

## RELATIONSHIP BETWEEN USERS AGE AND VISUAL PATTERNS IN DIGITAL MEDIA

### ODNOS STAROSTI KORISNIKA I VIZUALNE PUTANJE KOD KORIŠTENJA DIGITALNIH MEDIJA

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#### *Abstract*

The purpose of this paper is to investigate is there a relation between age and the way that people are using digital media content. By developing information and communication technology in the field of media communications, media content users are able to use more visual information of the same content, affecting the success of decoding the message and users can also manipulate part of the visual presentation by adapting the user interface to their visual needs. This puts the user in the position of the designer of the visual content. The information user today partially takes the role of the creator of the visual aspect of the information, so it comes to repositioning in relation the graphic designer - the recipient of the message. The paper examines whether the age of the user has an impact on the visual pattern used in the digital content utilization. The research approach is qualitative and exploratory in nature, as the aim is to develop a model of information consumption for elderlies in digital environment in which the information quality is challenged by the way of user's visual approach and visual pattern.

Through the empirical part of the research, user behavior was investigated in the use of media web content. Although, there are some differences between two users groups divided by age, we can not claim that these differences are connected

#### *Sažetak*

Svrha ovog rada je istražiti odnos između dobi i načina na koji ljudi koriste digitalne medijske sadržaje. Razvojem informacijsko-komunikacijske tehnologije u području medijskih komunikacija korisnici medija sadržaja mogu koristiti više vizualnih informacija istog sadržaja, što utječe na uspjeh dekodiranja poruke, a korisnici također mogu manipulirati dijelom vizualne prezentacije prilagodbom korisničkog sučelja njihovim vizualnim potrebama. Time se korisnik postavlja u poziciju dizajnera vizualnog sadržaja. Korisnik informacija danas dijelom preuzima ulogu tvorca vizualnog aspekta informacija, pa dolazi do repositioniranja u odnosu grafički dizajner - primatelj poruke. U radu se ispituje ima li dob korisnika utjecaj na vizualni obrazac koji se koristi u korištenju digitalnog sadržaja. Istraživački pristup je kvalitativnog i istraživačkog karaktera, a cilj je razviti model konzumiranja informacija za starije osobe u digitalnom okruženju u kojem se kvalitetu podataka dovodi u pitanje korisnikovim vizualnim pristupom i vizualnim obrascem. Empirijskim dijelom istraživanja istraženo je ponašanje korisnika pri korištenju medijskih web sadržaja. Iako postoje neke razlike između dvije korisničke skupine podijeljene prema dobi, ne možemo tvrditi da su te razlike povezane s dobi. Istraživanje je pokazalo da je glavni razlog određenog vizualnog uzorka zanimanje za određenu

with age. The research has shown that the primary reason for certain visual pattern is interest for specific theme. Based on conducted theoretical analysis and empirical research it can be concluded that visual communication in a new, converging media environment is experiencing redefinition and enables rapid transition from status information per se to status per nos, but the interest for content is still dominant regulator of specific users navigation through the content.

### 1. Introduction

The process of telecommunications, audiovisual and graphics industry convergence has begun. Thus the areas of creativity and work that once had only a few contact points, become an integrated whole, whose further development is impossible without systematic planning in the direction of common prosperity. European Commission in the "Green Paper on Technological Convergence" defined technological convergence as "the ability of different network platforms to execute essentially similar kinds of services and the convergence of consumer devices such as the telephone, television and personal computer" /1/. Today's modern world, which is saturated with information, requires tools and technology solutions that will allow easier and more efficient use of information. With the development of information and communication technologies in the field of media communication, media content users are able to use a different display technology of content, which affects the performance of decoding messages, and also users can manipulate themselves part of the visual display by customizing the user interface to their visual needs (eg. customization of the font size). Thus the user partly becomes a designer of visual content. Information user assumes the role of creator of visual aspects of information, so there is a repositioning in relation graphic designer - recipient. Now they partially share a role in the information chain.

