вкладиша і повертаються назад у вихідне положення на той же виток гайки.

ШГП виконують з однією або частіше з двома гайками, встановленими в одному корпусі. У конструкціях з двома гайками найбільш просто виключити осьової зазор в сполученні гвинт-гайка і тим самим підвищити осьову жорсткість передачі і точність переміщення. Усувають осьовий зазор і створюють попередній натяг шляхом відносного осьового (наприклад, за допомогою прокладок) або кутового зміщення двох гайок.

Найбільшого поширення набув напівкруглий профіль канавок з радіусом, що перевищує на 3 ... 5% радіус кульок, і з кутом контакту α = 45 °.

Успішно застосовують також профіль «стрільчата арка», який складніше у виготовленні, але дозволяє створити попередній натяг підбором діаметрів кульок.

Прямолінійний профіль різьблення (трикутний, трапецієподібний) є найбільш технологічним, але значно поступається по навантажувальної здатності криволінійному (так допустиме навантаження на шарик, що знаходиться в жолобі з профілем у вигляді дуги кола, більш ніж в три рази вище допустимої навантаження на шарик, що лежить на плоскій поверхні трикутного або трапецеїдального профілю). Тому прямолінійний профіль різьблення застосовують в ШГП для сприйняття невеликих осьових навантажень в приладах.

III. Висновки

В фотополімерному 3D – принтері для переміщення робочого столику краще застосовувати ШГП так, як ця передача володіє наступними перевагами:

- малі втрати на тертя. ККД передачі досягає 0,9 і вище (збірка без попереднього натягу);
- висока несуча здатність при малих габаритах;
- низький коефіцієнт тертя спокою і висока кінематична чутливість (можливість отримання малих і точних переміщень);
- відсутність осьового і радіального зазорів (мертвого ходу);
- надійна робота в широкому діапазоні температур в вакуумі;
- малий знос робочих поверхонь гвинта і гайки, що забезпечує високу точність і рівномірність поступального руху;
- високий ресурс.

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Determining the productivity of UI web systems in the context of use

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Abstract: In this paper the importance of the Web-systems in the work of modern business processes is considered. The relevance of the issue of increasing the competitiveness of sites in the context of increasing the number of Internet resources is presented. It is proved that the most important aspect in developing an attractive for the user site is usability – a characteristic that describes how effectively the user can interact with the product. In order to achieve the real goal of usability, certain technologies and methods of assessment are needed, which is being developed by an increasing number of analysts and scientists.

Keywords: website, usability, testing, Eye tracking, parametric model, reengineering.

I. INTRODUCTION

We live in an information society with inherent, different then before, speed and ways of creating and receiving information, methods of working with it, the global nature of information networks and the information field, communication possibilities [1]. It is now clear that information and communication technologies are the most influential in all areas of human life [2].

The new ideology of Web-production is helping to attract small and medium-sized enterprises to the electronic markets, enabling them to buy sufficiently functional solutions that meet their objectives at a reasonable price. One of the benefits of doing business on the Internet is reducing the number of intermediaries in the chain "manufacturer - distributor - dealer - retailer - buyer" [3]. The existing business classification identifies several business models that have their own construction methodologies, list of participants, inputs and outputs [4]. Since the most important link in the e-business are the clients of the company, the B2C model (the business is aimed at the end consumers – individuals) is chosen for consideration in this work.

This category of business includes a large number of e-commerce businesses: online stores, paid services for individuals, numerous companies selling consulting and information services. The B2C structure of the company includes the following components: an interactive Web site that performs the functions of a front office, shop windows; customer support; logistics service and others [4].

A website is a kind of interface between an enterprise and its environment - partners, suppliers, clients. So, it can be argued that the website, in this case, has taken on functions and tasks that many specialized services and departments perform in the ordinary enterprise. This is an attractive option for the company also because the cost of creating and promoting a site is much less than building a company structure.

Current trends lead to the fact that each company has a website that contains information about the company's services and catalog of its products. With the growing number of companies active in one area, the user is faced with the question of which company's services to use, and often the potential customer makes the choice for the company that has the most attractive or convenient website [3].

Most businesses use standard modular grids that are most user-friendly for their web pages, creation of which must take into account the mathematical models of modular grids that are suitable for the specific task. Using them with competent application can make the design of Internet resources more attractive and convenient, increase the functionality of sites [5].

II. ANALYSIS OF EXISTING METHOD OF EASY ASSESSMENT

Usually, users evaluate everything by their appearance, sites are no exception [6]. Users in this case are a wide range of people whose qualitative characteristics (age, gender, physical and psychological characteristics) are expanding every year. This additionally requires adaptation of the site design for individuals of different segments of the population, incl. the elderly, the visually impaired, with color blindness, etc., which will contribute not only to the increase of number of users of the site, but also to ensuring the principles of accessibility of information.

