The *Galaksija* Computer — The Road to Stars Paved with Words

UDC 050:004GALAKSIJA"1983/1984"
DOI 10.18485/infotheca.2024.24.1.5

ABSTRACT: The research is conceived as a content analysis of the popular science journal "Galaksija" (issues published during 1983 and early 1984). The aim is to determine, at the content level, how computers, robots, and the concept of artificial intelligence (AI) are portrayed in the materials published by this journal. Additionally, the study explores to what extent such writings contributed to the success of the *Galaksija* computer, the first Yugoslav computer intended for mass use. Through the analysis, it becomes clear how an active approach to problem-solving and the encouragement of creative work and thinking can be promoted, especially in moments when the state imposes objective constraints.
KEYWORDS: galaksija, computer, artificial intelligence, content analysis.

PAPER SUBMITTED: 27 January 2024
PAPER ACCEPTED: 15 March 2024

Olga Mirković Maksimović
olga.mirkovic@gmail.com
ORCID: 0000-0003-4255-9200
University of Belgrade
Multidisciplinary PhD Studies
History and Philosophy of
Natural Sciences and Technology
Belgrade, Serbia

1 The *Galaksija* computer – what's all the fuss about?

Galaksija was the first microcomputer in the territory of SFR Yugoslavia accessible to all the enthusiasts in the period when computers were intensively developed and brought closer to end users, both in the world and in the areas of the former SFRY. It is important to understand that the import of computers into the former Yugoslavia was not allowed in 1983, thus computer and technology enthusiasts couldn't import the object of their admiration legally. To protect domestic production from foreign competition, strict import rules were introduced in the SFRY, which made the development of computers in the country different from the development in the Western world (restrictions did not apply only to the import of computers). The government tried to control the influx of foreign home computers by

imposing import restrictions on price and memory size. As the passion was stronger than the restrictions, the people were resourceful – they continued to import computers piece by piece and assemble them without violating the applicable rules and regulations. They also got by with the help of friends and relatives who worked abroad and could legally obtain all the parts. The pressures of the state only increased the creativity and inventiveness of computer enthusiasts and encouraged them to self-organize in the desire to finally own a computer suitable for home use. The best illustration of the popularization of microcomputers can be found in the 129th issue of "Galaksija" in the text "Microcomputer close up", which says that: "Millions of people of various professions, students at all levels, poets and housewives, workers and officials, medical doctors and lawyers have already come in contact with a computer".

Several companies tried to make microcomputers similar to home computers from the 1980s, such as "Ivo Lola Ribar" Institute – *Lola 8*, "EI Niš" – *Pecom* 32 and 64, "PEL Varaždin" – *Galeb* and *Orao*, "Ivel" – *Ultra* and *Z3*, etc. (Le Parisien 2000). Their failure or positioning outside the home computer market was influenced by many factors:

- they were too expensive for individual buyers (especially compared to the popular foreign computers ZX Spectrum, Commodore 64, etc.),
- the small number of entertainment and other programs made them unattractive to contemporary computer enthusiasts,
- it was not possible to buy them in stores.

Domestic computers of this generation were therefore mainly used in state institutions (which were not allowed to buy imported computers).

Galaksija was the only computer that managed to find its place in the sun and win the hearts of home computer enthusiasts in SFRY. Its creator was Voja Antonić. In an interview he gave for the "Startit" portal, Voja talked about when and how he came up with the idea to make the *Galaksija* computer:

"(the idea) ... I came up with it in Montenegro while on vacation. For me, beach vacations are boring because there is nothing to do. So I grabbed a notebook and started to make some of my projects and sketches on the beach. That's where I first came up with the idea of how to make a video unit simply and economically, which was the most complicated thing for computers at that time. The price of a computer has always depended on the complexity of the video unit. I came up with the idea of how to make it simpler, to make a computer that is bad and incredibly slow because it spends four-fifths of

its time generating an image, but which was still a computer. I realized that such a computer worked and could be built very simply, so I thought, why not offer it to someone else? Then I decided to publish it somewhere as a "do it yourself" project. The "Galaksija" magazine had a special issue about computers, which was supposed to be called "Computers in Your Home". I reached out to Dejan Ristanović, the man who was supposed to write it, and told him my idea, to which he replied: 'Of course. It would be wonderful if, for the first issue, there was some self-made thing' and that's how we started." (Startit 2017)

In the same interview, we also learned about their expectations and the number of people who would want to assemble a *Galaksija* computer, which ranged from 50 to 500. The number of purchase orders that the magazine "Galaksija" got for the assembly of *Galaksija* computers was 8000 and exceeded even the wildest hopes.

