ANCIENT EGYPTIAN ORNAMENTS FOR THE CONTEMPORARY FASHION

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Abstract: As an object of design of clothes, ornaments and symbols are the instrument through which they become attractive to consumers. The ancient Egyptian ornaments, their elements, shapes, colors and proportions between them are a basis for creation of modern clothing. A comparative analysis is made of websites containing digital collections of ancient Egyptian symbols and are defined their advantages and disadvantages. A program algorithm is developed to obtain raster images from vector coordinates of ancient Egyptian symbols. The algorithm is used in the creation of elements for digital collection. The collection is realized on the Internet site. Proposals are made for application of the research and developments in practice.

Keywords: Contemporary fashion, Ancient Egyptian ornaments, Digital collection, Website indexing, Comparative analysis, Image processing, Google sites

1. Introduction

To ensure compositions aesthetic integrity of the clothes the designer can build and apply in his activities varied creative approaches [4,8,9].

The motifs of ancient Egypt are an inspiration for many talented contemporary designers and artists, and the tendency to learn from them has increased in recent years. An inspiration for the designers are gods and goddesses, kings and queens of ancient Egypt, which creates a truly unexpected combinations of form, texture, color, dominance and balance the different elements reminiscent of both urban architecture and escape to a distant and deserted place even back in the past. Thus the designers make us think about real and meaningful things that surround us.

To preserve the authenticity of ornaments of ancient Egypt and the use of decorative elements in the fashion design to create patterns, decoration of clothes, at contemporary stage are applied analytical techniques and image processing [3,5,10,15].

The resulting shapes and metadata for ornament from ancient Egypt can be used for creation of a digital collection, which consists of the following main components: Collection – organized groups of objects; Objects – digitized materials; Metadata – information about objects and collections of them; Initiative for development and use – programs and projects for creating, organizing and managing of the collections. The digital collection have to consists digital objects that are selected and organized to facilitate their discovery, access, and use. Objects,

metadata, and the user interface together create the user experience of a collection [22].

Digital collections bring significant benefits to the users through the following features: Improved access; Wider access; Improved information sharing. They are typically accessed through the Internet. They can be accessed virtually from anywhere and at any time.

The aim of this work is to examine the existing digital collections of ancient Egyptian elements and symbols, and to create such that expands the range of software tools by which can be accessed the elements in it.

2. Exposure

Ancient Egyptian motifs and their ornaments received worldwide fame. World famous designers include such elements in their collections. This is not surprising because the characters are beautiful, interesting, colorful, diverse and carry a positive charge. Furthermore, they return to the old days when traditional clothes were hand-decorated. Although today operates in accordance with a modern look and with a wide range of styles, methods and modern technology go back to ancient motifs that easily integrate into modern space.

The results of extensive analysis attest to a distinct tendency of implementation of ancient Egyptian ornaments, symbols, hieroglyphs in the complementary fashion. The application of these symbols in modern fashion and for inspiration of the designers is described in detail in numerous publications, more popular ones are:

- The “Kill Star Vulture Hood Dress” is presented on Figure 1a, which according to the author, allows to add the mystery of hieroglyphics to our look with stark black and white depictions of vultures, cats, and ankhs.
- Egyptian hieroglyphic leggings (Figure 1b). Sometimes women's fashion is like hieroglyphs to those who just don't get it. The author of that leggings compare them with the writing's on the wall: “These leggings are for the sphinxes who turn heads like all the peeps in ancient Egyptian paintings. Has anyone else noticed that? They always look like a hott little boss has just walked by...”
- Zaeem Jamal is a unique brand offering collection which are stunning beautiful both aesthetically and philosophically – a design alchemy in motion. In keeping with the fashion trends of Queens and nobility who reigned over the Egyptian Dynasties, fluid silk gowns in alabaster white sweep the floor in sumptuous heavy silks featuring beautiful, gilded necklines. Each dress is diffused in a blanket of sequins and hidden symbols, creeping deliberately onto cuffs, wrapping around waistlines and entwined around necklines. Cleopatra inspires the designer’s finale dress channeling a sense of youthful glamour, with a strong sense of spirit the collection is fit for a Queen (Figure 1 c).
- John Galliano took a prolonged stopover in Ancient Egypt for Dior's couture collection. With Cleopatra as his muse, he produced awe-inspiring metallic gold headdresses and sphinx masks (Figure 1 d).

a) Vulture Hood Dress [18]

b) Egyptian hieroglyphic leggings [19]

c) Cleopatra inspired dress [20]

d) Cleopatra inspired dress [21]

Fig.1. Modern fashion with ancient Egyptian symbols

20 websites were studied, containing digital collections of ancient Egyptian symbols.