Garcia et.al. /2/ point out that the technological convergence of the media is not reflected in the information shift into a new distribution

temu. Na temelju provedene teorijske analize i empirijskog istraživanja može se zaključiti da vizualna komunikacija u novom, konvergiranom medijskom okruženju doživljava redefiniranje i omogućava brzi prijelaz iz statusa per se u status per nos, no zanimanje za sadržaj još uvijek je dominantan regulator navigacije za određene korisnike sadržaja.

medium, but in the creation of information from multiple sources and their presenting and supporting the idea of messages through all available forms of presentation - text, video and audio, while at the same time leaving the possibility to the users to choose which information design will largely meet their communication needs. This big technical shift, has also led to big changes in media use habits. Information and communication technology (ICTs) affect people's everyday lives in many ways, both at work and in the home, for example, when communicating, keeping abreast of the news, interacting with public authorities, buying goods online or being entertained. Older individuals use the internet less frequently than younger people, and although uptake of internet use is increasing, it is doing so at a slower rate among older populations /3/.

According to EUROSTAT, as of the beginning of 2017, more than four fifths (84 %) of all individuals in the EU-28, aged between 16 and 74 years, used the internet (at least once within the three months prior to the survey date). At least 9 out of 10 individuals in Denmark, Luxembourg, Sweden, the Netherlands, the United Kingdom, Finland and Germany used the internet during the three months prior to the survey. By comparison, slightly more than two thirds of all individuals aged 16 to 74 used the internet in Italy (71 %), Greece (70 %) and Croatia (67 %), with this share falling to 64 % in Romania and 63 % in Bulgaria /4/.

According to the same source, share of elderly using internet is 28 % and 32.1% elderly are living alone /5/. More information on population using Internet is given in Table 1.

Table 1. Proportion of the population using the Internet, by age, 2014, %

	Internet access: at least once a week		Internet banking		Made an online purchase during the previous 12 months		Read online news sites / newspapers / news magazines		Participated in social networks	
	Total population	65-74 years-old	Total population	65-74 years-old	Total population	65-74 years-old	Total population	65-74 years-old	Total population	65-74 years-old
<b>EU-28</b>	75	38	44	22	50	23	52	25	46	10
Belgium	83	52	61	34	54	22	53	31	52	15
Bulgaria	54	9	5	0	17	0	41	7	40	3
Czech Republic	76	33	46	13	43	11	69	32	40	5
Denmark	92	76	84	71	78	53	71	56	66	29
Germany	82	47	49	23	70	33	61	34	42	6
Estonia	82	41	77	32	49	11	76	37	51	11
Ireland	76	33	48	17	50	15	37	15	50	8
Greece	59	12	13	3	26	4	54	12	41	4
Spain	71	23	37	11	37	7	59	20	51	9
France	80	49	58	34	62	32	39	24	39	9
Croatia	65	15	19	4	28	2	54	12	40	4
Italy	59	19	26	8	22	5	37	13	36	5
Cyprus	65	15	24	4	27	4	50	11	50	5
Latvia	72	28	57	22	34	5	65	28	53	14
Lithuania	69	19	54	11	26	2	68	20	47	4
Luxembourg	93	79	67	53	74	55	81	65	60	26
Hungary	75	27	30	7	32	6	65	25	61	15
Malta	70	34	45	15	47	14	54	26	53	15
Netherlands	91	70	83	61	71	38	57	40	59	23
Austria	77	36	48	14	53	17	54	25	44	10
Poland	63	19	33	8	34	6	47	15	37	5
Portugal	61	21	25	9	26	4	48	15	47	10
Romania	48	8	4	0	10	1	38	7	36	3
Slovenia	68	21	32	8	37	7	58	20	42	6
Slovakia	76	27	41	10	48	10	52	21	50	6
Finland	90	62	86	61	68	29	78	50	56	15
Sweden	91	76	82	65	75	50	82	68	65	33
United Kingdom	89	66	57	33	79	53	59	32	60	19
Iceland	97	83	91	70	66	23	93	77	83	53
Norway	95	74	89	68	77	38	89	67	71	27
Switzerland	86	57	54	29	67	35	68	38	43	8

Source: Eurostat (online data codes: isoc\_bde15cua and isoc\_bde15cbe)

It is interesting to notice a big digital divide between northern and western EU Member States on one hand and southern and eastern EU Member States on the other. Luxembourg (79 %), Denmark (76 %), Sweden (76 %), the Netherlands (70 %), the United (66 %), Finland (62 %) and Belgium (52 %) were the only EU Member States where more than half of the elderly population aged 65–74 used the internet in 2014 at least once a week. In Romania and Bulgaria, on the other hand, less than 10 % of senior citizens aged 65–74 went online at least once a week, a share that rose to 12 % in Greece and 15 % in Croatia and Cyprus /6/.

