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On the Development of Computer Science among Mathematicians[1]

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ABSTRACT: The development of computer science in the contemporary sense at the University of Belgrade, and especially among Belgrade mathematicians, is firmly connected to the procurement of the first reliable computer system in 1968 at the University, the IBM 360/44 system, as well as the conception of the development of programming as conceived by professor Nedeljko Parezanović. This paper outlines the events that led to establishing computer science as an independent discipline in Serbia.

KEYWORDS: computer science, programming, computer network, computer terminology, Nedeljko Parezanović

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1 Introduction

This year marks half a century of the first, significant installation of the computer system from the IBM 360 series at the University of Belgrade. It is, therefore, an appropriate occasion to give an account of how the qualities of this machine, and even more the people engaged with it, influenced the development of computer science among Serbian mathematicians, and in Serbia in general. To the extent to which our feeble memory and preserved documents allow us, we will attempt to demonstrate how this computer – once incorporated into a well-conceived development concept – set long-term trajectories of the development of Serbian computer science and its

[1] This text is a written version of my address regarding the development of computer science at the Faculty of Mathematics given at the occasion of the first Nedeljko Parezanović award for most successful computer science students in November 2017.

applications. As many later procurements of computer equipment show, it is obvious that it is far more important to conceive a notion for using computer equipment than obtaining it,[2] but also that not even this is sufficient for overcoming inner resistance to modernization.

The paper focuses on the role of this system among Belgrade mathematicians. The acknowledgement of programming skills as a "discipline of mathematical nature" (Dijkstra, 1974) by traditional mathematics paved the way for extending the scope of the application of mathematical methods beyond the established borders, introducing a "practical" component to mathematical work. The temptation to enter a new, unknown, interdisciplinary area was overcome slowly and with difficulty, of which there are traces even today. However, numerous successful introductions of computers in science, culture, and economy, are rooted in activities started in these circumstances and on this machine.

Half a century later, it is hard to imagine the problems that the process of introducing computers had faced at its very beginning. Let us just mention the issue of translating concepts of a (at the time) new discipline from English to Serbo-Croatian. Even the basic concepts like *computer*, *file*, *store* and *storage* do not have their stable equivalents in the Serbian language. *Computer*, for example, has the equivalents *kompjuter* and *računar*,[3] and both of these terms have generated their own derivational paradigms which are not in concordance with each other. Among the particularly interesting derivates we find, besides the term *informatika*, terms like: *računarstvo*, *računarske nauke*, *kompjuterske nauke*, *kompjuteristika*, which are almost always a substitute for the English term *computer science*. The confusion caused by such an unstable terminology is illustrated by the syntagma "computer science and informatics" (*računarstvo i informatika*) (or in the reversed order),[4] which does not have an adequate equivalent in the English language.

[2] Early attempts to develop a national, Yugloslav, computer, primarily focused on developing machines of the CER type at the Vinča Institute and the Mihailo Pupin Institute for, apparently, mostly military purposes, will not be discussed in this paper.

[3] We find both terms in the first, national glossary of computer science terms (Kontić, 1974), next to descriptions *device for processing data* and *electronic computational device*.

[4] For example, the Faculty of Mathematics at the University of Belgrade has the department Computer Science and Informatics, while the Singidunum University has Informatics and Computer Science, with essentially different content!

2 Vague Beginnings

Prior to the installation of the IBM 360 machine at the beginning of the 1960s, the Mathematical Institute procured an Elliott 803B *electronic computing machine*,[5] which was placed at the Faculty of Science and Mathematics in Simina Street 2. The information about this computer is obscure, and can be found in (Simonović and Krunić, 1964), where the preface states the following motive for procuring it: "Although application of electronic computing machines is spreading ever faster in our country, there are few publications in our native language that deal with programming systems for individual computing machines, or programming in general." This claim is affirmed by the shared catalogue of Serbian libraries, where one can find that there were only a few titles in Serbian libraries until 1968 that contained the keyword "programming" – mostly manuals for machines by the manufacturer UNIVAC.

The authors further write that Elliott belongs to a class of medium-size computers with a ferrite core memory in 4,096 words of 39-bit length. It can perform 1,150 add operations per second, and 220 multiply operations per second. It has input and output on a 5-track punched tape. The tape is read at 500 characters per second, and punched (as an output device) at 100 characters per second. Another option for input and output is a magnetic tape.

Figure 1. The look of the Elliot 803B machine, according to (Simonović and Krunić, 1964).

[5] Elliott 803 (on-line)

It used the programming language Autocad III, with a set of instructions for integer and real arithmetic. What is interesting is that real numbers in the so-called floating-point notation[6] are referred to as rational numbers in this manual, which is a far more precise term with regard to their nature that the later, accepted term.

At approximately the same time, Christian Anthony Richard Hoare began his career as a programmer while working on this machine, developing his famous algorithm for sorting "quicksort", as well as implementing the language Algol 60 (Hoare, 1980).

In Yugoslavia at the time, the most significant conference that gathered researchers from fields close to computer science was ETAN (short for Electronics, Telecommunications, Automatics, Nuclear technology). By reading the collection of works from the conference in 1968,[7] one can notice that the bursting development of computer science methods and devices had hardly any influence on research "at home" at the time. Among the rare "programming" papers is (Ракић, 1968), which discusses the possibility of teaching programming in the country. He notes that the Faculty of Electrical Engineering has two optional course, Computing machines and Programming, each with three classes a week per semester.[8] There is no information regarding the content of these courses. It is evident from his account that during that period, in Serbian academic circles, computer science was still not acknowledged as a discipline with foundations in mathematics and electronics, as well as a need for its own development.[9] An account of the national development of computer technology can be found in (Lazić, 2006).

[6] Real numbers are always expressed in computer memory by a finite number of binary digits, making the set of the expressed "real" numbers finite.

[7] ETAN 1968 (on-line)

[8] Teaching programming at the Department of Mathematics at the Faculty for Science and Mathematics began in 1961, but students did not have access to computers.

[9] One should mention that, beginning in 1965, a regular annual conference *Informatica* was held on the lake Bled, organized by the Federal Board for Data Processing as part of ETAN, and later the Slovenian association Informatika, with predominantly computer science topics.

3 IBM 360/44

In our opinion, the crucial step for the development of programming, as a key computer science discipline, was the installation of the IBM 360/44 system at the University of Belgrade in 1968.

IBM launched the machine series 360 in 1964, clearing the way, as it is commonly accepted, for a wide use of computers in both science and commerce,[10] due to its reliability and the compatibility of different computer models from this series. The model 44 is a special type of high-performance machine designed exclusively for scientific calculation. Bringing this modern machine with high performances (for the time) into a scientific environment paved the way for a valuable interaction between (primarily) mathematicians, but also other researchers from natural sciences, with the latest computer science technology.

When the machine was installed, it was, so it seemed, such huge news that there is an anecdote from that time, which says that some newspapers reported that the Faculty of Science and Mathematics installed a computer with a central *pro**f**essor* and *card **cl**ea**n**er*: the terms *processor* and *reader* (meaning a device) were completely unknown to a broader audience.

There is little information regarding how this machine was purchased. According to (Vujičić i Čavčić, 1972), the equipment was purchased with funds given by the Federal and Republic Association for Scientific Research, but there is no reliable information regarding the amount of these funds. The computer's initial configuration had an internal memory of 64Kb and two removable IBM 2315 disk cartridges with a capacity of 1Mb.[11] It had a card reader for input, and a printer or card punch for output. Later, in 1972, the internal memory was doubled to 128Kb, and two additional removable IMB 2311 disk packs were added, each with a capacity of 7.25Kb.

At the beginning, the only software available for this computer was a compiler for FORTRAN IV (Parezanović, 1970), apart from the assembler and modest utility programs of the time. This sort of system support was appropriate for the needs of intensive computation required by methods of numerical mathematics, but also of other natural sciences. Given the already-mentioned hardware expansion, the machine's possibilities were advanced

[10] IBM 360 (on-line)

[11] Today, this computer can be seen in the Museum of Science and Technology, in the Collection of Computers and Information technology, and the image of the central unit can be found at IBM3 60/44 from the Institute of Mathematics (on-line)

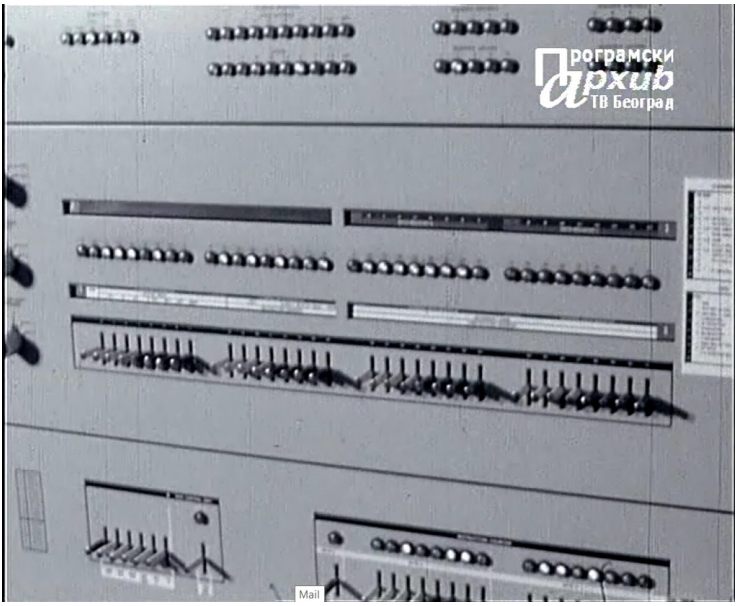

Figure 2. The IBM 360/44 control board (image taken from the Archive of Television Belgrade, on the occasion of the opening of the Centre).

due to the installation of a newer version of an operating system, and the procurement of the compiler for COBOL and PL/I languages for the needs of commercial application.

This computer equipment was entrusted to the Mathematical Institute of the Serbian Academy of Sciences and Art (SASA), and the premises was provided by the former Faculty of Science and Mathematics (PMF). A special unit was formed within the Institute – the Computer Centre, which employed several mathematicians and utility staff (operators working on the system and card punch), while the head of the Centre was professor Nedeljko Parezanović.[12] It was planned that the staff would during one part of their workday engage in commercial projects for the needs of the industry. During the other part, the Centre's associates were supposed to partake in lectures and research work in the field of computer science. This concept enabled

[12] For more details about the activities of professor Parezanović, see: Infoteka 9 (1-2), May 2008. Infotheca 2008 dedicated to Prof. Nedeljko Parezanović (on-line)

them to provide necessary means for maintaining the machine, but also to fulfill the needs of teaching programming at PMF.

The scientific research conducted by the Centre's associates, according to (Vujičić i Čavčić, 1972), occurred in two main fields:

– "theory of programming, which included the theory of algorithms, theory of formal languages, programming systems with an emphasis on operating systems and translation theory,
– numerical analysis with an accent on applying numerical methods on computers, especially numerical procedures in problems of optimization."

This machine made possible practical exercises for students of mathematics at the department for Numerical mathematics with cybernetics, and during its first year of activity numerous university, research and commercial organizations started to use it for their work, including the Water Management Institute, Mining Institute, Institute of Physics, and others. By 1972, over 70 scientific and commercial organizations used the services of this Computer Centre regularly or periodically. At the same time, this machine laid the foundation for the development of the application of computers in physics, chemistry, astrophysics and other natural sciences. It is interesting to mention that this machine was also used for the production of works of contemporary art (see Figure 3).

The first of the above-mentioned research fields embraced programming as the primary task of the Centre's associates, with research focus on major programming disciplines. This course cleared the way for research aiming to examine programming problems as such, with no immediate use in mind. Among the first programming projects of this kind was the development of the system METASS, a pre-processor for FORTRAN developed by Dušan Bratičević and later described in his master's thesis (Bratićević, 1978). The list of "programming" master's thesis under the mentorship of professor Parezanović can be found in (Настић, 2008).

4 Seminary

In the same year, 1968, when the first IBM 360/44 system was purchased in Belgrade, the world was witnessing the developing response to the first software crisis: a problem which emerged as a result of inadequate software tools for controlling the increasingly complex software products. During this period, several publications came out: on the one hand, the first of Knuth's

Figure 3. Visual poem 1970, collage on cardboard 71×50 cm, Miroljub Todorivić (Skopje, 1940) (from the permanent exhibition of the Museum of Contemporary Art in Belgrade 2018)

books *The Art of Computer Programming* (Knuth, 1968), and on the other, a short text by Dijkstra that condemns the usage of GOTO-statements in programming languages (Dijkstra, 1968), and later, the study *Structured programming* by Dahl, Dijkstra and Hoare (Dahl et al., 1972). New programming languages C and Pascal emerged, followed by tools like lex and yacc, as well as a crucial book about programming languages translation (Aho and Ullman, 1972).

Guiding the interest of young Institute associates towards modern programming topics of the time, primarily during their post-graduate studies, and under the leadership of professor Parezanović, led to forming a core team that dedicated its research activity to theorical and methodologic problems of programming. This new generation of programmers had obligatory courses during post-graduate studies that dealt with the theory of formal languages, the building of compilers and the theory of operating systems.

Nonetheless, through the development of an initial notion of scientific research in the Centre, it took almost an entire decade for a generation of young researchers dedicated to theoretical problems in programming to mature. The emergence of this generation is indicated by the launch of a permanent seminary in 1977 organized by the Mathematical Institute SASA and the Institute of Mathematics at PMF. In an account written by professor Parezanović, dating October 20, 1977, where he proposes this seminary, he calls it *the Seminary for Computer Sciences*, and suggests as discussion topics themes regarding operating systems, the theory of programming languages, translator's constructs, the correctness of programs, organization of data (structures and databases), as well as programming languages. He writes that, having in mind the associates' interests, he presumes that the seminary would gather around 20 participants.

The first seminary meeting was held already on November 8, 1977, with the topic The Analysis of the Finite-State Automatons by the Method of Isolating States, presented by Dušan Bratičević. This was followed by other regular meetings, with topics such as programming languages, data structure, correctness of programs, automated theorem proving, and other. Apart from the circle formed around the Computer Centre, the participants of the seminary were guests from other parts of Yugoslavia, including Suad Alagić from Sarajevo, Vlado Batagelj and Ivan Bratko from Ljubljana and others, as well as foreign guests. The contents discussed indicate the non-numeric character of the subjects, thereby clearly separating a new group of programmers from the ones who viewed programming primarily as a means for solving numerical tasks.

The Seminary is active to this day, with the occasional breaks, currently as the Seminary of the Department of Computer Science at the Faculty of Mathematics.[13]

5 Terminology

It is interesting that, at the beginning, it was disputed whether the seminary should be called "the Seminary of Computer Sciences" (*Seminar za računarske nauke*) or "the Seminary of the Science of Computers" (*Seminar iz nauke o računarima*), the uncertainty being resolved by the introduction of the term "computing" (*računarstvo*) coined by Prof. Slaviša Pešić the following year.

The problem regarding computer science terminology emerged at the very beginning of the seminary: the meeting held on April 24, 1978, was dedicated to terminology in computer science in Serbia. The participants included professors Đuro Kurepa, academician Mirko Stojaković, Slaviša Prešić and Nedeljko Parezanović from the Department of Mathematics, Mitar Pešikan from the Institute for Serbo-Croatian Language, Dušan Jović from the Faculty of Philology, and Vidojko Ćirić from the Faculty of Organizational Sciences. A transcript of this meeting was later published in the Slovenian journal *Informatika* (Vitas, 1978).

The need for creating a terminological system that would describe computer science concepts was present throughout the seminary. The ever-increasing number of computer science subjects in universities, as well as the process of introducing computer science courses into regular education, imposed the need for Serbian equivalents to the semantically non-transparent Anglicisms. Among the pioneering terminological solutions were *potisni* for *push-down* or *-liki* as a suffix corresponding to the English *-like*, such as *paskaloliki* (Pascal-like) or *algoliki* (Algol-like) *jezik* (language).

The English term "file", which nowadays is mostly used in the transcribed version as the Serbian *fajl*, is translated in (Kontić, 1974) as *datotetka*. Since this glossary was produced by translating the German column from the IBM English-German glossary, *datoteka* is probably a neologism coined from the adapted German term *Datei* (deduced from *Daten* and *Kartei*). Following this convenient, preliminary solution in the Serbian language, professor Parezanović proposed creating a word family consisting of compounds with *-teka*, coined in accordance with their contents: *programoteka* (program file),

[13] Seminary of the Department of Computer Science (on-line)

podatkoteka (data file), *audioteka* (audio-file), etc. Unfortunately, this convenient terminological solution did not survive in todays computer science textbooks.