In an interview for "Yugopapir", another witness - Dejan Ristanović, editor of the special issue of "Galaksija" called "Computers in Your Home" testified about the success of the action. He talked about how they made a mistake in estimating the circulation needed for "Computers in Your Home":

"We printed 30,000 copies of the first issue of 'Computers in Your Home'. They sold out in two weeks, so we had to reprint 20,000 copies which sold out as well, so in the end a reprint of the first issue was made in another 25,000 copies. The second issue was printed immediately in 50,000 copies, and as it sold out, I think another 25,000 copies will be printed these days. The third issue is being made in 50,000 copies. If we had estimated things a little better and printed 100,000 copies from the first issue, everything would have been sold out again, because when there were no more 'Computers' on the newsstands, people exchanged and photocopied them". (Yugopapir 2014)

Ristanović also writes on his personal blog about how the magazine "Galaksija" and the eponymous computer came together: "In order for this kind of action to succeed, it took several months to prepare and keep an eye on the texts in "Galaksija", and my text in which self-assembly was presented was published in September 1983. It was accompanied by a preliminary purchase order, and the response was incredible: over a thousand readers of "Galaksija" expressed their desire to build their first computer! Such a large response is probably due to the fact that the import of computers (as well as any other goods more expensive than 1.500 dinars at the time) was prohibited and thousands of people interested in computers saw no other way to expand their knowledge. The characteristics of the *Galaksija* computer were not very good, but it was usable, balanced, and, most importantly,

attainable – you just had to gather the courage and pick up the soldering iron!" (Ristanović)

The technical characteristics of the *Galaksija* computer (Figure 1) were as follows:

- Processor: ZiLOG Z80A at 3.072 MHz
- *Galaksija* ROM 'A' (ROM 'A' or '1') – 4 kB EPROM (2732 EPROM) with a simple operating system, and Galaksija BASIC code for the BASIC program-interpreter;
- Galaksija ROM 'B' (ROM 'B' or '2') – 4 kB (optional, same as 2732 EPROM), provides additional BASIC commands, machine language (assembler), machine code monitor and more;
- Galaksija ROM for characters – 2 kB (2716 EPROM) includes definitions of symbols (letters and characters);
- RAM memory: from 2 to 6 kB of static memory (6116 RAM) in the basic version, possible expansion up to 54 kilobytes;
- Text: 32 × 16 letters or characters, black and white
- Pseudographics: 2 × 3 matrix, total 64 × 48 dots;
- Sound: None, but a tape recorder interface could be used for this purpose, as on the Spektrum (ZX Spectrum);
- Data storage: cassette tape, recording at a speed of 280 bits per second;
- Input and output ports: 44-pin edge connector with Z80 bus, cassette recorder (DIN connector), black and white video signal with PAL synchronization (DIN connector), and UHF antenna output (RCA connector).

The main goal of the *Galaksija* computer was for people to assemble it themselves (since they could not buy a computer) and then use it and play games. The technical characteristics were such that people could, with a soldering iron and a little patience, assemble their first computer on their own. How popular self-assembly of computers was is also evident in the article from the 130th issue of the magazine "Galaksija", where the text "Club in Novi Sad" featured fifteen-year-old Ivan Zindović, who presented a self-made microcomputer at the forum of the Center for the Study of Social and Technological Progress, in the presence of about a hundred high school students. He managed to assemble a computer whose value was 6,000 dinars.

All this led to the *Galaksija* being the only computer in the homes of many in 1980s, which also enabled the popularization of the use of computers for home purposes.

Figure 1. *Galaksija* computer. (Source: https://www.limundo.com/kupovina/Racunari-i-oprema/Desktop-racunari/Retro-racunari-i-oprema/Racunar-GALAKSIJA/70103817)

2 The magic of the "Galaksija" magazine

"Galaksija" was a popular science magazine that was published once a month. Each issue had 66 pages. Its price from January to June 1983 was 45 dinars, and 50 dinars after that. In that period, the editor-in-chief was Gavrilo Vučković, and the editorial board consisted of:

- Esad Jakupović, deputy editor-in-chief;
- Tanasije Gavranović, assistant editor-in-chief;
- Aleksandar Milinković and Jova Regasek, editors.

"Galaksija" began to be published on March 1, 1972, as a "Journal of Aviation, Astronautics and Future Research", edition of the newspaper publishing company "Duga". In November 1972 (issue 8), the magazine was repositioned and the new header read "Journal for the Popularization of Science", and remained so until the end of the period we are covering in the research. If we look at the list of people who wrote for the "Galaksija" magazine, we can see that it tried its best to distance itself from pseudoscience and take an objective attitude towards topics that were of interest. This is evidenced by

the publishing council of the magazine, which consisted of, among others, PhDs, six of them, as well as two University professors.

In that period, topics that were interesting and talked about a lot in the media were the Apollo mission, nuclear power plants, computers, etc. The Cold War was fought with science and this caused a very wide interest of the population in topics from these fields.