That is why, given the contingent of users, design activities require additional tools to evaluate the quality and convenience of graphic and multimedia products, including from a psychological and ergonomic point of view [6]. Achieving a real *usability* goal requires certain technologies and assessment methods that have been in develop for a long time [7], but so far there is no clear metrological assurance of the research data (number, age of respondents, health restrictions), which complicates work in this area and makes the obtained indicators probable. This, in turn, raises the need for scientific research into the quality and convenience of multimedia products, how they present this data, and how they are interpreted to design the human-computer interface.

Usability tries to explain human behavior in complex systems in very specific circumstances, and therefore its results are less accurate than in sciences such as mathematics or physics. Thus, we can argue that usability in it's recommendations relies on past experiments and experiences rather than exact formulas [8]. There is an opinion that usability is practically unmeasurable: "usability cannot be measured quantitatively ... one can only say that it is more convenient to work with one system than with another". However, this only indicates that no specific metric is currently available to calculate [9-10].

Usability as a scientific discipline began to emerge in the 50's of the XX-th century. Until the mid-1990s, usability engineering seemed to be a fully formed field of activity based on a fundamental scientific base, thematic monographs. [11] and to an international standard ISO 9241-11: 1998 [12].

The first known attempt to parametrically describe the concept of "usability" was proposed by J. Nielsen: $B = V \cdot C \cdot L$, where B – is the business effect of the site; V – number of unique visitors; C – conversion rate (conversion of visitors to customers); L – loyalty level (reflects repeat visits, average order size, etc.) [11] (fig. 1). Web site usability is traditionally thought to affect C and L, although for loyalty, the effect is not entirely straightforward and accounts for about 1/3 of changes to that metric [13]. However, nowadays, usability affects V as search engines have begun to consider so-called behavioral factors in website ranking [13].

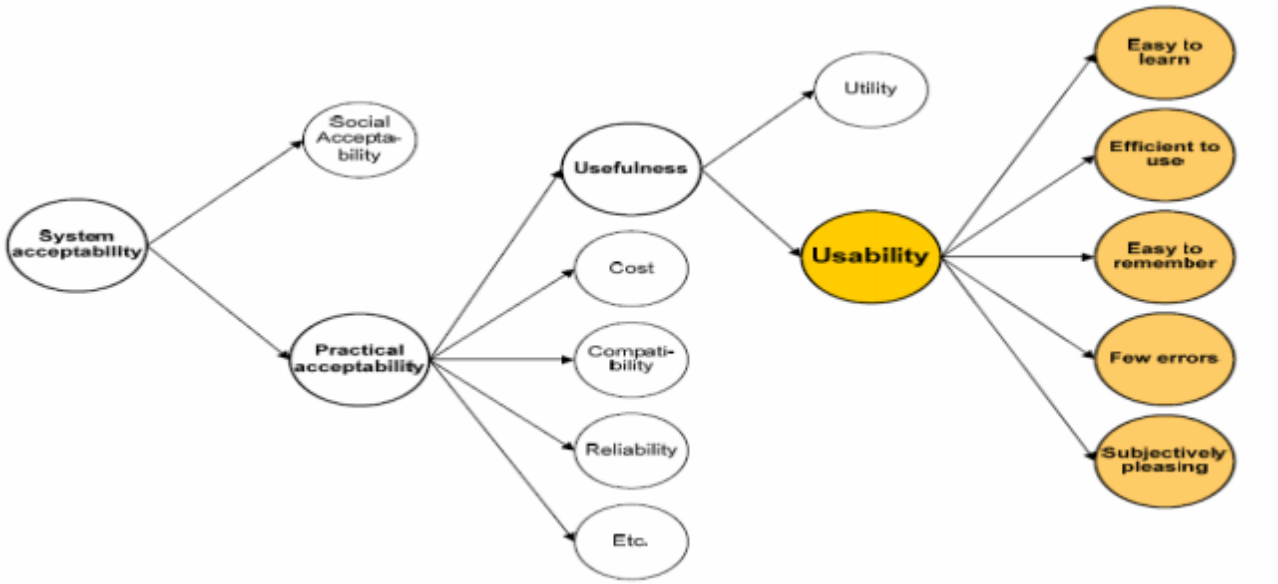

Fig. 1. System Acceptance Attributes Model (Nielsen, 1993) [13]

Design should also consider people's ultimate ability to process information, make decisions, and act accordingly. These human qualities have been carefully studied in recent decades, taking into account human-computer interaction.

