. This camera was appropriate for shooting inside and outside. [53]

The invention of *Kodachrome* by two American musicians from the *Kodak Research Laboratories* brought colour photography to light. It was filled with a reversal (negative-positive) film. After the World War II, Kodak invented the *Kodacolor* which became after some improvements and price reduction popular among amateur photographers. [54]

Rather than documentary pictures, the artists influenced by the *Abstract Expressionist*[4] art movement concentrated more on the quality of images and artistic experiments. Minor white, an American photographer, claimed, that the photography should contain an inner message that can be hidden under the surface of the picture. [55]

Numerous experiments followed, such as Graffiti, expressive nudes or close-up views of nature. All inclined to abstraction. Street photography was popular before and during the World War II. The purpose of these pictures was not to illustrate the social issue of those times but to capture “the vitality of

[4] The artists belonging to this artistic movement expressed spontaneous emotions in their paintings. [56]

urban life". The photographers wanted to capture the moments of everyday life. [57]

2.2.1.6. Post-Modern

In the 1980's a photograph Nan Goldin created a series called *The Ballad of Sexual Dependency* which is a diary consisting of intimate pictures of her friends, family and lovers. [58] This book brought intimate documentary work to light. Since the pictures were in colour, the atmosphere was rather real. At that time, she influenced other artists to photograph in colour. [59]

In the late 1980's Kodak developed digital cameras. The devices were heavy and produced pictures of a low quality. [60] However, they were able to send images directly to the computer where they could be altered in different programs. One of the first programs, which is one of the leading photo editors till now, was *Adobe Photoshop*, introduced in 1990. This photo editor can significantly alter the picture which could harm the truthfulness of the original picture. [61]

The ability to edit the picture after it is captured had an impact not only on the consumers but also on the newspapers and magazines which benefited from it. The alteration of digital pictures was popular also in the field of fashion and celebrities which led to the technique called *retouch* or *touch up*, minimizing the flaws of the models.

In 2007 Apple Inc. invented *iPhone* which increased the standard of digital pictures and their editing by development of applications for their immediate sharing on the internet. [62] [63] Nowadays, smartphone cameras can compete with the consumer digital cameras. First of all, it is easier to capture a picture by a smartphone since most people always carry it on themselves/them. Another indisputable advantage is that the pictures can be immediately shared on the internet, which is not possible by the majority of digital cameras. The quality of resultant images is still better when photographing with a digital camera, though many people prefer smartphone cameras for a variety of reasons. [64]

Nevertheless, modern technologies are also instrumental in the world mapping, military uses such as the remote targeting of drone missile strikes, or recording of fingerprints or portraits. [65]

The photography of the 21st century is both an art and a means of communication with endless possibilities of post-production expressing the personality or certain attitude.

3. PACTICAL PART

The practical part includes five translations of source texts, commentaries and glossaries. Two of the source texts are translated from English to Czech and three of the source texts are translated from Czech to English. The commentaries contain analysis of the texts and difficulties connected with translations. In the glossaries are included the most appropriate translations of special terms from the field of photography as well as unknown words.

3.1. English-Czech translation

3.1.1. Target text I

Počítačová fotografie se dostává do hledáčku [66]

Díky pokrokům v počítačové fotografii se stisknutí spouště stává pouhým začátkem. Technologie mění obor fotografie.

V průběhu posledních deseti let změnily digitální fotoaparáty způsob, jakým lidé pořizují a upravují snímky. Dnes je stisknutí spouště pouhým začátkem v procesu pořízení a úpravy fotografie. Fotografovi se dostává možnosti základní úpravy přímo ve fotoaparátu, ale k výraznějšímu pozměnění celkového vzhledu, dojmu a kompozice může také použít počítačové fotoeditory. „Můžeme využít výpočetní technologie, abychom zlepšili zpracování fotografie jak z hlediska estetiky, tak i větší flexibility," vysvětluje Frédo Durand, profesor informatiky a odborník na problematiku umělé inteligence z Massachusettského technologického institutu v Cambridgi.

Lytro fotoaparát zaznamenává celé světelné pole.

Vědci a technici koncept počítačové fotografie dále zdokonalují. Navrhují různé typy fotoaparátů, vyvíjí stále důmyslnější algoritmy a používají nové typy senzorů a systémů, aby se odvážně vydali tam, kam se zatím žádný fotograf nedostal.

Schopnost zaznamenat více informací o fotografované scéně a využívání výkonné technologie pro úpravu fotografie dále rozvíjejí tento obor. „Počítačová fotografie a její výsledné zobrazování jsou velmi rychle se rozvíjejícími oblastmi," tvrdí Shree K. Nayar, profesor informatiky z Kolumbijské univerzity v New Yorku.

Tyto fotoaparáty využívající počítačovou technologii, spolu s mnohem vyspělejším softwarem, zcela pozmění lidský pohled na fotografii a její využití. Umožní například zaznamenat drobný předmět či nepatrný pohyb v zorném poli. Umí pozměnit perspektivu i po stisknutí spouště fotoaparátu či poskytnout 360-ti stupňový panoramatický pohled. Mohou také pozměnit realitu a změnit ohnisko fotografie ještě po zachycení snímku.

Mezitím se bude fotografie dále rozvíjet prostřednictvím výkonnějších senzorů zabudovaných do těl smartphonů. V kombinaci se specializovanými programy a službami založenými na principu cloudu posunou současný koncept fotografie na novou fascinující úroveň.

Lepší obraz

Není žádným velkým tajemstvím, že digitální fotoaparáty změnily odvětví fotografie. Přechod od kinofilmu k pixelům umožnil způsoby zpracování a sdílení fotografie, jež byly v minulosti nepředstavitelné. Dnešní fotoaparáty jsou nicméně stále značně závislé na stejných prvcích a technologii zaznamenávající obraz jako předtím kinofilmové fotoaparáty, většinou mají stejnou konstrukci, pouze obohacenou o nové prvky. „Tyto prvky představují spoustu omezení. Je velmi obtížné pozměnit způsob chování fotoaparátu či zachycování snímků,“ vysvětluje Durand.

Využití počítačové fotografie, zobrazování výsledné fotografie a optika však slibují výraznou změnu v postoji lidí k odvětví fotografie a ve způsobu pořizování a úpravy fotografií. Například William Freeman, profesor informatiky z Massachusettského technologického institutu říká, že fotoaparáty využívající počítačovou technologii dokáží zaznamenat několik fotografií najednou tak, aby se odstranilo riziko výpalů, přesycení barev a další expoziční problémy. Mohou také eliminovat nutnost použití blesku. „Při použití blesku dochází velmi často k narušení tonality fotografií, ale kombinací několika fotografií, jak s použitím blesku, tak

Průřez tělem fotoaparátu Canon EOS 5D Mark II.

bez něj, je možné získat jeden zaostřený snímek bez šumu se správnou tonalitou.“ Schopnost změnit ohnisko fotografie po jejím zachycení by pak rovněž mohla umožnit zaostření na osobu v popředí a zároveň také na vzdálený předmět jako např. Eiffelovu věž nebo Sochu svobody, vše ostatní by bylo na fotografii rozmazané.

Počítačová fotografie může vést ke změnám ve výrobě fotoaparátů, jako například k novým typům těl fotoaparátů, čočkám a optice.

Běžně dostupný Lytro fotoaparát – který zaznamenává celé světelné pole v záběru (v podstatě data o hloubce ostrosti v celém záběru) – již uživateli umožňuje pozměnit ohnisko na fotografii a upravit světelnost po zachycení fotografie. Stejně tak by senzor, který by zachytil různé úrovně světla do různých pixelů, mohl vytvořit zcela nové typy fotografií včetně snímků s výrazně odlišnou světelností a škálou barev.

Technologie, kterou počítačová fotografie využívá, může vést ke změnám ve výrobě fotoaparátů. Jak zdůrazňuje profesor Nayar z Kolumbijské univerzity, počítačové prvky jako takové představují značné zlepšení, navíc také představují možnost dát vzniknout novým tělům fotoaparátů, jejich čoček a optiky. Zabudováním počítačové čočky do smartphonu může tato technologie například napodobit prvky drahých výkonných optických čoček za mnohem nižší cenu nebo může vytvářet zcela nové prvky. Fotograf by získal možnost zachytit snímek za pomoci jednoduchých či mnohočetných čoček poskytujících možnost 3D obrazu či zpomalit a pozastavit sekvenci snímání kvůli otřesu fotoaparátu, obzvlášť ve tmavém prostředí a při pohybu, což je pro pořízení snímku nevhodné.

Z výhod plynoucích z počítačových fotoaparátů a softwaru nebudou těžit jen zákazníci. Tato technologie může mít vliv i na různá odvětví průmyslu jako například na medicínu, výrobní průmysl, dopravu a bezpečnost, jak upozorňuje Marc Levoy, profesor informatiky a elektrického inženýrství ze Stanfordovy univerzity v Palo Alto v Kalifornii, jenž se nedávno rozloučil s týmem vývojářů Google Glass, s nimiž spolupracoval na inovaci Google brýlí. Podle Levoye mohou fotoaparáty s pokrokovějšími počítačovými prvky pozměnit způsob, jakým pohlížíme na okolní svět a vytvořit obraz dosahující za hranice běžných fotografií či videí.

Spolu s vědci například navrhnul vývoj počítačového fotoaparátu, který by dokázal vidět skrz davy lidí, předměty a osoby. Podobná technologie, by také mohla vytvořit ohniskový shluk v jediném snímku. To by otevřelo nové možnosti v biologii a mikroskopii, říká Levoy. „Laborant by získal možnost fotografovat struktury buněk bez zaostření mikroskopem; k zaostření by došlo až po zachycení snímku.“ Dodává, že by počítačový fotoaparát také zvládl automaticky spočítat počet buněk na fotografii a poskytnout danou informaci rychleji a přesněji než kterýkoliv člověk.

Příkladem využití systému počítačové fotografie, který aktuálně přitahuje pravděpodobně největší pozornost, jsou brýle Google Glass. Jejich fotoaparát zachycuje snímky, poskytuje dodatečné informace a rozbor několika možných situací a scénářů, což znamená pokrok v rozvoji a rozšíření prvků každodenního světa. Tým pracující na Google Glass brýlích je zaměřen na rozvoj sběru mapových dat, jazykové překlady, informace o cestování a dopravě a dále také na aplikace monitorující srdce, zaznamenávající data o cvičení a měřící tělesné hodnoty. Zařízení také disponuje sekvenčním snímáním a dokáže vytvořit HDR fotografii s možností upravit světelnost i po pořízení snímku.