An analysis of publications is made over the last five years 2012, 2013, 2014, 2015 and 2016. 160 keywords are investigated – names of Egyptian symbols, with Google Scholar [6].

The analysis of the resulting data sets is realized with three methods ABC, HML and VED, well described in detail in [1], the results of which are combined.

- The ABC analysis is to control raw material components and work-in-progress inventories in the normal course of business. Here this method is used for measuring the change of number of publications and for analysis of the indexing of websites.
- The VED analysis is to determine the stocking levels of spare parts. It is used for analysis of the indexing of the webpages related to digital collections of ancient Egyptian symbols.
- The HML analysis is mainly to control purchases, but here it is used to assess of the use of keywords of symbols over the years.

At every stage of this work is required the use of specialized software in the field of CAD systems and tools for spreadsheets and programming.

3. Results and discussion

The results of a comparative analysis of the contents of the digital collections are presented in Table 1. The names of the topics are indicated, with which are related to the presented symbols and basic Web address where is located the website. A nomenclature is defined by numbers S1-S20, corresponding to those websites that will be used for the presentation of the survey results. The structure of the collection is evaluated in three levels depending on the conditions to navigate and search for content on the website. Besides the criteria relating to access information - whether it is free or not, is there any information about symbols, etc., is indicated and the indexation of the website in the two most frequently used search sites Yandex [16] and Google [7]. The indexing is determined by online check [2].

Table 1

A comparative analysis of Websites with digital collections of ancient Egyptian symbols

Name of the collection	General Web address	№	Structure of the Website	Required registration	Search in site options	Raster images	Vector graphs	Presentation of the symbols	Information about the symbols	Parameters of symbols	Free to download	Yandex indexing	Google indexing
Egypt and Art	http://www.egyptartsite.com/	S1	M	N	Y	Y	N	S	Y	N	Y	400	381
Egyptian Gods	http://www.landofpyramids.org/	S2	M	N	N	Y	N	S	Y	N	Y	100	128
Egyptian Symbols	http://symboldictionary.net/	S3	M	N	N	Y	N	S	Y	N	Y	700	645
Ancient Egypt	http://www.crystalinks.com/	S4	M	N	Y	Y	N	S	Y	N	Y	7000	7180
Egypt signs and symbols collection	https://creativemarket.com/	S5	H	Y	Y	Y	N	G	N	N	Y	2000000	427000
236 Egyptian Graphics	http://www.freepik.com/	S6	M	N	Y	Y	Y	G	N	N	Y	2000000	1450000
Vector Egyptian hieroglyphs	http://www.shutterstock.com/	S7	H	Y	Y	N	Y	G	N	N	N	70000000	16600000
Free Vector Egypt	http://www.vecteezy.com/	S8	M	N	Y	Y	Y	G	N	N	Y	300000	387000
Ancient egypt symbols vector	http://all-free-download.com/	S9	M	N	Y	Y	Y	G	N	N	Y	8000000	5360000
Free Vector Ancient Egyptian Symbols	https://www.123freevectors.com	S10	M	N	Y	Y	Y	G	N	N	Y	30000	692000
Egyptian Symbols	http://vector.me/	S11	M	N	Y	Y	Y	S	N	N	Y	3000000	455000
Egypt symbols silhouettes	http://www.gettyimages.com/	S12	M	N	Y	N	Y	G	N	N	N	1000000	26200000
Ancient Egyptian Symbols	http://www.ancient-symbols.com/	S13	H	N	N	Y	N	S	Y	N	Y	500	580
Egypt: Ancient Egyptian Symbolism, The Forms and Functions	http://www.touregypt.net/	S14	M	N	N	Y	N	S	Y	N	Y	10000	13800
Ancient Egyptian Gods and Symbols	http://www.artsconnected.org/	S15	M	N	N	Y	N	S	Y	Y	Y	10000	79000
Egyptian civilization, Royal Symbols	http://www.historymuseum.ca/	S16	H	N	Y	Y	N	S	Y	N	Y	10000	20800
Ancient Egypt Online	http://www.ancientegyptonline.co.uk/	S17	H	N	N	Y	N	S	Y	N	Y	500	454
Egyptian Symbol Tattoos	http://tattoos.lovetoknow.com/	S18	M	N	N	Y	N	S	Y	N	Y	500	557
Ancient Egypt, Hieroglyphics	http://history-world.org/	S19	M	N	N	Y	N	G	Y	N	Y	2000	4510
Ancient Egyptian Society and Family Life	http://fathom.lib.uchicago.edu/	S20	M	N	N	Y	N	S	Y	N	Y	2000	4510

