THE DEVELOPMENT OF INFORMATION DATABASE FOR DESIGNING OF HATS

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***Abstract**: The article deals with the problem of designing hats. As follows from the analysis of the design processes the information base used in the solution of design tasks are cross-cutting, this mainly refers to anthropometric databases. There was conducted a consumers' survey that showed that the main complaints about hats concern their bad fit, discomfort and pressure that hats make on certain parts of the head. As follows from the research of the supporting surfaces of a human head there are 8 types of three-dimensional forms.*
***Key words**: design, construction, anthropometric base, design database, stages of designing, hats.*

1 INTRODUCTION

The development of the garment industry in Ukraine has the priority areas of research to develop new modern methods of product design, such as automated systems for intensification of process design process and improvement of the quality of work. The analysis of the nature and structure of the stages of the design process revealed that each component of the design process, such as design, engineering and technology integrated into each other at the information level, and information components meet in various stages of design. Improvement of the design hats process requires optimization of informational database. Past studies have shown the need to develop the classification of space forms bearing surfaces of the human head.
The aim of this study is to determine the characteristics of a single original project design framework for designing hats.

2 THE STRUCTURE OF THE DATABASES FOR DESIGN-DESIGN

Modern industrial production is growing rapidly and uses computers more and more often. High demand on clothes, namely on hats, is determining and forming requirements that are mainly connected to the demand and manufacturing. Nowadays, the activity of manufactures is occurring in the conditions of high competition, amplification of manufacturing processes and lack of resources. The process of construction is being formed by the set of basic constituents, each of which is being made with a certain specialist (Figure 1). The process of designing is composed from three stages: draft design, constructive design and technical project.
Nowadays each stage of design construction is realized with a separate specialist. It retards projecting process and worsens its final result. The analysis of a character and structure of stages of the process of construction [1, 7-9] allowed determining, that each constituent part of the construction process is integrated in one another. Relatively designer, constructive and technical projects are interconnected informatively, and final information is used to complete one or another task on a certain stage of draft designing reechoes with the constructive design and technical project.
The survey had revealed the fact that the task is not being solved in complex, because each stage of it is being completed by different

specialists, which retards the construction process. Also the adaptation of existing informational database and development of total database for provision of transparent construction is required. The informative base is needed to provide designing and manufacturing of a garment for a typical and untypical figure type (Figure 1). The problem of transparent designing is actual and up-to-date nowadays and is being realized in CAD system.

The analysis of stages and ways of designer projects realization in modern manufacturing had shown that its implementation is being formed from the following tasks: determination of visual structure, determination of anthropomorphic structure, creation of the material structure.

The question of forming of visual structure has been envisaged in many scientific works and articles connected to solutions of the project in a virtual environment. Modern automatized methods of graphic images forming allow deciding the problem of adequacy of draft interpretation, which has no real scale or scope and proportions if it is created in a traditional way (painting of imaginary picture or drawing of a designer). Besides, such draft cannot be used in further automatized construction of clothes and hats [2-5]. Determination of anthropomorphic structure is above all connected to the parameters of anthropometric structure of human's head that allows determining a type of a head and its size to complete the designing project (Figure 2).