Za hranici pixelů

Vyvinout takové systémy a algoritmy však není ani zdaleka snadné. Problém je v tom, že se vědci pokoušejí rozšířit počítačové prvky za hranice uživatelských fotoaparátů do dalších odvětví jako je astronomie, medicínská fotografie nebo fotografování automobilů. Nabízí se také možnost zachycování snímků za hranicemi světelného spektra, zapojování environmentálních senzorů či nacházení nových způsobů využití senzorů k zaznamenání nepatrných, ale důležitých změn v okolí. Jak Levoy říká: „Tato technologie možná nebude dotažena do cíle.“

Durand také tvrdí, že výhody nejsou omezené pouze na uživatelské fotoaparáty. Nové typy fotoaparátů a programů by mohly být schopny vytvořit kvalitní 3D fotografie, které dokáží odhalit předměty, jež běžná optika odhalit nedokáže. Ve spolupráci s Freemanem vyvinul Durand algoritmy, jež dokáží zaznamenat krevní oběh v lidské tváři či tep srdce na základě jemných záchvěvů hlavy. Tato technologie se vztahuje k takzvané „motion magnification technologii“, která by potenciálně mohla být využita k odhalení slabých míst na mostech či budovách, jelikož zesiluje impulzy a zvýrazňuje barevné spektrum. „Lidské oko není schopno tyto signály zaznamenat, jsou ovšem odhalovány pokrokovým počítačovým zobrazováním a analýzou zpomaleného záběru sekvence snímků,“ vysvětluje Freeman.

Vladimir Katkovnik, profesor zpracování signálu na technické univerzitě v Tampere ve Finsku, říká, že značnou překážkou k dosežení těchto cílů je vývoj algoritmů, které roztřídí veškerá data a užitečně je aplikují. Navzdory možnosti využití větších senzorů, které dokáží zachytit více dat, nastupuje trend podporující vytváření snímků složených z více pixelů. „Větší množství megapixelů umožní tvorbu fotografií složených z více pixelů o menší velikosti. Menší počet fotonů na pixel zachycených během expozičního času způsobuje větší množství šumu. Odstraňování šumu je v dnešní době velkou výzvou, co se každého zobrazovacího či snímacího zařízení týče, jelikož výsledná kvalita závisí na tom, jak dobře byl šum omezen.“

Další výzvou je, jak říká Durand, vývoj výkonných algoritmů, které by byly vhodné pro umístění do malých přístrojů, jako jsou fotoaparáty, smartphony a tablety. „Problémem není pouze vývoj algoritmu, který by fungoval, ale spíše to, zda je možné navrhnout efektivní výpočetní technologii aplikovatelnou do hardwaru. „Vývoj optimalizačního kódu, který může těžit z moderního hardwaru, včetně mobilních procesorů, je extrémně obtížný.“ Momentálně vyvíjí kompilátor pro snadnější dosažení dobrého výsledku bez potřeby zapojení týmu vývojářů, který by tento úkol splnil.

Nayar věří, že vědci proniknou do „big data technologií“ a v některých případech budou zkoumat a analyzovat existující fotografie k vytvoření algoritmů, které se účastní mnohem propracovanějšího zpracování obrazu. Nyní, „když se pokoušíte odstranit osobu či předmět z fotografie, neexistuje snadný způsob, jak prázdné místo zaplnit, i s poměrně kvalitními fotoeditory,“ říká. „Využitím milionů fotografií a aplikováním strojového učení algoritmů je možné prázdná místa zaplnit vizuálně přijatelným způsobem.“ Dodává, že v budoucnu by se tyto možnosti mohly objevit ve fotoaparátech, ve smartphonech i tabletech a mohly by poskytovat možnost téměř okamžité manipulace a nástrojů na úpravu fotografií, díky nimž by dnešní způsoby úpravy fotografií zanikly.

Díky vývoji technologií s rostoucím výkonem procesorů a lepší znalostí fyziky vědci pravděpodobně dosáhnou průlomu do konce následujícího desetiletí. Algoritmy, které se používají dnes, jsou většinou teprve ve stádiu vývoje,“ říká Nayar. „Zatím se většina výzkumu točí kolem rozšíření schopností tradičního zobrazování a hledání způsobů, jak zdokonalit provedení digitálních fotoaparátů.“ Nayar tvrdí, že získáváním většího množství informací o netradičním zobrazování a optice „vše od sestrojení čipů, přes čočky až po nastavení fotoaparátu dozná četných změn.“

Nakonec Durand říká, že je důležité zasadit počítačovou fotografii, zobrazování a optiku do správného kontextu. Technologie nenahradí dnešní fotoaparáty ani fotografy; pouze zdokonalí jejich schopnosti a bude pokračovat v rozvíjení procesu, který započal před tisíci lety vývojem „dírkových fotoaparátů“. Počítačová fotografie využívá data lépe a inovativním způsobem, ať už je aplikuje na sekvenování DNA či na vylepšení dopravních kamer nebo další bezpečnostní nástroje.

Jak říká Durand: „obor fotografie je jen špičkou ledovce. Díky ní máme možnost nahlížet na svět ze zcela jiné perspektivy.“

3.1.2. Glossary

Photography & Computer	
3-D capability	možnost 3D obrazu
algorithm	algoritmus
artificial intelligence	umělá inteligence
burst of images	sekvenční snímání
camera shake	otřes fotoaparátu
cloud-based service	služba založená na principu cloudu
color range	škála barev
color variations	barevné spektrum
compiler	kompilátor
computation	výpočetní technologie
computational photography	počítačová fotografie
consumer camera	uživatelský fotoaparát
conventional camera	uživatelský fotoaparát
depth of field	hloubka ostrosti
digital camera	digitální fotoaparát
environmental sensor	environmentální senzor
exposure time	expoziční čas
film	film, kinofilm
flash	blesk
focal stack	ohniskový shluk
focus	ohnisko
glare	výpal

high-dynamic range	HDR
chip design	sestrojení čipu
image enhancement technology	technologie pro úpravu fotografie
imaging	zobrazování
light field	světelné pole
lighting	světelnost
low-noise image	fotografie bez šumu
map data	mapová data
to marry video	zpomalit snímání
optical lens	optická čočka
optics	optika
oversaturation	přesycení barev
panoramic view	panoramatický pohled
perspective	perspektiva
photoediting software	fotoeditor
pinhole camera	dírkový fotoaparát
pixel	pixel
sensor	senzor
snap of a photo	stisknutí spouště (pro zachycení snímku)
spectrum of light	světelné spektrum
tonal scale	tonalita
Others	
cutaway view	průřez
development team	tým vývojářu

3.1.3. Target text II

Technologická perspektiva

Otevřené platformy pro počítačovou fotografii. [67]

Richard Szeliski

POČÍTAČOVÁ FOTOGRAFIE je poměrně novou disciplínou, která umožňuje vytvářet kvalitnější fotografie za pomoci neobvyklé kombinace digitální fotografie, algoritmů, optiky a senzorů. Tento obor tak spojuje úpravu fotografií, počítačové zobrazení s počítačovou grafikou a napomohl vzniku workshopů a konferencí s touto tématikou. Dal rovněž vzniknout mnoha novým funkcím používaným v digitálních fotoaparátech a smartphonech.

Ačkoli vědci využívají obrazovou analýzu a výkonnější technologie ve fotografiích po desetiletí, počátky využívání propracovaných algoritmů v běžné uživatelské fotografii začaly teprve v první polovině devadesátých let. Poprvé byly tyto algoritmy použity například při vytváření panoramatických snímků za pomoci skládání bez viditelných přechodů mezi jednotlivými snímky, při vytváření HDR snímků za pomoci propojení snímků o různých expozičních hodnotách a při spojení fotografií pořízených s bleskem a bez blesku pro získání více detailů v tmavých oblastech bez výrazných stínů.

Stejně jako většina výpočetních technologií, algoritmy počítačové fotografie byly původně vyvinuty a využívány pro práci v profesionálních pracovních stanicích a na stolních osobních počítačích. Bohužel nemožnost využití těchto algoritmů v běžných fotoaparátech znamenala značné omezení pro testování těchto technologií v reálném světě a tím i dalšího prosakování vědeckého pokroku do světa běžných spotřebitelů.

Přenesení těchto algoritmů do hadrwaru a firmwaru bránilo množství faktorů. Například algoritmy pro úpravu digitální fotografie využívané fotoaparáty jsou chráněny patenty a obchodním tajemstvím. Prodejci také bedlivě sledují počínání uživatelů na rozdíl od otevřenějšího přístupu, který zaujímá komunita vytvářející nové aplikace.

Mnohem závažnější překážkou rozšíření vývoje a využití algoritmů ve fotoaparátech je chybějící jasná a transparentní struktura pro kontrolu funkcí fotoaparátu, navržení algoritmů pro zpracování a zobrazování obrazu v reálném čase. Následující konferenční příspěvek vypracovaný Adamsem a kolektivem se jako první zaobírá tímto problémem, a to vytříbeným a vkusným způsobem.

Okamžité zpracování obrazu a bezprostřední zpětná vazba vyžadují od fotoaparátu zvládání různých úloh ve stejný moment. Fotoaparáty například musí určit optimální expoziční čas, nastavení uzávěrky, analogový záznam a nastavení zaostření u každé fotografie.

Vytvořit elegantní programovatelnou strukturu a různá API (programátorské rozhraní), které by podporovaly využití výkonných algoritmů počítačové fotografie je velice náročným problémem pro konstruktéry. Autoři tvrdí, že k vytvoření něčeho takového je zapotřebí, aby tato struktura umožňovala přesné vymezené nastavení parametrů (jinak nazývané jako „shots“), které volí způsob, jakým mají být jednotlivé fotografie pořízeny.

Jelikož nastavení těchto parametrů může trvat dlouho, systém zachovává požadované a aktuální parametry propojené s RAW fotografiemi a uschovává je v obrazovém procesoru. Kompletní systém navrhovaný v příspěvku z konference se tedy skládá z „shots“ (požadované nastavení parametrů), senzorů zachycujících jednotlivě každý snímek, sekvenci či několikanásobné snímky a záběrů, které vyvolávají zaznamenané fotografie a metadata, a zařízení jako jsou například čočky a blesky, které mohou být kontrolovány programem.

Aby prokázali užitečnost a univerzálnost svého návrhu, sestavili autoři článku experimentální

Frankencameru na míru podle svého návrhu na využití běžně dostupných částí fotoaparátu potřebných pro vytvoření fotografie a přeprogramovali smartphone Nokia N900. Následně vytvořili řadu užitečných a přesvědčivých algoritmů pro počítačovou fotografii.

Od své první publikace v SIGGRAPH 2010 zaznamenal konferenční příspěvek o Frankencameře a s ní souvisejících hardwarových a firmwarových systémech dramatického vlivu jak na výzkum a výuku počítačové fotografie, tak na běžné uživatelské fotografické zařízení. Frankencamery a jejich software byly použity v cyklu přednášek o počítačové fotografii CS 448A na Stanfordově univerzitě, a také v řadě dalších přednášek na jiných univerzitách. Mnohé aplikace využívající počítačovou fotografii jsou dnes k nalezení ve smartphonech a nápady inspirované příspěvkem z konference se také využívají v nově připravovaných verzích systémů a knihoven smartphonů.