The pinnacle of the efforts to establish a system of computer science terms was the work on the glossary that would enable the translation of *Oxford's Dictionary of Computer Science* (Ilingvort, 1990) to the Serbian language. After a series of successful translations of other dictionaries, the editor of the *Nolit* publishing house Slobodan Đorđević proposed creating a glossary that would enable the translation of Oxford's dictionary to Serbian. The terminology of the time (as well as todays) made this an impossible task. The example that the editor found particularly inspiring was the entry *middleware: products that in some sense occupy a position between hardware and software...* When translating these terms as *midlver*, *softver* and *hardver*, the translation of the above description seems like complete nonsense. The work on the glossary supported by the software developed on the IBM 360/44 lasted for several years, and the translation was finally finished in 1990, due to the editor's persistence and the patient and dedicated work by professor Parezanović on creating the glossary, with the help of Bogdan Janković and the author of this paper.

This dictionary was not accepted by the wider audience in Serbia, since it introduced a number of neologisms as substitutes for transcribed Anglicisms. However, many terminological solutions went into use, especially in computer science courses at the Faculty of Mathematics.

6 The Computing Laboratory

Despite the initial success of the Computer Centre, problems soon emerged regarding financing of computer science activities. One source of the problem was determining the real price of services provided by the Computer Centre that would cover – apart from the staff and basic material cost – the cost of the amortization of this (at the time expensive) machine. Given the social circumstances, however, this issue was put aside, probably because it was believed that the money for developing or replacing the machine could be provided by the funds for research and sciences. There were at least two reasons for the interruption of the development of the machine in 1972, which lead to its eventual loss of significance, and an end to its activities in 1986. On the one hand, many of the original users purchased their own machines and started working on them, resulting in lesser returns. Besides, rapid change in technology, especially new possibilities offered by operating

systems, made batch processing, especially through punch cards, adequate only for specific applications.

The other source of the problem was the unsolved issue of the internal distribution of funds. Before the computer equipment was installed, the Mathematical Institute was given government grants for scientific research. With the arrival of computers more funds began to flow in, mostly from business applications. In addition, this hybrid financing structure was occurring within a self-governing framework, where the distribution of funds was decided by employees through voting, according to the so-called "rewards according to performance" principle. This situation demanded a magic formula that would reconcile the two different financing systems and determine the satisfactory relation of price between the published scientific paper, as a criterion of scientific research, and a produced program, as a criterion of programming productivity. If one considers other factors, like investing in a program that has yet to gain a new user (for a lower price than the real one), financing programs based on scientific merit and not commercial value, or categorizing them as a scientific result, it was practically impossible to solve the problem of fund distribution to everyone's satisfaction. What is more, this led to an increasingly deeper division between theoretical researchers and the programming section of the Institute, which further narrowed the space for achieving the goals stated in (Vujičić i Čavčić, 1972).

During the mid-1982, the author of this paper was named the head of the Computer Centre with the primary task of resolving the issue of equipment renewal. In those days, the first personalized computers had already emerged, but also a whole range of computer fields, from the Japanese project of the so-called Fifth generation of computers, to the intense development of office automation systems. These new programming ideas were impossible to follow on a machine with the punch card as the sole medium for input, and printer for output.

The amortization saved during the 15 years of the Centre's activities was hardly enough for purchasing in 1983 one of the "better" micro-computers of the time, like *Partner* by Iskra in Kranj.[14] A new concept was needed in order to solve accumulated problems and pave the way for further development of computer science at the Faculty of Mathematics.

At the same time, the need for renewal of equipment emerged in other parts of the former Faculty of Science and Mathematics, especially among physicists and chemists. Instead of the time-worn and isolated IBM 360

[14] Micro-computer *Partner* produced by Iskra, Kranj (on-line)

system, the purchase of new equipment was considered, which would satisfy both the needs of intensive calculation and the needs of teaching, and provide access to networks already established in Europe. A small group of young researchers, including Svetozar Niketić from the Department of Chemistry, Dževad Belkić from the Institute of Physics, Dragan Krpić from the Department of Physics, Nikola Tucić from the Department of Biology, Gabor Mesaroš from the Institute for Biological Research, Cvetana Krstev and the author of this paper, under the patronage of professor Parezanović, worked out a concept for modernization that solved the above-mentioned problem in a satisfactory way.

It was clear, based on the experience with the Computer Centre at the Mathematical Institute, that the procurement and maintenance of a high-performance machine went beyond the available finance of the Faculty of Science and Mathematics and the Institute. The only solution was to rent time on some of the existing machines that enabled simple transfer of application from the 360 system and clear the way for their further development. One favourable circumstance was that the head of the Statistical Office of the Republic of Serbia (RZS) had close ties with computer scientists at PMF. At that time, the centre of RZS made plans to replace the existing system with a new IBM machine. At the end of the 1984, during negotiations between the representatives of RZS (particularly the head of their Computer centre Mile Todosijević) and the representative of PMF, a cooperation was agreed, allowing researchers and students from PMF to use RZS's resources. This agreement was part of the argument which enabled RZS to purchase the IBM 4381 MG14 machine in 1986.[15] The resources of this machine were used for lectures and research in the fields of mathematics and natural sciences. From an organizational perspective, this implied a highly complex transformation of the Computer Centre (see Figure 4). On the one hand, the Computer Centre was displaced from the Mathematical Institute at PMF, as a new organizational unit – work community,[16] and named Computing Laboratory. This new unit took over the staff, equipment and work that previously belonged to the Mathematical Institute. The Computing Laboratory even got its own bank account, thus gaining financial independency that the Computer Centre did not have.

[15] IBM 4381 Processors (on-line)

[16] Back then, work communities were organizational parts of institutions that served its other parts. That is why, for example, the administration or accounting services were organized as special organizational units – work communities.

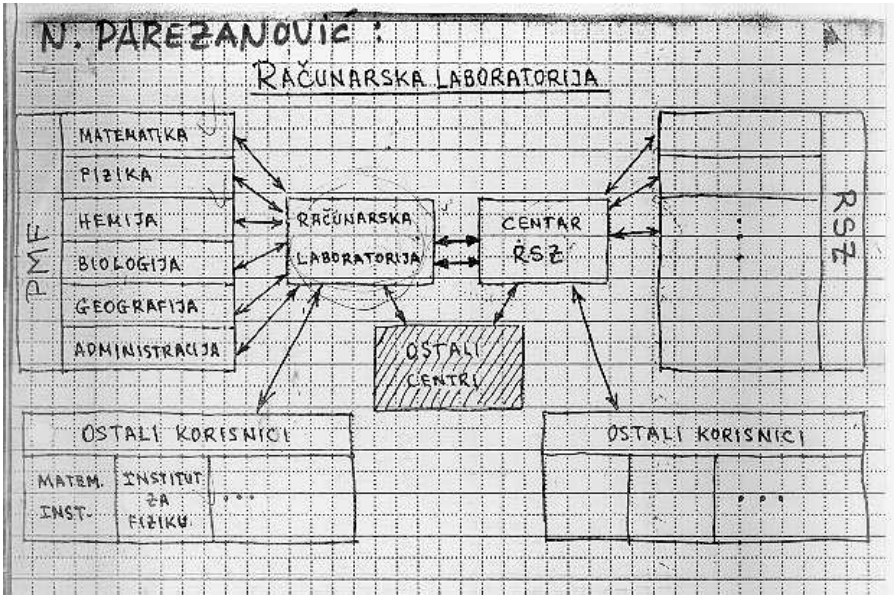

Figure 4. The concept of the Computing Laboratory outlined by professor Parezanović

The equipment for the Computing Laboratory was purchased from joint funds of departments at PMF, the Institute of Physics and the Institute for Biological Research. The equipment consisted of two clusters with 15 monochrome terminals of the 3278/2[17] type and one colour graphic terminal 3279/3 connected with RZS through rented telephone lines. Apart from this, two personal computers were purchased, one IBM PC Junior (with two floppy-disk units) and one IBM PC XT (with a 10Mb fixed disc and a 128Kb memory). To my best knowledge, those were the first "serious" personal computers at PMF.

7 The Development of the Computing Laboratory

The Computing Laboratory was launched in January 1985, providing computer science students facilities for practical exercises and researchers with access to a high-performance machine where one could execute programs with high demands for processor time, and allowing former users of the Computer Centre to harmlessly migrate to a new ambient. This way, and for the second time, conditions were met for an accelerating development of computer science, as imagined when the Computer Centre was established, which meant integration of three components: research, teaching and cooperation with commerce (Parezanović et al., 1988).

As for research, the Laboratory had, since the very beginning, participated in several significant projects in the period until 1990, like the scientific research project "Computer Science with Application", the sub-project "Computational Understanding of Natural Languages" in the scope of the project "Artificial Intelligence with Application", and the sub-project "The System of Student Services" as part of the developing project "The Integrated Information System of the University of Belgrade" (Krstev et al., 1988), financed by the Republic Scientific Community. For the needs of the Federal Standardization Office two application projects were realized: "Adaptation of TIT-thesaurus from the English to the Serbo-Croatian Language" and "Long-term Program of Standardization in the Field of Computer Science" funded by the Federal Ministry of Science.

As for the last major users of the Computing Laboratory, the Faculty of Forestry and State Enterprise "Srbijašume", for whom a complex application for the management of state forests on the territory of Serbia and Montenegro

[17] IBM 3270 terminals (on-line)

was developed, their software was transferred to an RZS machine, while the massive data input was left in the Laboratory (Jović et al., 1987).

A notable success following the transformation of the Computer Centre was when PMF joined the European Academic and Research Network (EARN). This network, formed in 1983, connected university institutions across Western Europe and was a branch of the American BITNET. Eastern European countries were not able to join, probably because of both political and technological reasons. Joining this network implied creating a national node, which had to be one of the host IBM machines in an academic institution. In former Yugoslavia, only PMF satisfied this necessary technological condition for joining. And so, thanks to the creation of the Laboratory, and relying on the support of RZS, in 1986[18] PMF was already experimentally included in this network, which provided researchers from institutions gathered around the Laboratory with (up to then) unimaginable services, like e-mail, forum access, or file transfer. Later, other institutions of the University of Belgrade joined this network, as well as institutions from other parts of Yugoslavia.

Thanks to the experience with a network like EARN, a group of researchers from PMF, gathered around the Laboratory, conceived the Specialized system of scientific and technological information[19] in the field of mathematics and natural sciences. At the contest, organized by the Federal Ministry of Science, for the choice of a specialized systems implementer as part of SNTIJ, their proposal was selected, and the implementation duties were given to PMF. Contrary to other parts of SNTIJ, which focused on building library systems for specific areas, this proposal was based on an integrated support for research activities that would be accessible to researchers through the network. This sort of conception was an early articulation of a typical research ambient of today, but in that time, it was a Copernican turn in organizing provision of information (Vitas, 1990; Витас и др., 1991; Vitas et al., 1990) .

This dynamic beginning of the development of the Computing laboratory was put to an end in 1990, with the disassembly of PMF into separate faculties. The Laboratory was incorporated into the Faculty of Mathematics, where it has stayed to this day.

[18] The issue of wider joining was not just a technological and financial question, but gained a political dimension as well.

[19] *Specijalizovani sistem naučnih i tehničkih informacija Jugoslavije* (in Serbian) – SNTIJ

8 Conclusion

Most of the facts revealed in this paper have been covered by oblivion. Nowadays, given the omnipresence of computer and information science, it is hard to even imagine the gradual development of computer science and its separation into a distinct discipline. Resistance, still very present, especially in conservative university circles, was slowly overcome, only thanks to visions of development, which in the last half of the century have always belonged to professor Parezanović.

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Designing effective multiple-choice questions for assessing learning outcomes

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ABSTRACT: Nowadays, multiple-choice question tests (MCQ tests) present a popular tool for assessing learning outcomes because they are flexible, relatively easy to implement and grade, and able to assess large content in a short time. More important is the fact that these questions are versatile and reliable, which increases their attractiveness. Additionally, the examiners can use question sets in their assessments that are already prepared for previous courses or are available online. On the other hand, many authors argue that MCQs are commonly used to assess cognitive skills on lower levels as defined by Bloom's taxonomy. However, the comprehensive analyses confirm that this type of assessment tool has the capacity to evaluate certain higher-order thinking.

KEYWORDS: Multiple-choice question tests, levels of cognition, difficulty index, discrimination index

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1 Introduction

Assessment is the systematic collection and analysis of information to improve student learning (Stassen et al., 2001). The measurement of student learning through assessment is important because it provides useful feedback to both teachers (examiners) and students about the extent to which students are successfully meeting course learning objectives. It is also useful for teachers in developing the rationale for pedagogical choices in the classroom.[1] The

[1] Michael R. Fisher, Jr., "Student Assessment for Teaching and Learning", Center for Teaching, Vanderbilt University (on-line)

most widely used traditional assessment tools are multiple-choice question tests, true/false tests, short answers and essays.[2] Brown and Knight (1998) asserted that utilizing a mixture of different tools, improves the reliability of the assessment. However, this approach is quite challenging because the examiners should be able to properly weigh the scores produced by the different tools of assessment.

Nowadays, muliple-choice question tests (MCQ tests) are commonly utilized by teachers, schools, universities and assessment organizations because they present an effective and efficient way to assess learning outcomes (a detailed explanation about MCQs' advantages, as well as their limitations, is given in the following two sections). Each *multiple-choice question*, also known as *item*, consists of a given problem (known as a *stem*), and a list of suggested solutions (known as *alternatives*). The alternatives usually include one correct answer (the best alternative), as well as several incorrect or inferior alternatives, known as *distractors* (Brame, 2013). Student's task is to select the alternative that presents the best answer for the given problem. The purpose of the distractors is to appear as plausible solutions of the given problem for those students who have not achieved the objective being measured by the item. Conversely, the distractors must appear as implausible solutions for the students who have achieved the objective.

This paper is organized as follows. The present section provides an overview of the MCQs' advantages and limitations in the process of assessing learning outcomes. Section 2 is dedicated to the standard protocols for increasing MCQ's validity. At the end, the potential of MCQ tests for evaluating higher-order thinking skills is highlighted, including some recommendations how to construct such tests.

1.1 Advantages of multiple-choice questions

Multiple-choice questions tests have certain advantages, as well as limitations, just as any other type of test items. Examiners must be aware of these features in order to use multiple-choice questions effectively. Below are presented the most important advantages of using MCQ tests as an assessment tool (Burton et al., 1991; Chan, 2009; Dikli, 2003; Towns, 2014).

Versatility. MCQ tests are applicable in many different subject-matter areas and can be used to assess various levels of learning outcomes (from simple

[2] Maryellen Weimer, "Advantages and Disadvantages of Different Types of Test Questions", Faculty Focus, (on-line)

recall of knowledge to more complex levels, such as application, analysis and evaluation). However, these tests cannot be applied in each testing because students are choosing from a set of potential answers. For example, they are not an effective way to test students' ability to organize their thoughts or express their creative ideas (Section 1.2).

Reliability. Reliability is defined as the degree to which the test consistently measures the learning outcomes. Appropriately written MCQ tests are more reliable than the tests including other types of questions. For example, they are less susceptible to guessing than true/false questions. Also, their scoring is easier to understand than short-answer test scoring because there is no need to resolve partial and misspelled answers. Furthermore, MCQ test assessment is more objective than the assessment including essay questions. The essay test scores can be affected by the examiner's inconsistencies and are not immune to the influence of bluffing and writing ability factors, which can lower their reliability.

Validity. Validity is defined as the degree to which the test measures the learning outcomes it aims to measure. Because MCQ is usually answered more quickly than an essay question, tests based on MCQs can focus on a relatively broad course material, thus increasing the validity of the assessment (Bacon, 2003).

Efficiency. The usage of MCQ tests is very important for the examiners because they allow easy and quick evaluation. These tests are particularly essential for the examiners who cover multiple courses with large number of enrolments. MCQ test assessment expedites the reporting of students' results, thus allowing the examiner a quick insight of their achievements and an opportunity to give additional clarifications and instructions before the course is completed.

1.2 Limitations of multiple-choice questions

Despite the aforementioned advantages, the assessment of learning outcomes with MCQ tests is often criticized. The rest of this subsection presents an overview of the MCQ tests' limitations (Burton et al., 1991; Chan, 2009; Dikli, 2003; Towns, 2014).