The maximum circulation of "Galaksija" was approximately 85,000 copies; it started with 50,000 copies (Planeta 2021), although there were times when it dropped to 30,000–35,000 copies. The concept was such that each issue had its lead topic, which was presented on the front page and covered in detail in the magazine through several texts. Other topics were not permanent and differed from one issue to another. The "Games, Hobbies, DIY" section was always there and usually occupied the last six pages of the magazine.

The "Galaksija" magazine was characterized by the great loyalty of its fans, which we can see in the letters of the readers, but also in the way in which the editors engaged in direct communication with them. The editors were so open that they even recommended foreign magazines that dealt with the same topic - even though they were their competition. This is directly evidenced in issue 132 in the text "Foreign magazines", which says: "We would recommend two: 'MC microcomputer' and 'Micro and personal computer'. The subscription is about 30,000 TRL lira, and the addresses to write to are..."

3 Methodological concept and research instruments

When something needs to be done for the first time, when a novelty is introduced either at the level of society or a smaller community - change is initiated by communication: how is the novelty presented, what is the message that is being sent and in what way, and what are the important questions that need to be answered. As the introduction of computers into the everyday life of the people in Yugoslavia was one of the very important tasks for the further development of industry, the economy, and thus the entire community, it is extremely important to analyze the communication that preceded the great success of the first domestic computer intended for wide use (*Galaksija*), which users could assemble themselves. It is important to understand the messages, their intensity and frequency, their quantity and quality – especially if we want to repeat the success of introducing novelties like this in the future. The quality of writing about a particular problem, as

Stjepan Gredelj states in "On the other side of the mirror" (Гредељ 1986), includes: the number of texts in the sample, their size, and communicative value. The first two indicators are immediately visible and easily measurable. Communication value is a derived indicator that is the result of an assessment of the importance attached to the text considering its position in the structure of the paper. The most important are the texts that occupy the main pages of the newspaper, the front page, the first, and the second, while the texts on the other pages are less important.

Content analysis is as a research procedure that strives to build a systematic experiential record of social communication (Manić 2017). Content analysis in sociology). Content analysis mainly deals with the analysis of secondary material – the one that was not created for the research, but rather independently. It was the chosen method because it allows for both quantitative and qualitative analysis of the material – in this case, the analysis of the content of the "Galaksija" magazine, which was then the most important scientific magazine in the Yugoslav market. One of the few that, at that time, systematically covered topics in the field of computer development and technology. The success of the magazine justifies its choice as one of the sources of material.

The sources used to study the contents of the magazine "Galaksija" about the eponymous Yugoslav computer were:

- existing historical and scientific theoretical literature on Yugoslav society during 1983 and 1984;
- statements and testimonies of people who participated in the creation of the *Galaksija* computer and wrote texts for the magazine "Galaksija" at that time (Voja Antonić, Dejan Ristanović, Stanko Popović);
- methodological literature on the method of content analysis;
- selected editions and texts of the magazine "Galaksija" on which content analysis was applied.

All covered copies of the magazine were found and purchased through the Kupindo platform as collector's editions, given that digital versions of the issue could not be obtained. As the copies were acquired in a rather poor condition: the sheets were damp and exposed to smoke for a long time, and given the type of binding, any disassembly would have completely destroyed the magazine copies. Due to the lack of professional equipment and knowledge in the field of paper restoration, I decided to apply the original method of content analysis, which consists of reading texts and manually counting terms and selected phrases.

The sample for content analysis includes all "Galaksija" magazines that were published in 1983 from issue 129 (January 1983) to the first two issues of 1984: 141 and 142 (except for issue 136, which could not be found on the market, and access to libraries was difficult due to restrictions caused by the global coronavirus pandemic). The time frame was defined in accordance with the subject of the research, that is, the creation of the *Galaksija* computer, which was the focus of the research. As the original plan for the release of the *Galaksija* computer was the last quarter of 1983, the goal was to track the way the topic was introduced to the target group, the intensity of writing before the action was initiated, the change in intensity of writing during the action, the connotation given to the topic, as well as the impact of writing on the sales results. Therefore, the period from January 1983 to February 1984 was chosen as ideal.