Population ageing is one of the greatest social and economic challenges facing the EU. Projec-

tions foresee a growing number and share of elderly persons (aged 65 and over), with a particularly rapid increase in the number of very old persons (aged 85 and over).

Eurostat's statistics on information and communication technologies (ICTs) show that in 2014 more than one third (38 %) of the elderly population — defined here as those aged 65–74 — in the EU-28 used the internet on a regular basis, in other words at least once a week /7/.

Some senior citizens remain somewhat wary of technology and in particular computers and the internet. A growing proportion of the elderly go online, either as younger generations who have used the internet move into the older age classes, or as people develop internet skills in their old age.

The concept of digital exclusion among older people is complex, with various factors contributing to individuals decreased likelihood of accessing and using the internet proficiently on a frequent basis. The 'digital divide' has been described as a two-tier phenomenon, with inequality present in terms of initial access to the internet, as well as having the skills to use the Internet /3/. Previous work has shown decreased levels of internet use among those with declining visual acuity and motor skills, as well as those with poorer cognitive function /8/. Higher education is linked to higher rates of internet use among older people, most probably because better education is linked to occupations in which individuals are more likely to use the internet or email, compared to occupational types in which the internet is not commonly used, which may be associated with lower educational attainment /9/.

Financial status has also been shown to be a significant predictor of the likelihood of investing in and using new technologies, as well as having confidence in using the internet /10/. It should be noted also that many of the social inequalities present across the lifecourse are associated with widening inequalities in both socio-economic circumstance and health in older age /11/.

This paper gives the analysis and comparison of using a web portal with news in two age groups with aim of determining whether age is influencing on fixation number on the presented media content. Using the eye tracking technology, we determined the number of fixations, which tells us did the content get noticed, was it read and was it maybe deeply read.

## 2 Eye tracking research review

Research using eye tracking technology give us a valuable and objective insight into the functioning and characteristics of visual attention, which in turn allows more effective design of media content. While traditional research techniques for computer-mediated communication are sufficient to obtain information for navigating the site, eye tracking technology is successful in analyzing the use of the user interface between clicks and mouse

navigation. This kind of research gave an insight into what attracts most attention, how people move eyes through the visual content, which visual elements cause confusion, what kind of visual elements users completely ignore, and which content gain most of their time and attention. Eye tracking technology has proved to be very effective in the field of research on interaction human-computer interaction /12/. Research in the field of graphic communications using the system to monitor the movement of the eye to focus on the images, graphics and layout of the publication /13/, highlighting what and how visual representation is presenting reality.

For designers, the most important questions that the eye tracking system can answer are related to the so-called entry points (where the reader begins to read?), a form of reading (how does the reader move through the media content?), depth of reading (is the article carefully read?) and the impact of local factors design (colors, images, title, subtitles, quotes, etc. ).

Online editions of newspapers, radio and television programs converged the three, until recently, completely different content /14/. Author research wheather there is a need of a different visual presentation of the content regarding media convergence and how the use of converged content affects the reception of information. Studies have not gone in that direction yet, but they researched the use of the press, Internet or television, the differences between the use of print media and the Internet, but not the effect resulting from technological amalgamation of different modes of reproduction of information. Barthelson /15/ focuses exclusively on Internet users. Barthelson found that 59% of fixations are in the middle of the website, which contained the title of the article and photos. But, unlike the press, the primary focus was on the text, while the articles are read only then if the user has a particular interest in the content. When designing the webpages of newspapers magazines and online publications designers often, as a guide often use some sort of personal opinion and assumptions about how the reader will use the content.

The importance of obtaining new scientific knowledge in this area has been proven in research of Wartenberg and Holmqvist /16/, in which they found that there are differences between what designers think about how visual information are read and used and their actual use. In their research, professional designers had to determine the order in which they think content will be read, and then, using eyetrackin system, a study showed the (un)success of their assessment. Designers also had to define the reason why they think an article will be in the field of interest, and the most common reason cited, was the content and theme, while the layout and design were neglected. The study also found that designers overestimate the impact of color – they assessed that the articles in color will be observed before and that they will gain more attention. Photos and drawings were overestimated also - subjects devoted less time to them than the designers anticipated. Designers underestimated infographics - subjects devoted more time to them than the designers anticipated.