Další podstatnou složkou v usnadnění vývoje algoritmů pro počítačovou fotografii jsou vyspělé programovací jazyky a kompilátor uzpůsobený pro takové programy. Naštěstí v příspěvku z konference SIGGRAPH 2012 je popsán systém zvaný *Halide*, který slibuje něco podobného umožněním programátorům zapsat složité popisy algoritmů a následným zadáváním příkazů kompilátoru o požadovaných úrovních tile-based kešování mezipaměti, paralelním a zřetězovaném zpracování instrukcí a opětovném použití.

Počítačová fotografie je z jedné strany rozvíjejícím se odvětvím výzkumu a z druhé strany jde kupředu jako vědní obor a rovněž jako praktické využití, které ovlivňuje všechny aspekty digitální fotografie. Následující příspěvek z konference poskytuje krásný příklad toho, jak mohou dobře navržené struktury pro systémy výpočetní vědy ulehčit a urychlit přijetí nových technologií a seznámit studenty s inovativními možnostmi.

3.1.4. Glossary

Photography & Computer	
algorithm	algoritmus
analog gain	analogovový záznam
aperture	uzávěrka
API	programátorské rozhraní [68]
compiler	kompilátor
computer vision	počítačové zobrazení
continuous stream of shots	několikanásobné snímky [69]
digital camera	digitální fotoaparát
digital image	digitální fotografie
exposure time	expoziční čas
flash unit	blesky
frame	záběr
high dynamic range (HDR)	HDR, vysoký dynamický rozsah [70]
image analysis	obrazová analýza
image processing	úprava fotografií
open platform	otevřená platforma
optics	optika
parallelism	paralelní zpracování instrukcí
pipelining	zřetězované zpracování instrukcí [71]
raw image	RAW fotografie
real-world experimental validation	testování v reálném světě

tile-based caching	tile-based kešování
Others	
enhanced-quality	kvalitnější
harsh shadow	výrazný stín
parallelism	podobnost
percolation	prosakování
tailored	uzpůsobený
trade secret	obchodní tajemství
vendor	prodejce

3.1.5. Commentary

A commentary is an analysis of the source text (ST) in comparison with the target text (TT). It deals with the grammatical, lexical and stylistic occurrences of the ST, which are described in the first part of the commentary – the macro approach. The problems that needed to be dealt with, particular examples of differences in the structure of the TT from the ST are mentioned in the second part of the commentary – the micro approach. All source texts are available in the Appendices (Appendix 2-Appendix 6).

3.1.5.1. Macro approach

1. **Source texts**

The source texts are articles published in the *Communication of the ACM* journal, “the leading print and online publication for the computing and information technology fields”. [72] It deals with an introduction of a modern technique invented to improve photography to the readers of the printed as well as the online version of this journal. The text *Computational Photography Comes into Focus* is the first source text of my translation (further only ST 1), *Open Platforms for Computational Photography* is the second source text (further only ST 2).

Both texts are well-arranged, which helps its comprehensibility. The texts are introduced with a title written in bold; the title of ST 1 is followed by a brief introductory paragraph written in italics. The difference between the typefaces again serves the comprehensibility. The text is divided into paragraphs which in case of ST 1 form several minor topics which are always introduced with a subtitle.

The ST 1 includes, apart from the text, also a photo of a Lytro camera and a picture of Canon EOS 5D Mark II which helps to draw attention of the readers and makes the whole article more interesting and more informative. To put emphasis on an important part of the text, the author of ST 1 takes the part out of the text, places it on a separate visible place and intensifies the importance by enlarging and changing the colour of the script.

The topic of both texts is an integration of efficient algorithms of computational photography into consumer devices. It deals with the development and improvement of current devices with the help of multiple devices.

2. Background

The texts focus on the technological field describing the substance and potential benefits of a newly emerging technology – the computational photography. This technology is a current topic in the field of photography which is also supported by the date of the texts publication. Further technical knowledge is expected to fully understand the terms and ideas expressed in the articles.

3. Authors

ST 1: Author of the text is Samuel Greengard, a journalist based in West Linn, writing about business and technology for Baseline, CIO Insight and other publications. [73] He quotes different experts, who are concretely named, to prove the veracity and support the coherence of the text.

An author of the in-text photography in is John Biehler, a Canadian technologist, 3D printing advocate and photographer. [74]

An author of the drawing in is not specified, the only further piece of information is the permission from the producer of the device to publish this image (image courtesy of Canon USA).

ST 2: Author of the text is Richard Szeliski, the director and a founding member of the Computational Photography applied research group at Facebook and an Affiliate Professor at the University of Washington. [75]

The texts are written in the third person, authors do not use the first person to avoid subjectivity.

4. Audience

Readers of these articles should possess at least basic knowledge of technical photography on the grounds of an occurrence of technical terms, e. g. *image capture, photoediting software, algorithms, sensors, panoramic view, compiler,* etc. An explanation for those interested in more information or for unacquainted with the terms cannot be found in the text.

However, the articles can be easily understood to a reader with the deficiency of knowledge of technical terms in photography. The author mentions examples and describes the processes in detail so readers are able to imagine the particular functions of computational photography.

5. Subject matter

ST 1: The subject matter of this article is an introduction of the computational photography as a new technology in capturing and editing photography. The author introduces readers the functions and benefits of the computational photography giving concrete examples such as Lytro camera or already existing Google Glass. The author mentions the intentions of the developers to spread the technology into user devices including smartphones and digital cameras, which is not a simple task because of the current inability to develop algorithms and sensors which could be installed into user cameras.

ST 2: The subject matter of this article is an introduction of the computational photography to the new generation of students. The text deals with the usefulness and benefits of the integration of this new technique to conventional devices such as smartphones cameras. The scientists have developed new algorithms but they cannot apply them to conventional cameras yet, which inhibits the testing of new functions. The authors of the article assembled an experimental camera called “Frankencamera” from parts of camera from different sources and from a smartphone. They installed new algorithms into the Frankencamera and used it to show the people how the algorithms work when applied to a camera.

6. Function of the text

- Educative
- Informative

7. Style of the text

The texts are written in a popular scientific style. The authors introduce a technical topic to the general public in an appropriate way; they explain new issues and gives examples. Therefore, not only people aware of new terms are able to read these articles.

8. Language of the text

The texts are written in informal language to reach a wider audience.

Special terms occur, especially from the field of computing technology, e.g. *algorithms, machine learning, hardware, hardware, firmware, software, smartphone, sensors,* etc. as well as from the field of photography, e.g. *to snap, tonal scale, oversaturation, flash, raw images,* etc.

ST 1: The article frequently uses direct speech and reported speech, placed either initially (*As Levoy puts it, “There is a potential for this technology to be extremely disruptive.”*), medially (*“The algorithms being used today are still mostly in the infant stages,” Nayar says. “So far, most of the research has revolved…“*) or finally (*“These signals cannot be detected by the human eye, but they are revealed through advanced computational imaging and slow-motion analysis,” Freeman explains.*).

ST 1: The author uses metaphorical expressions to make the reading of the article more entertaining and interesting, e.g. *Computational Photography Comes into Focus, digital cameras have radically refocused the way…, Photography is just one aspect of a much bigger picture..,* etc.

Both texts are written in American English, judging from the spelling of the word *color*, which opposes the British variant of the word spelled as *colour* in ST 1 and the spelling of the word *analog* in ST 2 which has a British variant *analogue*.

3.1.5.2. Micro approach

Grammatical level

A phenomenon called *the infinitive construction* typically occurs in English. In the Czech language it can be replaced by dependent clauses, finite verbs, nouns or it can stay in the form of an infinitive. Which form is more appropriate to apply in the translation depends on the context. See the examples below.

ST1 - infinitive constructions

ST: "We can use computation ***to make*** *the process* ***better****, both aesthetically and in terms of greater flexibility."*
TT: „Můžeme využít výpočetní technologie, ***abychom zlepšili*** *zpracování fotografie jak z hlediska estetiky, tak i větší flexibility. "*

ST: …but also may use photoediting software on a computer ***to*** *significantly* ***alter*** *the look, feel and composition.*
TT: …ale ***k*** *výraznějšímu* ***pozměnění*** *celkového vzhledu, dojmu a kompozice může také použít počítačové fotoeditory.*

ST: In the end, Durand says it is important ***to place*** *computational photography, imaging, and optics in the right context.*
TT: Nakonec Durand říká, že je důležité ***zasadit*** *počítačovou fotografii, zobrazování a optiku do správného kontextu.*

ST2 - infinitive constructions

ST: ***To demonstrate*** *the utility and generality of their approach…*
TT: Aby ***prokázali*** *užitečnost a univerzálnost svého návrhu…*

ST: The following article by Adams et al. is the first ***to address*** *this problem, and it does so in a beautiful and elegant fashion.*
TT: Následující konferenční příspěvek vypracovaný Adamsem a kolektivem se jako první ***zaobírá*** *tímto problémem, a to vytříbeným a vkusným způsobem.*

ST: Early examples of such algorithms include stitching multiple images into seamless panoramas, merging multiple exposures ***to create*** *and display high dynamic range (HDR) images…*
TT: Poprvé byly tyto algoritmy použity například při vytváření panoramatických snímků za pomoci skládání bez viditelných přechodů mezi jednotlivými snímky, při ***vytváření*** *HDR snímků…*

Further, there is a difference between the Czech and English language in the use of quotation marks with direct or quoted speech. See examples below.

ST 1 – quotation marks

ST: Says Durand, "Photography is just one aspect of a much bigger picture…" [76]
TT: Jak říká Durand: „obor fotografie je jen špičkou ledovce. "

ST: As Levoy puts it, "There is a potential for this technology to be extremely disruptive."
TT: Jak Levoy říká: „Tato technologie možná nebude dotažena do cíle. "

Another phenomenon called *modulation* frequently occurs when translating from English to Czech. In this case, it means that the passive voice used in English is converted into active voice in Czech translation. See examples below.