Versatility. Certain researchers emphasize that the MCQ tests evaluate student's ability to memorize, rather than understand, apply and analyze information (Walsh and Seldomridge, 2006). However, it is obvious that these tests can also be used to assess higher-order thinking. This can be achived by including questions that focus on higher levels of cognition, presented in the well-known Anderson and Krathwohl's taxonomy (the revised Bloom's taxonomy) (Bloom, 1977; Anderson et al., 2001). The stem of such question types presents a problem, which can only be resolved with analysis and application of particular principles from the examined area. The alternatives can also contribute to this process, through the necessity to be evaluated. However, the process of developing MCQ tests for assessing higher-order thinking, requires more skills and capabilities than developing questions that evaluate simple recognition and memorization (Palmer and Devitt, 2007).

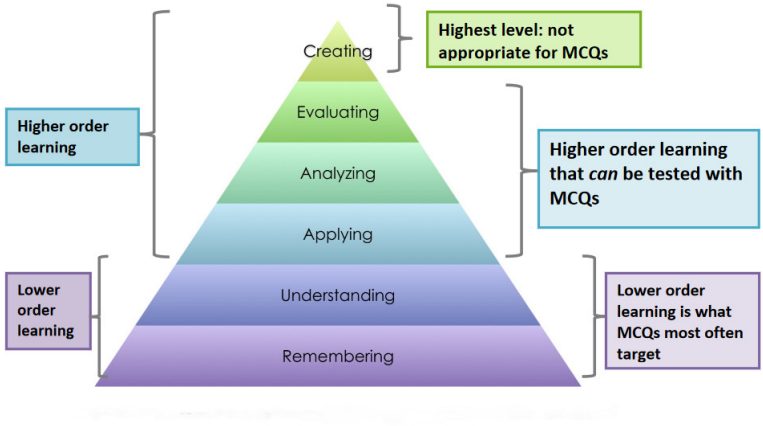

Figure 1. Suitability of MCQs to different levels of cognition of Anderson and Krathwohl's taxonomy

Figure 1 outlines Anderson and Krathwohl's taxonomy[3] for the cognitive domain, which is broken into six levels of objectives. It also includes annotation about the suitability of the MCQ tests for assessing the presented levels.

[3] Workshop: Designing Effective Multiple-Choice Questions, Teaching and Learning Services, McGill (on-line).

Furthermore, Table 1 briefly describes the levels' complexity and specificity. According to Anderson and Krathwohl's taxonomy, MCQs are not appropriate for testing only the highest level of cognition (creating). The reason is that creating requires students to put parts together in a new way, or synthesize parts into something new and different, creating a new form or product. This process is the most difficult mental function in the present taxonomy.[4]

Table 1. Description of the six levels of complexity in the Anderson and Krathwohl's taxonomy

Level	Definition
Remembering	Recalling information
Understanding	Identifying examples of a given term, concept, or principle. Interpreting the meaning of an idea, concept or principle.
Applying	Using information, rules and procedures in concrete situations.
Analyzing	Breaking information into parts to explore patterns and relationships. Analyzing charts, data to support conclusions.
Evaluating	Justifying a decision or a course of action.
Creating	Generating new ideas or products.

Reliability. MCQs are less susceptible to guessing than true/false test items, but they are still affected to a certain extent. The guessing factor reduces the reliability of MCQs scores somewhat, but increasing the number of items offsets this reduction in reliability.

Table 2 presents the probabilities of scoring 50% or higher on MCQ test by blind guessing the correct answers (P). The results are obtained using the Binomial distribution:[5]

[4] Leslie Owen Wilson, "Anderson and Krathwohl – Bloom's Taxonomy Revised", The Second Principle (on-line)

[5] Ronald E. Walpole et al., *Probability & Statistics for Engineers & Scientists*, Prentice Hall (on-line)

Table 2. The probability of scoring 50% or higher by blind guessing, depending on the number of MCQs

Number of 4-alternative multiple-choice questions in the test (n), with only one correct answer	**Probability of scoring 50% or higher by blind guessing (P)**
5	0.1035
10	0.0781
20	0.0139

$$P = \begin{cases} \sum_{k=\frac{n}{2}}^{n} \binom{n}{k} p^k (1-p)^{n-k}, & \text{if n is even} \\ \sum_{k=\lfloor \frac{n}{2} \rfloor + 1}^{n} \binom{n}{k} p^k (1-p)^{n-k}, & \text{if n is odd} \end{cases}$$

where $\binom{n}{k} p^k (1-p)^{n-k}$ is the probability to get questions right, and $p = \frac{1}{4}$ is the probability to get an individual question right. As can be noted from table 2, the probability P equals to 0,0139, when the test consists of 20 MCQs. If the total number of students is equal to N, it can be expected that $p \cdot N$ of them will score 50% or more by blind guessing. This means that, for example, if 100 students are tested with 20 MCQs (each containing 4 alternatives, and only one of them presents the correct answer), then the expected number of students to pass the test by blind guessing is one.

Difficulty of construction. The key to take advantage of MCQs' strengths (presented above), is to construct good multiple-choice items. However, good MCQs are generally more difficult and time-consuming to write than other types of questions. This is particularly evident for the process of determining plausible distractors, which requires a certain amount of skills. These capabilities, however, may be increased through study, practice and experience.

2 Increasing MCQ validity by implementing standard protocols

Versatility and reliability are inherent qualities of MCQs, but their validity cannot be assumed due to the possibility of the student to guess the correct answer even when he or she lacks the expected knowledge. Therefore,

standard **prevalidation** and **postvalidation** protocols are recommended to increase the validity of MCQs (Ramakrishnan et al., 2017).

2.1 Standard MCQs prevalidation protocols

Prevalidation is a process that prevents error occurrence in the construction of MCQs by using guidelines and checklists. The most important observation is to construct MCQ test with independent items. This will disable students to use information from one item in order to answer another one, thus reducing the test validity. The most notable guidelines which should be observed when developing effective multiple-choice items are presented below. For better illustration, the guidelines are augmented with multiple-choice question examples from the test-collection described in (Jovanovska, 2018). All of the questions are taken from the Macedonian State Matura, and are publicly available on the State Examination Center's web site.[6] The correct answers are highlighted.[7]

Constructing an effective stem. The following requirements are crucial in the process of constructing an effective stem (Frey et al., 2003):

1. The stem should be meaningful by itself and should present a definite problem. Such a stem guarantees that the item is focusing on assessing learning outcomes (table 3).
2. The stem should not contain irrelevant information, which can reduce the reliability and the validity of the test results (table 4) (Haladyna and Downing, 1989).
3. The stem should be expressed with a negation only when a significant learning outcome requires it. Studies confirm that students have difficulty in understanding items with negative phrasing (Michael Rodriguez, 1997). If there is a necessity of a negative expression for assessing specific expertise (such as in medicine), then the negation must be emphasized with italics or capitalization (table 5).
4. The stem should be a question or a partial sentence (Statman, 1988). A question stem is preferable because it allows the student to focus on answering the question, rather than memorizing the partial sentence and subsequently completing it with each of the alternatives. Studies

[6] State Exam Center, Bureau for Development of Education (on-line)

[7] In on-line edition they are indicated in red, in printed edition they are given in small caps.

have already confirmed that the cognitive load increases if the stem is constructed with initial or internal blank, Table 6) (Brame, 2013).

Constructing effective alternatives. The process of creating item's alternatives should fulfill the following recommendations (Frey et al., 2003):

Table 3. An example of an item with a meaningless stem and its improved formulation

Item with a meaningless stem	**Item's improved formulation**
Which of the following thesis is true:	Phenomenology is the science of?
A. phenomenology is the science of the circumstances in nature	A. the circumstances in nature
B. phenomenology is the science of the beauty things	B. the beauty things
C. PHENOMENOLOGY IS THE SCIENCE OF THE PHENOMENA IN CONSCIOUSNESS	C. THE PHENOMENA IN CONSCIOUSNESS
D. phenomenology is the science of the goodwill principles	D. the goodwill principles

Table 4. An example of a stem with irrelevant information and its improved formulation

A stem with irrelevant information	**Stem's improved formulation**
When Aristotle was 18 years old, he came to Athens to study at Plato's Academy. As a best student, associate and lecture, afterward, he became a tutor of:	Whose teacher was Aristotle?
A. ALEXANDER THE GREAT	A. ALEXANDER THE GREAT
B. Philip of Macedon	B. Philip of Macedon
C. Socrates	C. Socrates
D. Al-Farabi	D. Al-Farabi

Table 5. An example of a stem with a negation and its improved formulation

A stem with a negation	**Improved formulation**
Which of the following does NOT belong to the five pillars of Islam?	The five pillars of Islam, as Muslim's religious and ethical obligations, include all of the following except:
A. Shahada	A. Shahada
B. Salat	B. Salat
C. Zakat	C. Zakat
D. Halakhah	D. Halakhah

Table 6. An example of a stem with an internal blank and its improved formulation

A stem with internal blank	**Improved formulation**
Together with Holbach, _____ is one of the most important French encyclopedists.	Who is one of the most important French encyclopedists along with Holbach?
A. Helvetius	A. Helvetius
B. Camus	B. Camus
C. Proudhon	C. Proudhon
D. Derrida	C. Derrida

Table 7. An example of implausible alternatives for a given stem

Implausible alternatives (B and D)
Which philosopher is the most influential representative of the modern intuitionism?
A. Henri Bergson
B. Albert Einstein
C. Norbert Wiener
D. John Kennedy

1. All alternatives should be plausible. Implausible alternatives don't present functional distractors and should not be used. The common students' mistakes provide the best source of distractors (table 7).

2. The alternatives should be stated clearly and concisely and should be mutually exclusive. Students consider that the items containing alternatives with an overlapping content can undermine the confidence of the evaluation.

3. The alternatives should not provide clues which rule them out. Otherwise, the sophisticated students can reveal the correct answer easily. Therefore, it is important that the alternatives are similar in length, use the same expression style and have a grammar consistent with the stem.

4. The alternatives "all of the above" and "none of the above" should be avoided when designing multiple-choice items. If the alternative "all of the above" is used as a correct answer, the student who can identify more than one alternative as correct, can select the correct answer even though he or she is not sure about the other alternatives. The same argument is true when the alternative "none of the above" is used as a correct answer. In both cases, it is possible to apply partial knowledge to correctly answer the item.

5. The general assumption in the process of designing multiple-choice questions is that the order of the alternatives is completely irrelevant, until answers are randomly assigned to positions or equally distributed among them (Attali and Bar-Hillel, 2003). In that sense, Hohensinn and Baghaei (2017) examined if the item difficulty depends only on the item stem, or it is influenced by the position of the correct answer. The analysis confirmed that the position of the correct answer has a very small effect on the multiple choice item difficulty and the common practice of distributing correct options randomly is valid. Haladyna et al. (2002) presented a taxonomy of guidelines for creating MCQs. The part referring to the positions of the alternatives emphasizes that the alternatives should be given in a logical order (such as alphabetical or numerical) to avoid biases towards certain positions.

6. The number of alternatives can vary among multiple choice questions, as long as all the alternatives are plausible. There is no strong evidence that confirms significant differences in the item difficulty and the reliability of the test results between the questions that contain two, three or four distractors (Haladyna, 2004).

2.2 Standard MCQs postvalidation protocols

Postvalidation helps to identify MCQs with questionable validity so that they can be appropriately modified before reusing or discarded. Item analysis is a postvalidation procedure which characterizes every MCQ by assigning numerical values, such as: difficulty index, discrimination index and distractor analysis. Based on the standard acceptable limits for these numerical values, MCQs can be accepted, modified and revalidated, or discarded.

Difficulty index. The difficulty index is one of the most commonly used statistics for item analysis. It is a measure of the proportion of those students who answered the item correctly, and therefore it is frequently called the p – value. A higher p – value indicates that a greater proportion of the students answered the item correctly, and thus the item is considered as an easier one. The difficulty index is obtained by dividing the number of students who answered the item correctly by the total number of students who answered that item, thus ranging between 0.0 and 1.0 (Crocker and Algina, 1986). Table 8 presents three different item categories depending on the range to which the difficulty index value belongs.

Table 8. Item categories depending on the difficulty index value (Wiersma and Jurs, 1990)

Range of the difficulty index	Item category
$p \leq 0.30$	difficult
$0.30 < p \leq 0.70$	acceptable
$p \geq 0.70$	easy

Discrimination index. The item discrimination index demonstrates how well the item is able to distinguish between students who achieved the learning outcomes and those who did not. In computing this measure, a group of the best performing students is analyzed (the upper group), along with a group of students who did poorly on the overall test (the lower group). To ensure stability, it is preferable that the groups include larger number of students. It is also desirable for these groups to be more diverse, in order to make the discriminations clearer. According to Wiersma and Jurs (1990), the use of 27% of the total number of students in each group, maximizes these two features.

The discrimination index is defined by:

$$D = \frac{U - L}{N}$$

where U and L are the number of students in the upper and lower group, respectively, who answered the item correctly, and N is the number of students in the largest of the two groups. Wood (1960) stated that when more students in the lower group than in the upper group selected the correct answer of the item, then the item has a negative validity. A negative value indicates that the item is not only useless, but also decreases the test validity. Table 9 presents four different item categories depending on the range to which the discrimination index value belongs.

Table 9. Item categories depending on the discrimination index value (Ebel and Frisbie, 1986)

Range of the difficulty index	Item category
$D \geq 0.40$	very good
$0.30 \leq 30 \leq 0.39$	reasonably good (possibly subjected to improvement)
$0.20 \leq D \leq 0.29$	marginal (necessity of revision)
$D \leq 0.19$	poor (necessity of major revision or elimination)

Distractor analysis. The two measures defined above do not consider the characteristics of the item distractors and the way they influence the student's decision to select one of the alternatives. Distractor analysis addresses these issues by examining the quality of the distractors as one important element of the item quality. Each distractor must be plausible and clearly incorrect.

One simple approach of distractor analysis includes determination of the proportion of students who selected each of the alternatives. These proportions can be particularly informative. For example, when the proportion of students who selected a given distractor is greater than the proportion of students who selected the correct answer, then the item should be examined to determine if the correct answer is mistaken. The distractor analysis can also reveal implausible distractors. For example, if the students consistently

fail to select a given distractor, this may be an evidence for its implausibility. Distractors not selected by 5% or more of the students are considered ineffective and should be revised or eliminated (Linn and Gronlund, 2000).

2.3 Relevant research

The conducted research confirmed that there is a significant space for improving the quality of many tests based on multiple choice questions. Analyzing a sample of 60 multiple-choice questions from medical field, Ramakrishnan et al. (2017) concluded that more than one third of all the distractors were not functional, i.e. they were not acceptable. Those distractors should be modified or replaced and tested again, until meeting the defined criteria (achieving distractor effectiveness equal or higher than 5%). Halikar et al. (2016) analyzed 20 multiple-choice questions from the same field (medicine) in detail and noticed that all questions had at least one nonfunctional distractor, while the total number of nonfunctional distractors was 23% from the set of distractors. The results also revealed that the percentage of the acceptable questions, based on the difficulty index and discrimination index, was 35% and 50%, respectively. Therefore, the authors recommended a generation of a pool with valid MCQs, where each question is associated with its index values. Thus, the examiners can choose proper MCQs from that pool for certain testing. In their research, Battista and Kurzawa (2011) highlighted that the examiners need training courses and support, in order to be sure that their MCQ tests are well-designed and have acceptable discriminatory power. The process of creating high-quality MCQ tests is a skill that can be learned (Jozefowicz et al., 2002).

3 Considerations for writing MCQs that test higher-order thinking

Despite the fact that the initial designing of the cognitive skills' taxonomies was accomplished to overcome the distinctiveness of the different domains, the experts agree that the higher-order cognitive processes are inherently domain-specific. Anderson et al. (2001) acknowledged that each major field should have its own taxonomy. The experts are faced with the challenge of operationalizing general taxonomy levels for their specific area (Morrison and Free, 2001). Therefore, the number of MCQ basic construction rules for different cognitive levels is partly restricted. Nevertheless,

some strategies are identified that may help when designing MCQs, which reach beyond mere recall. Following paragraphs offer some recommendations that might facilitate this process.

Application of specific verbs. Morrison and Free (2001) associate certain verbs to the various cognitive processes (table 10). When a particular verb is placed in an item, it may serve as an indicator that the corresponding cognitive level is assessed. However, this strategy should be used carefully because some verbs could be placed in multiple levels, and much depends on the context of the item in which the verb is placed. Nevertheless, this mapping gives an objective and transparent basis for the item developers.

Table 10. Examples of verbs associated with various categories of Bloom's Taxonomy (Morrison and Free, 2001)

Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Identify	Describe	Apply	Analyze	Compose	Appraise
Define	Differentiate	Calculate	Categorize	Construct	Assess
Know	Discuss	Classify	Compare	Create	Evaluate
List	Explain	Develop	Contrast	Design	Judge
Name	Rephrase	Examine	Distinguish	Formulate	
Recognize	Restate	Solve	Determine	Modify	
State	Reword	Use	Investigate	Plan	

Using realistic scenarios. One of the best ways to promote and evaluate higher-order thinking is to use questions based on realistic situations, especially those that simulate real work experiences (Scully, 2017).