According to Dejan Ristanović, one of the authors of the "Galaksija" magazine, for him the "Galaksija" project began on June 24, 1983, when Zoran Vasiljević contacted him with the idea of taking a look at a small home computer that could be of interest to the readers of this magazine. Thus, the period before the June issue of the magazine "Galaksija" can essentially be viewed in one way, as the creation of texts that the authors organically dedicated to a certain topic. On the other hand, the period after June, when the magazine became a part of the joint project in a different way – it was more focused on action and propagation of certain ideas and actions with a pre-defined sales goal. Dejan Ristanović wrote about it on his blog: "... I wondered how willing the magazine would be to 'get involved' in something that is not its main interest, but it turned out that the interest was huge: Jovan Regasek, then the editor of the section in which I wrote about computers, and Gavrilo Vučković, the long-time editor-in-chief of 'Galaksija', immediately noticed the importance of this idea and showed a great willingness to fully commit themselves to its implementation. With one important change: the project will not be published in 'Galaksija', but in a special edition of 'Computers in Your Home', which was to be published at the end of 1983". (Ristanović)

The analysis included two basic units: topics and symbols. The analysis of topics determined the most important subjects of writing that dominated in the selected period and their relation to the phenomena and events to which they are dedicated. Also, whether something preceded the action dedicated to assembling the computer, happened in parallel with it, or after the action itself. This procedure required the interpretation of the material, and the created assessments were checked in other data sources – primarily, in

the scientific literature related to that period and topic, as well as in the testimonies of the actors themselves.

The analysis of symbols attempted to determine the terms used on the pages of the magazine "Galaksija" during 1983 and at the beginning of 1984. In the value and motivational impact of means of communication, certain words are carriers of a specific message and even the entire topic. The frequency of use of these terms and their orientation (whether it is positive, negative, or neutral) were measured. In addition, placing words in a certain context is essential when it comes to influencing changes in certain processes - in this case, ordering and self-assembling *Galaksija* computers.

Before the categorial system for the analysis was prepared, preliminary research was carried out on a smaller sample of texts from the observed period, followed by grouping of categories by logical connection. We encounter two types of categories:

1. content categories – considering what was said;
2. categories of forms of presentation of content – considering how something is said.

Content categories examine the subject and direction of messages. The subject answers the question of what the message is about. Direction refers to the symbols and determines whether they are positively disposed toward the subject, neutral, or negatively disposed.

The research distinguished the texts within the section "Games, Hobbies, DIY", which was always located at the back of the monthly issue (the last six pages), the texts of the topic that was presented on the cover of the magazine, as well as the texts found in the edition related to a topic, but not related to the section or the topic of the issue. The quantity of writing about the selected problems comprises the number of writings included in the sample, their size, and communication value. The selected topics are as follows:

- man and machine, robot – as one of the topics, due to the illustrative fusion of man and machine into a robot;
- artificial intelligence – as a topic that was seriously discussed both in the world and in our country, and which sparked various controversies;
- pocket, home computers, computers as one topic – because they are often used as synonyms;
- microcomputers as a separate segment due to the different use of the term, primarily in the context of business and professional computer use.

When it comes to the senders, those to whom the message is intended, and the effect of the message itself, indirect data were extracted, checked, and supplemented with data found in reports and analyses available from that period. The senders of the message are, first of all, the authors of the texts and the editorial staff of the magazine "Galaksija". The recipients of the message are the readers of this magazine, who were interested in computers and innovations on the market and did not want to be excluded from world trends. The answer to the question of "how" lies in the magazine "Galaksija", at that time one of the most popular science magazines that dealt with topics in the field of technology and computers. Texts aimed at dispelling myths about computers themselves, promoting self-assembly of computers, as well as the "Do It Yourself" section actively promoted the topic.

4 Quantity of writings on selected issues

The number of articles included in the sample and their volume are directly perceivable as the number and size of the texts, while the communication value is a derived indicator, the result of an assessment of the importance attached to the text considering its position in the structure of the paper. The highest weighting factor was assigned to the text promoted on the front page, which was the topic of the issue with the largest number of pages devoted to it. The texts on other pages were less important. There are a total of five weighting factors shown in Table 1. If one of the selected topics ("man and machine, robot", "artificial intelligence", "pocket, home computers, computers", "microcomputers") belongs to one of the categories, it is assigned a corresponding weighting factor:

Section	weight
Topic of the issue	5
Second page	4
Third page	3
Fourth page	2
Other pages	1

Table 1. Weighting of texts.

The sample included 13 issues. Each issue of "Galaksija" had 66 pages. The number of pages devoted to the "Games, Hobbies and DIY" section is

on average six (ranging between five and seven) – so 9% of the magazine is devoted to topics of interest. In addition to this section, texts devoted to the topics of computers, robots, and artificial intelligence appear in different segments in seven issues, which make up 53% of the covered issues. In those seven issues, a total of 12 texts are devoted to selected topics: man and machine, robot, artificial intelligence, pocket computers, home computers, computers, and microcomputers. The representation can be seen in Table 2.