ST 1 - modulation

ST: "These signals ***cannot be detected*** *by the human eye…"*
TT: „Lidské oko ***není schopno*** *tyto signály* ***zaznamenat****…"*

A passive verb phrase in English can be also converted into a noun in Czech which does not express any voice:

ST: "…focusing would take place after the picture ***is taken****. "*
TT: „…k zaostření by došlo až po ***zachycení*** *snímku. "*

In some cases, it is appropriate to convert an active voice used in English into passive voice when translated to Czech:

ST: A photographer ***can make*** *basic changes to a picture from within the camera…*
TT: Fotografovi ***se dostává*** *možnosti základní úpravy přímo ve fotoaparátu…*

Or the voice of the verb can be preserved:

ST: Durand also says the gains ***are*** *not* ***limited*** *to conventional cameras.*
TT: Durand také tvrdí, že výhody ***nejsou omezené*** *pouze na uživatelské fotoaparáty.*

ST 2 – modulation

ST: The migration of these algorithms into hardware and firmware ***has been hampered*** *by a number of factors.*
TT: Přenesení těchto algoritmů do hadrwaru a firmwaru ***bránilo*** *množství faktorů.*

Conversion into a noun:

ST: Numerous computational photography apps ***can*** *now* ***be found*** *for smartphones…*
TT: Mnohé aplikace využívající počítačovou fotografii ***jsou*** *dnes* ***k nalezení*** *ve smartphonech…*

Or the voice of the verb can be preserved:

ST: As with most of computing, computational photography algorithms ***were*** *originally* ***developed*** *and* ***deployed*** *on professional workstations and desktop personal computers.*
TT: Stejně jako většina výpočetních technologií, algoritmy počítačové fotografie ***byly*** *původně* ***vyvinuty*** *a* ***využívány*** *pro práci v profesionálních pracovních stanicích a na stolních osobních počítačích.*

Lexical level

Foreign words frequently occur in the text. They often do not have Czech variant and are more frequently used in their original form. Many of these foreign words already reached the *loanword* status – they are used in everyday conversation and can be declined according to Czech grammar. [77]

Since the article is written in a popular scientific style, the occurrence of loanwords is rather frequent. It can be words originating from Greek, Latin or Old French, which has been used in number of languages around the world for centuries. [78]

<u>Greek:</u> technologie (technology), fotografie (photography), estetika (aesthetics), systém (system), panoramatický (panoramic), optika (optics)

<u>Latin:</u> digitální (digital), flexibilita (flexibility), profesor (professor), inteligence (intelligence), koncept (concept), senzor (sensor), systém (system), univerzita (university), realita (reality), kombinace (combination), optika (optics), eliminovat (eliminate)

<u>Old French:</u> kompozice (composition), flexibilita (flexibility), profesor (professor), inteligence (intelligence), algoritmus (algorithm), perspektiva (perspective), realita (reality), kombinace (combination), specializovaný (specialized)

However, there also appear foreign words which are comprehensible only to the people with certain technical knowledge, e.g. *software, pixel, tablet,* etc. With some of these words there is a Czech translation, which makes it more understandable to lay people, who meet the term for the first time, e.g. *software = program*. In this case, a Czech translation is not needed, because it is a technical text.

Although, some terms and abbreviations need further explanation as Czech readers do not possess the same knowledge as English speaking readers.

ST 1 – analysis of terms

- ***MIT*** = Massachusetts Institute of Technology [79]
- ***MA*** (mentioned in the original text) = Massachusetts

- ***Cloud-based***= a cloud is a kind of application or a website which allows to its user to upload their data on the internet and have them available online.
- ***3D*** = a three dimensions of an object, which are width, depth and height. [80]
- ***Google Glass*** = "*Google's project program for developing a line of hands-free, head-mounted intelligent devices that can be worn by users as "wearable computing" eyewear.* " [81]
- ***Motion magnification*** = a technique that acts like a microscope for visual motion. It can amplify subtle motions in a video sequence, allowing for visualization of deformations that would otherwise be invisible. [82]
- ***Big data techniques*** = "'Big Data' is the application of specialized techniques and technologies to process very large sets of data. These data sets are often so large and complex that it becomes difficult to process using on-hand database management tools." [83]

The terms and names that require further clarification are for example the following:

Institutions:

ST: Massachusetts Institute of Technology
TT: Massachusettský technologický institut [84]

ST: Columbia University
TT: Kolumbijská univerzita

ST: Stanford University
TT: Stanfordova univerzita [85]

Technical terms:

ST: film cameras
TT: kinofilmové fotoaparáty

This term could be also translated as *fotoaparáty na film* or *fotoaparáty na kinofilm*, which would bear the same meaning, however, the collocation *kinofilmové fotoaparáty* reaches higher score of usage frequency when searched with Google tools.

ST: machine learning
TT: strojové učení [86]

Machine learning is a special term from the field of technology that stands for "a method of data analysis that automates analytical model building". [87] Masaryk University also provides a course of the same name, which helped to translate the collocation correctly.

ST: DNA sequencing
TT: sekvenování DNA [88]

The term sequencing from the field of medicine can be also translated as *sekvencování* or *sekvenace*, however, the collocation *sekvenování DNA* is more frequent in specialized texts available on the internet and in academic databases.

ST 2 – analysis of terms

- ***HDR (high dynamic range)*** = a set of techniques to enhance an image of a greater dynamic range between the dark and light areas of the captured scene. [89]
- ***API*** = application programming interface [90]
- ***Raw image*** = an uncompressed HDR format of a picture [91]
- ***Shots*** = here as the specification of parameter sets, which include size, shape, hardness, etc. [92]
- ***SIGGRAPH*** = an international organization for fans of computer graphics and interactive techniques [93]
- ***Halide*** = "a new programming language designed to make it easier to write high-performance image processing code on modern machines. " [94]

The terms and names that require further clarification are for example the following:

ST: tile-based caching
TT: tile-based kešování

This term needed to be discussed with an expert because there was no Czech equivalent of the word *tile-based*. The word *kešování* [95] is a loanword from English word *caching*. The Czech language uses also another equivalent words for English word *cache*, e.g. *kaše, keš, mezipaměť, vyrovnávací paměť, paměť cache,* etc. [96]

ST: parallelism
TT: paralelní zpracování instrukcí

By prior agreement with an expert, the English word *parallelism* has to be translated into Czech as *paralelní zpracování instrukcí, paralelní zpracování* or *paralelismus* when writing about programming. For people not engaged in the topic it could be misleading because the literal translation in Czech would be *podobnost*.

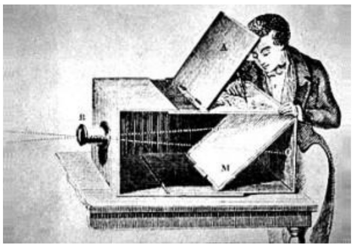
3.2. Czech-English translation

3.2.1. Target text III

FROM CAMERA OBSCURA TO DIRKOMA [97]

December 25, 2013

„Camera obscura“ is a designation for the historically first cameras well as a synonym for terms such as pinhole camera, pinhole chamber, dark room or pinhole. It was originally used by painters such as Leonardo da Vinci, when they were working on their pieces. However, the Chinese already knew hundreds a years ago that the light into a dark room through only a tiny aperture in the wall reflects the outer scenery on the opposite wall, only upside down. The artists were putting papers and cloths onto that opposite wall to trace the image easily. They created a precise “sketch” this way and then completed the paintings in their ateliers so they looked much more realistic. Naturally, the authors of patents on various types of cameras later drew from this invention.



Camera Obscura as used in painting.

At that time, the pinhole cameras used to be of larger size. Some of them looked like a real room. Nowadays, on the other hand, they are also known as tiny home-made boxes, which we use to capture images on a negative. Of course, certain laws of physics exist showing how such a pinhole camera should look like to make resulting image "work". Important is both the size of a pinhole, through which comes the light, and the distance from a wall or film (or even from the photographic paper), on which the image is reflected. No other aperture can let the light spreading into the dark room.

Cameras produced by Dirkoma

Such camera, functioning without an objective, shutter, and not using any batteries, can be easily made at home. There is also a possibility to assemble it from the made-ahead units of the Pinhole Camera 4M kit. However, the Czech company Dirkoma introduces a true rarity. It is the only producer of wooden pinhole chambers in the Czech Republic. The pinhole chambers of several different designs can be also found in the Analogue shop. They are made of a high-quality wood and are thick-walled – which makes them more stable and resistant. Their appearance is literally charming. These cameras look elegant; as if they embodied a possibility to combine modern design with traditional nostalgia. Pick one by size, colour and shape. Load the 135 or 120 film, photographic papers or leaf films. Every photographer should complete his/her collection with at least one such magnificent camera piece.

3.2.2. Glossary

Photography	
dírková kamera	pinhole camera
dírková komora	pinhole chamber
fotografický papír	photographic paper
listový film	leaf film
negativní film	negative
temná komora	dark room
založit film	to load film
Painting	
náčrt	sketch
plátno	cloth
Others	
tlustostěnný	thick-walled

3.2.3. Target text IV

PINHOLE CAMERA 4M – JIGSAW PUZZLE AND JOY, ALL IN ONE PACKAGE [98]

September 11, 2013

Have you ever tried to make your own pinhole camera? A camera that can capture images without using the objective and other photographic equipment? Glasses, fine wires, wheels and a shutter…what for? Sometimes, it is necessary not to take even the photography so seriously and not to succumb to modern age that puts emphasis on quality and perfection. You can also experience adventure while photographing and the result we actually push the shutter button for can be memorable and unique even without the help of professional equipment!

When we were kids, almost all of us used to be creative. Even in adulthood we enjoy ourselves crafting, assembling something or doing it ourselves. Pinhole Camera 4M is a brilliant solution to make ourselves happy and get busy; in case you are a fan of jigsaw puzzles, photography, analogue and plastic cameras are your thing. In such case, you have just discovered a product that will surely satisfy your needs!

Pinhole camera can be assembled even from a packet of playing cards. However, anyone who has already tried it has to admit it is not a discipline for fingers of whichever shapes or lengths. It requires a bit of skilfulness to assemble pinhole in the way so it works and in most cases it does not turn out very well – it simply does not work! And that is only because you did not keep the ideal distance just where it was important to do so, a light penetrates inside from somewhere or because you cannot cut properly and straight with scissors, the camera is asymmetric and after you place it on a table it topples over (that may also be because you picked inappropriate materials for its production).

So here is our advice – do not worry! You can get a Pinhole Camera 4M for a song in our shop. You will have a field day with it. In the package you will find the individual parts of the plastic camera and even a manual! So isn't it wonderful? It will save you a lot of time with racking your brains over it, there is no chance of failure and you can be sure you eventually really shoot something!

3.2.4. Glossary

Photography	
fotografická technika	photographic equipment
objektiv	objective
zmáčknout spoušť	to push the shutter button
Others	
lámat si hlavu	to rack one's brains over something
převážit se	to topple over
skládačka	jigsaw puzzle
vyřádit se	to have a field day
za pár korun	for a song

3.2.5. Target text V

ANALOGUE SERIES ON PROTIŠEDI.CZ [99]

July 30, 2014

Do you like reading about analogue photography tips and search for an inspiration? Are you interested in the history of photography? Follow our analogue photo series on Protišedi.cz

Since last autumn we regularly post articles in the Protišedi.cz magazine for you. We write articles about the development of photography and important historical events that bring a great deal of interesting techniques into the current analogue photography; it would be a shame not to try them. If you look for an inspiration, read our articles!

So far we have written for you:

The analogue photography: Where did it come from and why is it so amazing?