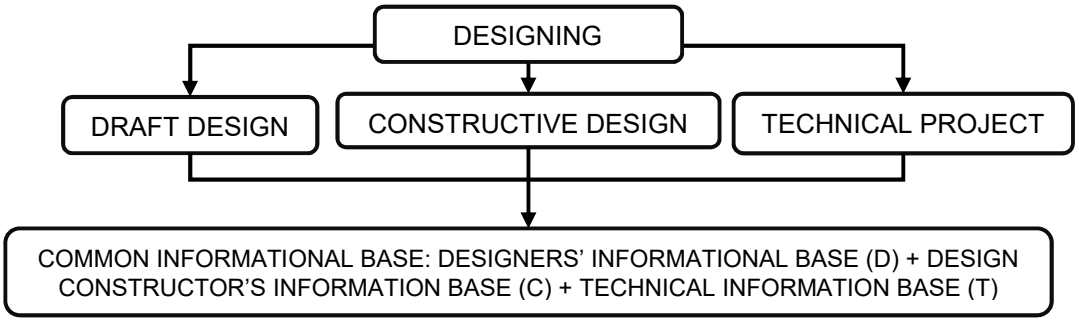


Figure 1 Structural scheme of improvement of a hats designing process

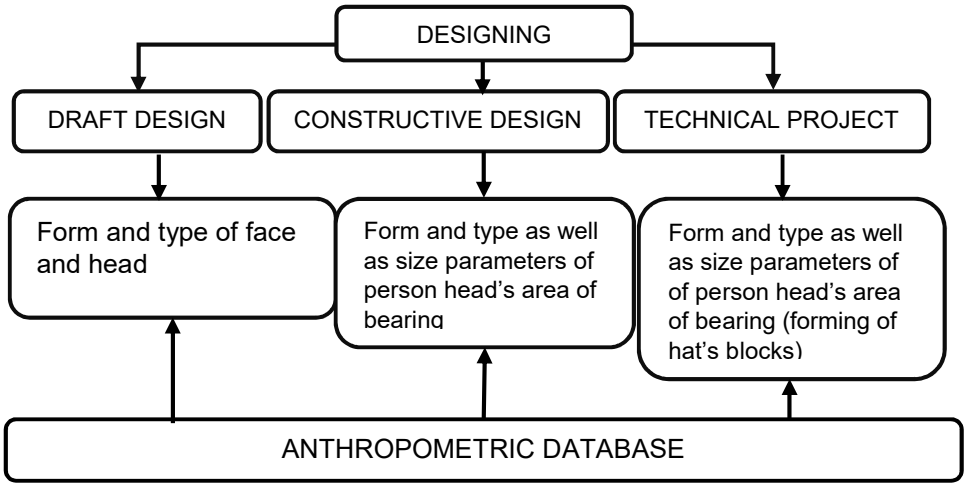


Figure 2 Structural scheme of usage of anthropometric database in the process of hats designing

3 DETERMINATION OF ANTHROPO-METRIC PARAMETERS FOR HATS DESIGN

On the modern stage of development, the most up-to-date decision of such problem lies in a 3D manikins modelling, which will allow not only making the closest to reality garment draft but also estimate its real proportions and receive precise data about parameters of head or future garments' pattern. In other words such virtual three-dimensional manikins can be used practically on any stage of design construction. Analysing substituent parts of each state of construction of hats it is possible to say that precise anthropometric base that would reflect not only sizes but also would give an opportunity to set parameters of human head's form, is necessary in all stages. Analysis of anthropometric database for construction of hats has shown that sizes used while projecting do not reflect real three-dimensional form of human's head. Existing classifications are based on descriptive features and are not evaluated in numbers [10]. Classification of three-dimensional forms of humans' head is absent, and the existing one is only working with plans of head under different angles separately. Thus this information can barely be used and useful while projecting and construction (Figure 3).

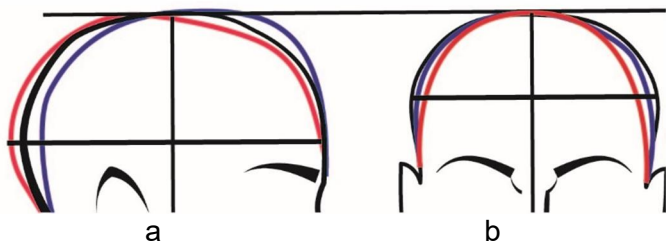


Figure 3 Projection pictures of different types of heads under different angles: a) sagittal, b) frontal

Priority consumer preferences based on a questionnaire survey of consumers younger and middle age groups and processing the results of mathematical statistics methods were defined. The criteria for selection of hats in almost equal measure are the following factors as a fashion, a comfort, a color and a good fit of the product. "A comfort and a fashion" or "a comfort and a good fit of the product" were often chosen when selecting two defining characteristics. The main disadvantages of a product that indicate consumers are discomfort and poor fit of the product.

Analysis of methods of hat construction has shown that in production of hats and development of drawings from them typical matrixes are used, the construction of which is simplified and doesn't reflect peculiarities of head building [6, 10, 11]. But the survey of consumers about quality of garments and requirements for hats has shown that choosing modern garments of this assortment group only 19% do not have problems with fitting and do not feel any discomfort wearing the garment (Figure 4).