The researchers cited are, for example, Hicks (1952), Fitts (1954) [14], or Miller (1956) [15]. William Hicks was a pioneer in experimental psychology and ergonomics. One of his most famous studies has focused on the time it takes a person to make decisions as a result of possible options, given the cognitive capacity of information, which has been expressed as a formula known as Hicks law.

Paul Fitts was a human factor psychologist and pioneer who developed a mathematical model of human motion known as Fitz Law based on aimed fast-moving motion. This model is used, in the field of ergonomics and human interaction with the computer, to predict the time it takes to quickly reach the target area, such as pointing with a hand or finger, or using a pointer to the computer interface.

George Miller was a cognitive psychologist who studied the average capacity of a person's working memory to store information. His research concluded that the average person can hold in memory a number of objects at 7 ± 2. This is known as the Miller Law or "magic number 7". One important consequence of this finding is the ability of an individual to evaluate and judge alternatives that are limited to 4 to 8 variants. Placing all these research contributions into a simple set of design principles is problematic, so another approach is to define heuristics to evaluate the usability of interfaces.

International standard ISO 9241-11: 1998 Guidance on usability [12], in turn, defines three aspects of usability as properties: performance, productivity, satisfaction. But the same standard proposes usability to be understood more broadly, including aspects of emotions and perceptions typically associated with user experience. If objective data on performance and effectiveness cannot be obtained, subjective measurement methods based on user perceptions of products can be used [12] (fig. 2).

III. Development of Parametric Model of Usability Assessment

Traditional usability research methods often reveal the inconvenience of user interaction with the product, but often cannot answer why. Quality and usability assessment of a business site is performed only based on indicators that can be verified by certain criteria, so the methods of usability expertise and usability testing are used. Usability expertise provides a qualitative assessment of the site and usability testing – quantitative [16].

This paper discusses the possibility of creating a parametric model for determining convenience based on known usability expertise and usability testing methods. It is known that by [12] *UI = efficiency (S), satisfaction (T), productivity*. If S and T can be determined by the results of a survey of respondents (receipt of checklists), then the "productivity" can be determined only when performing usability testing with Eye Tracking technology.

In this case, "Productivity" is presented as "areas of noticeability" and "areas of interest": Productivity = areas of noticeability (N) – many modern methods of constructing modular grids, areas of interest (P) – many descriptions of patterns ("Reading Gravity"). Thus, we define the basic parameters that are required to solve the task *UI=<M, S, T, P, N>*.