Photography was one of the most wonderful inventions of the 19th century and there is no one who would not appreciate it till now. Nowadays, almost all of us go in for photographing, whether it is only capturing of pieces of information on a mobile phone (or not). We long for images, which would be attractive for its unique atmosphere; we want to free ourselves from the quality hunt, because we are more concerned about the message or the aesthetics. Therefore it is no wonder that the analogue photography becomes again a mass phenomenon enthralling the entire world, even though we were all ready to bury it only few years ago and replace it, buying spanking digital cameras.

We shoot with a pinhole

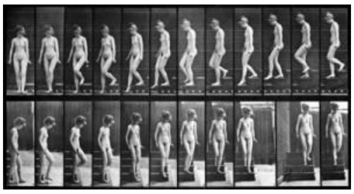
Nowadays, working with pinhole chambers is not a hobby only of the professional photographers. Anybody of us can easily and playfully learn the methods of using these cameras these days. It allows us to understand the principle behind image capturing and perceive the medium as the means of communication, a way of art. If you want to take a close look at photography, assemble your own camera! We will teach you to do it.

Improvised home atelier

In history, it took a while before the first photographers brought the technology to light. At first, they focused on creation inside the atelier, as for example on still life. Most of them devoted themselves to painting; therefore an attempt to create artistically attractive compositions can be noticed even in the ancient images. Their ateliers were furnished simply –we are still talking about the first half of the 19th century. And this is the exact studio, you can create yourself at home.

Analogue portrait photography

The first photographers already captured portraits of people in both ateliers and exterior. They also experimented with nudes and self-portraits. Nowadays, as the analogue creation is back on the scene, the photographers are coming back not only to the original/former technical design but also to the portrait stylization that gives current viewer the impression of something new and unhackneyed.



Artistic nude photography and analogue

“Ars una, species mille – there is only one art but a thousand approaches. [100] That is also why I perceived photography as one of the methods of artistic awareness of expression,” as stated in the František Drtikol’s notes. His collection of photos is the most valuable and most voluminous source of inspiration in the field of nudes in rendition of analogue photography combined with painting.

How to be good at capturing moments

One of the first documentators in the field of photography was Robert Capa whose name will always have a dominant position among the top-class photographers in history. It is hard to say if all his images are truly authentic and unarranged. Speculations were led especially concerning his photography of Spanish loyalist. After all, important things are “the eye” and rendition.

Artistic self-portrait versus selfie

How did the self-portraits from the old times of catching things only on photographic films look like? Where, after all, did our own constant need to document everything around us, including ourselves, shift the self-portrait creation? Let’s go back in history to times, when the self-portrait was still a unique and only an artistic issue.

Summer in the sign of landscape photography

It is landscapes that we usually choose when we are discovering the magic of photography for the first time. We take our new camera outside and go “shooting”. We often let the nature to speak for itself, which is a pity. Let us inspire you and learn to be more creative.

From now on, follow Protišedi.cz and our analogue photography tips. We will continue to write for you.

3.2.6. Glossary

Photography & Painting	
analogová fotografie	analogue photography
dírková komora	pinhole chamber
domácí ateliér	home atelier
zátiší	still life
portrétní fotografie	portrait photography
akt	nude
autoportrét	self-portrait
nejšpičkovější fotograf	top-class photographer
Kajinářská fotografie	landscape photography
Others	
honba za kvalitou	quality hunt
krásno	aesthetics
zbrusu nový	spanking new
prostředek komunikace	means of communication
neokoukaný	unhackneyed
umělecké cítění	artistic awareness
provedení	rendition

3.2.7. Commentary

3.2.7.1. Macro approach

1. Source texts

The articles all written by Karol Koštialová were published on the *analogue.cz* website, which introduces a click-and-mortar company [101] of the same name, analogue photography workshops and also a blog, written either by Karol Koštialová or Radovan Pavlista. It deals with an introduction of a technique of photographing using an analogue camera and a film. The text *Od camery obscury až po Dirkomu* is the third source text of the translation part here (further only ST 3), *Pinhole camera 4M – skládačka a radost v jednom balení* is the fourth source text (further only ST 4) and finally *Analogový seriál na Protišedi.cz* is the fifth source text (further only ST 5).

The articles are supported by pictures of several unnamed authors. The structure of all three texts is similar; the text is introduced with a title written in bold followed by paragraphs interspersed with pictures and their captions.

2. Background

The texts focus on the development and benefits of the analogue photography. They introduce their readers the history preceding the modern techniques of photographing and mention the possibility to visit their store or an online shop where they offer a wide range of analogue cameras and accessories. The authors put emphasis on the originality of the pictures and distinctive style of the photographer, which could be achieved with the help of these analogue cameras.

3. Author

Author of the texts is Karol Koštialová, now working at *Crea Studio* [102], which is a creative photography and graphic studio based in Prague. [103] She is a freelance photographer and alt model[5]. [104]

[5] Alternative model

The text of these three articles is written partly in the third person to present the facts, partly in the first person to involve the readers in the story and to ”liven up” the text and also in the second person to address the reader.

4. Audience

Readers of the articles can be both lay people and people educated in the field of photography. In the texts, special terms rarely occur. These terms are immediately explained. The author mentions concrete examples and defines the terms by a number of modifiers.

Potential readers are expected to be interested in analogue photography, either by photographing with analogue cameras or by being interested in buying one of the cameras.

5. Subject matter

The subject matter of these articles is the usefulness and versatility of analogue photography. It deals with the alternative possibilities of taking pictures and describes the methods of analogue photography. It highlights the endless creativity of a human improved by the technology.

ST 3: The article deals with the introduction of the pinhole camera from the view of its development and appearance. The author mentions a Czech company *Dirkoma*, which is the only producer of pinhole cameras in the Czech Republic.

ST 4: This article offers readers a product available to purchase in the Analogue click-and-mortar store. It mentions the features of a Pinhole camera 4M, which could be assembled at home from the original parts included in the package.

ST 5: The article introduces a brief history beginning with the camera obscura, mentioning important personalities from the history.

6. Function of the text

- Educative
- Informative
- Entertaining

7. **Style of the text**

The texts are written in a popular scientific style. The author writes about a topic which is not necessarily familiar with the general public in an accessible language. The topic is simplified with both language and limited content.

8. **Language of the text**

The texts are written in informal language to address both lay people and scholars. Informal language connects the readers with a technical topic.

Special terms occur, especially from the field of photography, e.g. *dírková kamera, temná komora, fotopapír, objektiv,* etc.

ST 5: The author mentions in the text a photographer, František Drtikol, quoting an unnamed author which connects the readers with the ideas of more than one person.

In ST 4 and ST 5 the author frequently puts questions in the text which are rather rhetorical in nature, e.g. *Jak vypadaly autoportréty v dobách, kdy se fotografovalo pouze na film?, Kde se vzala a proč je tak úžasná?, No, není to báječné?,* etc. The questions are further answered in the texts or stay unanswered. In both cases, it forces the readers to think about the questions.

3.2.7.2. Micro approach

Grammatical level

The target text that is a translation of ST 3 contains infinitive construction which was in the source text in the form of a finite verb. See example below.

ST: Malíři přikládali papíry a plátna právě na protilehlou stranu proto, aby jednoduše obraz ***obkreslili****.*
TT: The artists were putting papers and cloths onto that opposite wall ***to trace*** *the image easily.*

In ST 3 and ST 5 occurs modulation; its definition is found in the previous commentary. See examples below.

*ST: Existují samozřejmě pravidla, která čerpají z fyziky, jak má taková dírková komora vypadat, aby výsledný obrázek „**fungoval**“.*
*TT: Of course, certain laws of physics exist showing how such a pinhole camera should look like **to make** a resulting image “**work**”.*

*ST: Také v Analogue je **najdete** v několika provedeních.*
*TT: The pinhole chambers of several different designs **can be** also **found** in the Analogue shop.*

*ST: Většina z nich se věnovala malbě, takže I na těch nejstarších snímcích **můžeme zaznamenat** pokus o vytvoření výtvarně zajímavé kompozice.*
*TT: Most of them devoted themselves to painting; therefore an attempt to create artistically attractive compositions **can be noticed** even in the ancient images.*

Lexical level

In ST 3 and ST 5 frequently occurs a phenomenon called *repetition*. It means that a word, phrase or clause is repeated in the text which serves to highlight the key words of the text or an important part.

ST 3: *malíř, fotoaparát, camera obscura, dírková komora, otvor,* etc.
ST 5: *analogový, fotografie, snímek, ateliér, inspirace,* etc.

This is connected with another lexical phenomenon called *synonymy*. In these three texts occur synonyms especially from the field of photography.

- camera obscura – dírková kamera – dírková komora – temná komora – pinhole
- obraz – snímek – obrázek - fotografie

Also a literary tool called *personification* is used in ST 3. In the English translation it lost its quality because it would lose the meaning in case of literal translation.

*ST: Tento fotoaparát, který funguje bez objektivu, spouště a **nepolyká žádné baterie**, si můžete snadno vyrobit sami.*

TT: Such camera, functioning without an objective, shutter, and ***not using any batteries****, can be easily made at home.*

During the translation emerged several difficulties that needed to be dealt with. Some terms needed a further clarification in the translation or there was no appropriate equivalent in the English language.

ST 3 – analysis of terms

ST: Ta je jediným ***naším*** *výrobcem dřevěných dírkových komor.*
TT: It is the only producer of wooden pinhole chambers ***in the Czech Republic****.*

The possessive pronoun used in the source text can be also translated as the same pronoun. However, it would use its meaning because the original article was written for Czech audience.

ST: Také v ***Analogue*** *je najdete v několika provedeních*
TT: The pinhole chambers of several different designs can be also found in the ***Analogue shop****.*

It was not easy to decide whether the author writes about the website of the company or the click-and-mortar store. Supposing she tries to attract potential customers, this variant is the most appropriate one.

ST 4 – analysis of terms

ST: Zkoušeli jste si už někdy vyrobit vlastní ***pinhole****, neboli* ***dírkovou kameru****?*
TT: Have you ever tried to make your own ***pinhole camera****?*

Since the source text includes English translation of the word *dírková* kamera, repetition of the same term would be disturbing and pointless.

ST: ***Za pár korun*** *si u nás můžete pořídit fotoaparát Pinhole Camera 4M.*
TT: You can get a Pinhole Camera 4M ***for a song*** *in our shop.*

English idiom *for a song* is suitable for the translation of the Czech expression *za pár korun*. Instead of this translation other words could be used, e.g. *cheap, pargain-priced, unexpensive,* etc. However, this idiom spices up the translation. In the Czech language there exists an idiom of similar structure as the English *for a song* which is *za hubičku*.

*ST: S ním se také **dosyta vyřádíte**.*
*TT: You will **have a field day** with it.*

Another English idiom is *to have a field day* meaning to have a great time or to have fun which corresponds with the phrase in the source text.

ST 5 – analysis of terms

*ST: Fotografování se dnes **věnujeme** téměř všichni….*
*TT: Nowadays, almost all of us **go in for** photographing…*

English idiom *to go in for something* makes the Czech expression *věnovat se něčemu* more interesting than English expressions like *to devote oneself to something* or *to dedicate oneself to something* would.