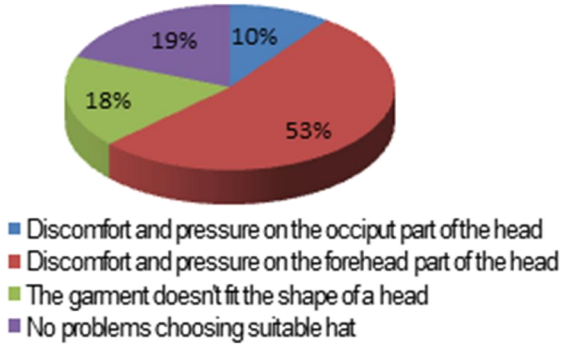
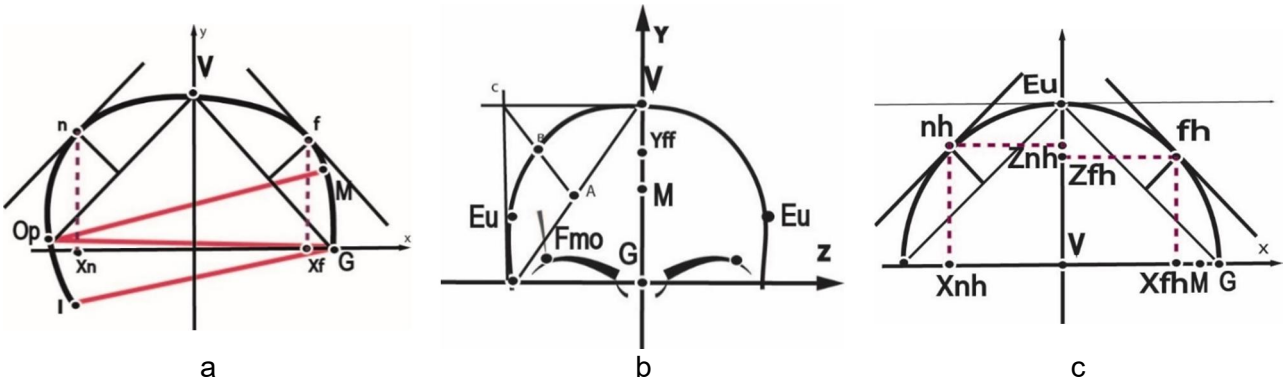


Figure 4 Usual complaints of consumers on faults of hats

As follows from the survey results there is a need to conduct studies of a human head and to identify existing three-dimensional types. To solve the problem of improvement of the information database for designing hats there is a need to conduct anthropometrical surveys of heads. Sample size was 240 women of young and middle age groups [12]. To conduct the study there was determined an anthropometric basis of points and there was proposed a layout of the head in the sagittal, frontal and horizontal projections in the coordinate system XYZ (Figure 5).



a b c

Figure 5 Scheme to define the head type in a) sagittal projection b) frontal projection c) horizontal projection

Sagittal view of the head shown in a coordinate system YX, where point V (vertex) is situated on the axis Y (Yn, X0), and point G (glabella) - on the X axis (Y0; Xn). Front projection is represented in a coordinate system ZY, where point G is at the origin (Y0; Z0), and point T on the axis Y (Yn, Z 0). Ground plan is presented in the coordinate system Zx, where point V is at the origin (Z0, X0), and point G on the axis X (Z0; Xn).
To characterize the convexity of the head in the sagittal plane there were auxiliary tangent lines introduced (Figure 5a). They are parallel to segments |Op-V| and |VG|, that determine points n and f, describing a sagittal arc in the occipital and frontal parts (Table 1).

Table 1 Human head types in sagittal projection

Head type	Defining relation between areas of the head	Defining proportional values
Frontal	Fts = Xf > Xn	$\frac{Xf}{Xn} = 1.3 \div 1.9$
Symmetric	Rts = Xf ≈ Xn	Xf ≈ Xn
Occipital	Nts = Xf < Xn	$\frac{Xf}{Xn} = 0.5 \div 0.7$

In frontal projection the outline of a human's head is characterized by the allocation of points Eu (euryon) (Figure 5b), t (tragion) that V (vertex) relative to the zero point of the coordinates (Table 2).