Issue No.	No.of pages Games, Hobby	weight	No.of for computer assembling	weight	Additional texts dedicated to topic	No.of pages additional texts	weight	Total No. of pages dedicated to topic
129	5	5	1.5	1.5	0	0	0	1.5
130	5	5	1.5	1.5	0	0	0	1.5
131	6	6	2	2	1			2
132	6	6	1.5	1.5	1	1.5	1.5	3
133	7	7	2	2	2	4	4	6
134	6	6	0.5	0.5	1	1.5	1.5	2
135	6	6	1	1	2	9	45	10
137	6	6	1.5	1.5	0	0	0	1.5
138	6	6	2.5	2.5	4	10	50	12.5
139	6	6	2	2	0	0	0	2
140	7	7	0	0	0	0	0	0
141	6	6	2	2	1	1	1	3
142	6	6	2	2	0	0	0	2

Table 2. Weights for pages dedicated to the topics.

We notice that there is no issue in which at least one of the topics (man and machine, robot, artificial intelligence, pocket, home computers, computers, and microcomputers) is not covered. In the graph (Figure 2), we can see an uneven distribution of the total number of pages dedicated to topics and a clear downward trend at the beginning of 1984, after the release of a special edition dedicated to computer assembly. The peak was reached in the October issue 138, where the topic was the computer, so it is not surprising that the maximum attention was paid to the chosen topic. The graph also clearly shows the editorial interest in the topic and the increase in representation even before learning about the existence of the *Galaksija* computer and the plan of action.

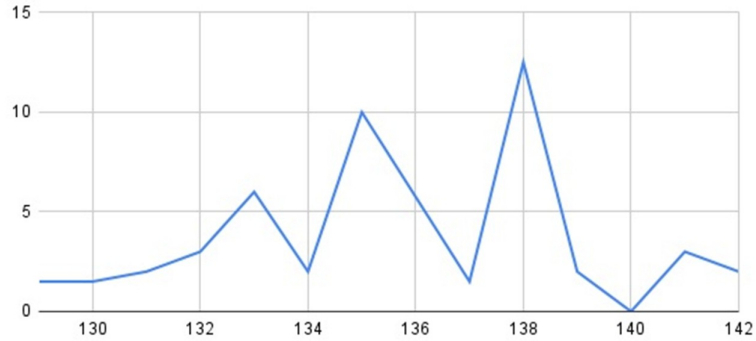

Figure 2. Total number of pages dedicated to topics per issue of "Galaksija".

When it comes to the cover, there are a total of three issues (23%) where one of these three elements is present (the cover contains the word *computer*, the cover contains the term *artificial intelligence*, and the cover contains a graphic representation of a computer). In issue 138, the topic is the computer, so this word is present in the title itself, as well as in the graphic illustration on the front page. The connotation of themes is never negative: it is either positive or neutral. Table 3 shows the percentage representation of topics on the cover of "Galaksija".

Description	%
The cover includes the word *computer*	7.69%
The cover includes the term *artificial intelligence*	7.69%
The cover includes a graphic representation of a computer	23.08%

Table 3. Percentage representation of topics on the cover of "Galaksija".

A total of 47 texts were covered in the research. Each magazine was read following the method of content analysis, all the phrases and words that were covered were counted, and the data compiled into tables. The size of the texts was also covered, as it is a specific indicator of the publicity given to a certain issue and topic at a specific time. "Galaksija", as a popular science magazine, is specific because it was not intended for one-time use (unlike daily editions of newspapers), but its copies were kept, re-read, and

in certain segments served as textbooks and manuals. This makes the value of each text greater – the impact of that text is more far-reaching, it is not just a temporary entertainment and pastime. The topic of computer assembly is always present. On average, one and a half pages in each issue are dedicated to the topic. The maximum number of pages devoted to the topic is 2.5, and only one issue did not have a text devoted to that topic.

Galaksija issue	man and machine, robot	AI, intelligent machines	home computers, computers etc.	micro computer	computer democratization
129	0	1	16	5	0
130	0	0	13	4	0
131	0	4	40	2	1
132	19	1	34	2	0
133	0	2	133	1	0
134	0	0	30	0	0
135	184	8	60	1	0
137	1	1	43	1	0
138	5	14	129	32	0
139	0	0	30	0	0
140	0	0	25	0	0
141	5	0	53	11	0
142	0	0	53	2	0
total	214	31	659	61	1
average	16.46	2.38	50.69	4.69	0.08

Table 4. Representation of the topic in the covered editions of the "Galaksija" magazine.

Table 4 clearly shows a stable trend and the presence of texts related to computer assembly. On the other hand, the presence among the texts outside that section is very unstable and with large peaks, and it is clear that part of the systematic efforts of the editors was to push the selected topic and draw attention to it. It can be noticed that in the first months of 1983, the selected topics did not appear outside the Hobby section, but from the summer that year, the intensity has changed considerably, as shown in graph (Figure 3).