*ST: Než se historicky první fotografové **vydali** s technikou **ven**, chvíli to ještě trvalo.*
*TT: In history, it took a while before the first photographers **brought** the technology **to light**.*

The Czech equivalent of the English idiom *to bring something to light* would be also *vyjít s něčím na světlo*, however, *vyjít s něčím ven* bares the same meaning.

4. CONCLUSION

The main aim of the bachelor thesis was a translation of English and Czech texts from the field of photography to Czech and English language. The thesis consists of two main parts – the theoretical part and the practical part.

The theoretical part includes a summary of the theory of translation with concrete terms and their definitions, e.g. what the translation is, what the function of the translation is, what the source text and the target text are, what the factors influencing the process of translation are, etc.

The next chapter of the theoretical part deals with photography and its definition and evolution beginning in the ancient times and continuing to the 21^{st} century. In this chapter, there are stated concrete names of inventors, authors of photos or other important personalities like Aristotle, Roger Bacon, Leonardo Da Vinci, Louis Jacques Mandé Daguerre, etc. as well as important dates like the invention of camera obscura, the development of wet collodion process and digital cameras, etc. The particular paragraphs introduce several historical periods.

The practical part is composed of five translated texts, commentaries and glossaries. The first group of texts consists of two popular scientific articles from the field of computational photography translated from English to Czech. The articles were intended for people possessing of certain knowledge of this topic, therefore it was difficult to deal with the terms. Several terms did not have a Czech equivalent. The group of English texts is followed by a commentary which is divided into macro analysis and micro analysis. Macro analysis deals with the general features of the source text, e.g. background, author, audience, language, etc. Micro analysis introduces concrete examples and difficulties resulting from the process of translation, for example the translation of idioms occurring in the source texts or an occurrence of unknown words. The group of Czech texts is followed by a commentary, too. All translated texts are accompanied by a glossary that is divided according to the lexical fields of the words.

The main goal of the translation was to translate the source texts from the field of photography bearing in mind the importance of the quality of the translation. This included preserving the message covered in the source texts and preserving the structure and functional style of the source texts.

Even though the target text is expected to be as equivalent to the source text as possible, several changes in the grammatical, lexical or even syntactical field needed to be done to introduce its readers a comprehensible translation. Both printed dictionaries were helpful to translate the source texts properly, however, in some cases it was necessary to consult the terms with an expert.

It was expected from the technical texts to be rather demanding for translation than the non-technical texts, which has proved to be true. The technical texts consist of a wide range of special terms and complicated phrases which may not be known to the Czech reader, e.g. cloud-based, motion magnification, machine learning, etc. The translation of these terms was rather difficult.

As has been proved in this bachelor thesis, the most important thing on a proper translation is always the message hidden in the source text, not a meaningless literal translation.

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7. ABSTRACT

The purpose of this bachelor thesis is to translate texts from the field of historical and modern photography and to analyse all selected texts and target texts in a commentary completed by a glossary to each source text.

The thesis is divided into two main parts – the theoretical part and the practical part. The theoretical part consists of two chapters. The first chapter deals with the theory of translation and the description of its main features. The second chapter introduces a brief overview of the history of photography. The knowledge included in the theoretical part is applied in the practical part. The practical part is made up of the translations of the source texts followed by the commentary and glossary. The commentary deals with the analysis of the source texts and the target texts. The glossary includes specific terms and expressions.

8. RESUMÉ

Cílem této bakalářské práce je překlad textů z oblasti historické a moderní fotografie a následná analýza všech zvolených i přeložených textů v komentáři doplněném o glosář ke každému z nich.

Práce je rozdělena na dvě hlavní části – na část teoretickou a část praktickou. Teoretická část je složena ze dvou kapitol. První kapitola se zabývá teorií překladu a popisem jeho hlavních rysů. Druhá kapitola zahrnuje stručný přehled historie fotografie. Poznatky obsažené v teoretické části jsou aplikovány na praktickou část. Praktická část se skládá z překladů textů následovaných komentářem a glosářem. Komentář se zabývá analýzou překládaných a přeložených textů. Glosáře zahrnují specifické termíny a výrazy.

9. APPENDICES

Appendix 1

Camera Obscura

A camera itself was not originally invented with the purpose of capturing a piece of art. Its basis was known to the ancient Greeks and Chinese and it is used by many curious artists up till today. The name of this apparatus comes from two Latin words meaning *'dark room'*. [105]

Its first users were Arab astronomers to observe various cosmic occurrences and scientists (formerly known as naturalists) were therefore capable of examining the laws of projection. [106] [107] [108] At that time it was hard to imagine that a camera could fix images permanently. The name of the first photographic invention was *camera obscura*, also known as a pinhole camera. [109] [110]

Characteristics

Camera obscura is a darkroom with a single aperture, through which the rays of light flow and therethrough comes into existence an upturned projection of the scene surrounding the outer side of the aperture on the opposite wall. The pinhole must be of a certain size to be able to project the whole image on the plate or later a sheet of glass or paper to easily trace the lines of the projected image. [111]

The illuminated image outside of the pinhole camera creates the rays and a limited number of the rays is allowed to go through the pinhole which causes the reversed image on the opposite side of the position of the hole. The shape of the point continuing through the hole is not exactly rounded as it meets the opposite compact material but it has a disc form, which harms the sharpness of the picture. The size of the hole has no influence on the sharpness of the point because of the diffraction of light caused by every barrier against its natural spreading. [112] [113]

The angle captured by the camera obscura is extremely wide and the rays of light appear as first in the centre of the projection. The edges of the image come up later because of less exposure of the outlying parts – the more to the centre, the brighter the colours will be. [114]

One of the disadvantages could be the inability to capture moving objects caused by the length of the exposure time, which could be in the case of camera obscura counted in hours or even days, especially in bad lighting conditions. [115]

According to Johann Zahn, the size of the image depends on its distance from the hole. In 1685 he published his book named *Oculus Artificialis Teledioptricus Sive Telescopium* in which many illustrations and descriptions of the camera obscura can be found. He is also an author of portable camera obscura which bore a resemblance to the cameras of the 19th Century. [116]

The projected image provided a realistic perspective. Another advantage is that the images taken by camera obscura possess the infinite depth of field meaning that either the object is close to the pinhole or further from it, all the objects are equally sharp. The process of copying a picture from the view projected by camera obscura requires holding a paper or canvas opposite to the pinhole followed by tracing and shading the outlines of the image surrounding the apparatus. [117]

The design and size of the camera obscura have changed and developed since the 16th century. The apparatus was designed with or without lenses, some with reversing mirrors or with various arrangements of materials which served as a projecting screen. [118]

Later people had a use for camera obscura in two different inventions. The first invention was a *portable box device* used as a drawing tool as we have already mentioned for the artist of the 17th and 18th century, as for example Johannes Vermeer, an author of the well-known painting *Girl with a Pearl Earring* or Paul Sandby, a British author of watercolours, who will be mentioned later. [119] [120]

Since the apparatus is used for capturing an image, not just projecting and viewing it, another additional tool is necessary to be installed in the camera obscura, which is a light-sensitive material such as photo paper or a film. This material has to be put into the apparatus in the dark without the infiltration of the rays of light. The next step is to place the covered pinhole of the camera towards certain scene that should be captured and uncover it so the rays of light can strike on the film which is further processed. [121]

The usage of the camera obscura is not limited to the capturing of an image. Earlier they were used as spy cameras, these days it is used for UV rays, cosmic rays, gamma rays and for projection of an image from a negative by reversing the principle of camera obscura. The outcome is a magnifying apparatus, which served in the production of an integrated circuit. [122]

Appendix 2

Technology | DOI:10.1145/2557445

Samuel Greengard

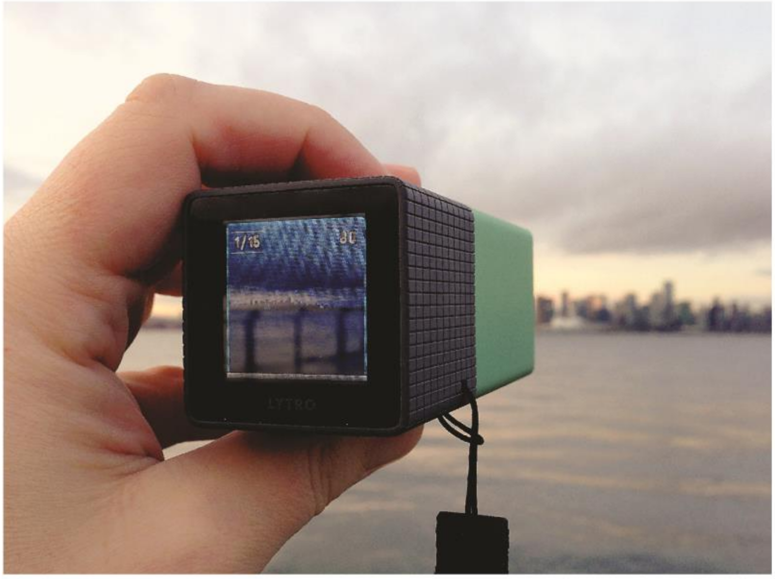
Computational Photography Comes into Focus

Advances in computational photography are making image capture the starting point. The technology is transforming the field.

OVER THE LAST decade, digital cameras have radically refocused the way people capture and manipulate pictures. Today, the snap of a photo is merely a starting point for composing and manipulating an image. A photographer can make basic changes to a picture from within the camera, but also may use photoediting software on a computer to significantly alter the look, feel and composition. "We can use computation to make the process better, both aesthetically and in terms of greater flexibility," explains Frédo Durand, a professor in the Computer Science and Artificial Intelligence Laboratory at MIT in Cambridge, MA.

Researchers and engineers are now taking the concept further. They are designing different types of cameras, developing increasingly sophisticated algorithms, and using new types of sensors and systems to boldly go where no camera has gone before. The ability to record richer information about a scene and use powerful image enhancement techniques are redefining the field. "Computational photography and computational imaging are extremely vibrant areas," states Shree K. Nayar, professor of computer science at Columbia University in New York City.

These cameras, along with more advanced software, will radically change the way people view and use images. For example, they will make it possible to detect a tiny object or imperceptible motion from the field of view. They might change the perspective or angle after a photo is snapped, or provide a 360-degree panoramic view. They might also augment reality and refocus various objects in scenes, after a photo has been shot.



The Lytro camera captures the entire light field.

PHOTOGRAPH BY JOHN BIEHLER

Meanwhile, smartphone cameras will further redefine photography by incorporating sensors and greater onboard computational power. Combined with specialized apps or cloud-based services, they will stretch the current concept of photography in new and intriguing ways.

A Better Image

It is no secret that digital cameras have reinvented photography. The transition from film to pixels has created an opportunity to manipulate and share photos in ways that were not imaginable in the past. However, today's cameras rely heavily on the same features and image capture techniques as film cameras; they are largely designed the same way film cameras were, but with new features. "They present a lot of limitations. It is very difficult to change the way the camera behaves or the way it captures images," Durand explains.