Table 2 Human head types in frontal projection

Head type	Defining the projective discriminant
Platicephalic	f_p = (1.301÷1.481)
Obrculocephalic	f_o = (0.988÷1.104)
Lofocephalic	f_l = (1.190÷1.300)

To characterize the convexity of the head in the horizontal plane there were introduced auxiliary tangent lines that are parallel to segments |Eu-Op| and |Eu-G|. Also there are points nh and fh that characterize the convexity of the frontal and occipital parts of the arc G-Eu-Op (Figure 5c). The results of the research are shown in Table 3.
According to the results of researching of models of heads, received in this survey, it has been defined that in horizontal plane brachycephalic head (round) can be seen for only 20% consumers, only 53% of surveyed women have symmetrical (normal double-sided type) in a sagittal plane, and the obrculocephalic (taken as standard) type of frontal plane can be seen only within 54% of women (Figure 6).

Table 3 Human head types in horizontal projection

Head type	Defining relation between areas of the head	Defining proportional values
Oval	(Xnh ≈ Xfh) ≈ (Znh ≈ Zfh)	$\frac{Xnh}{Znh} \approx \frac{Xfh}{Zfh} = 1.2 \div 1.8$
Round	(Xnh ≈ Xfh) ≈ (Znh ≈ Zfh)	$\frac{Xnh}{Znh} \approx \frac{Xfh}{Zfh} = 1.0 \div 1.1$
Egg-shaped	(Xnh ≈ Xfh); (Znh > Zfh)	$\frac{Xnh}{Xfh} \approx 1;\ \frac{Znh}{Zfh} = \frac{1.2 \div 1.4}{1}$
Sphenoidal	(Xnh ≈ Xfh); (Znh > Zfh)	$\frac{Xnh}{Xfh} \approx 0.8 \div 0.7;\ \frac{Znh}{Zfh} = \frac{1.5 \div 1.8}{1}$

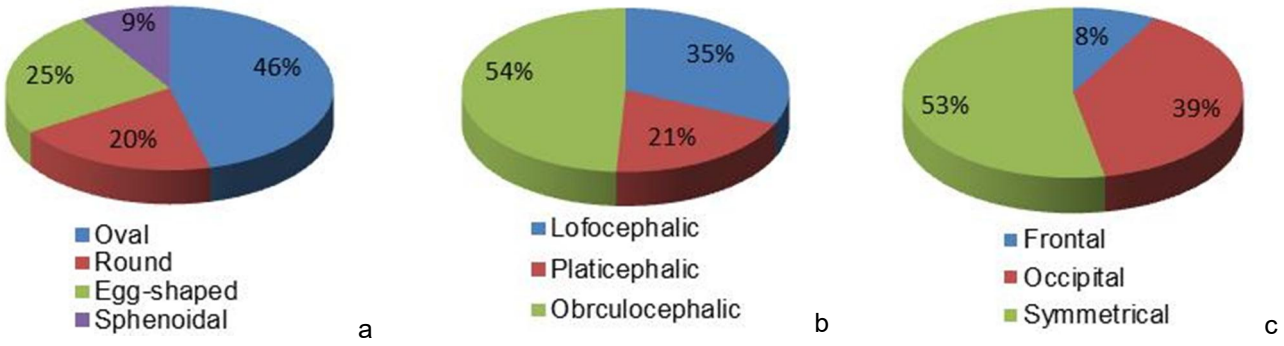


Figure 6 Percentage ratio different types of heads in a horizontal (a), frontal (b) and sagittal (c) planes under the results of anthropometric survey

Just 6% of surveyed women possess all "ideal" types and the area of bearing of the hat has "ideal" plane shape of a hemisphere (ORS type).