Analysis of visuals. Critical thinking skills can be assessed by asking the students to analyze or interpret information from visuals, which are provided as an integral part of the question stem or the alternatives. In many cases, these visuals, such as diagrams and graphs, simulate the real tasks from different workplaces (Burton et al., 1991).

Request to elaborate the answer. Higher-order thinking can also be evaluated if the students are asked to synthesize what they have learned.

This means that the answers should include explanations that support them (Lord et al., 2009).

4 Concluding comments

The assessment of learning outcomes is crucial for educational improvements. The process of student assessment should align with curricular goals and educational objectives. Identifying the proper assessment strategies for students' progress evaluation within individual programs is as important as establishing curricular content and delivery methods. MCQs, as one of the frequently used assessment strategies, have certain strengths and weaknesses. They are efficient, flexible, objective, easy to implement and grade and can be used to assess large content of the curriculum. However, the development of a good MCQ test for evaluating students' achivements is a very challenging goal. Even when examiners follow a series of guidelines for constructing fair and systematic tests, different factors may influence student's perception of the test items. In order to increase the MCQs' quality, it is vital to analyze items' difficulty and discrimination indices, which might help the test developers to make the test assessment more meaningful.

It is often argued that the multiple-choice items are suitable for assessing only the lower-order thinking skills. Nevertheless, a more accurate assertion may be that the multiple-choice items measuring complex cognitive processes are simply rarely constructed. Adhering to certain strategies, it is possible to construct multiple-choice items that measure processes such as knowledge application, analysis and evaluation.

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BITEF 212 : From the Idea to the Realization[1]

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ABSTRACT: The Belgrade International Theatre Festival – BITEF is the first international festival launched on the territory of former Yugoslavia, and it is significant both for regional culture and for the history of world theatre. The First BITEF, sponsored by the Secretariat of Belgrade, was held in 1967, and it took place in Atelje 212. From its beginnings to this day, the festival has been held every year with no exceptions, generating a large number of documents, posters, audio-visual and other materials. This paper presents the political, cultural and historical events that influenced the creation as well as the shaping of the festival, but also its influence and the significance for the regional and the world theatre scenes. The paper also discusses the jurisdiction of the Historical Archives of Belgrade over the BITEF fond, as well as the entirety of archival materials relating to the first BITEF 212.

KEYWORDS: BITEF, theatre, Belgrade, Historical Archives of Belgrade, archival material, Yugoslavia

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[1] This article is based on author's Master's Thesis titled: "BITEF 212 : From the Idea to the Realization - The archival and documentary approach to the BITEF's materials stored in the Historical Archives of Belgrade" which was done under the supervision of professor Dr Bojan Đorđević, at the Department of Library and Information Science, Faculty of Philology, University of Belgrade. The work was defended in September 2017.

1 Introduction

Ever since it was first set up in 1967, BITEF has been one of the most significant international cultural manifestations of the 20th century. Its significance can be seen in the exchange of artistic, theatrical, social, and cultural information between participating countries and the spectators. By giving artists a chance to get to know each other and cooperate, BITEF has also broken down prejudice regarding the people and cultures of politically opposed Eastern and Western Blocs and Third World countries. Belgrade, the socialist Yugoslavia, and especially BITEF, were becoming an exceptionally appealing and provocative neutral ground where artists, critics, theorists, culturologists, journalists and audiences from all over the world could meet and get to know each other. BITEF was also successful in paving the way for FEST and other international manifestations held in Serbia, most of which exist to this day. In this period, Belgrade was one of the quintessential capitals of culture people would turn to when they wanted to visit Europe and attend cultural gatherings of international significance.

The survival of BITEF during the end of the 20th century and the beginning of the 21th century bears witness, above all, to the respect held for the festival's jury, and the prejudice-free approach by artists and the audiences from all over the world. In its fifty years of existence BITEF has pushed many boundaries, becoming a cultural institution of national and international importance. It has also become a valuable resource for scientific research, a testament to which is the entire documentation kept in the Historical Archives of Belgrade and the BITEF directoriate.

2 Prerequisites for the establishment of BITEF

A large number of cultural and artistic institutions were founded on the territory of Yugoslavia after the Second World War, including theatres, cinemas, libraries, galleries and cultural centres. Several independent theatres were set up in Belgrade alone: the Terazije Theatre, the Belgrade Drama Theatre, and some time later – Atelje 212, the Zvezdara Theatre, and the BITEF Theatre. Every cultural centre in the country was required to have a stage which would host shows and theatrical pieces.

Yugoslavia's geopolitical and economic position contributed to the development of modern Serbian theatre. Even though Yugoslavia was close to the Eastern Bloc in the post-war period, its politics of independence gradually distanced it from the Soviet Union, in a process that culminated with Josip

Broz Tito's initiative to establish the Non-aligned Movement in Belgrade in 1962, opening the doors of Yugoslavia to the rest of the world.

Serbian theatre scene established itself as a part of European culture of special significance when the Yugoslav Drama Theatre participated in the Theatre of Nations festival in Paris in 1954, with Marin Držić's *Dundo Maroje*, directed by Bojan Stupica, and in 1955, with Maksim Gorki's *Jegor Buličov*, directed by Mata Milošević (Volk, 2003). During the 1950s and 1960s, the Yugoslav Drama Theatre's guest performances in most European capitals paved the way for the Belgrade stage culture and laid foundations for international cooperation in the field of stage art.

Famous people including Henry Moore, Irving Stone, Jean-Paul Sartre, Simone de Beauvoir, Laurence Olivier, Vivien Leigh, Peter Brook, William Saroyan, Elizabeth Taylor, Samuel Beckett, Louis Armstrong, Igor Stravinsky, Luciano Pavarotti, Salvatore Quasimodo, Alfred Hitchcock, Arthur Rubinstein, Mario Del Monaco and Burt Lancaster, visited Belgrade and contributed to its cultural life in the fifties and sixties further establishing international cultural cooperation during their stay.

Belgrade thus became a metropolis that embraced progressive views, especially with respect to art. The person most responsible for shaping the new cultural politics of Belgrade was Milan Vukos, who, after serving as a secretary of culture in the Social Republic of Serbia, became a vice-president of the City Assembly of Belgrade in 1967. All cultural institutions such as theatres, publishing houses, music production companies and film production companies, received special attention and substantial funding. This is precisely why the sixties are a decade of unique historical importance.

The year 1967 was a turning point in all cultural domains. The film industry produced films such as *I Even Met Happy Gypsies* by Aleksandar Petrović, *The Morning* by Puriša Đorđević and *Love Affair, or the Case of the Missing Switchboard Operator* by Dušan Makavejev, which became world famous and influenced other film industries, Influential works were produced in the area of literature, as well as visual and applied arts, in line with international trends. It is in the spirit of these developments that festivals of international significance such as BITEF, BEMUS, FEST and the Joy of Europe, were founded. The centre of all these manifestations was Atelje 212, as its stage most clearly demonstrated a desire to follow in the footsteps of the international avant-garde.

2.1 Atelje 212

Mira Trailović (1924-1989), one of the most prominent women of the Yugoslav culture, especially of the theatrical world, was the founder and long-time managing director of Atelje 212 and BITEF. In 1953, together with Borislav Mihajlović Mihiz, (1922-1997), author and scriptwriter, she came up with the concept of a modern and avant-garde theatre in Belgrade, one that would, compared with the theatres, have a repertoire more modern, and a form more free, a theatre that would be more independent from the government. This theatre would include chamber plays, pantomime, chansons, monodramas, recitals and literary cabarets. The waiting-room of the news agency Borba was used to accommodate the new theatre, and Borislav Mihajlović Mihiz named this theatre Atelje 212, after the number of seats in the room. The grand opening of Atelje 212 took place on 11 November 1956.[2] Following this event, Mira Trailović, together with the Serbian teatrologist and author Jovan Ćirilov, founded the Belgrade International Theatre Festival - BITEF.

It was in May 1964 that the idea of organizing the first international theatre festival in Belgrade first came to public attention. Even back then, the building of Atelje 212 was considered the most apt for a review of chamber theatre achievements from around the world. In this way BITEF was set up at last, in 1967, and the slogan "New theatre tendencies" conveyed the power of the theatrical avant-garde of the late sixties, as well as of new tendencies of classical theatre.

Atelje 212 itself was most influenced by "New theatre tendencies", especially by the theatre of the absurd and other new literary movements, so its repertoire differed significantly from what as available in other theatres.[3] The boundaries that existed between the stage and the audience were torn down on the stage of Atelje 212, and a sense of intimacy ensued that defined shared desires, feelings and aspirations for the creation of new, avant-garde theatre.

[2] History of the theatre (on-line)

[3] In this multi-colored theatre programs were printed for the first time in Serbia. These programs were printed as magazines, and they included: the history of the play's stagings, the auhtor's biography, the director's explanation of the play's concept, excerpts from previous critiques, sharp observations from contemporaries, and sometimes philosophical or political musings on the period. Following this model, daily bulletins were typed and printed during the festival; today they are stacked and kept in the archival boxes as documents of special significance.

What the Yugoslav Drama Theatre was for our capital in fifties and sixties, the Atelje 212 theatre became during the following two decades. Run by Mira Trailović, Atelje 212 and BITEF became one of Belgrade's trademarks, which are recognized and respected throughout the world to this day.

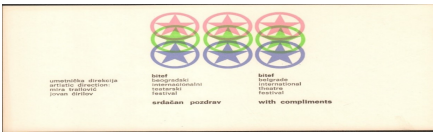

Figure 1. An invitation for the grand opening of BITEF 212

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3 The first BITEF 212

"You could feel it in the air: the revolution in the way young people were behaving, and not only in the sphere of eroticism; America was troubled by the Vietnam War, aged dictators were ruling Spain and Portugal, the dictators in Greece had just come to power, Egypt and Israel were at war, Khrushchev was no longer with the Soviet Union, and Yugoslavia was no longer burdened by severe international debt. It was a time of an increased importance in the role Yugoslavia played in international affairs, of rapid growth in living standards that promised the entry of our country into the big world of the developed countries" of a thirst for this world was growing exponentially with a desire to learn more about it. And at the same time, in Belgrade, the capital of Yugoslavia, not a single international festival existed." (Stamenković, 2012)

At the height of these events, in 1967, as one of the first among the international festivals in Yugoslavia Belgrade International Theatre Festival, BITEF was created, under the auspices of Atelje 212.[4] However, even though this came about on the insistence and with the engagement of individuals,

[4] The first and the second BITEF were held in Atelje 212, but the organizers of the third festival were already following the international trends of negating the theatre in a traditional sense, and instead chose unconventional places for the performance of the theatrical pieces; the organizers were looking for new spatial

the festival became the expression of a common need felt by this society, thus taking on the features of a cultural institution. The need for the funding of such an organization was met with understanding, support, and financial coverage by the country's top political leadership. The festival was accompanied by a degree of propaganda previously unheard of intended to stir the public and provoke an emotional response. The tickets would be sold out as soon as they were on sale, in spite of the fact that they were not exactly affordable. For this reason some theatre pieces had to be performed two or three times, and the halls of Atelje 212 were overcrowded.


Ателье 212

ВАС ПОЗИВА ДА НА ВРЕМЕ ОБЕЗБЕДИТЕ ПРЕОСТАЛЕ УЛАЗНИЦЕ ЗА

I БИТЕФ 212

ПРВИ БЕОГРАДСКИ ИНТЕРНАЦИОНАЛНИ ТЕАТАРСКИ ФЕСТИВАЛ

ОД 8. ДО 30. СЕПТЕМБРА 1967. ГОДИНЕ

УЧЕСТВУЈУ НАЈБОЉЕ ТРУПЕ ИЗ:

ИНДИЈЕ, ПОЉСКЕ, ФРАНЦУСКЕ, ВЕЛИКЕ БРИТАНИЈЕ, РУМУНИЈЕ, ЧЕХОСЛОВАЧКЕ, САД, ШВАЈЦАРСКЕ И НАШЕ ЗЕМЉЕ

БЛАГАЈНА ЈЕ ОТВОРЕНА СВАКОГ ДАНА ОД 18 Ч — 20 Ч. — ТЕЛЕФОН: 20-383. — ИНФОРМАЦИЈЕ: 20-496.

18218 Б

Figure 2. The advertisement of the first BITEF published in the daily newspaper *Politika* on August 26, 1967.

The initial BITEF board, comprised of Mira Trailović, Predrag Bajčetić, Dejan Čavić Jovan Ćirilov, Ljubomir Draškić, Borislav Mihajlović, Slobodan Selenić, and Mlađa Veselinović, created the festival programme comprised of utterly conflicting forms and expressions, awarding certain performances after the closing of the festival.

The BITEF 212 programme included the following theatrical performances:

1. The Kathakali Theatre (Kerala Kalamandalam, India); *Ramayana*

solutions for certain performances. Among these places were a gunpowder magazine in Kalemegdan, fair halls, factories, garages, quarries, sports halls, former war shelters, warehouses, underground passages and open spaces, demolished industrial and other complexes, as well as other theatre houses in Belgrade, and elsewhere in Serbia.

2. The Laboratory Theatre (Warsaw, Poland); Pedro Calderón de la Barca: *The Constant Prince* (El principe constant; Książę Niezłomny); direction Jerzy Grotowski
3. Théâtre de Poche-Montparnasse (Paris, France); Romain Weingarten: *Summer* (L'Été); directed by: Romain Weingarten
4. The Citizens Theatre, Glasgow (Glasgow, Great Britain); Olwen Wymark: *The Triple Image*; directed by: Michael Mitchum
5. The Drama Theatre (Skopje, Yugoslavia); Branislav Nušić: *The Deceased* (Pokojnik); directed by: Ljubiša Gregorijevski
6. The Comedy Theatre (Bucharest, Romania); William Shakespeare: *Troilus and Cressida*; directed by: David Esrig
7. The Theatre on the Balustrade (Prague, Czechoslovakia); Franz Kafka: *The Trial* (Der Prozess); directed by: Jan Grossman
8. The Slovene National Theatre (Ljubljana, Yugoslavia); William Shakespeare: *King Lear* (Kralj Lear); directed by: Mile Korun
9. The Living Theatre (New York, United States of America); Sophocles: *Antigone*; directed by: Judith Malina, Julian Beck
10. The Theatre Beyond the Gate (Prague, Czechoslovakia); Anton Pavlovich Chekhov: *Three Sisters* (Три сестры); directed by: Otomar Krejča
11. Nouveau Théâtre de Poche (Geneva, Switzerland); Friedrich Dürrenmat: *The Marriage of Mr. Mississippi* (Le Mariage de Monsieur Mississipi); directed by: Gérard Kara, Richar Vasu
12. (Moscow, USSR - the Union of Soviet Socialist Republics); Soviet poets' recital entitled *Life is a miracle after all*; contributing: Bella Akhmadulina, Bulat Okudzhava, Viktor Bokov, Garoljd Registan.

"After the round table meeting commenced on Sunday 1 October, at 11 a.m. in the yellow salon of Atelje 212, where the participants were expressing their opinions regarding the best theatrical performance of the first Belgrade International Theatre Festival, the Board of Initiative of BITEF 212 withdrew to the café-theatre in order to come to a final decision. The following board members attended the meeting (listed alphabetically): the president Bajčetić, Dejan Čavić, Jovan Ćirilov, Ljubomir Draškić, Bora Drašković, Borislav Mihajlović, Slobodan Selenić, Mira Trailović, and Mlađa Veselinović. Journalists were also in attendance. The following decision was reached:

The first BITEF 212 considers that the following troupes provided the most valuable performances with regard to "New theatre tendencies" (in order of appearance):

– The Laboratory Theatre from Warsaw, with the theatrical piece *The Constant Prince* by Calderón
– The Comedy Theatre from Bucharest, with the theatrical piece *Troilus and Cressida* by Shakespeare
– The Theatre Beyond the Gate from Prague, with the theatrical piece *Three Sisters* by Chekhov.

It was decided that their names were to be inscribed on the memorial sculpture of the First Belgrade International Theatre Festival 212, as awarded performances".[5]

By awarding the Grand Prix to three performances, *The Constant Prince*, *Troilus and Cressida*, and *Three Sisters* our festival set itself apart from other international festivals.[6] Atelje 212's The Cat in the Sack by Georges Feydeau, directed by Arsa Jovanović, was shown outside the competition. At the end, the question was raised whether BITEF would be held the following year, the City Assembly of Belgrade making the final decision.