However, the use of computational photography, imaging, and optics promises to significantly change the way people approach photography, capture images, and edit them. For example, William Freeman, a professor of computer science at MIT, says computational cameras could capture multiple images at a time to compensate for glare, oversaturation, and other exposure problems. They could also eliminate the need for a flash. "Too often, flash ruins the tonal scale of images," he says, "but by combining multiple shots, both with flash and without, it is possible to create a single sharp, low-noise image that has a beautiful tone scale."

Similarly, the ability to change focus after capturing a shot would make it possible to fix on a person in the foreground while also focusing on an object in the distance, like the Eiffel Tower or Statue of Liberty; everything else in the photo would appear blurred. The commercially available Lytro camera—which records the entire light field in the frame (essentially, depth of field data about the entire scene)—already allows a user to refocus pictures and adjust lighting after image capture. Likewise, a sensor that would capture different levels of light on different pixels could create entirely new types of photographs, including images with markedly different brightness and color ranges.

The technology of computational photography could also lead to changes in camera design. As Columbia's Nayar points out, computational features alone deliver significant improvements, but they also create the possibility for new types of camera bodies, lenses, and optics. Adding a computational lens to a smartphone, for instance, could mimic the high-end features of an expensive optical lens at a much lower price point, or may create entirely new features. A photographer might snap on a lens or multiple lenses that would provide 3-D capabilities, or marry video and still photography to address camera shake, particularly in difficult low-light or high-speed environments.

The benefits of computational cameras and software are likely to extend far beyond consumers. The technology could impact an array of industries, including medicine, manufacturing, transportation and security, points out Marc Levoy, a professor of computer science and electrical engineering at Stanford University in Palo Alto, CA, who recently took leave to work with the Google Glass development team. Levoy says cameras with more advanced computational capabilities could redefine the way we think about the world around us, and provide insights that extend beyond basic images or video.

For example, he and other researchers have explored the idea of developing a computational camera that could see through crowds, objects, and people. The technology could also generate a focal stack within a single snapshot. This could create new opportunities

Computational photography could lead to changes in camera design, such as new types of camera bodies, lenses, and optics.

in biology and microscopy, Levoy says. "A technician could capture images of cell cultures without focusing a microscope; focusing would take place after the picture is taken." A computational camera could also automatically count the number of cells in an image and provide information faster and more accurately than any human, he adds.

Perhaps the highest-profile example of a computational photography system to date is Google Glass. Its camera captures images and provides additional information and insight in an array of situations and scenarios—a step toward more-advanced augmented reality tools. Among other things, the Google Glass team is focused on developing map data, language translations, travel and transit information, and apps that track health, exercise data and body information. The device also can capture a burst of images and deliver improved high-dynamic-range imaging and low-light imaging.

Beyond Pixels

Engineering these systems and developing the algorithms to support these devices is no simple task, particularly as researchers look to extend computational capabilities beyond the world of consumer cameras into fields such as astronomy, medical photography, and automobile photography. There also is the possibility of capturing images beyond the visible spectrum of light, incorporating environmental sensors, or finding ways to apply algorithms to detect small but important changes in the environment. As Levoy puts it, "There is a potential for this technology to be extremely disruptive."

Durand also says the gains are not limited to conventional cameras. New types of cameras and software could generate robust 3-D images that reveal things not visible through optics alone. Already, he and Freeman have developed algorithms that can sense the flow of blood in a person's face, or detect one's heartbeat based on subtle head motions. This relates to a technique called *motion magnification*, which could potentially be used to detect weaknesses in bridges and build-

A cutaway view of the Canon EOS 5D Mark II camera body.

IMAGE COURTESY OF CANON USA

ings; it amplifies pulse signals and color variations. "These signals cannot be detected by the human eye, but they are revealed through advanced computational imaging and slow-motion analysis," Freeman explains.

Vladimir Katkovnik, a professor of signal processing at Tampere University of Technology in Finland, says a significant hurdle to accomplishing all this is the development of algorithms that sort through all the data and apply it in usable ways. Despite the prospect of larger sensors that can capture more data, there is a trend toward more pixels in images. "Larger numbers of megapixels means images with more pixels of a smaller size. As smaller numbers of photons appear on a pixel during exposure time, there is a larger amount of noise generated. Noise removal is a growing challenge in any imaging or sensing device; the end quality depends on how well noise is removed."

Another challenge, Durand says, is developing robust algorithms that work effectively on relatively small devices such as cameras, smartphones, and tablets. "The issue is not necessarily whether you can develop an algorithm that works; it is whether it is possible to map the computation to the hardware in an efficient manner. Writing optimized code that can take advantage of modern hardware, including mobile processors, is extremely difficult." He is currently developing a compiler to make it easier to achieve high performance, without devoting a large development team to the task.

Nayar believes researchers will tap into big data techniques and, in some cases, examine and analyze existing photos to build algorithms that drive even more sophisticated image processing. Right now, "if you try to remove a person or object from a photo, there is no easy way to fill the hole, even with fairly sophisticated photoediting software," he says. "By using millions of pictures and applying machine learning algorithms, it is possible to fill the holes in visually plausible ways." At some point, he adds, these capabilities will likely appear on cameras, smartphones, and tablets, and provide nearly instantaneous manipulation and editing tools that make today's image-editing options pale by comparison.

Researchers are likely to hit the tipping point within the next decade, as increasingly powerful processors and a greater knowledge of physics push the technology forward. "The algorithms being used today are still mostly in the infant stages," Nayar says. "So far, most of the research has revolved around extending the capabilities of traditional imaging and finding ways to improve the performance of digital cameras." As knowledge about nontraditional imaging and optics converge, he notes, "everything from chip design to lens and camera design will undergo major changes."

In the end, Durand says it is important to place computational photography, imaging, and optics in the right context. The technology will not replace today's cameras and photographs; it will enhance them and continue advancing a process that dates back thousands of years, to the development of pinhole cameras. Computational photography puts data to use in new and better ways, whether it is applied to DNA sequencing or to improved traffic cameras or security tools.

Says Durand, "Photography is just one aspect of a much bigger picture. With it, we are able to see the world in a fundamentally different way."

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Samuel Greengard is an author and journalist based in West Linn, OR.

Opportunity

Heidelberg Laureate Forum

Individuals may apply through the end of February for one of 200 openings to attend the second Heidelberg Laureate Forum (HLF), to be held Sept. 21–26 at Heidelberg University in Germany.

HLF allows researchers from all over the world to interact with laureates of the most prestigious awards in computer science and mathematics. Last year, 40 laureates, including recipients of the ACM A.M. Turing Award, the International Mathematical Union's Fields Medal and Nevanlinna Prize, the Norwegian Academy of Science and Letter's Abel Prize, addressed young researchers on topics that ranged from "how to do research" to deep technical areas of science and math.

ACM Europe chair Fabrizio Gagliardi, one of a number of ACM members (among others) who helped organize the initial Forum, said about last year's event, "I was impressed by the attitude of the laureates who all spent a considerable amount of time networking with the young researchers; not only during the HLF sessions, but also during meals and in after-dinner discussions. This is probably the highest value of the event: providing a relative small set of promising future scientists with the unique opportunity to engage with some of the most brilliant minds in mathematics and computer science."

Interested researchers may apply on the HLF website, at https://application.heidelberg-laureate-forum.org.

HLF is organized by the Heidelberg Laureate Forum Foundation in cooperation with Klaus Tschira Stiftung and the Heidelberg Institute for Theoretical Studies, as well as ACM, the International Mathematical Union, and The Norwegian Academy of Science and Letters.

—Lawrence Fisher

Appendix 3

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Technical Perspective
Open Platforms for Computational Photography

By Richard Szeliski

COMPUTATIONAL PHOTOGRAPHY IS an emerging discipline that enables the creation of enhanced-quality photographs through novel combinations of digital images, algorithms, optics, and sensors.[2,5] The field lies at the intersection of image processing, computer vision, and computer graphics, and has spawned its own workshops and conferences. It has also engendered many new features used in digital cameras and smartphones.

While scientists have applied image analysis and enhancement techniques to images for decades, the application of sophisticated algorithms to consumer photography started in the mid-1990s. Early examples of such algorithms include stitching multiple images into seamless panoramas, merging multiple exposures to create and display high dynamic range (HDR) images, and combining flash and no-flash images to provide better details in dark regions without harsh shadows.

As with most of computing, computational photography algorithms were originally developed and deployed on professional workstations and desktop personal computers. Unfortunately, the inability to deploy these algorithms inside cameras has severely limited real-world experimental validation and the percolation of these scientific advances into consumer products.

The migration of these algorithms into hardware and firmware has been hampered by a number of factors.[1] For example, digital image processing algorithms used by cameras are protected by patents and trade secrets. Vendors also tightly control the user experience, rather than taking the more open approach embraced by the app development community.

An even more fundamental impediment to the widespread development and deployment of in-camera algorithms is the lack of a clean open architecture for controlling camera features and writing the corresponding real-time processing and viewing algorithms. The following article by Adams et al. is the first to address this problem, and it does so in a beautiful and elegant fashion.

The need for real-time processing and immediate feedback requires cameras to perform many different tasks in parallel. For example, cameras need to determine the optimal exposure time, aperture, analog gain, and focus settings for each picture.

Coming up with an elegant, programmable architecture and the APIs that support the deployment of sophisticated computational photography algorithms is a challenging architectural design problem. The authors show that in order to achieve this, the architecture must allow the specification of parameter sets (called shots) that control (or suggest) how individual images should be taken.

Because setting up these parameters can take time, the architecture keeps the desired and actual parameters tightly coupled with raw (unprocessed) images returned to the image processor. The complete architecture proposed in the paper therefore consists of shots (desired parameter sets), sensors that capture either individual, burst, or continuous streams of shots, frames that return the captured images and metadata, and devices such as lenses and flash units that can be controlled by the program.

To demonstrate the utility and generality of their approach, the authors built a custom-made experimental Frankencamera from commercial imaging parts and also reprogrammed an existing Nokia N900 smartphone. They then developed a collection of useful and compelling computational photography algorithms.

Since its original publication at SIGGRAPH 2010, the Frankencamera paper and associated hardware/firmware systems have had a dramatic impact on computational photography research and teaching, as well as consumer-level photography devices. The Frankencamera devices and software have been used in the Stanford CS 448A course on Computational Photography[4] as well as computational photography courses at other universities. Numerous computational photography apps can now be found for smartphones, and ideas inspired by the paper are also being incorporated into upcoming versions of smartphone operating systems and libraries.