Keywords and phrases that appear most often within the analyzed texts:

1. *Pocket computer, home computer*, and *computer* (used as synonyms) – a total of 659 times, an average of 50 times per issue.
2. *Man* and *machine*, *robot* – a total of 214 times, an average of 16 times per issue.
3. *Microcomputer* – 61 times, an average of four times per issue. The term microcomputer is used more for business use of computers and is not a usual term when discussing home and personal use of computers – therefore it is chosen as a keyword in the analysis.
4. *Artificial intelligence* – 31 times, an average of 2.38 times per issue.
5. *Computer democratization* – only once, in issue 131, when the computer fan clubs were announced. Before that, number 130 introduces the concept of clubs as an excellent way of organizing computer enthusiasts. Given the period in which the magazine was created, it is clear that the word democratization was not popular and, regardless of its completely benign use in this context, it was never used by the editorial staff later even though these topics were discussed.

Through the keyword analysis itself, it becomes clear that the emphasis was placed on personal computer use and that the choice of words included terms and phrases close to the readers, which do not create repulsion. Preference was also given to the relationship between man and machine, as well as robots, rather than artificial intelligence itself, even though that branch of science was developing very intensively at that time. This statement is illustrated by the following fact: in issue 129, when defining the CPU, it is stated that: "The central processor is the heart and brain of the computer, the part of the machine that thinks". Graph (Figure 3) shows the distribution of keywords by issue and clearly shows the influence of the topic of the issue on the representation and frequency of keywords. It can also be seen that from the summer until the publication of the special issue dedicated to the assembly of *Galaksija* computers, keywords were intensively covered, indicating that the editorial team was preparing the ground for action.

5 The sky is the limit: the wildest dream – 1000 purchase orders; 8000 arrived

In the SFRY, in 1983 and 1984, the import of goods with a value of 1,500 dinars and more was regulated. As Tanjug reported on July 22, in the first half of the year, the Yugoslav trade deficit with the West was more than

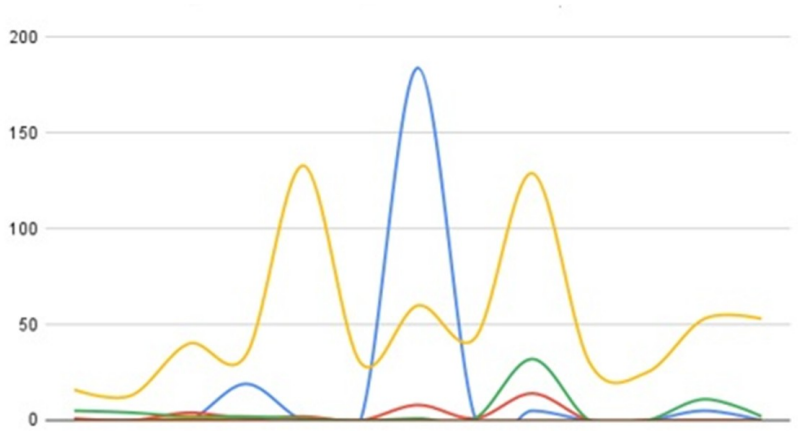

Figure 3. Distribution of keywords and phrases: blue line: *man and machine*, *robot*; red line: *AI*, *intelligent machines*; yellow line: *home computers*, *computers*, etc.; green line: *microcomputer*; orange line: *computer democratization*.

halved (from 2.12 to 0.99 billion dollars) thanks to reduced imports and increased exports. In addition, the Constitutional Court objected to the Federal Assembly because of the law requiring a deposit of 5,000 dinars for travel abroad (introduced in October 1982), which made frequent trips abroad very difficult. Due to customs measures, the import of complete computers was impossible. Yugoslavia officially went bankrupt in 1983, although it never announced this to its citizens (but others did), and stopped paying all its obligations to foreign countries, which resulted in large shortages. On the other hand, the domestic industry failed to make computers for home use quickly enough and at reasonable prices. Many people were interested, personal computers were a "hot topic" among technology enthusiasts, who used all kinds of means to get at least the components to assemble their computer and start programming or enjoy playing games. The editorial board of the magazine, primarily the three people most creditable for following the topic, Stanko Popović, Dejan Ristanović, and Voja Antonić, each of them through his network of contacts, his activity, conversations with the readers, monitoring of local events, and the questions they received, noticed an increase in interest in computers and decided to respond to the increase in demand.