H-very well structured; M-acceptable structure; L-poorly structured. Y-yes; N-no. G-in group; S-with single symbol

Most of the files that can be downloaded in vector form are in *.eps; *.ai; *.svg file format. The raster files are in *.jpg and *.png. EPS stands for Encapsulated PostScript, and is a variant of the PostScript format. The latter is an image format, usually in vector form. The *.ai extension is for the program Adobe Illustrator, which requires Adobe Illustrator to open. *.svg is an open standard for vector graphics similar

to Flash. The advantage with *.svg is that it can be edited with any text editor – the same way PostScript could. This is useful for software development and web site design. A *.jpg file consists of a sequence of segments, each beginning with a marker, each of which begins with a 0xFF byte followed by a byte indicating what kind of marker it is. Some markers consist of just those two bytes; others are followed by two bytes indicating the length of marker-specific payload data that follows. A *.png file is an image file stored in the Portable Network Graphic (PNG) format. It contains a bitmap of indexed colors and uses lossless compression, similar to a *.gif file but without copyright limitations. *.png files are commonly used to store graphics for web images.

There are few digital collections where the files are available in most common file format *.dwg. In the submitted web pages are not available files with symbols that are represented in other widely used programs such as spreadsheets.

Table 2

ABC-VED analysis of the indexing of websites in Yandex and Google

	V	E	D
A	S7, S9		
B	S12	S5, S6, S11	
C	S10		S1, S2, S3, S4, S8, S13, S14, S15, S16, S17, S18, S19, S20

In Table 2 are presented results of the analysis of the indexed websites. With high levels of indexing are the websites with an acceptable level of organization of the content. Two of these websitec require registration. It is observed that there are available both in raster and vector variants of the presented symbols. In these sites is preferred presentation of the symbols as a single file in one group. It is obvious that there is not presented no information about symbols. Moreover, the submitted vector and raster files can be downloaded freely.

Table 3 presents the search results in Google Scholar for use of the names of ancient Egyptian symbols in scientific publications and Internet sources. The search was conducted by insertion in the field “Custom Range” the year for which information is needed as a range, such as 2012-2012; 2015-2015. The results of this survey of the number of publications per year are presented in the table. The symbols are in alphabetical order.

Table 4 presents the results of VED-HML analysis of search results by years by keywords matching the most commonly used in practice and publishing activity names of ancient Egyptian symbols. In group V-H fall 7 symbol that shows that they are related to highest number of publications. In group E-H are 21 characters. In D-H falls only one symbol. In V-M the symbols are two. The largest number of symbols fall into the group E-M, they are 55. In the group D-M the symbols are 32. In B-L does not fall within none of the symbols. in E-V is one symbol. In the group D-L, where at least the symbols used, they are 14.

The examination with first derivative characteristic change the number of publications by year showed that seven of the symbols are an increasing function, 126 do not change for the study period and 27 have a decreasing function.