Different eye tracking technologies are used in the last fifty years in the world, and conducted research can be summarized in three main conclusions: 1. fixation views appear in the visual areas that include a high degree of semantic or visual information; 2. fixation views are responsible for the perception and generally are considered to be reflection of individual cognitive strategies and 3. sequences of fixation views allow decoding, storage and recreation the visual data /17/.

Previous studies have dealt with the systematization of the impact of graphics factors on the order of reading in media, but did not include the changes that have occurred with the convergence processes and especially the problem of users age in this context.

### 3 Research procedure and methods

Participants used the same computer configuration: HP EliteBook 8760w, procesor Intel(R) Core(TM) i5-2540M CPU at 2.60GHz, 4.00 GB of RAM, 32-bit, connected to a 22 inch screen with resolution of 1600x900. Both groups used the web page stored on the computer. Respondents were able to use only the page

formatted for this study, but they could move within it in whatever order they wanted. Participants were asked to use the website in usual manner, not to read more or less than they normally do.

For processing and data analysis, appropriate procedures of descriptive (median, average) and inferential statistics (Mann-Whitney test) were used. Data was analyzed with SPSS 21 software package.

For each of the participants we calculated the number of fixations on the article to determine whether the article was observed, scanned or read.

The examinees were divided into two groups (two groups with 20 participants ). Groups were divided by age and the both groups used the same visual stimuli.

### 3.1 Measure Instrument

In the experimental part of the work we used eyetracking system Tobii X60. The device is not intrusive, and enables uninterrupted use of the computer and head movement which provide natural behavior, and thus acceptable results.

Table 2. Technical data of Tobii X60

	<b>Tobii X60</b>
<b>Accuracy</b>	0.5 degrees
<b>Drift</b>	< 0.3 degrees
<b>Data transfer rate</b>	60 Hz
<b>Freedom of head movement</b>	44x22x30 cm
<b>Binocular tracking</b>	Yes

The data were processed using software Tobii Studio. The program is used for the presentation of stimuli, recording, analysis, visualization and partly for statistical analysis of the data obtained.

The used media stimulus was divided into areas of interest (AOI), and for each AOI (each article is a separate AOI unit), was calculated the total number of fixation

### 3.2 Research participants

The study included a total of 40 respondents. While conducting the research, we took into account that we have 20 participants aged over

60. They were divided in group A (aged 18-59) and group B (aged 60+). All participant use Internet, are digitally literate and all of them who are over 60 are still working. This is also a weak point of our research, because they are not a best representative of elderly population (we only have respondents who are in some way connected to technology through their work, are well educated and with good financial status (digital divide mention in /3/, /8/, /9/, /10/, /11/ here is not present). Since the eyetracking device is a pretty robust and the research could be conducted in one place only, we were limited on a available choice of potential participants. Jenkins /18/ examines language coins "digital natives" and "digital immigrants" that originally referred to the generational gap in information and communication literacy, indicating the years can not really be the only one classification criterion in one of these groups, because this type of literacy is also influenced by socio-economic status, personal interests, etc. UK study showed that education is directly linked to non-use of the internet, as 61% of internet non-users had no formal education qualifications whereas only 6% of those with a higher education qualification were internet non-users. The same research showed that income was positively related to internet use and negatively related to non-use. 43% of those retired people with an annual income of £12,500 or less were internet users, while 99% of those with an income more than £40,000 were users /19/.

### 3.3 Research stimuli

The visual stimuli used in the research consisted of a news site created for this research. The page was consisted of a total of 21 news / articles and two advertisements. News were divided into sections: Main news, Analysis, Croatia, Highlights, Sports, Columns and Interesting. When selecting the news (information) for the stimuli, it was taken care of to be representative of all the usual news items: "hard news" - current information, "up-to-the-minute" information, events that are interpreted as possible destabilizing for the social environment, then "soft news" - events that often relate to the private sphere and in which speed delivery is not

critical. This division is important because news by its content must also be visually clearly separated, which was taken into account when designing the research model. Visual classification of content was made by positioning, using color, frame, size and color of the title.