When reading the texts, one notices very open communication with the readers based on questions and answers, published in the section intended for this purpose. It can also be seen that the editorial team is aware of local events in the cities, especially the clubs of computer enthusiasts, and gladly visits them and writes about them. This helps them build networks of contact and continuously receive information from all parts of the country - constantly checking the pulse of readers and events. This is exactly how editors and journalists learned about the topics that interest the readership and came up with a way to respond to them. In addition, by reading the contents of the "Galaksija" magazine, it is very clear that journalists followed all foreign editions, translated articles, and adapted them for the local market. In his interview for "Yugopapir", talking about foreign magazines on the topic of computers that could be obtained in Serbia, Dejan Ristanović says: "The real quality that these foreign magazines offer us is the outstanding presentation of new types of computers and peripherals, but that is still too little for the price of the paper and postage, which is paid in foreign currency". (Yugopapir 2014)

According to the data of the Statistical Office, the average monthly salary in Serbia was 15,161 dinars (Republički zavod za statistiku 2006), and the special edition of "Galaksija", which dealt with computer assembly, cost 200 dinars. This means that about 1.3% of the average salary had to be set aside for that special issue of "Galaksija". In 1983, the price of one kilogram of apples was 35 dinars, and a kilogram of chocolate cost 257 dinars (Milićević 2018) – therefore, based on the data of "Makroekonomija", we could assume that the price of "Galaksija" could cover the daily expenses of an average family in Serbia.

As Ristanović himself points out, "it had its purpose at a time when computers needed to be popularized and when there were not enough programs in the country...". (Yugopapir 2014)

At the very beginning, the most important thing was the realization that self-assembly was possible, and that is what preceded the writings of "Galaksija". All integrated circuits could be legally imported by mail from abroad, and the acquisition of printed circuit boards, keyboards, and boxes could be organized in Yugoslavia. The plan was to program the EPROM memories, because the initial assumption was a maximum of 100 requests, the bravest expected 1000 – however, 8000 requests arrived.

In the words of Ristanović: "In order for this kind of action to succeed, it took several months to prepare and pursue it in the texts in 'Galaksija', so in September 1983 my text which presented the self-assembly was published.

It was accompanied by a preliminary purchase order, and the response was incredible: over a thousand readers of 'Galaksija' expressed their desire to build their first computer! (...) When an action goes well, the people who participate in it are very motivated to continue with their effort: Voja Antonić improved the hardware and software of the computer countless times in the following months, and 'Galaksija' tried to find the most suitable way to organize the supply of kits for self-assembly, relying on the 'small economy', which was just emerging in those years. Thus, we reached an agreement that 'Mipro' and 'Elektronika' from Buje, in cooperation with the Institute for Electronics and Vacuum Technology, would deliver printed circuit boards, keyboards, and masks, that 'Mikrotehnika' from Graz would send chips, and that 'Galaksija' would collect purchase orders and program the EPROM."

That is exactly what "Galaksija" did. It covered the topic very well and created a demand by choosing great authors – excellent experts on the topic, familiar with the trends that existed in the world, who wrote in a way that is close to the readership. The insistence on self-assembly, "do-it-yourself" and active participation in the assembly of computers, which "Galaksija" dealt with for years, paid off, and readers were convinced that they could pick up a soldering iron and assemble their own computer and start doing something useful on it. Excellent instructions, graphic displays, positive connotation of the computer were the wind in the sails of the whole project. Here are some examples:

- In issue 131, in the text entitled "Communication with a computer", there are six illustrations of the process of communication with a computer. As can be seen in Figure 4, in each illustration the computer is smiling and happily communicates, and the cooperation with the human is represented as teamwork.
- In issue 135, the text with the creative title *The Varaždin 'seagull' has taken off*, announced the first Yugoslav microcomputer intended for personal and home use – that is, its entry into mass production. The price of the computer is said to be 89,035 dinars and it is stated that it is quite high for what is offered. The text is accompanied by a photo of a computer with the explanation: "In terms of external appearance, the 'seagull' can be compared to many foreign computers".
- In issue 139, under the title *"More and more powerful"*, graphics of the "Galaksija" computer was shown. The first message written on the screen read: "You too can make a *Galaksija* computer" – no better motivation was needed.

Figure 4. Communication with a computer.

Problems arose in the realization of the project itself – logistics and procurement were the first to break down. "First, there were no fiberglass epoxy laminated sheets, then there were no keys, then there was not enough money for production (payment was made by cash on delivery), then there were no chips... Murphy's laws were very much in action: chip prices were down for years, only to suddenly increase at the beginning of 1984. Static RAMs became more expensive right at that time, there were problems in obtaining 4 kilobyte EPROMs, the Z-80 became cheaper, but Galaksija's Z-80A became more expensive. EPROM programming was a little slow, 'Mikrotehnika' was late by several months, MIPRO and 'Elektronika' by almost a whole year, and all these problems made the editorial phone of 'Galaksija' constantly ring. Thousands of phone calls were the main cause

of both the *Computer 2* delay and the slow progress of *Galaksija* computer development". (Ristanović)

The only way to get the job done involved a lot of direct work and contact with the customers, as well as a lot of patience to solve the procurement and logistics issues. At the beginning of 1984, radio came to the rescue, and Zoran Modli, Dejan and Voja joined forces. Every Friday a new episode aired, and the topics were popular and interesting for many listeners – mostly games and demos: *Castle*, *Jumping Jack*, *Mastermind*, *Evolution*, *Galactic War*, *Hammurabi*, *Biorhythm*.