Table 3

Number of publications by year for symbol names

Symbol name	2012	2013	2014	2015	2016	Symbol name	2012	2013	2014	2015	2016
Abtu	3	7	3	3	2	Mortuary	504	651	615	589	278
Aker	55	57	55	65	26	Mummy	566	605	568	507	228
Akh	92	83	82	100	34	Mut	264	324	300	301	138
Akhet	92	83	82	100	34	Naos	89	77	83	48	37
Amarna	282	383	325	316	152	Natron	99	89	101	84	33
Amenta	22	17	39	24	15	Nebu	47	52	138	49	18
Ammut	7	13	8	8	6	Necropolis	347	518	443	444	196
Amulet	423	462	427	405	169	Neith	90	88	85	86	52
Amun	236	268	291	254	127	Nekhbet	23	39	24	35	15
Ankh	200	221	222	199	90	Nemes	48	61	44	46	23
Anrosphinx	0	0	0	0	0	Nephthys	87	87	80	76	39
Anthropoid	89	96	103	98	45	Neter	43	37	39	26	14
Anubis	249	271	227	334	111	Neter-Khertet	0	0	0	0	0
Apis	264	320	374	281	101	Nilometer	24	29	25	20	13
Aquert	0	0	0	0	0	Nine	7450	8070	8060	7210	3490
Atef	97	97	100	105	44	Nome	310	310	326	307	133
Aten	146	179	167	150	55	Nu	1340	1410	1260	1100	474
Ba	3170	3430	3640	3090	1360	Nut	745	878	826	682	315
Bakhu	0	3	2	1	5	Obelisk	374	426	393	429	184
Barque	80	95	95	93	41	Ogdoad	26	38	26	35	22
Bastet	57	55	65	59	29	Opening	7120	7640	7690	6840	3360
Benben	24	25	26	31	6	Opet	41	52	33	32	9
Bennu	19	13	21	22	10	Osirid	1	4	2	1	0
Birth	8510	9350	9370	8350	4040	Osiris	883	979	1130	841	402
Book	13300	14500	14400	13100	6430	Ostracon	65	101	89	98	33
Canopic	71	91	83	77	25	Pantheon	2050	2170	2310	2040	1070
Cartonnage	28	33	38	34	11	Papyrus	1370	1560	1440	1360	600
Cartouche	138	188	139	160	69	Pet	1560	1600	1640	1440	660
Cenotaph	95	123	119	126	60	Praenomen	37	42	44	26	12
Coffin	1410	1420	1480	1300	581	Pronaos	38	38	46	38	15
Colossus	369	394	340	316	156	Prophet	3660	3900	3890	3560	1670
Criosphinx	1	0	3	1	0	Propylon	16	29	31	16	18
Deshret	2	3	7	6	4	Pshent	2	4	0	2	1
Divine	6769	7150	7130	6560	3140	Ptah	237	232	215	212	91
Djed	40	54	52	47	15	Pylon	111	119	109	110	58
Djew	2	1	1	3	1	Pyramid	1530	1630	1580	1390	681
Dromos	41	68	61	45	27	Pyramidion	11	17	26	16	7
Duat	43	39	43	47	13	Ra	3190	3540	3680	3140	1530
Electrum	95	109	143	79	44	Red	7120	7860	7910	7020	3410
Ennead	60	100	68	86	38	Rock-Cut	158	199	199	203	83
Faience	172	232	216	201	82	Sa	5460	5790	5980	5220	2580
Fecundity	505	558	569	478	244	Saff	21	19	22	26	7
Flagellum	32	36	37	35	11	Sarcophagus	491	559	493	503	212
Flame	1930	2050	1940	1830	817	Scarab	195	260	217	200	82
Funerary	1090	1340	1270	1190	530	Sed	795	979	991	883	363
Geb	138	151	175	153	76	Sekhem	14	25	22	22	5
Hapi	43	53	47	39	19	Sekhet-Aanru	6	5	3	2	2
Hathor	273	332	257	266	137	Sekhet-Hetepet	6	3	0	0	1
Hedjet	0	0	0	0	0	Sekhmet	83	62	75	72	36
Hieracosphinx	0	0	1	0	0	Sema	72	90	106	70	57
Hieratic	265	318	279	277	109	Sepat	4	1	5	3	0
Hieroglyph	292	362	371	344	151	Sesen	0	2	4	1	3
High	14900	16300	16200	15000	7400	Set	15100	16300	16200	14800	7280
Horus	591	629	669	545	255	Seth	737	727	771	737	367
Hypostyle	49	73	89	72	23	Shawabti	17	28	19	12	12
Ibu	48	75	49	61	21	She	12000	13200	13000	11800	5720
Ieb	18	13	12	6	4	Shen	348	400	436	447	203
Isis	1040	1090	1380	1420	789	Sistrum	67	61	56	59	30
Ithyphallic	47	65	60	58	29	Sobek	56	63	66	74	30
Ka	1810	2110	2210	1920	902	Sphinx	711	813	705	675	333
Khepresh	6	3	3	7	6	Stela	238	310	342	289	141
Khepri	33	45	35	32	14	Talatat	9	13	11	14	3
Khet	16	21	11	17	10	Taurt	3	15	7	2	1
Khnum	58	75	76	75	31	Theban	311	410	392	333	141
Khu	57	63	65	50	26	Thoth	367	336	360	309	148
Lector	208	221	210	187	100	Tiet	8	10	8	11	1
Lotus	531	612	560	524	258	Tuat	35	32	41	42	13
Maat	179	241	209	193	85	Udjat	19	11	18	13	10
Mammisi	24	16	12	20	12	Underworld	1530	1650	1710	1520	706
Manu	1250	1470	1490	1240	492	Uraeus	88	95	76	87	46
Mastaba	45	97	99	82	36	Ushabti	7	10	17	8	4
Menat	34	30	35	25	6	Wadjet	28	33	31	38	16
Menhed	0	0	0	0	0	Was	13800	15300	15300	14000	6830
Min	2880	3280	3370	2890	1460	Winged	1330	1530	1390	1330	591
Mistress	1350	1510	1350	1270	597	Zodiac	381	383	397	326	157