Already during the first BITEF, there occurred a cultural clash of two great traditions – those of the East and the West. It was an obvious demonstration of the difference between the specific Eastern and Western experiences of observing the phenomenon of existence and the purpose of art. The Kathakali Theatre represented the former, and the Laboratorium Theatre the latter tradition.[7]

[5] HAB, BITEF I 7.3., Bulletin no number

[6] Awarding the official jury prize to certain theatrical performances was a type of propaganda, conceived by Mira Trailović. The idea was that certain artists that stood out in some way, or won over the audience and the board, would be awarded a prize by the festival, one that they could bring back to their countries. The award was a work of art built by Nebojša Mitrić, a sculptor. It could happened that the Grand Prix award was divided equally among two or three performances, as was the case with the first BITEF (In 1990, this award was renamed Grand Prix Mira Trailović). Three more awards were subsequently introduced; the Special Award, introduced early on in the history of the festival to recognize an extraordinary style or genre of a performance; the Politika award, introduced in 1977 for a performance selected by a jury made up of the theatre critics of the newspaper Politika; and an unofficial audience award, which further engaged the audience through their voting for their favourite performance.

[7] "During the first couple of years, BITEF became a meeting place for the East and the West: it brought American content to Europe, and Eastern content to the West. As soon as something would happen somewhere in the world, it would happen in Belgrade. No artist who missed BITEF was thought to have really vis-

The immense amount of energy successfully accumulated around BITEF was directed towards change. The energy of this type, with this intensity, was yet unknown in any other area of our theatre life. The Board of Initiative had to make compromises in the creation of the programme, ensuring invitations to perform were purposefully extended to marginal theatre troupes, from small, private theatres which could not compete with great ensembles, and which were all the more interesting for that very reason. In light of this, BITEF was a precious experience that left a strong impression on everyone present, especially since the authors were directly confronted with the audience and their questions during round table events.

Following the end of the first BITEF, when all the impressions were summed up, especially the results the success of the first, trial festival, the Belgrade Assembly decided to approve the budget and support the festival in the following season. Already during the second season BITEF became an integral part of the theatre life in Belgrade.

3.1 The New theatre tendencies

The repertoire of the first BITEF programme became a turning point of "New theatre tendencies", that the festival has kept showing throughout the next five decades, so far.

The critical elite of the world theatre responded to the BITEF slogan "New theatre tendencies". It was in Belgrade that you could see performances that have only recently become known to the rest of the world, and international media were there to take note of these performances. At that time, participating in this festival was considered a great privilege all over the world, because the festival was a pathway to the grand avant-garde society (Vagapova, 2010). Still, society never gave up on its traditional theatre; it accepted the BITEF programs as alternatives meant to enrich the cultural life, affirm the social order, and produce exceptional propaganda material for our country.

By the end of the sixties, one could notice an extremely expressive tendency in BITEF – a howling, a rage, a rebellion. BITEF was burdened with showing the entire world the openness of Yugoslav cultural politics, the state administration's tolerant attitudes, and a break from the theory and practice

ited Europe. Artists from the East who couldn't be received anywhere else would go to Belgrade. It was the only place where everyone could see their work. As far as the theatre is concerned, the way to the world is through Belgrade." (Pašić, 2006)

of socialist realism in the area of art, but also with hiding the existence of political censorship (Prnjat, 2005).

During the first couple of years, the conservative theatre circles believed that BITEF was bringing some unprofessional theatres to Belgrade, which were undermining the academically grounded principles of this art form, confirming the decadence, moral demise and promiscuity of the West. Mira Trailović, Jovan Ćirilov and other members of the selection team defended their cause by saying BITEF was created to discover, not conceal. This meant that the performances shown during the festival did not depend on the selectors' personal tastes, but rather on their relevance in displaying a theatre trend present in the contemporary world, regardless (or rather because) of its shock value.

During the seventies, postmodernism was dominating all art forms, from literature to sculpture. With the arrival of postmodernism, almost everything was allowed on stage, and the borders between the old and the new in the area of stage movement became blurred. The drama theatre and the dance theatre were merged in the eighties, so ballet choreographies in particular became more and more present on stage. The BITEF theatre was opened on 3 March 1989.[8] The nineties were very challenging for our country, even on the local theatre scene. This was a decade of nonverbal theatre, with little to no dialogue, many musical numbers, and stylized movement and gestures that reflected events from real life. During the 21st century, there was an onset of video-technology and cyber theatre virtual reality. BITEF kept track of all these phenomena, and showed them on stage as soon as they would appear.

3.2 BITEF – Its Influence and Significance

Theatre artists, and then artists from the fields of music and film, used Yugoslavia's political freedom to create BEMUS, the Belgrade Music Festival and the Joy of Europe, two years after BITEF was founded; in 1971, the first International Film Festival, FEST, took place. This also meant that

[8] At the end of the eighties, the mayor Aleksandar Bakočević ceded the building of the abandoned evangelical church on the Bajloni market to Mira Trailović and BITEF, to be transformed into the BITEF Theatre. The theatre would be the Yugoslav centre of international collaboration, with no permanent ensemble, but rather hosting projects that brought people together. Regular troupes that fit the idea and the concept behind BITEF would be the guests of BITEF throughout the year.

our doors were wide open to artists from the entire world. The four aforementioned festivals exist to this day.

Yugoslavia's geopolitical position and status as a non-aligned socialist country made crossing state lines easy for almost all citizens of the world, festival participants and audiences alike. Theatres from countries with which Yugoslavia had poor diplomatic relations, such as Spain, Portugal, Israel and South Africa, would also attend BITEF.

From the very beginning, BITEF was extremely significant for all theatres and theatre pieces created on the territory of Yugoslavia, especially the ones that were part of this festival's programme. Many of these works received no international recognition, but the festival made it possible for foreign artists to come and see our performances. The first list of all theatre pieces performed at BITEF was compiled in 1997, on the occasion of the festival's 30^{th} jubilee.

BITEF survived for five decades in a very turbulent world and an even more turbulent immediate environment. One finds it difficult to explain how this was possible in spite of all the regime changes, political conflicts, embargos and blockades, isolations, inflations, bombings and wars, coups, recessions, transitions and the popular revolutions.

Thanks to BITEF and the people gathered around this festival, the works of numerous theatre giants have been translated and published in Serbian. Heated debates were lead during festival's meet-the-author sessions and round table meetings held after every performance.

BITEF has hosted accompanying programs along with the main program, including BITEF on film (filmed retrospectives of theatre productions from previous festivals, or those that, for some reason, couldn't be included in the repertoire), various exhibitions, musical manifestations, workshops and lectures, and since recently, the BITEF ZONE, meant to directly include the community into the BITEF space. Every September, respected theatre critics and theatrologists from all over Europe have been visiting Serbia. The events of the festival have been covered in critiques and reviews published by various journals and newspapers from predominantly European countries.

4 The BITEF archival materials

The personal fonds of Jovan Ćirilov and the fonds of the Belgrade International Film Festival can be found in the Historical Archives of Belgrade.[9] The BITEF archival materials are take up 170 metres, or 434 archival boxes.

The Historical Archives of Belgrade have collected and inventoried the BITEF archival materials on two occasions, between June and September 2004. Initially, 17 metres of archival and registry materials, covering the period from 1967 to 2003 were taken over, followed by another 128 archival boxes with 34 posters and a total of 40 catalogues, or 13 metres.[10]

In special boxes belonging to the fonds of the Secretariat of the City of Belgrade and its subfonds of the Secretariat for Culture, one can find the BITEF founding acts and legal terms and conditions, while its statute is stored in the BITEF materials fund.

[9] For over seventy years, The Historical Archives of Belgrade has been successfully dealing with the protection, sorting, processing, publication and lending of archival materials relevant, primarily, to the study of the history of Belgrade and its citizens. The Historical Archives of Belgrade is one of this city's most significant cultural institutions. Founded in 1945, as part of the Belgrade City Library, it became an independent institution in 1947. The National Committee for the Liberation of Yugoslavia had also reached a decision in 1945 to "protect and look after cultural monuments and antiquities." That was when the archives of all state institutions were placed under the protection of the state. (Драшкић, 1995)

[10] The Historical Archives of Belgrade, as an institution meant to protect cultural goods and cultural heritage, on the other hand, has done everything in its power not only to protect BITEF-related documentation from wasting away, but also to classify and process this information in accordance with international archival standards. This means putting hard work into making these materials easily available to the public through the creation of an electronic electronic informational resource that will be searchable on the internet. The BITEF archival fonds have been classified according to festivals, and subclassified into different classification groups according to the type of accompanying events and work related to this festival. The BITEF archival materials comprise theatre piece dossiers where one can find documentation, scripts, correspondence, photographs, posters, audio-visual and digital material, catalogues, advertisements, press clippings, photo albums, and visitors logs. In other words, there is a mine of different information that helps any form of multidisciplinary research, not just of local but also of international significance. (Latinčić et al., 2007)

The Department for the Application of Information Technologies[11] of the Historical Archives of Belgrade, together with the relevant archives services, has developed an information system Janus based on existing work processes, international archival and ISO standards regulating archival activity. New data is entered into Janus every day, which is searchable on the Archives' website.[12] Janus is, above all, a way in which to gain insight into the variety of materials in the possession of the Archives, as well as into their physical location within the Archives' premises.

Janus is a functional system that automates work processes in the Archives and improves the efficiency of customer service with the ultimate goal of producing an informatically arranged archive that quickly provides the requested information both to the Archives' users and online.[13] In the Janus search engine, available on the Historical Archives of Belgrade website,[14] a search query "BITEF" returns 628 results related to BITEF from the total of 522 fonds/collections, that is the 149,379 records[15] on the documentation the Archives' workers had entered into Janus. No document can be accessed via Janus, but the full title and the signature of every document are generated, facilitating the physical search of the fonds and records. All materials relating to BITEF in the possession of the Archives can be viewed in the reading room of this institution.

4.1 The BITEF 212 Archival materials in the Historical Archives of Belgrade

The archival material belonging to the first BITEF 212, which took place from 8 September 1967, is located primarily in the BITEF fonds and in the the Secretariat of Belgrade. The employees of the Archives have listed the materials in an analytical inventory[16] and then divided them into two boxes. Each box has its own inventory number, each document that can be found in the boxes has its own signature, and they are all listed in a certain order in the analytical inventory. Once inside the boxes, the materials are sorted into folders and envelopes according to their order and type.

[11] The Department for the Application of Information Technologies (on-line)
[12] The Historical Archives of Belgrade website (on-line)
[13] Janus (on-line)
[14] The Janus search engine (on-line)
[15] Data retrieved on 12/04/2018
[16] No analytic inventory for the first four BITEFs exists at this time.

In the first box, one can find a catalog, invitations, photographs, performances (from the first to the twelfth ensemble) and correspondence. This box is marked with an inventory number I. Clippings from serial publications (daily newspapers and magazines) related to the first BITEF are located in the box with inventory number II, in a dedicated book (periodicals collections or press clipping) each page of which features one clip and the name, date and place of the publication.

Searching the analytical inventory of BITEF 212, one first encounters the Analysis of the contents of both boxes, then the Indices to accompany the analytics, followed by The press clippings analytics, and lastly, the introductory text of the BITEF 212 catalogue, "Regarding the first BITEF", a text about the jury and the recipients of the awards from the last bulletin, as well as informative texts about the performances from the first Festival, also taken from the catalogue.

At the very beginning of the analytical inventory, the name of the fonds, Belgrade International Theatre Festival BITEF is presented, followed by the dates of the festival (8–30 September 1967), the range of the content signatures (HAB, BITEF, K-2 / I, 7, 3-7, 4, 1), the span of years during which the materials related to the first festival were created (1964–1968), and the total number of inventory sheets (276, including the list of materials in the periodicals collection). In the box, marked with an inventory number **I**, the material is divided into:

1. The general archive, containing the correspondence with the troupes represented within the program; information on the timetable of the performances, expenses, decor transport, cooperation, signed contracts; translations of letters and agreements; information on purchases of the equipment necessary or performances;
2. The program archive, containing two programs, one program guide and four program posters;
3. The theatrical performances archive, containing the material related to the performances of the first BITEF, a total of 14 sheets, 71 photographs, a drawing, two programs, clippings from newspapers, and a book.

The materials found in the first box consists of sheets (102), photographs (71 – all are black and white and most are artistic with authors' stamps), a drawing, programs (7), a book and clipping from a periodical. These materials are in Serbian, English, French, Italian, German, Czech and Polish.

In the second box, with the inventory number **II**, one can find BITEF periodicals collections photographs, and other printed materials. The ma-

terial found in this box contains sheets (276), photographs (4, all of which are black and white), a catalog, invitations (5) and posters (2), in Serbian, Croatian, Slovenian and Macedonian.

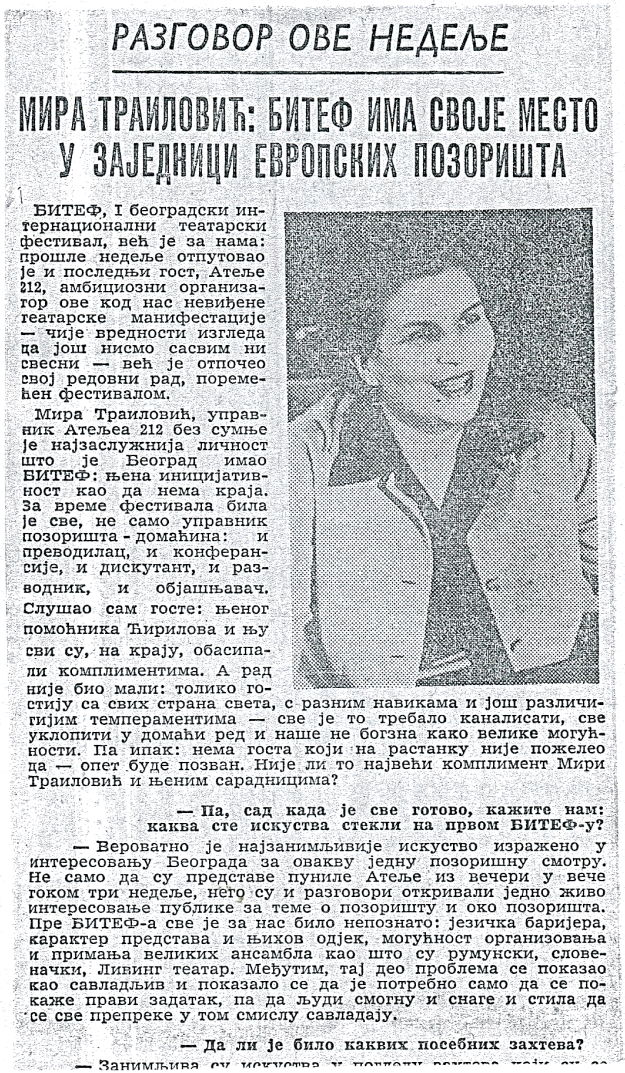
In the periodicals collection of the first BITEF, one can find clippings from various newspapers and magazines published in Yugoslavia starting from 8 July 1967: *Večernje novosti*, *Politika*, *Ekspres*, *Borba*, *Jež*, *NIN*, *Radio Revija*, *Književne novine*, *Nedeljne novosti*, *FILM-Novosti*, *Susret*, *TV Novosti* (Belgrade); *Dnevnik* (Novi Sad); *Ljubljanski dnevnik*, *Naši razgledi* (Ljubljana); *Večer* (Maribor); *Večernje novine*, *Oslobođenje*, *Svijet* (Sarajevo); *Vjesnik*, *Telegram*, *Studio*, *Večernji list*, *Studentski list* (Zagreb); *Novi List* (Rijeka); *Nova Makedonija* (Skopje). There is a total of 280 clippings.

The authors of the newspaper articles about the first BITEF are Jovan Ćirilov, Vladimir Stamenković, Milosav Mirković, Dragan Gajer, Slobodan Selenić, Ivan Mazov, Momo Kapor, Muharem Pervić, Raša Popov, Toni Tršar, Petar Volk, Predrag Bajčetić, Dobrica Ćosić and others.

The box containing clippings from local press releases, also contains around thirty clippings from foreign newspapers and magazines, texts published between 1967 and 1972: *The New York Times*, *Time* (United States); *Financial Times* (Great Britain); *Die Presse Kultur* (Austria); *Życie literackie* (Poland); *Le Monde*, *Humanité*, *Le Figaro*, *Combat* (France); *Umanitá*, *L'Unità* (Italy) and many others.