The editors and creators of *Galaksija* computers were not satisfied with the creation of software by end users. Out of thousands of purchase orders, only five or six software solutions worth publishing have arrived. The editorial office concluded that creating a program was a much more demanding job than assembling a computer and that it was important to provide creators with commercial compensation for their work and effort.

6 Conclusion

Nowadays, it is difficult to imagine a situation in which you are unable to go to a store and buy anything you need: whether it is a computer, a mobile phone, or a software solution. You do not even have to go anywhere – all it takes is a "click" and you can make all purchases online, and then pick it up the next moment or have it delivered to your home address. The presented case of the first local computer, Galaksija, intended for home use and assembly, shows that even in moments of great limitations and restrictions, it is possible to find a solution if you use your own knowledge and skills, i.e. if you take an active stance towards the solution of the problem. The role assumed in that case is active, and not passive – consumer role. In this case, man is an active creator, and the media (in this case, the popular science magazine "Galaksija") can contribute to the initiation of action, encourage people to take a specific action and give them enough faith and inspiration to succeed in their intention. The goal of writing was to move people to action, without the initial desire for commercial success – which, in the end, was nevertheless achieved. In an interview he gave to the "Startit" portal when asked why he gave *Galaksija* to people for free, Voja Antonić explains: "For the same reason I did everything else. It was my goal. Later, when the first issue of the magazine was published, a company from Istria appeared that distributed components, imported them from Austria, and sold them together with programmed EPROMs. They did well financially. When I finally calculated how

much they sold, it turned out that they earned more than a million marks at the time. That, in theory, should have upset me, but it didn't. It was their goal, I lacked the greed to do something like that". (Startit 2017)

The relationship with the readers of "Galaksija", which took place through dialogue (at that time asynchronous as it required correspondence via postcards or telegrams), indicates the existence of a discourse on the topic of assembling a computer, choosing the best options in a certain price range, researching potential solutions and encouraging creativity.

This type of communication with magazine editors has almost completely disappeared today. As comments are left via the Internet and various platforms, their creators do not use enough time and energy to articulate their views and thoughts and create a constructive dialogue. On the other hand, the editors are far from devoting time and energy to the views of the readers, their questions, or dialogue with them. Moderation of comments takes place at a completely different level and within other teams, most often those in charge of social networks. The issue of posting and not posting comments and impressions of readers is the same as it was in 1983 – unfortunately, we will never know how much remained unpublished and why.

Based on the testimony of the actors, as well as the research data, it is clear that the *Galaksija* computer would never have achieved success without the systemic support of the "Galaksija" magazine. The project is a good example of how to encourage an active attitude towards problem-solving, as well as creative work and thinking at times when there are objective restrictions imposed by the state.

References

Le Parisien. 2000. *Dictionnaire Sensagent.* Retrieved from Dictionnaire Sensagent. http : / / dictionnaire . sensagent . leparisien . fr / List % 20of % 20computer % 20systems % 20from % 20the % 20Socialist % 20Federal % 20Republic%20of%20Yugoslavia/en-en/.

Manić, Ž. 2017. *Analiza sadržaja u sociologiji.* Beograd: Čigoja štampa.

Milićević, D. 2018. *Makroekonomija.* Accessed on March 18, 2018. Retrieved from Makroekonomija. http://www.makroekonomija.org/0-dragovan-milicevic/sfrj-%E2%80%93-iluzija-ili-stvarnost-boljeg-zivota/.

Planeta. 2021. *Planeta.rs.* Accessed on April 04, 2021. Retrieved from Planeta.rs. http://www.planeta.rs/54/04_temabroja1.htm.

Republički zavod za statistiku. 2006. *Zarade u Republici Srbiji 1965–2005.* Technical report. Retrieved from Republički zavod za statistiku. https://pod2.stat.gov.rs/ObjavljenePublikacije/G2006/Pdf/G20066004.pdf.

Ristanović, D. *Dejan Ristanovic.* N.d. Retrieved from dejanristanovic.com. https://www.dejanristanovic.com/galaks.htm.

Startit. 2017. *Startit.* Accessed on July 15, 2017. Retrieved from Startit.rs. https://startit.rs/voja-antonic-danas-su-kompjuteri-bela-tehnika-a-nekada-su-bili-cudo-prirode/.

Yugopapir. 2014. *Yugopapir.com.* Accessed in August 2014. Retrieved from Yugopapir. http://www.yugopapir.com/2014/08/dejan-ristanovic-intervju-sa-mladim.html.

Гредељ, Стјепан. 1986. *С ону страну огледала. Истраживање промена модела комуникације у југословенском друштву на основу анализе садржаја писања листова Борбе и Политике у периоду од 1945. до 1975. год.* 232 стр. Београд: Истраживачко-издавачки центар ССО Србије.