Table 4

Combined data from VED and HML analyses

	H	M	L
V	Amun, Lotus, Min, Sa, Set, She, Was	Ba, Ka	
E	Anthropoid, Atef, Bastet, Cenotaph, Fecundity, Geb Hathor, Isis, Ithyphallic, Lector, Mortuary, Mut, Neith, Nephthys, Obelisk, Sekhmet, Sema, Shen, Sistrum, Sphinx, Uraeus	Aker, Akh, Akhet, Amarna, Amulet, Ankh, Anubis, Apis, Aten, Barque, Canopic, Cartouche, Coffin, Colossus, Dromos, Electrum, Ennead, Faience, Flame, Funerary, Hieratic, Hieroglyph, Horus, Hypostyle, Ibu, Khnum, Khu, Maat, Manu, Mastaba, Mistress, Mummy, Naos, Natron, Necropolis, Nome, Nu, Nut, Osiris, Ostracon, Papyrus, Pet, Ptah, Pyramid, Rock-Cut, Sarcophagus, Scarab, Sed, Sekhmet, Sobek, Stela, Theban, Thoth, Winged, Zodiac	Nebu
DD	Ogdoad	Abut, Amenta, Ammut, Benben, Bennu, Cartonnage, Deshret, Djed, Flagellum, Hapi, Ieb, Khepresh, Khepri, Khet, Mammisi, Menat, Nekhbet, Nemes, Neter, Praenomen, Pronaos, Propylon, Pyramidion, Saff, Sekhem, Sekhet-Aanru, Shawabti, Talatat, Tiet, Tuat, Udjat, Ushabti	Bakhu, Criosphinx, Djew, Hedjet, Hieracosphinx, Menhed, Neter-Khertet, Opet, Osirid, Pshent Sekhet-Hetepet, Sepat, Sesen, Taurt

The results of the analysis of the use of studied ancient Egyptian symbols are used to develop a collection of 40 of them. On the Internet sources are found bitmaps of the symbols. They are vectorized by program algorithm, presented in previous studies [17], and the coordinates of the points were preserved in *.mat files.

In the present work is designed program algorithm for conversion of vector coordinates files for each character back in raster format. The purpose of this conversion is to obtain parameters of an ancient Egyptian symbols such as short axis, long axis, perimeter, area and calculating the ratios between them.

Table 5, presents the steps of the algorithm and its pseudocode. Functions are used to create raster image, conversion to black and white and calculating the parameters of the closed contour.

Table 5

Algorithm for conversion from vector to raster image

Stage	Function	Pseudocode
A	Loading coordinates of the the symbol from *.mat file	`load a40` `x=a40`

B	Conversion of vector coordinates in raster format	`g=figure`
		`set(gca,'xtick',[],'ytick',[])`
		`fill(x(:,1),-x(:,2),'r','linewidth',2)`
		`axis off`
		`f1 = getframe(gcf);`
		`[v, f2] = frame2im(f1);`

C	Converting the image in black and white	`v=im2bw(v)`
		`v=double(v)`
		`v=imcomplement(v)`

D	Separation of contour of the object in the image	`figure; hold on; imshow(v)`
		`B = bwboundaries(v);`
		`for k = 1:length(B)`
		`  boundary = B{k};`
		`end`
		`c3=[boundary(:,2), boundary(:,1)]`
		`plot(c3(:,1),-c3(:,2),'r','linewidth',2)`
		`grid on`

E	Obtaining of parameters of the object	`s = regionprops(v,'all');`
F	Calculating ratios of the symbol	$\frac{d_f}{D_f}$; $k_s = \frac{D_f}{d_f \cdot 100}$; $k_s = \frac{A_f}{A_{ca}}$; $k_x = \frac{A_f}{A_{bb}}$; $k_{pa} = \frac{P_f}{A_f}$ d_f – short axis; D_f – long axis; A_f – area of figure; A_{ca} – convex area; A_{bb} – area of bounding box; P_f – perimeter of figure

An example of the work of the algorithm for conversion from vector to raster image and determination of the parameters of object is presented in Figure 2. The coordinates of an ancient Egyptian symbol are loaded from a file (Figure 2a).

a) Loading coordinates of the the symbol from *.mat file

b) Conversion of vector coordinates in raster format

c) Converting the image in black and white

d) Separation of contour of the object in the image

e) Obtaining of parameters of the object

Fig.2. Visualization of the algorithm stages

In figure 2b is shown the resulting raster image, and then, converting it into binary, as shown in Figure 2c. The extracted contour of the object from the binary image is shown in Figure 2d. From this circuit are derived parameters and coefficients of the object, they appear in tabular form (Figure 2e).

The total processing time of each symbol is 6,20s. Total of 215 operations are Executed. The maximum number of calls to an operation is 200 times, and minimum 2. The calculations are based on 24 basic variables.