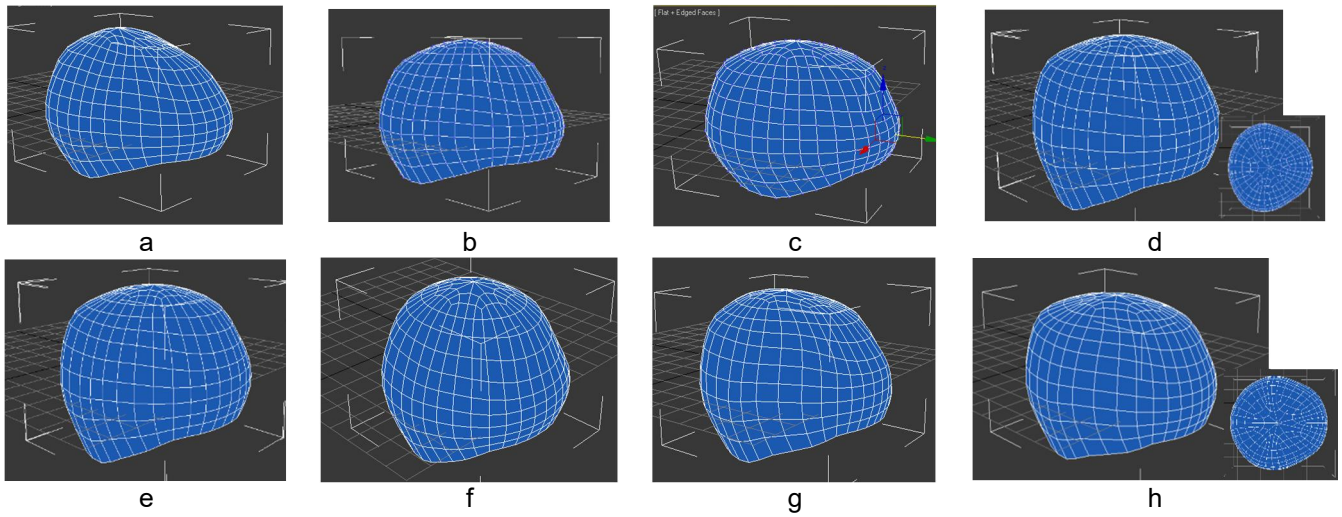


Figure 7 Determining the of types of three-dimensional forms of human heads: a) Orbicular, ellipsoid occipital type (OEO) type, b) Orbicular, ellipsoid, symmetrical type (OES), c) Lofocephalic, ellipsoid, symmetric type (LES), d) Orbicular ,pentagonal, symmetric type (OPS), e) Orbicular, ovoid, symmetric type (OOS), f) Orbicular, round, symmetric type.(ORS), g) Orbicular, pentagonal, occipital type (OPO), h) Lofocephalic, egg-shaped, symmetric type (LESS)

Therefore, existing today dummy-pattern may correct only a small group of women, as well as hats, developed on its basis. By results of the analysis of the anthropometric data types were allocated the types of three-dimensional forms of human heads (Figure 7) as the most frequently meet: OEO type (orbicular, ellipsoid occipital type) 14%, OES type (orbicular, ellipsoid, symmetrical) 10%, LES type (lofokran, ellipsoid, symmetric) 8%, OPS type (orbicular, pentagonal, symmetric) 6%, OOS type (orbicular, ovoid, symmetric) 6%, ORS type (orbicular, round, symmetric) 6%, OPO type (orbicular, pentagonal, occipital) 6%, LESS type (lofokran, egg-shaped, symmetric) 7%.

4 CONCLUSION

Analysing the nature and structure of the stages of the design process the following conclusions can be made:

1. Each part of the process design and related design is integrated with each other. Conceptual design, design and technology are interrelated on the informative level (background information is needed to perform a particular task in a certain stage of the project design echoes the design and technical one). The adaptation of existing databases and development of a common database for transparent design on basis of basis of designer, draft and technological information that would provide manufacturing of quality and ergonomic industrial garment.
2. Anthropometric information base is used at every stage of planning and design and requires updated data on the form, proportions and size.
3. Surveys and anthropometric studies conducted among consumers had showed imperfections in existing anthropometric databases for designing hats and confirmed the need to develop a classification of types of three-dimensional forms.
4. Studies that were carried out identified the classification of types of three-dimensional forms of the human head. From the data was singled out eight common types of the human head.

These results confirmed the need for further research and improvement of data bases for designing hats

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VÝVOJ INFORMAČNEJ DATABÁZY PRE NAVRHOVANIE KLOBÚKOV

Translation of the article
The development of information database for designing of hats

Článok sa zaoberá problémom navrhovania klobúkov. Ako vyplýva z analýzy dizajnových procesov, informačné bázy použité pri riešení konštrukčných úloh sú prielomové, čo sa týka predovšetkým antropometrických databáz. Prieskum vykonaný u nositeľov klobúkov ukázal, že hlavné nedostatky týkajúce sa ich nosenia sú, že klobúky zlé padnú, sú nepohodlné a vyvíjajú tlak na niektoré časti hlavy. Ako vyplýva z výskumu povrchov ľudskej hlavy existuje 8 typov troj-dimenzionálnych tvarov hlavy.