During the BITEF 212, fifteen bulletins were published, a single copy every day from 15 to 30 September 1967. All copies of these bulletins are kept in the Historical Archives of Belgrade and in the BITEF directorate. The bulletins contain regular and guest columns. The regular columns include the conception, the opening, the program of the performances, the round tables[17] and the accompanying activities, the jury decisions, news and interesting facts. The guest columns include synopses of the performances, biographies, theatrical syntheses by the authors, directors, theatre critics and theorists, reports, press clippings and statistics.

[17] Round-table discussions were held after every performance, free of change. Some of the BITEF 212 round-table topics included contemporary theatre and the Eastern tradition; Jerzy Grotowski: On my work with actors; Is there an avant-garde in 1967?; New theatre tendencies beyond large cultural centers; Nušić and contemporary theatre; Shakespeare and contemporary theatre; Kafka and contemporary theatre; Theatre and the revolution; Films: Romeo and Juliet 63 – a discussion on method; The contemporary world and Dürrenmatt's dramaturgy. The round table publicly discussed the *Golden Round Table Award 212* and the recital *Life is a miracle after all.*



РАЗГОВОР ОВЕ НЕДЕЉЕ

МИРА ТРАИЛОВИЋ: БИТЕФ ИМА СВОЈЕ МЕСТО У ЗАЈЕДНИЦИ ЕВРОПСКИХ ПОЗОРИШТА

БИТЕФ, I београдски интернационални театарски фестивал, већ је за нама: прошле недеље отпутовао је и последњи гост, Атеље 212, амбициозни организатор ове код нас невиђене театарске манифестације — чије вредности изгледа да још нисмо сасвим ни свесни — већ је отпочео свој редовни рад, поремећен фестивалом.

Мира Траиловић, управник Атељеа 212 без сумње је најзаслужнија личност што је Београд имао БИТЕФ: њена иницијативност као да нема краја. За време фестивала била је све, не само управник позоришта - домаћина: и преводилац, и конферансије, и дискутант, и разводник, и објашњавач. Слушао сам госте: њеног помоћника Ћирилова и њу сви су, на крају, обасипали комплиментима. А рад није био мали: толико гостију са свих страна света, с разним навикама и још различитијим темпераментима — све је то требало каналисати, све уклопити у домаћи ред и наше не богзна како велике могућности. Па ипак: нема госта који на растанку није пожелео да — опет буде позван. Није ли то највећи комплимент Мири Траиловић и њеним сарадницима?

— Па, сад када је све готово, кажите нам: каква сте искуства стекли на првом БИТЕФ-у?

— Вероватно је најзанимљивије искуство изражено у интересовању Београда за овакву једну позоришну смотру. Не само да су представе пуниле Атеље из вечери у вече гоком три недеље, него су и разговори откривали једно живо интересовање публике за теме о позоришту и око позоришта. Пре БИТЕФ-а све је за нас било непознато: језичка баријера, карактер представа и њихов одјек, могућност организовања и примања великих ансамбла као што су румунски, словеначки, Ливинг театар. Међутим, тај део проблема се показао као савладљив и показало се да је потребно само да се покаже прави задатак, па да људи смогну и снаге и стила да се све препреке у том смислу савладају.

— Да ли је било каквих посебних захтева?

— Занимљива су искуства у погледу разгова[illegible]

Figure 3. Article published in Politika newspapers on October 8, 1967: An interview with Mira Trailović about BITEF

5 Conclusion

Together with the Avignon Festival in France and the Edinburgh Festival of Arts in the UK, BITEF is considered to be the most esteemed annual theatre events in Europe. From the very beginning, BITEF has been a place where different cultures would come together and learn about one another, sending an open message of successful mutual understanding, regardless of political developments. In doing so, BITEF has influenced and continues to influence cultural events throughout the world.

Many monograph and serial publications have been written about BITEF both in Serbia and all over the world. The performances shown at the festival have been filmed and various features have been produced for TV and radio. For the last ten years or so, the latest festival news have been accessible on the Internet. Special exhibitions have been hosted showing materials collected throughout the history of the BITEF festival.

During decades of work, BITEF has created, collected and entrusted to the Historical Archives of Belgrade a lot of precious archival documents and registry materials, and these two institutions are expected to continue their cooperation in future. The BITEF directorate is also trying to raise the funds and adequate expert assistance as soon as possible, in order to begin the digitization process of these documents of extraordinary national and international significance. These documents are of exceptional importance for the world theatre and represent our society's cultural heritage.

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Informatics for Library and Information Science students with special focus on Python

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ABSTRACT: Students of Library and Information Science (LIS students) at the Faculty of Philology in Belgrade attend thirteen different obligatory computing courses during the four-years period of their undergraduate studies. In this paper we highlight the content of the programming courses held during the fifth semester. Using Python programming language, students are introduced to basic programming concepts, data structures and their different applications. We also make a brief preview of other computing courses and suggest how the gained knowledge could be applied in the field of information technologies and natural language processing.

KEYWORDS: Python, programming, information technologies, natural language processing, information retrieval

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1 Introduction

The first two generations of librarians in Serbia were educated in the early sixties of the twentieth century, when the Department of Library Science was founded at the Faculty of Philology in Belgrade. After the education reform in 1978, the Faculty of Philology re-introduces a librarianship module, which includes four-semester studies with regular four-year studies in one of the groups of the Faculty of Philology. From 1990/91 the Department of Library and Information Science is being re-established, at the four-year study level. More about the history and the emergence of the Department as it is today is described in (Vraneš, 2008).

Teaching staff within the Department provides students with knowledge in various fields: librarianship, archivistics, museology, as well as mathemat-

ics and informatics. In this paper we will focus on courses that deal with the concepts of algorithmics and programming.

This paper is organized as follows. In Section 2, some of the discussions whether Python[1] is the most suitable as the first programming language for beginners of different age are listed and described. We also offer a brief insight in the current status of programming classes in elementary schools in Serbia, as well as the role of Python in this process. As an introduction to the content of the programming course itself, Section 3 contains a summary of computing courses that preceded it, in order to gain insight into the prior knowledge that students acquire, while the programming course itself is described in Section 4. Computing courses that follow are listed and briefly described Section 5. In Section 6 a special analysis of the application of the acquired knowledge is discussed, both in further education and later, within in the labor market. We also analyze the overall knowledge gained during these studies, and present the possible work positions for which these students acquired competencies. We state the final conclusions in Section 7.

2 Python as a first programming language for LIS students

Discussions about which programming language represents the best candidate for beginners have being going on for many years now. It is obvious that the choice depends on several factors: the age of the person who begins to learn programming, prior knowledge and experience in the field of computing, level of English language usage, as well as the expected field of application.

Over time, different programming languages were considered preferable candidates for beginners. In the 1980s, it was BASIC and Pascal, and in the late 1990s and at the beginning of the 2000s it was the programming language Java (Hosch, 1996; King, 1997; Hadjerrouit, 1998). Authors in (Radenski, 2006) change the program of the first programming course in favor of Python and conclude that it is much easier for students to adopt the syntax of this programming language than Java. As the use of ready-made modules is more practical in Python, students develop even more complex applications than those developed by the preceding generations, who coded in Java. The same question still exists, after many years. Authors

[1] Python is a high level, interpretive programming language of general purpose. It was patented by Guido van Rossum in 1991

in citepAmbikesh2011 divided participants in the initial, high-school programming course in two groups. The first group learned Java as the first programming language, i.e. they adopted the object-oriented paradigm as their first paradigm. The second group was first introduced to the basic concepts (expressions, conditional clause, loops) in Python, and then joined Java students. Upon course completion, a comparison of the success of these two groups was made. It turned out that the second other approach (Python with Java) gave a better outcome. Another question these authors asked was: Should beginners be taught the most popular programming language at that moment, or rather the one preferred in the labor market? Over time, being not only objectively suitable for beginners, Python become the language of the industry. This is a consequence of the expansion of artificial intelligence in many fields and the role that Python had in its development. The mean incentive were the modules: *scikit-learn* (Pedregosa et al., 2011) for machine learning algorithms, *tensorflow* (Abadi et al., 2016) for handling multidimensional matrices, *nltk* (Bird and Loper, 2004) for natural language processing (NLP) and many others.

Another active discussion is the one concerning the programming paradigm that will be initially introduced to beginners. Authors in (Goldwasser and Letscher, 2008) believe that this should be an object-oriented paradigm, but they also recommend Python as a language, which supports this paradigm in addition to procedural and functional. Basic concepts of programming and basic data structures are introduced to students at the University of Witwatersrand using the Scheme programming language (Sanders and Langford, 2008). This programming language supports the functional programming paradigm, which is somewhat less present in applications for everyday use. Deeming it thus unpractical, students who already had programming experience did not accept this programming language well. In the subsequent academic year, the same course was held using Python. It turned out that Python was now well adopted by both beginners and by students who already had previous programming experience.

In papers (Agarwal and Agarwal, 2005; Vasljević, 2013) the syntax of the Python programming language was analyzed, as well as the availability of tools for its application in teaching. The authors (Ranum et al., 2006) present their experiences with Python as part of an initial programming course. They conclude that Python has proved to be very convenient for this purpose, primarily because of its simple syntax and availability of development tools

Given the conclusions of the aforementioned authors, as well as their experiences, Python was selected as the initial programming course to be

taught within the studies of librarianship and informatics at the Department of Library and Information Science at the Faculty of Philology in Belgrade. One of the important factors that led influenced this decision was the existence of the module nltk for the processing of natural languages, which can be particularly useful for students of the Faculty of Philology.

Another reason for this decision is related to the content of informatics courses in prior education. Starting from 2017/18, a course named "Informatics and Computing" was for the first time introduced as obligatory in elementary schools in Serbia. Members of the "Petlja" Foundation[2] actively contribute to the modernization and popularization of informatics and computing in Serbia. The aim of the Foundation is to raise the level of awareness in the society regarding the general educational importance of algorithmic literacy, as well as to encourage the society to actively work towards the development of algorithmic literacy and programming. The contribution in the form of resources for teaching "Informatics and Computing" in the fifth and sixth grade is one of the prominent activities of this foundation. According to the curriculum, the course also includes compulsory programming lessons, which start already in the fifth grade, using Scratch[3]. For this purpose, an interactive handbook[4] and practicum[5] have been developed.

In the subsequent year, students switch to a textual programming language of teachers choice. In 2018/19 the first generation will attend programming classes in a textual programming language, according to the new program. Members of the "Petlja" Foundation believe that teachers should choose Python, and they offer a collection of resources helpful to both, the teachers and the six-graders. These materials include an interactive manual,[6] an accompanying collection of algorithmic tasks,[7] and a collection of short test questions.[8]

This also influenced our decision regarding the structure of the programming courses at the Faculty of Philology. Upcoming generations will already posses an algorithmic way of thinking, as well as a thorough knowledge of the syntax. With its curriculum, the study program of Library and Informatics

[2] Petlja Foundation (on-line)
[3] Visual Programming Language, *Scratch* (on-line)
[4] Programming in Scratch, a fifth grade manual (on-line)
[5] Programming in Scratch, a fifth grade practicum (on-line)
[6] Programming in Python, a sixth grade manual (on-line)
[7] Programming in Python, a sixth-grade algorithmic assignment collections (on-line)
[8] Programming in Python, a collection of short questions for the sixth grade (on-line)

is well prepared to welcome new generations, and continue to develop their existing programming skills.

3 Informatics courses in early semesters

In this section, we make a brief overview of computing courses that LIS students attend during the first four semesters. The list of courses and their curricula is available on-line. From the very beginning of the studies, within an unique study program, computing subjects are adequately included (see (Krstev, 2002) for more details).

During the first two semesters students attend a course named "Informatics for librarians". At the beginning, it covers different numeral systems, as well as conversion algorithms between different numeral systems. Afterwards, basic concepts of a set, a relation, an operation, a function, and a sequence are being introduced. Finally, the last part of the course is dedicated to mathematical logic. This course establishes the necessary foundation required for the adoption of basic concepts in information science (starting from the binary system and its application in computational arithmetic, through functions and relations, required for understanding the concept of, e.g, relational databases). Slowly the process of designing a programmatic way of thinking among students begins.

Students simultaneously attend the course "Informatics practicum", which, as its final outcome has the understanding of the design and principles of modern computers, familiarity with the basic hardware characteristics, as well as acquiring basic knowledge about different software types and training for their active and creative use in everyday life and subsequent professional work.

It is important to emphasize the relation and synchronization of these two subjects. In the practical part of the "Informatics Practicum", students are trained for the advanced use of Word and Excel software from the Microsoft Office package. After the adoption of the concept of relations and mathematical operations within "Informatics for librarians" course, students can observe practical application of arithmetic and relational operators within Excel. Afterwards, the notions of function and composition of functions are being introduced, which are practically demonstrated through solving problems using built-in functions in Excel. Concepts of mathematical logic are also followed by their practical application using logical operators and built-in logical Excel functions.

In the digital era, representation and processing of written text in a computer are very attractive and important topics for philology, and especially LIS students. This is precisely the scope of the subject named "Digital Text", taught during the third and fourth semester. The first topic of the course covers the lowest, bit-wise level of text representation in a computer. Subsequently, the representation of different alphabets and symbols, using various code schemes and standards is thoroughly studied.

Theoretical lectures are followed by practical classes, where students are trained for the advanced use of various text preparation and formatting systems. The first such system, LaTeX,[9] has the greatest application for the preparation of scientific texts. Unlike Word, which is the what-you-see-is-what-you-get type of text processor, in LaTeX an author performs formatting separately from entering content. Easy formatting is accomplished using the already defined commands and environment, which provides a uniform and almost completely controlled layout of the document. This text processor encourages modularity, in the sense of separating different logical units in different files, by using existing or by writing new macros. Its use already represents some form of programming (Šandrih, 2016).

Students continue to practice the mechanism for entering plain text first, and dealing with its formatting afterwards, by learning mark up languages and languages for text formatting for display on the Web. The course covers the creation of content of web pages using HTML, and their styling using CSS. Within the course there are two obligatory practices that are realized at the University Library "Svetozar Markovic" in Belgrade. The first practice involves the use of various Google services, while within the second, students are trained to create pages in Wikipedia, which at the same time introduces the third mark up language taught in this course.

With such experience gained, it is safe to say that, after the first four semesters, students have a strong informatics foundation, but also acquire a basic programming intuition, which should be further encouraged.

4 Programming classes

During the fifth semester, programming is taught in two related courses: "Structure of Information 1" and "Informatics Practicum 3". The curriculum for the first course is available on-line and includes: representing text and numbers in a computer, concepts of algorithms, operations, expressions,

[9] Text Editor LaTeX (on-line)

if-clause, loops, strings, recursion, and search and sort algorithms. Beside pseudo-code, accompanying examples are also demonstrated in the code written in the programming language Python.

Simultaneously, the "Informatics Practicum 3" course covers all the above mentioned concepts, but in a somewhat more practical context. The course curriculum is available on-line. This course covers the following topics: data types (primitive types, lists, sets, dictionaries), arithmetic and logical expressions, string formatting, if-clause, loops, various built-in functions, search and sort algorithms.

During the first thirty-six hours of the course, the so-called "literate paradigm" is applied, first introduced by Donald Knuth (Knuth, 1984). Parts of programming code are separated into smaller logical units, intertwined with explanations written in some natural language. This approach is especially practical when it comes to Python, thanks to Anaconda[10], which includes Jupyter[11], an interactive development environment that contains executable code snippets along with explanations, comments, tables, images etc.

It is important to mention a related graduate study program at the University of Belgrade, "Social Sciences and Computing".[12] The aim of these studies is to provide bachelors of social sciences with knowledge that will enable them to apply modern computing technologies in their area of expertise. Within the course "Programming for linguists", the literate paradigm is applied for teaching Python and its application to NLP. Teaching staff (Stanković et al., 2017) points out the good sides of this approach and records successful outcome.

During the remaining sixteen teaching hours, students make stand-alone desktop applications using the PAGE module.[13] These Desktop application are mostly aimed at text processing.

At the Faculty of Philology, Python was taught for the first time in the winter semester 2017/18.[14] This teaching plan can be considered experimental and subject to changes. Based on the experience we gained, we state our goals for the upcoming years in the next chapters.

[10] Python distribution, *Anaconda* (on-line)
[11] Interactive Python development environment, *Jupyter* (on-line)
[12] Social Sciences and Computing (on-line)
[13] Development module for desktop applications, *Page* (on-line)
[14] Students have the opportunity to take an exam in both, Python and Visual Basic

5 Informatics courses in latter semesters

Along with the above mentioned subjects, in the same semester, students attend the "Statistics in libraries" course. The aim of this course is acquiring basic theoretical knowledge and skills necessary for statistical data analysis. Within this course, the following topics are covered: basic concepts of statistics (notions of population, variables, measurements, measuring instruments, measures, measuring scales, samples, distribution and sample size), measures of average and variability, percentiles and percentile ranges, introduction to theory of probability (concepts of experiment, outcome, probability of an event, concept of distribution of discrete and continuous variables, standard normal distribution, confidence intervals), correlation coefficients, determination of statistical significance and reliability of statistical measures.