Table 6, presents in summary form the results of algorithm work for determination of the parameters of ancient Egyptian symbols. Five parameters were examined. There is a small standard deviation and coefficient of variation of less than 30% at all the parameters of the symbols. The standard error is up to 2%.

Table 6

Descriptive statistics for all symbols

Coefficient / Parameter	Short axis over long axis	Eccentricity	Solidity	Extent	Perimeter over area
Mean	0,787	0,588	0,600	0,479	0,043
Standard Error	0,019	0,023	0,017	0,015	0,002
Median	0,817	0,576	0,594	0,492	0,039
Standard Deviation	0,117	0,148	0,109	0,098	0,012
Coefficient of variation	0,149	0,251	0,182	0,204	0,284
Sample Variance	0,014	0,022	0,012	0,010	0,000
Kurtosis	0,580	0,596	-0,475	-0,887	1,176
Skewness	-0,978	-0,178	0,222	0,219	0,864
Range	0,513	0,716	0,439	0,355	0,060
Minimum	0,473	0,165	0,405	0,318	0,022
Maximum	0,986	0,881	0,844	0,673	0,082

The data for ancient Egyptian symbols, raster and vector files were used in constructing of a digital collection that was put into up for this purpose Internet site.

The first important step in the development of the website is the choice of programming language and platform.

The modern Internet sites are designed primarily to HTML, Java (JavaScript) and PHP, each offering its own advantages and disadvantages. HTML provides many opportunities for the creation of static sites. Java (JavaScript) is perhaps the most currently used language for the creation of Internet applications, but is dependent on

the browser. PHP is a widely used language mainly for server applications and the development of dynamic web content.

The main advantage of an online website builder platform is that it is quick and easy to use, and often does not require prior experience. Often, a website can be built and be up and running live on the Internet. Technical support is provided, as are how-to video and help files. Though there are many general websites builders that can easily find an online website builder created especially for a specific niche, with features needed for this niche.

To build the website of the digital collection is selected complete platform. It was chosen Google Sites. The reason is that today, a growing number of people are using Google Sites as part of Google business apps to build their company intranets and internal project sites. Google Sites makes it easy to create secure web pages with the capacity to support intranet, team projects or client extranets. Easy in the sense that really do not need HTML coding or web design experience to get Google Sites operating system up and running. With Google Sites can be used its cloud based capability to centralize presentations, documents, spreadsheets, slideshows, videos, and more, which is good for collaboration requirements. Google Sites comes with Google apps as a fully hosted offering. Do not need any software to deploy or servers to maintain.

In creation of the website for the digital collection are used the results of this research to existing websites on this theme. It is considered how are organized these sites, their realization, how these sites are complete, how is presented the information. The need for current study arose in order to outline the proper model for development and to explore what the user intuitively expects to see in this type websites.

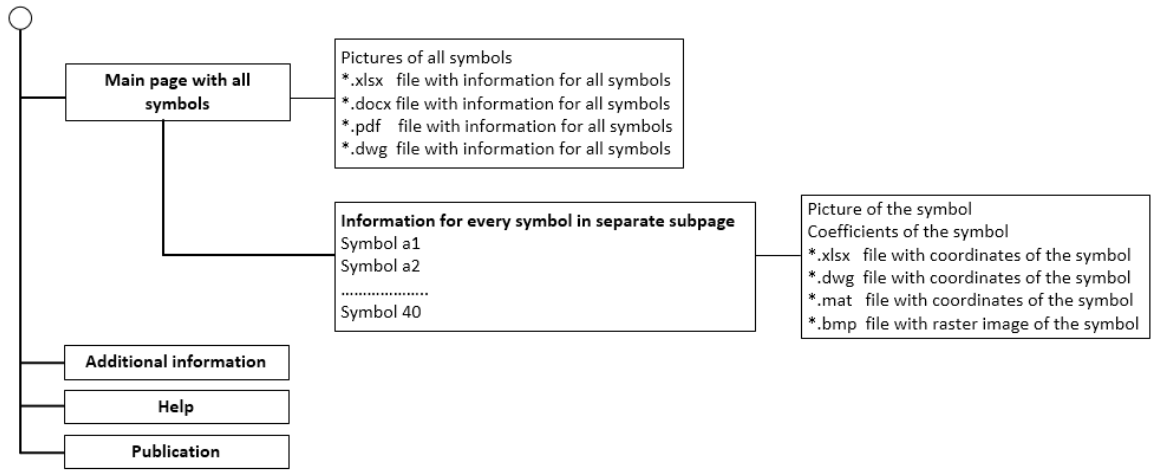
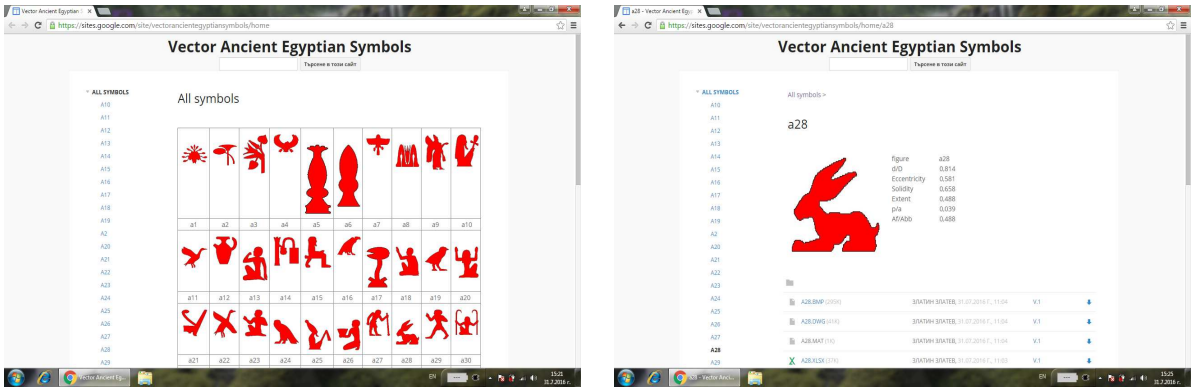