One additional ingredient needed to make computational photography algorithms easy to develop is a high-level language and compiler tailored to such programs. Fortunately, a SIGGRAPH 2012 paper describing a system called *Halide* promises to do just that by enabling programmers to write high-level array-like descriptions of algorithms and then giving hints to the compiler about the desired levels of tile-based caching, parallelism, pipelining and reuse.[3]

Computational photography is blossoming as both a research field and a vibrant application area affecting all aspects of digital photography. The following paper provides an elegant example of how well-designed architectures in computer science can facilitate and accelerate the adoption of new technologies and expose novel capabilities to new generations of students.

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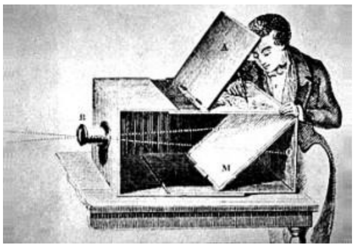
Richard Szeliski (szeliski@microsoft.com) is a distinguished scientist at Microsoft Research, Redmond, WA.

Appendix 4

OD CAMERY OBSCURY AŽ PO DIRKOMU

- Prosinec 25, 2013

„Camera obscura" je označením pro historicky první fotoaparát, ale také synonymem názvů jako jsou: dírková kamera, dírková komora, temná komora nebo pinhole. Původně ji využívali malíři při jejich tvorbě, jako byl například Leonardo da Vinci. Ale již stovky let před naším letopočtem v Číně věděli, že světlo, které prochází skrze stěnu pouze malým otvorem do tmavé místnosti, zrcadlí venkovní scénu na protější stěnu a to vzhůru nohama. Malíři přikládali papíry a plátna právě na protilehlou stěnu proto, aby jednoduše obraz obkreslili. Udělali si tak přesný „náčrt" a ve svých ateliérech obrazy dotvářeli tak, že vypadaly mnohem více realistickými. Z tohoto objevu pochopitelně později čerpali autoři patentů na různé druhy fotoaparátů.



Využití camery obscury v malířství.

Tehdy byly dírkové kamery o rozměrech spíše větších. Některé vypadaly opravdu jako místnosti. Dnes je známe i jako titěrné krabičky vlastní výroby, díky kterým jsme schopni na negativní film zachytit snímky. Existují samozřejmě pravidla, která čerpají z fyziky, jak má taková dírková komora vypadat, aby výsledný obrázek „fungoval". Důležitá je velikost otvoru, kterým světlo prochází a vzdálenost od stěny či filmu (nebo dokonce rovnou fotografického papíru), na kterou se odráží. Do temné komory nesmí žádným jiným otvorem pronikat světlo.

Fotoaparáty Dirkoma.

Tento fotoaparát, který funguje bez objektivu, spouště a nepolyká žádné baterie, si můžete snadno vyrobit sami. Můžete si ho ale také poskládat z již předem připravených dílků ze sady Pinhole Camera 4M. Opravdovou raritu však přináší česká firma Dirkoma. Ta je jediným naším výrobcem dřevěných dírkových komor. Také v Analogue je najdete v několika provedeních. Vyrábí se z kvalitního dřeva a jsou tlustostěnné – tím je zvýšena jejich stabilita a odolnost. Jejich vzhled je doslova půvabný. Tyto fotoaparáty působí elegantně a jakoby představovaly možnost kombinovat moderní design s tradiční nostalgií. Vyberte si podle velikosti, barvy a tvaru. Založte filmy 135, 120, fotopapíry nebo filmy listové. Alespoň jeden skvostný kousek by rozhodně neměl chybět ve sbírce každého fotografa.

Appendix 5

PINHOLE CAMERA 4M – SKLÁDAČKA A RADOST V JEDNOM BALENÍ

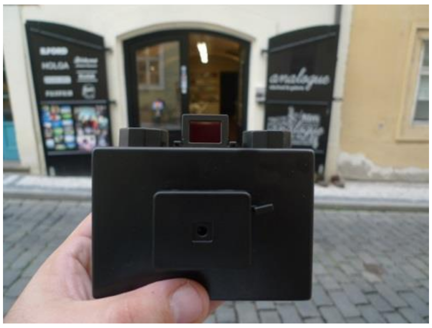
- Září 11, 2013

Zkoušeli jste si už někdy vyrobit vlastní pinhole, neboli dírkovou kameru? Fotoaparát, který zachytí snímky bez použití objektivu a jiné fotografické techniky? Na co sklíčka, drátky, kolečka a spoušť… Někdy je třeba i fotografii nebrat úplně tak vážně. Nepodlehnout moderní době, která klade důraz na kvalitu a dokonalost. Během fotografování si můžete užít i nějaké to dobrodružství a výsledek, pro který vlastně vždy spoušť zmáčkneme, může být poutavý a jedinečný dokonce bez použití profesionální techniky!

Jako děti jsme byli tvořiví snad všichni. Dokonce v dospělosti nás neopouští chuť si něco vyrobit, poskládat, vykutit. Pinhole Camera 4M je skvělým řešením, jak si udělat radost a zabavit se, pokud jste zrovna příznivcem skládaček, fotografování, analogu a jsou vám sympatické plastové foťáčky. V tomto případě jste právě objevili produkt, který zaručeně uspokojí vaše potřeby!

Poskládat si dírkovou komoru můžete třeba i z karet, jenomže každý kdo to kdy zkoušel musí dát za pravdu, že to není disciplína pro jakékoliv tvary a délku prstů. Chce to trošku zručnosti, poskládat ji tak, aby fungovala a většinou to nedopadne podle našich očekávání – nefunguje! To jenom proto, že jste tam, kde je to důležité, nedodrželi tu ideální vzdálenost, někudy vám dovnitř proniká světlo, a protože neumíte pořádně rovně stříhat, fotoaparát je nesouměrný a po postavení na stůl se převáží (to asi také proto, že jste si zvolili pro výrobu nevhodné materiály).

A my vám dáme radu – netrapte se! Za pár korun si u nás můžete pořídit fotoaparát Pinhole Camera 4M. S ním se také dosyta vyřádíte. V balení se nachází jednotlivé kusy plastového fotaparátu a dokonce i návod! No, není to báječné? Ušetří vám to mnoho času s lámáním si hlavy, nehrozí, že se dílo nezdaří a máte jistotu, že tím ve finále opravdu něco nafotíte!



Appendix 6

ANALOGOVÝ SERIÁL NA PROTIŠEDI.CZ

- Červen 30, 2014

Čtete si rádi o analogových tipech, vyhledáváte inspiraci a zajímá vás historie fotografie? Sledujte náš analogový foto seriál na Protišedi.cz.

Od podzimu minulého roku pro vás pravidelně každý měsíc přispíváme do magazínu Protišedi.cz. Píšeme pro vás články o vývoji fotografie a důležitých historických událostech, které do dnešní analogové fotografie přináší spoustu zajímavých technik, které je škoda si nevyzkoušet. Hledáte-li inspiraci, čtěte naše články!

Zatím jsme pro vás napsali:

Analogová fotografie: Kde se vzala a proč je tak úžasná?

Fotografie byla jedním z nejbáječnějších vynálezů 19.století a není snad osoby, která by si ji v dnešní době stále nepovažovala. Fotografování se dnes věnujeme téměř všichni, ať už jde o pouhé zachycení informací mobilním telefonem. Mnohdy ale toužíme po snímcích, které budou zajímavé svou výjimečnou atmosférou, chceme se oprostit od honby za kvalitou, protože nám jde mnohem více o sdělení, případně o krásno. Proto není divu, že se analogová fotografie opět stává masovým fenoménem pohlcujícím celý svět, ačkoliv jsme ji všichni ještě před několika lety pohřbívali koupí zbrusu nových digitálních fotoaparátů.

Fotíme na dírkovou komoru

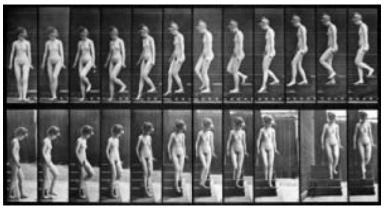
Práce s dírkovými komorami v dnešním světě rozhodně nepatří mezi koníčky výhradně profesionálních fotografů. Způsob užití těchto fotoaparátů se dnes snadno a hravě může naučit kdokoliv z nás. Dovolí nám pochopit princip zachycení snímku a vnímat toto médium, jako prostředek komunikace, který lze pojmout výtvarným způsobem. Chcete-li fotografii poznat zblízka, postavte si vlastní foťák! Naučíme vás jak na to.

Improvizovaný domácí ateliér

Než se historicky první fotografové vydali s technikou ven, chvíli to ještě trvalo. Nejprve se soustředili na ateliérovou tvorbu, jako je například zátiší. Většina z nich se věnovala malbě, takže i na těch nejstarších snímcích můžeme zaznamenat pokus o vytvoření výtvarně zajímavé kompozice. Jejich ateliéry byly jednoduše zařízené – bavíme se přeci jen o první polovině 19. století. A právě takové studio si můžete snadno vytvořit doma.

Analogová portrétní fotografie

Již první fotografové zachycovali portéty lidí jak v ateliérech, tak v exteriéru. Experimentovali rovněž na poli aktů či autoportrétů. Dnes, kdy je analogová tvorba opět v módě, se fotografové vrácí nejen k původním technickým provedením, ale také stylizaci potrétů, které na současného diváka působí vlastně novým a neokoukaným dojmem.



Výtvarný akt a analog

„Ars una, species mille – umění je jediné, podob je tisíc. A tak jsem se také já díval na fotografii jako na jeden vyjadřovací způsob uměleckého cítění," stojí v zápiscích Františka Drtikola. Jeho fotografie jsou tím nejvzácnějším a nejobsáhlejším zdrojem inspirace na poli aktu v podání analogové fotografie kombinované s malbou.

Jak být dobrý v chytání momentů

Jedním z prvních dokumentaristů na poli fotografie byl Robert Capa, jehož jméno bude mít už navždy dominatní postavení mezi těmi nějšpičkovějšími fotografy napříč celou historií. Těžko říct jestli všechny jeho snímky jsou zcela autentické a neinscenované. Velké spekulace se vedly především kolem jeho fotografie Španělský loajalista. Důležité je ale ve finále hlavně „oko" a provedení.

Výtvarný autoportrét versus selfie

Jak vypadaly autoportréty v dobách, kdy se fotografovalo pouze na film? Kam vlastně naše neustálá potřeba dokumentovat vše kolem sebe, včetně nás samotných, posunula autoportrétní tvorbu? Vraťme se tentokrát v historii tam, kde byl ještě autoportrét výjimečnou a čistě výtvarnou záležitostí.

Léto ve znamení krajinářské fotografie

Jsou to právě krajiny, na které se většinou vrháme jako první, objevujeme-li kouzla fotografování. Vezmeme svůj nový fotoaparát a jdeme si ven „zafotit". Často necháváme hovořit přírodu samu za sebe. A to je škoda. Nechte se od nás inspirovat a naučte se být více tvořiví.

Sledujte dále Protišedi.cz a naše analogové tipy. Budeme pro vás psát i nadále.