In the next, sixth semester, students take compulsory course "Informatics Practicum 4", which covers the following topics: markup languages XML and JSON, DTD and XML Schema for XML documents structure manipulation, BibTEX format for bibliography management in LATEX, as well as regular expressions (Утвић, 2003). The course is supported by a variety of additional activities — besides the plethora of practical tasks that should be completed by students during classes, there are also two seminar papers. With the acquired skills, various types of documents are prepared and annotated in accordance with a given DTD scheme, which represents the task for the first seminar paper. For the second seminar paper, the task is to prepare a bibliography a the scientific paper of a particular journal or conference proceedings using BibTEX, which is a moderately light challenge to LIS students, thanks to the knowledge gained in courses related to librarianship.

Along with this course, students also attend the course of "Information Structure 2". It covers the following topics: abstract data structures (lists, trees and graphs), XML as the general standard meta-language for various documents and other types of information markup, UNIMARC as a specific library standard for presenting catalog and bibliographic information, a universal digital documents description language known as the Dublin Core, the TEI standard for marking digital text, semantic web and RDF.

In the next, seventh semester, students attend the course "Database and Library Information Systems", which covers basic models in databases development, detailed insight in the relational model, the use of the Access program within the MS Office package, the design of databases and complex queries .

In the last semester of undergraduate studies, there are two more obligatory computing courses: "Multimedia documents" and "Information retrieval". Knowledge acquired in the field of librarianship and informatics is creatively expressed within a joint project of the former course. The concept and structure of this course are described in (Krstev and Trtovac, 2014), and more about some of the previous students' projects can be read in (Lazić and Poklopić, 2011; Kovrlija et al., 2012; Obradović et al., 2016) and (Stošić et al., 2018).

A lot of high-quality and important knowledge in the field of information retrieval (IR), whose specialists are today highly sought-after, is provided by the course with the same name, which covers the following topics: use of inverted indexes, Boolean and vector queries and their extensions, optimization of operations on inverted-indexes, evaluation of information retrieval systems, string matching algorithms, automatic indexing of individual terms, automatic calculation of term weights, use of thesaurus, etc.

The Department of Library and Information Science also provides non-mandatory "Language Technologies", another two-semester undergraduate computer science course. The aim of this course is to familiarize students with language technologies, especially with language tools and resources, the current international standards for their implementation, and to train them for their active use. The focus of this course is the usage of existing language tools for the Serbian language.

We also briefly describe computer science courses that can be chosen by Master students.

The aim of the course "Advanced Language Technologies" is to review the basic methods in the processing of natural languages, concluding with syntax parsing. The course focuses on the usability and applicability of these methods into the Serbian language. The classes of the course "Electronic Publishing and Digital Libraries" are designed to introduce students to forms of electronic publishing and its implications on the work of modern libraries. The aim of the course is to familiarize students with the types of digital libraries, the ways of their creation, as well as with the possibilities of connecting with traditional collections. "Designing and Maintaining Web Content" introduces students to the basic forms and characteristics of Web content preparation and maintenance, Wiki-technologies, and the use of content management systems. The course "Advanced Methods in Information Retrieval", building up on the knowledge acquired the undergraduate course, outlines the concepts of advanced information retrieval systems, as well as of systems on which they are based: indexing, classification, cluster-

ing, summarization and information extraction. Finally, the content of the "Bibliometrics" is suitable for students who wish to continue doing research professionally, as well as to librarians from scientific research organizations whose task is to assist researchers in evaluating their own work.

6 Application of Python

The joint agreement of the subject teachers is that, starting from winter semester 2018, the course"Informatics Practicum 3" should tackle more practical problems from statistical processing mentioned in "Statistics in libraries" classes. Beside built-in functions for solving basic statistical tasks in Python (mean, variation, deviation, different correlation coefficients, etc.), there is also *scipy*,[15] an ecosystem of free, open-source mathematical modules that enable more advanced statistical processing.

Usage of existing Python modules for the processing of already annotated texts would be a novelty for the "Informatics practicum 4" course. One of the interesting modules for working with XML documents is *BeautifulSoup*,[16] which helps manipulating and extracting the content of marked elements. Another application of newly acquired knowledge within the same course could be the extraction of data from Web pages. Students interested in computational linguistics could compile corpora in this way, and then process that content using the already mentioned *nltk* module.[17]

Presentation of the document as a Bag-of-Words (BoW), as well as automatic calculation of term weights using *tf-idf* (term frequency - inverse documents frequency), are options supported by the *scikit-learn* module.[18] The first generation of students who enrolled in the "Information retrieval" course with previously acquired programming skills in Python, could make, for example, a comparative analysis of the various literary works of an author. Every story or a novel (i.e. text document) can be presented as a B-o-W, and then the terms present could be weighted using tf-idf measure in order to determine the most discriminate terms per document. The terms obtained could be compared for different literary works, and the results could then be discussed. A similar analysis can be also applied to the Web - for

[15] Python statistical modules, *scipy* (on-line)
[16] Module for working with structured text documents, *BeautifulSoup* (on-line)
[17] Python module for NLP, *nltk* (on-line)
[18] Machine learning module, *scikit-learn* (on-line)

example, specific terms that users can use in different social networks could be determined.

The knowledge of Python programming language, markup languages and statistical concepts, combined with information retrieval and three foreign languages, offer these students numerous opportunities for employment in the information technology field. This wide range of work positions includes: software testing, database maintenance, statistical tools usage, maintenance of indexes in information retrieval systems, creation of diverse textual material from the web, web applications development, big data analysis etc.

7 Conclusion

Even after a very brief overview of the computer science courses curricula given in this paper, it is obvious that LIS students acquire multidisciplinary knowledge and skills that can be applied in different contexts. The Python programming course is just one part of a modern program that LIS Department offers, along with various application opportunities. The task of the teachers is to encourage students to develop their interests in the direction that is attractive, but also prosperous. Thus, the contribution of LIS students in the development of resources and Web tools for Serbian language could be very significant.

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Grey Literature – The chameleon of information resources

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ABSTRACT: This paper describes grey literature, its origins, definitions and the role of grey literature in modern digital age and scholarly communication. Grey literature plays an important role in the rapid and timely distribution of in-depth, recent, scientific and technical information, and also provides access to a broad range of data and often contains new ideas. Furthermore, grey literature is an important source of original research and up to date information. In this paper we will analyze the role of 2014 Pisa Declaration on Policy Development for Grey Literature Resources and its contribution to better understanding and recognizing the role of grey literature as an essential resource in scholarly communication, research, policy making and a key source of evidence, argument, innovation, and understanding in many disciplines. The last part of this paper will investigate the relations between grey literature and scientific heritage, by introducing a set of criteria for the scientific heritage collections in order to define them as a grey literature.
KEYWORDS: Grey literature, Pisa Declaration, GreyNet, scientific heritage

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1 Grey Literature – Overview

The term 'grey literature' first appeared in scientific publications in the 1970s. Prior to this period, this term was associated with different types of technical, scientific and economic reports. At the same time, grey liter-

ature was often described as 'informal,' 'non-conventional,' 'running away,' 'invisible' or 'half-published' (Nahotko, 2008).

Nowadays, grey literature is usually defined as a field in library and information science that deals with the production, distribution, and access to multiple document types produced on all levels of government, academics, business, and organizations in electronic and print formats, but not controlled by commercial publishing, i.e. where publishing is not the primary activity of the producing body (Schöpfel, 2010). Examples of grey literature include patents, technical reports from government agencies or scientific research groups, working papers from research groups or committees, white papers, and preprints.

Grey literature may be made available to the public, or distributed privately within an organization or group, and often lacks systematic means of distribution and collection. The standards of quality, review and production can also vary considerably. Grey literature is therefore often difficult to discover, access, and evaluate. Among the most frequently enumerated features we can find the following common characteristics of grey literature resources:

- difficult to identify, access and locate;
- often come in the form of limited editions;
- inaccessible in bookstores;
- lack of bibliography registration;
- absent in library collections and catalogues and in a publisher's catalogues as well;
- difficult to acquire in libraries;
- tend to be unpublished or published with delay.

All these characteristics have high impact on the inaccessibility of grey literature resources. The lack of bibliographic standards and regulations make them even more invisible and often hidden from the wide public.

2 Defining Grey Literature

According to experts in the field, grey literature has as many definitions as there are forms of publications. This is mostly because of the ephemeral and changing nature of grey publication types, editions, and formats, as well as to the relative "newness" of the field. In addition, the evolving impact of the Internet since the mid-1990s has only "further muddied the definitional waters" (Rucinski, 2015).

The metaphor "the chameleon of information resources" maybe describes the grey literature in best way, as "it can constitute of virtually anything and be written for and by anyone in almost any format" (Rucinski, 2015). The ephemeral and variable nature of grey publication types, editions, and formats makes it hard to describe and define. Despite that, there are many definitions of grey literature. The Prague definition from *The Twelfth GL International Conference (Prague, 2010)*, defines grey literature as follows:

> Grey literature stands for manifold document types produced on all levels of government, academics, business and industry in print and electronic formats that are protected by intellectual property rights, of sufficient quality to be collected and preserved by library holdings or institutional repositories, but not controlled by commercial publishers i.e., where publishing is not the primary activity of the producing body (Schöpfel, 2010).

Most of papers define grey literature as a set of various document types, above all reports, working papers and conference proceedings. Below are given some examples of different types and forms of grey literature:

- Technical reports, working papers and proceedings (Japzon and Anderson, 2004);
- Working papers, reports, newsletters, conference proceedings, committee reports, theses and dissertations, and government sponsored research reports (Costello, 2007);
- Scientific reports (Stock et al., 2006);
- Unpublished works, materials from conferences that are not readily available and rare government reports (Gheen and Olmsted, 2010);
- Conference papers, memos, technical drawings, project reports, theses (Biagioni and Giannini, 2009);
- Government publishing, research reports of various kinds, guidelines for carrying out research, reprints, informational material from political parties, religious congregations, and associations (Juliusdottir, 2014);
- Handwritten notes as grey literature sources (Ćirković, 2016).

Furthermore, these authors are mentioning also other characteristics such as:

- Usually difficult to discover or obtain, often difficult to find in libraries, online databases and on the web, non-accessible, at risk of being lost without investment (Jackson, 2005);

– Non-commercially published, not widely published or unpublished, "neither bibliographically accessible in catalogues open to the public nor available through traditional distribution channels of market publishing" (Juliusdottir, 2014).

Ramos-Lum and Vogel (2005) cite the GreyNet Luxemburg definition of grey literature and distinguish it from "ephemera", i.e. "materials (physical or electronic) that regardless of appearance, quality or quantity, at some point were considered disposable and of little or no value, through time, had become valuable in such a way that it had broadened their appeal and made them desirable to be collected and preserved by individuals, collectors and information institutions". In fact, they describe "ephemera" as a special kind of grey literature.

3 Grey Literature Today

From 2006 to the present, the grey literature field has been in a state of transition characterized by definitional changes, preservation challenges, and new cooperative research initiatives among various groups. These collaborations are embodied by projects as *OpenGrey* and the *GreyGuide*, a newly launched open resource project between GreyNet International and ISTI-CNR (Pisa, Italy), focused on the sharing and development of good practices in the field of grey literature. Today, the grey literature community continues to explore and challenge conventional norms through its international conference series and through its publications in the Grey Journal, which represents the only currently published scholarly journal dedicated to the field of grey literature.

4 Grey Literature Network Service (GreyNet)

The Grey Literature Network Service (GreyNet)[1] was founded in 1992 as the first scholarly association dedicated to the study of grey literature. Its mission is to facilitate dialog, research, and communication between persons and organisations in the field of grey literature. GreyNet further seeks to identify and distribute information on and about grey literature in networked environments. Its main activities include the International Conference Series on Grey Literature, the creation and maintenance of web-based resources, a moderated Listserv, a combined Distribution List, The Grey

[1] GreyNet (on-line)

Journal (TGJ), as well as curriculum development in the field of grey literature. In 1993, GreyNet held its first International Conference on grey literature in Amsterdam, with subsequent global conferences held every two years to the present. The upcoming Twentieth International Conference on Grey Literature "Research Data Fuels and Sustains Grey Literature" will take place in New Orleans, Louisiana USA, on December 3-4, 2018.[2]

GreyNet is fully open access compliant. Authors and researchers in grey literature communities worldwide know that their metadata, full-texts, slide presentations, research data, and other outputs are preserved and made openly accessible to the broader public, available in the following repositories:

- GreyGuide Portal and Repository;
- OpenGrey Repository;
- Dans Data Archive;
- OpenAIRE European Repository Network;
- WorldWideScience.org Global Science Gateway.

In the time of fast information exchange, grey literature has an important role and offers to scientists faster and free access to the knowledge. Therefore, it is important to include grey literature in open access databases and repositories in order to increase recognition of grey literature for open access to research, open science and knowledge transfer.

5 Pisa Declaration on Policy Development for Grey Literature Resources

The Pisa Declaration on Grey Literature[3] was developed at a forum held in Pisa, Italy in May 2014 organized by *GreyNet* and the National *National Research Council of Italy*. It is currently translated into 20 languages worldwide (English, Armenian, Bulgarian, Croatian, Czech, Dutch, French, German, Greek, Hindi, Hungarian, Italian, Japanese, Korean, Macedonian, Russian, Serbian Cyrillic, Serbian Latin, Spanish, Tagalog, Turkish).

The Pisa Declaration provides a 15-point roadmap that should serve as a guide for organizations involved with the production, publication, access and use of grey literature well into this 21th century.

[2] The 20th International Conference on Grey Literature (on-line)
[3] Pisa Declaration (on-line)

Until now, the problem was the lack of cooperation and coordination between and among organizations dealing with grey literature. *The Pisa Declaration* marks an end to ad hoc policy and decision making with regard to grey literature resources. The main points set out in the Pisa Declaration can be grouped into five categories:

1. Organizational commitment to open access and the sharing of open data standards;
2. Commitment to research and education, where recognition and reward is associated with quality of grey literature, and where attention is given to good practices in the field;
3. Commitment to address and safeguard legal issues inherent to grey literature by exploring the various types of licensing agreements now available and by fostering constructive relations with commercial publishers;
4. Commitment to sustainability linked to a financial prerequisite. Identifying funding and grants for special collections and repositories, commitment to long-term preservation, and investments in new technologies;
5. Firm technical commitment to continued online services and further cross-linking of textual and non-textual content – a commitment that ranges from tackling broken links to facilitating interoperability regardless of the system or portal in which grey literature and its accompanying data are housed (Farace, 2014).

> "It is in this way that the Pisa Declaration can revel in the strengths and opportunities that grey literature offers, while at the same time exposing the weaknesses and threats facing our community. No longer are we resigned that grey literature is hard to find, but instead how can we best search and access it. No longer hold in question its worth and value, but instead set out the review process it has undergone. And, no longer hesitate as to whether it is published or not, but instead cite and reference grey literature – make it openly public isn't that what published means?" (Farace, 2014)

There is no doubt that grey literature represents important resource of scientific research, and the main purpose of Pisa Declaration is to increase the awareness of scientific community, governments, organisations and all important bodies about the true value of grey literature and its usability and accessibility. One of the values and research potentials, which grey literature has, is its relation to a scientific heritage, which will be discussed in the following chapter.

6 Grey literature and scientific heritage

Why is it important to invest in older grey literature? Because these documents are "hidden treasures" of historical value (Stock et al., 2006; Biagioni and Giannini, 2009), interesting for institutional history and commemoration (Anderson et al., 2007). In other words, for the authors who are writing about the older grey literature, the value is record of progress, not information itself. The value of older materials can be increased by making them more readily available: "The biggest challenge left to our library is to make our grey literature and ephemera collection available to our users" (Ramos-Lum and Vogel, 2005). This means a systematic search and collection of resources from a variety of agencies and organizations (Costello, 2007) or digitization and web dissemination of collections that were before fairly inaccessible (Gheen and Olmsted, 2010). Another related purpose is digital preservation which, along with dissemination through the different web platforms, prevents grey literature "from moving further toward black" (Ramos-Lum and Vogel, 2005). Another way of preservation would be through central depositories, especially institutional repositories (Jackson, 2005; Lynch, 2017).