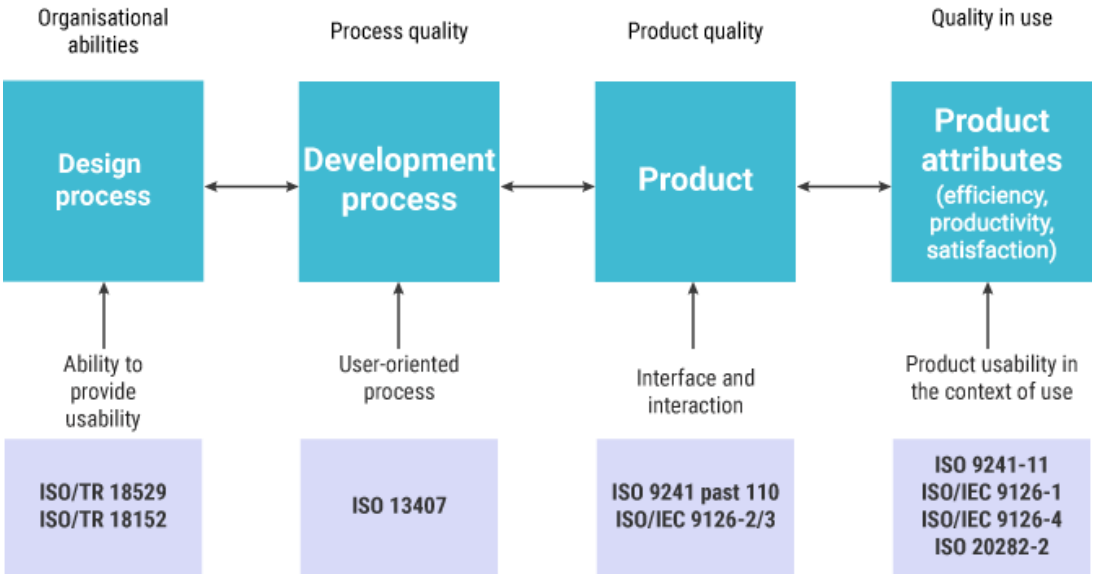

Fig. 2. Usability standards classification

Users are recognized as the main element in the evaluation process. Users in this case are a wide range of people whose qualitative characteristics (age, gender, physical and psychological characteristics) are expanding every year. This additionally requires adaptation of the site design for individuals of different segments of the population, incl. the elderly, the visually impaired, with color blindness, etc., which will contribute not only to the increase of number of users of the site, but also to ensuring the principles of accessibility of information. Denote them by M with possible classification $M=\{M_b, M_e, M_i, M_t, M_o\}$, where M_b – main users (14 - 24 years); M_e – experienced users (25 - 44 years); M_i – inexperienced users (45-60 years); M_t – third generation users (60+ Years). You can enter an additional gender metric for this section M_b ($M_{bv} – M_{bm}$, $M_{ev} – M_{em}$, $M_{iv} – M_{im}$, $M_{tv} – M_{tm}$), M_o – others (division by age and physico-psychological characteristics) [17].

S – conditional set of site design (by purpose) where S_v – business card site; S_k – corporate site; S_P – promotional site; S_F – showcase-website; S_i – all possible site ranking options. It should be borne in mind that the set S may contain subsets that indicate the specifics of the site under study, as an example, give a description of the element of the set $S=\{C_E, C_S, C_P,\ldots, C_j\}$, where C_E – electronics store; C_S – construction shop; C_P – trading platform; C_j – all possible variations of e-shops.

T – set of design quality assessment options; $T=\{T_1, T_2, T_3, T_4,\ldots,T_n\}$ where T_1 – efficiency; T_2 – ease of use; T_3 – usefulness; T_4 – emotional attractiveness; T_n – other satisfaction ratings.

Set the rating scale using the user-defined linguistic and numerical values, for example, give the following rating scales:

$$T_2 = \begin{cases} 1, \textit{ simple and convenient} \\ 0, \textit{ inconvenient} \end{cases}$$

$$T_4 = \begin{cases} 80 \le T_4 \le 100, \textit{ like} \\ 60 \le T_4 \le 79, \textit{ rather like} \\ 40 \le T_4 \le 59, \textit{ rather don't like} \\ 0 \le T_4 \le 39, \textit{ don't like} \end{cases}$$

The proposed rating scale will allow a comprehensive assessment in the test groups to determine the correctness of the proposed UI.

Synthesis of the method of weighting coefficients and empirical experience is used to determine the "degree of importance" of a given coefficient. In this case, you need to assemble a team of experts and test the most popular sites, according to user qualifications and rankings in the international search engine, in accordance with the proposed theory. To obtain adequate data, it's necessary to create at least 3 groups divided by age.

It is known that about 80% of information is perceived by the person through vision. Using modern web design technologies, it is possible to influence this feeling by attracting attention to the object of design, to achieve the necessary degree of perception by potential clients of the site. The result of good design is a well-known essence that performs its functions better than it did them before this design variant. Graphic design affects the emotional component of the consumer decision-making process, which is especially important for promoting ideas and content [2]. In addition to answering the questions, you need to use an "intensity map" obtained with the Eye Tracking system, which will show which visual objects the user is paying attention to and determine the trajectory of the pattern.

Therefore, for further research, the existing relationships between user attention and the modular grid that the page was designed for are considered [18], that is, it is necessary to take into account the conventional arrangement of the basic elements of the

page, which causes the emergence of such a concept as "reading gravity", or "pattern", which returns readers to the logical axis of orientation, accelerating the reading and comprehension of text. Basically reading the text is based on: F-pattern; Z-pattern; a golden triangle; Gutenberg diagram. Then P is the set of pattern descriptions (Reading Gravity); $P=\{P_F, P_Z, P_T, P_G\}$ where P_F – F- pattern; P_Z – Z-pattern; P_T – golden triangle pattern; P_G – Gutenberg diagram pattern.

N – set of modern modular grid construction methods; $N=\{n_1, n_2, n_3, n_4, n_5\}$, where n_1 – construction based on Fibonacci numbers; n_2 – the rule of thirds; n_3 – sine wave design; n_4 – the principle of the Golden Rectangle; n_5 – the principle of "golden section".

IV. CONCLUSIONS

The analysis of existing usability studies and standards allowed us to develop a parametric model for usability assessment. Based on this model, a reference sample for comparison with the obtained by technology Eye Tracking can be created. Next, the image analysis will be performed in the MathLab environment by the resulting matrices, the elements of which will capture the color of the image point: 0 – black, 255 – white.

As a result of the processing of the resulting image matrices, we get areas of high attention of users that will coincide / do not coincide with the areas that the developer wants to highlight and on this basis we can develop recommendations for site reengineering.

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