Figure 1. Visual stimuli

## 4 Results and discussion

Measurements were made on a total of 21 articles. Since participants have had complete freedom in how to use the web page, there are differences in the opening of individual articles. Those articles that have not been popular subjects, were not included in the analysis. Nine articles were analyzed, since they were opened by 10 or more participants. Reading involves scanning and reading. Content which had one or more fixation has been noticed, content which had 20 or more fixations has been read and deeply read content has 200 or more fixations. Figure 2. shows the example of one used article and visualisation of eye fixations. The area with most fixations (marked red) is the first paragraph, we can say that this is the most read area, and other areas are noticed, but they are not read with full attention, just scanned.



Figure 2. Example of an used article and heatmap showing the areas of interests

In Table 3. we can see the data about the fixation number and the statistical relevance. Five of the nine analyzed articles have shown result is significant at  $p < .05$  or  $p < .01$  level.

Table 3. Fixation number

		Participants (N)	Fixation number (Mean)	Mann-Whitney (U) at $p < .05$	z-score	p at $p < .05$
Article 1 (Highlights)	Group A	15	71,33	44,5	-1.34164	.18024
	Group B	9	83,55			
Article 2 (Highlights)	Group A	10	97,01	34,5	-1.13389	.25848
	Group B	10	109,80			
Article 3 (Highlights)	Group A	16	67,88	54	1.92659	.0536
	Group B	12	47,33			
Article 4 (Sport)	Group A	13	77,92	9.6*	2.54347*	.01108*
	Group B	6	88,13			
Article 5 (Sport)	Group A	12	67,64	8	2.15248	.03156
	Group B	5	33,60			
Article 6 (News)	Group A	11	25,82	1*	3.57326*	.00036*
	Group B	18	83,16			
Article 7 (News)	Group A	13	119,92	89	1.10088	.27134
	Group B	18	130,33			
Article 8	Group A	7	54.14	5*	3.37417*	.00076*

(News)	Group B	16	94,19			
Article 9	Group A	6	67,71	9*	3.23797*	.0012*
(News)	Group B	18	108,27			

\*significant at  $p < .01$

Note: The approximation to the form of the normal distribution becomes less robust at sample sizes smaller than 10, so caution is appropriate here in making use the Z-value calculation.

Two groups have shown a statistically significant difference in using article in sport section. One article has drawn more attention of an older group and the second one of a younger group. The difference in interest for particular sport in different ages. Other significant results were in the news section – all three articles have drawn the attention of the older population. They have opened the articles more and they also have had more fixations. The result for these three articles is significant at  $p < .05$  or  $p < .01$  level (see Table 3.). The results should be analyzed with caution, without generalization, given that the research and statistical analysis were performed on a relatively small, available sample.

If we see this research as an indication of a certain user behavior, we can conclude that people are very superficial regarding reading digital content – none of the articles was not deeply read (in both groups). All of the analysed data was read (fixation number mean was over 20), but this is the data for only 9 articles of 21. Majority of them didn't even get noticed.

#### 4. Conclusion

As the world population ages and older adults comprise a growing proportion of current and potential Internet users, understanding the state of Internet use among older adults may clarify how to support digital media use within this population. The internet is a powerful communication tool and information resource which can bring many benefits to the older population. Digital divide today is present, but results in this paper show that if we manage to remove the digital divide caused by different skills levels, older people do not show many

differences in using digital media content. If differences are present, they are here because of different interest scopes (and in this case age is important). It must be borne in mind that future cohorts of older people will (though not in every instance) have been more exposed to the internet, be it in the workplace, at home, or during their educational careers, than current cohorts. It is expected that in all likelihood, and taking account of "drop-out" rates, many people currently engaging with the internet will continue to do so in their old age. This research was aiming to investigate how do older people use digital media content and we can conclude that people who have the skills and digital competence, use the internet the same way as younger people do. Visual patterns do not differ, but the interest for different media topics is present and that is what is influencing on number of fixations (interest).

#### Notes

- /1/ Libro verde sobre la convergencia de los sectores de Telecomunicaciones, Medios de Comunicación y Tecnologías de la información y sobre sus consecuencias para la reglamentación, European Commission. COM(97) Versión 3, Bruselas, 1997.
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