However, there are a lot of challenges which need to be overcome, such as, lack of bibliographic control, heterogeneity, locations in different places and organizations, in order to use grey literature in its full capacity. If we define grey sources as not published, it means we can consider handwritten notes as grey literature source in terms of scientific heritage – they are important for the scientific research, but they are not visible. That makes them grey, their non-visibility and non-obligation to be a part of bibliographic records. The way of increasing their visibility and usability, would be through introducing new bibliographic standards with special fields for grey literature sources, which will bring the new value in terms of valorisation of all different types grey literature.

If the scientific heritage source is not published, and is not part of library catalogues, but is important in terms of scientific research, it could be considered as grey literature source.

7 Conclusion

Grey literature is an important source for scientific research, since it provides rapid exchange and dissemination of information among the scientific

community. However, it is still on margins and its importance is not recognized by wider community. There are a lot challenges which need to be overcome in order to give the grey literature the deserved place in academic community and scholarly communication.

In last decade some significant steps have been made in order to increase the visibility, usability and wider public awareness about the grey literature. One of important events was publishing of *Pisa Declaration on Policy Development for Grey Literature Resources* in 2014, which provides us with clear guidelines how to treat grey literature sources in order to increase the awareness of scientific community, governments, organisations and all important bodies about the true value of grey literature. Still, there are many open questions, such as, older grey literature sources, their definition and determination with regard to scientific heritage, grey literature and open access sources, which are waiting to be answered and investigated in some future researches.

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Creation of the multimedia document "I'm passing through your street"

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ABSTRACT: This paper presents the process of creating the multimedia document "I'm passing through your street", undertaken as part of the course Multimedia Document by final-year undergraduate students of Library and Information Science at the Faculty of Philology, University of Belgrade, during the 2016/7 academic year. It provides a brief historical overview of the development of Belgrade streets and how they got their names. The method of collecting, processing and publishing content on a website is described, and a detailed display of the website itself is also provided.

KEYWORDS: multimedia document, informatics, library science, street names, famous women, Belgrade

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1 Introduction

Belgrade is situated at 116.75 metres above sea level, at longitude 44°49'14" N and latitude 20°27'44" W. There are 17 municipalities and more than 4,000 streets. Today the longest street in Belgrade is Bulevar kralja Aleksandra (8.23 km), and the shortest one is Uskočko sokače, near Kalemegdan (36 m).The first official information about Belgrade street names ("alleys") dates from 19 February 1847 (Павловић, 1998, 9), and it refers to 30 alleys of the inner city, the so-called moated town. The streets were named in reference to their location, to nearby institutions or to famous people, but these names would take time to become established.

It was not until 1864 that all the streets in the town were named for the first time, by order of Prince Mihailo (Стојановић и др., 2004, 5). From 1872, when Belgrade's streets were officially named, to this day, its street names have often been changed. Each change of authority and historical and social circumstances was followed by a change of street names. In 1850 Belgrade's population was 15,485 and in 2002 1,576,124 while the number of streets rose from 30 to more than 4,000 during the same period (Стојановић и др., 2004, 6). In Dušan Pavlović's "Znamenite ličnosti na ulicama Beograda" (Famous Persons on Belgrade Streets) (Павловић, 1998), the author points out that a street name should contain full forename and surname, as well as nickname, pseudonym or pet name, title or rank. Although it has been twenty years since the publication of the book, some of the women who have had streets named after them in Belgrade are yet to be identified, as is the case for "Coca".[1] However, in the course of working on this project, we obtained new data that might aid future scholars.

2 Are women, overshadowed by men, neglected?

Given that our document is concerned with those streets in Belgrade that have been named after famous women, we will present in this chapter an overview of the relation between streets named after famous women and those named after famous men, and we will also provide an overview of their changes. For centuries women have occupied a socially subordinate position. They have been neglected and ignored, not just in our country but in the whole of Europe. The legal position of women in independent Serbia was not regulated by the civil code. Articles referring to women remained unchanged for a hundred years, from the adoption of the civil code in 1844 to 1945, when the socialist regime altered them. The law of 1884 placed women in the same group as minors, which meant that women could not witness wills and could not receive presents without the approval of their husband. Education and employment also depended on the assent of husbands. All other rights were in keeping with their subordinate legal position.

Nevertheless, higher education was available to them. As early as 1871 the Belgrade Higher School was open to female students, and after 1882 there were state scholarships for women to study at European universities. Unfortunately, women were later faced with the impossibility of finding jobs

[1] Coca's street is in the municipality Zvezdara.

commensurate with their qualifications. The labour law of the time stipulated that clerical and ministerial positions could be occupied only by those who had served in the army. Women were therefore automatically prevented from joining the civil service and becoming doctors, professors, teachers in higher grades, engineers or architects. As a result, few famous women held influential positions.

It is worth noting that in 1900 there were more men than women in Serbia (752 women per 1,000 men) (Стојановић, 2013, 269). Today it is the other way around throughout the world – according to the Statistical Office of the Republic of Serbia women account for 51.3% of the total population (Žene i muškarci u Republici Srbiji, 2017, 10). This brings us to the question: Why are women still in the shadow of men?

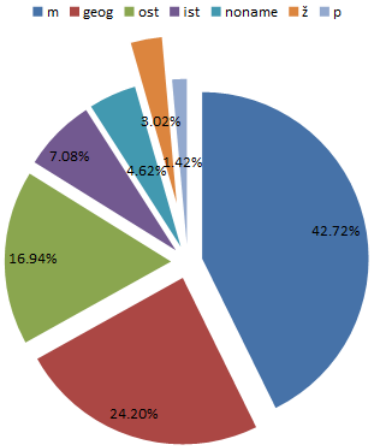

Figure 1. Distribution of streets by name types: m - men, ž - women, p - families, geog - geographic names, ist - historical events, ost - other, noname - without official names.

The chart in Figure 1 shows the distribution of street-name types. Streets named after famous men (42.72%), such as *Pablo Pikaso street*, are marked in blue. The names of almost a quarter of Belgrade's streets (24.2%) include geographical names, for example *Zrenjaninski put* and *Niška street*,

and 7.08% of the streets are named after historical events, including *Beogradskog bataljona street* ("Belgrade's Battalion"). Only 3.02% are named after famous women (e.g. *Desanka Maksimović* and *Kraljica Marija* streets), and 4.62% have no official names, such as the streets *Kvantaška pijaca* and *Tržni centar pijaca* in Block 44 in New Belgrade named after nearby markets. The category "Other" makes up 16.94% of street names and includes such names as *Sajdžijska street* ("Watchmakers'"), *Bunarska street* ("Well's") and *Hrastova street* ("Oak's"). The category "Family" makes up only 1.42%, e.g. *Porodica Gajić street* ("Gajić Family") in Sremčica.

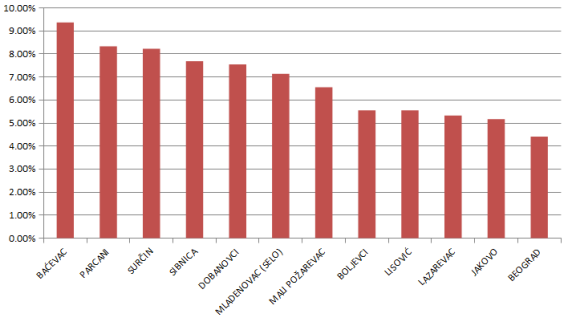

Figure 2. Distribution of streets by municipality.

When the percentage of streets named after famous women is taken into consideration, we see that even in this women are in the shadow of men. Most of the streets named after women are in Baćevac (3 out of a total of 32, or 9.38%). As shown in Figure 2, the inner city is ranked twelfth among the municipalities of Belgrade in the number of streets named after women (merely 154 of 3,489 streets, or 4.41%).

Figure 3 shows the number and the type of street name changes for streets previously named after women. Of those streets, 17 are now with no official name ("noname"), 12 fall under category "other", 11 are now named after famous men, 7 are again named after women, the new names of 2 of them had been derived from geographical names, while the new names of the remaining 2 had been derived from historical events. We were struck by the fact that most of the streets that had been named after famous women actually lost their names and are now without an official name.

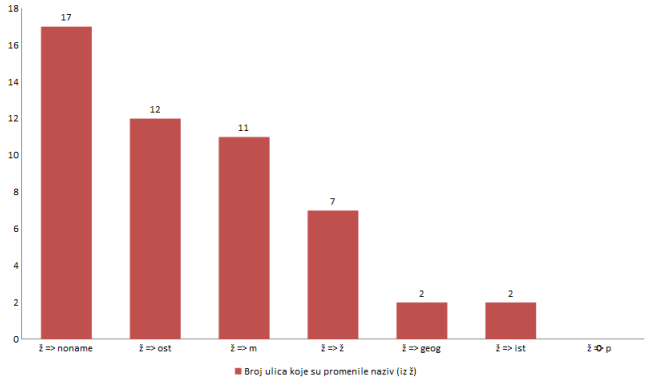

Figure 3. Distribution by name categories of streets that were previously named after women.

We have further analyzed the process by which the streets came to be renamed, and Figure 4 displays the number of streets renamed with the names of famous women. Of those streets, 9 had previously been named after famous men, 7 had already been named after women, the former names of 4 of them had been derived from geographical names, and the former names of the remaining 2 fall under our category "Other".

3 Data collection, analysis and content formation

When we began creating this multimedia document we received a list of the streets of Belgrade. Using the website Open Street Map,[2] we were able to connect the street names to their respective municipalities. Our first task was to classify the streets according to what they are named after into those named after men, women, geographical places, historical events and families. Additional categories were reserved for streets without names and those falling outside all the other categories. Each student was assigned 300 streets. Once this task was completed it was easier to identify the streets named after famous women. In answer to the questionnaire formulated by our lecturers we stated how familiar these names were to us, and we then classified the names according to the merit of the women.

[2] OpenStreetMap (on-line)

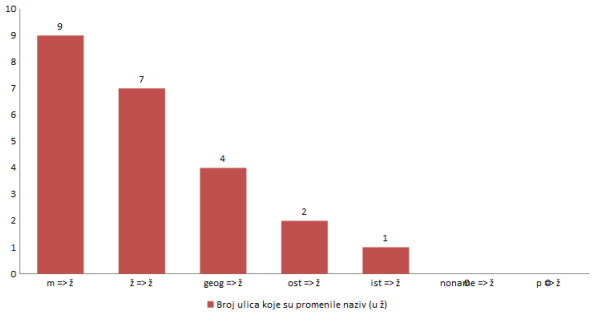

Figure 4. Streets named after women that were previously named after men or something else.

1. Fictional characters [“fictional”] (Ana Karenjina)
2. Real women
   a. Title (queens, empresses, princesses etc.) [“highness”] (Princess Milica, Princess Zorka etc.)
   b. Professional merit
      I. Artists
         A. Visual [“visual artist”] (Milena Pavlović Barili)
         B. Theatrical [“theatrical artist”] (Rahela Ferari)
         C. Musical [“musical artist”] (Danica Obrenić)
         D. Literary [“literary artist”] (Desanka Maksimović)
         E. Other [“other artists”]
      II. Educators [“educator”] (Zagorka Dragović)
      III. Doctors [“doctor”] (Isabel Hutton)
      IV. Scientists [“scientist”] (Mileva Marić Ajnštajn)
   c. Other [“other professions”] (Snežana Hrepevnik, sportswoman)
   d. Combat merit (national heroines) [“national heroine”] (Dragica Končar)
3. Unknown [“unknown”] (Coca)

Each student carried out further research on eight streets. Their task was to discover basic information about each of these women so that we could share this information with our colleagues in the form of presentations. During this step we were faced with a lack of certainty about the identity of some of these women and with a lack of basic information about many of them. After collecting additional information from the literature (Јеко, 2003;

Секулић, 2014) and various other sources (Web, encyclopedias, archives and museums), we prepared articles on each woman, which we later uploaded to Google Drive, our default space for making this material available to all participants of the project. We also searched for photos of these women and personally took photographs of the streets named after them.

Our initial idea was to upload all the articles to Wikipedia, but when we faced difficulties in receiving approval from Wikipedia, we gave up on that idea. Instead, all our articles were proofread and uploaded to a blog[3]. Given that we had the opportunity to learn at least two foreign languages during our studies, each student was able to choose a language into which to translate articles. These articles have also been uploaded to Tumblr. We decided to connect the whole project to social networks, namely Facebook, Twitter and Instagram, where we promoted the project, so that as many people as possible could see it. We used Tumblr and other social networks as a replacement for the database that most MMD projects had previously used.

Our idea was also to present visually all the information about streets named after famous women. Professor Cvetana Krstev invited Professor Ranka Stamatović of the Faculty of Mining and Geology, who is an expert in geological information systems, to instruct us in how to enrich our project by connecting the collected information to a map of Belgrade.

After processing the data, each student was given additional tasks. Marija Daković gathered information about the women and conducted further research about those who were still unknown to us. Slađana Subotić, Dragana Đorđević and Milica Banović found out more about national heroines in the Banjica camp. Anastasja Mandić, Anna Širka and Jelena Devetak completed the work of the students who had given up on the project. Jovana Radivojević and Valentina Žimbrek wrote the bibliography about significant women and the streets of Belgrade. The correction of articles written in Serbian was done by Dragana Polić, Bojan Mihailović, Milica Sekulić, Dušan Filipović and Rastislav Marković. Petar Milutinović was the Wikipedia co-ordinator. Sanja Slankamenac and Konstantin Stanković connected the streets to the map of Belgrade, and Irena Radošević, Aleksandar Zdravković and Goran Rajković connected our project to social networks. Mihailo Đurašević and Milica Milović came up with the concept for the website, and Filip Stanković then designed it.

[3] Our blog "I'm passing through your street" is also available on the home page of Prof. C. Krstev.

4 Creation of the website and user accounts on social networks

The website aesthetic is based on minimalistic and retro design. An illustration of a city, populated mainly by women, forms the background, conveying the theme and concept of the project (see Figure 5). We decided on a simple design so that users could navigate easily and efficiently on every platform, and the design is adapted to all operating systems and mobile devices.

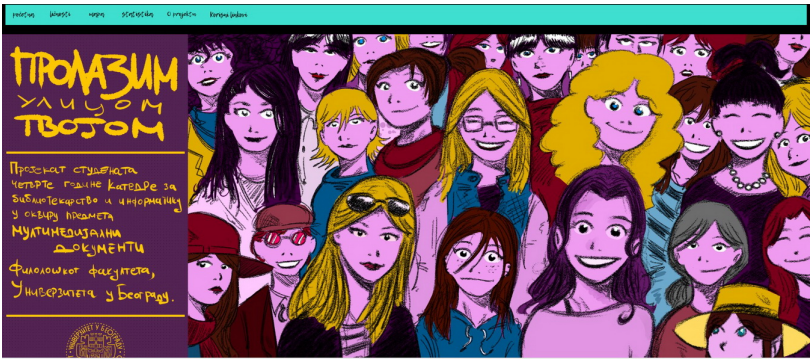

Figure 5. The home page of the project (Design and realization by Filip Stanković).

The main page is in the form of an entrance redirecting users to the Tumblr blog, where the primary database is stored. We selected Tumblr because it provides a better overview of information and is aesthetically adaptable. In addition, the blog's markup language is simple and accessible, which allows the articles to be better classified and labeled. As a result, more students took part in uploading the articles and were able to participate equally in the creation of the website.

The start page consists of the title and a short description of the project, as well as a navigation bar. There is a music player, with songs about streets, in the header. The page opens with the principal musical theme, "Whistle at Eight", performed by Đorđe Marjanović. The tab "Persons" redirects users to two classifications, one in alphabetical order and the other in order of merit. The "Map" tab opens an interactive map with an alternative search

function. Clicking on a particular street opens an article about the person the street is named after. Statistical graphs are under the "Statistics" tab, with respective descriptions below. The graphs can be expanded by clicking on them. The tab "About the project" contains the project description, as well as a list of the participating students.

In the tab "Useful links" there are links redirecting users to a documentary on Youtube entitled *Partizanke – Žene Jugoslavije u NOB-u* (Women Partisans – Women of Yugoslavia in the National Liberation Struggle) and to accounts on Facebook, Twitter and Instagram. The use of social networks emphasizes the interactive side of this multimedia project and allows the public to learn about it and access the information it provides. There will be further texts and photos posted on these accounts in future, as well as links to more thorough articles on Tumblr. We have also made it possible for visitors and followers to publish information they have gathered themselves.

Acknowledgements

We owe a great debt of gratitude to our professor, Cvetana Krstev, who was the leader and designer of this project, as well as to her assistant, Branislava Šandrih, without whose co-ordination we could not have succeeded. Considerable support was also provided by staff members of the Historical Archive of Belgrade and the Belgrade City Museum.

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