Fig.3. Structure of the created website

Defined web site structure (Figure 3) contains four main pages and subpages for each symbol. The main page contains all of the symbols with their raster and vector files. Additional information where are summarized the results of the study. Another important part is the help information to users where are made some brief remarks on the importance of symbols and the parameters of used file formats. In the final part of the main menu is presented this article in Section "Publications". The sub-pages of each symbol contained raster image of the symbol in *.jpg file format, coefficients of a

particular symbol and CAD files in formats *.dwg, *.mat and *.xlsx and raster image in *.bmp file.

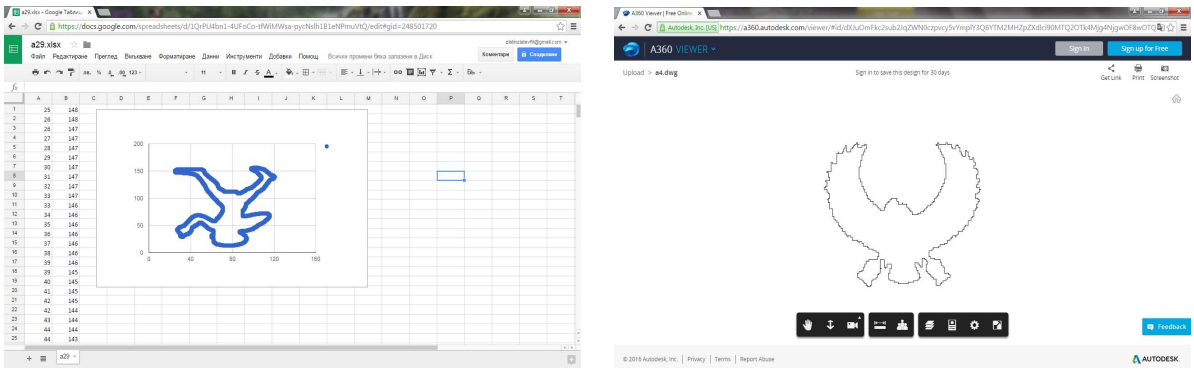
The website is designed to keep the user's attention early on. This requires effectively appearance. For this purpose it is created main page with all of the characters. From this home page the user can select each symbol and receive information for it (Figure 4).



a) Main page with all symbols b) Information and files for one symbol

Fig.4. Website with vector ancient Egyptian symbols

The files with raster and vector images can be downloaded free from the users of the website. In addition to the basic software that can open these files as a *.dwg with AutoCAD, *.xlsx with MS Excel, they can be visualized with free online application that support the appropriate file format. An example of the aforementioned is presented in Figure 5, where the *.xlsx file is opened with the online application Google Sheets, and *.dwg via Online AutoCAD viewer.



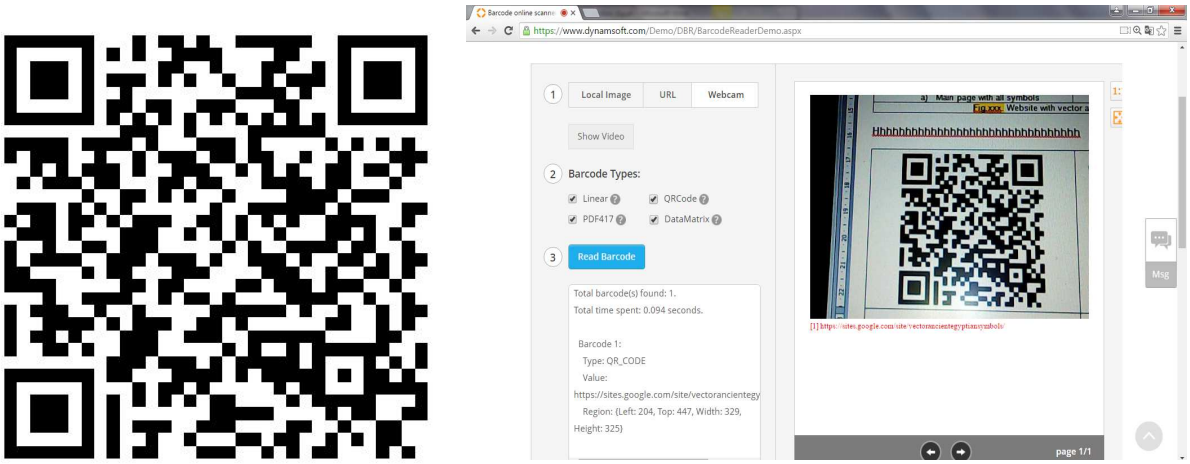
a) Google Sheets
https://www.google.com/sheets/about/

b) Online AutoCAD *.dwg viewer
https://a360.autodesk.com/

Fig.5. Visualization of the symbols with online viewers

For quick and easy access to the digital collection of ancient Egyptian symbols and in its website is generated QR code (figure 6). Having a website and using QR code with it can place a positive first impression of the user's mind. By incorporating QR code, user doesn't have to dial any numbers or even click anything to get where he wants to go.

For processing of the QR Code is used online application "Barcode Reader". The same application can be used in processing of bar-codes. One-dimensional bar-codes have not found extensive use in the area of presentation of websites.



a) QR code of the created website

b) Recognition of the QR code https://www.dynamsoft.com/Demo/DBR/BarcodeReaderDemo.aspx

Fig.6. QR-code of the main webpage

Prior to formulate a conclusion, and to summarize the results of research and development in this report can make a discussion on the possibilities for the application of the results.

The results of this study can be used for formulation of methodology for research and analysis of websites for digital collections, creation of software tools for image processing and generation of web content:

- On the first stage is a survey of existing digital collections containing ancient Egyptian symbols;
- On the second stage based on the indexing of websites, data are analyzed with the appropriate mathematical apparatus and the results are summarized;
- On the third stage have been studied the most commonly used ancient Egyptian symbols for the last five years and the results are analyzed and selection is made of the most frequently used symbols;
- On the fourth stage are developed software tools for the analysis of these symbols using techniques for image processing;
- On the fifth stage, based on analysis of existing websites and information on the selected symbols is built website that complements existing digital collections with a less widely used file formats for vector representation of symbols and information about them.

The results of the research can be applied in the training of future professionals in studying the shape formation and design of garments.

The research and results can also be used in the creation of virtual laboratories for training that are subject of study in contemporary publications [11,12,13,14]. This is important for modern education because the conduct of traditional laboratory is often limited for various reasons such as cost of implementation, problems with the schedule of classes, limitation of space in school laboratories. For these and other reasons, many researchers are turning their attention to virtual laboratories as an effective tool to conduct laboratory classes.

4. Conclusion

Analyzing the results of the research can be concluded that the symbols are an important element in the design of clothing and instrument through which the product becomes attractive to the consumer.

Ancient Egyptian symbols and their elements are the basis for the creation of modern clothing.

For ease of use of decorative elements on clothing to create patterns, decoration of clothes, at contemporary stage are applied analytical techniques and image processing. The resulting shapes and metadata for symbols from ancient Egypt are used for creation of digital collections.

A comparative analysis of websites containing digital collections of ancient Egyptian symbols showed the highest level of indexing and corresponding demand by consumers are those containing vector images of these symbols.

160 of the most commonly used in practice an ancient Egyptian symbols are analyzed and through numerical analysis 40 of them are selected.

Developed and used are software tools to convert raster images into vector to obtain ratios in the dimensional characteristics of the studied symbols.

The results of the research, analysis and developments are used to create a digital collection containing vector and raster images of ancient Egyptian symbols and their dimensional characteristics. The collection is put into constructed for this purpose website.

The created collection complements the existing ones with vector images in less common file formats.

The results of the research can be applied in the training of future professionals in studying the shape formation and design of garments.

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