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ASSESSING THE IMPACT OF AESTHETIC PROPERTIES CHARACTERISTICS ON WOOD DECORATIVENESS

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ABSTRACT

Method of qualimetry assessment has been applied for researching wood aesthetic properties. It helps to get quality assessment not only with surface defects such as cracks or rot but also aesthetic features. During the survey, experts` skills were taken into consideration, so the reliability of assessments is quite high. There are method of expert selection is shown as well, which allows to select more qualified experts with high opinion conformity. Subsequent to the results of the research we have determinate that color combinations, texture pattern and its contrast (which were assigned to the texture parameters) have the greatest meaning for wood decorativeness.

Key word: assessment, decorativeness, qualimetry, weighting coefficient, wood species.

INTRODUCTION

Wood is widely used for creating design objects. One of the most important quality characteristic in highly aesthetic goods production is decorative properties. Under the term of "decorativeness", we mean the set of properties that increase artistic, emotional and expressive material qualities. At present, all methods of evaluation of wood materials by grounds of decorativeness bases on the method of expert or statistic assessment, in which need to attract a sufficiently large number of respondents. Methodology, which is considered in the article, is the basis for developing the evaluation system of decorative wood, which could eliminate the constant part of the respondents in future. The method of qualimetry assessment of aesthetic properties can be applied by companies engaged in sale of fine wood and low-value timber species or companies producing goods from them, for sort determination, not only on basis of surface defects such as cracks, light knots, rot, etc, but also aesthetic features. Some low-value wood species are known not to have pronounced texture and contrast color, but have a similar microscopic structure with valuable species of wood (UGOLEV 2004), properly chosen modes of impregnation allow to achieve various decorative effects in low-value timber species, which enhance natural beauty of wood, so they can replace valuably species of wood in restoration processes and mosaics. Peculiarities of wood structure allow getting unique texture images on different log cuts, not only on standard ones - radial surface, tangential section, transverse section, but also on cuts with unusual direction, which do not have the same artistic value that can be established evaluating the quality of timber. In addition, according to Roman Reh, exotic wood species suggest good perspectives for using it in furniture industry, he have found that red oak is suitable for application in furniture as a replacement for some commonly used wood species, because the quality of veneer made from red oak does not

differ from the quality of commonly used veneer (REH 2006), so the method of qualimetry assessment may help in selection of samples for veneering.

Decorativeness depends on personal view, so for the qualimetry it is appropriate to use a method of expert evaluation, as it allows measuring subjective perception of an individual (BESHELEV, GURVICH 1973, BULATOV 2008). Accuracy of the research depends on the method, a question list and expert competence.

Method of expert evaluation is distinctive from other means of sociological research, as highly qualified professionals in the area of researcher interests are involved into survey, thus make it possible to decrease the number of respondents and to achieve higher accuracy. In our opinion, from the variety of approaches concerning judgemental methods, the most appropriate one is the individual expert evaluation method, based on a prefatory information acquisition from experts, who are interrogated independently. Primary benefits of this method are operational efficiency, possibility to use individual abilities of experts, and no pressure from the side of authority (BESHELEV, GURVICH 1973).

METHODOLOGY

The method of research mentioned above takes into consideration experts` skills in analyzing and solving the issue under consideration, so the reliability of assessments and decisions based on expert judgment is quite high. The membership of expert commission depends on an estimation scale (BULATOV 2008):

$$N_E = \frac{\varphi d^2}{\Delta q^2 (1-\gamma)} \quad (1)$$

where: d - scope of the estimation scale, that is equal to difference between maximum and minimum assessment;

Δ q - Imprecision of assessment (in a step scale - it is a scale spacing which means difference between successive values);

γ - confidence probability, that is associated with a significance level by ratio:

$\alpha + \gamma = 1$;

φ - coefficient which depends on the value of γ.

Thus, the number of expert commission members should be not less than 16: under the conditions of a 5-point scope of the estimation scale,

d = dmax - dmin = 5 - 1 = 4 points,

Δ q = 1.

$\alpha = 0{,}05$;

$\gamma = 1 - 0.05 = 0.95$,

$\varphi \approx 0.05$,

then:

$$N_E = \frac{0{,}05 * 4^2}{1^2 * (1-0{,}95)} = 16$$

The expert group must satisfy conditions of competence and consistency (GOST 23554.1-79, GOST 23554.2-81). To provide accuracy of estimation special forms were developed which include methods of self-assessment and evaluation questionnaire data, which allow crating a competent expert group. Coefficient of competence that is quantity characterizes accuracy of judgments (CHEREPANOV 1989), was analyzed.

Weighting coefficient is used for this analysis, to determine significance of indicators and their impact on total assessment of experts' competence:

$$\upsilon_i = \frac{\sum_{j=1}^{m} R_{ij}}{\sum_{i=1}^{n}\sum_{j=1}^{m} R_{ij}} \tag{2}$$

where: m – quantity of expert commission membership;
n - quantity of criteria;
Rij – rank is assigned by j-th candidate for i-th criterion.
Coefficient of the j-th candidate self-assessment for the experts is:

$$K_{cj} = \frac{\sum_{i=1}^{n} \upsilon_i B_{ij}}{\sum_{j=1}^{m}\sum_{i=1}^{n} \upsilon_i B_{ij}} \tag{3}$$

where Bij – an assessment of j-th candidate expert according to i-th criterion.
Coefficient of competence of j-th candidate expert according to the questionnaire:

$$K_{aj} = \sum_{i=1}^{n} \upsilon_i \beta_{ij} \tag{4}$$

where β ij - valuation factor for the i-th response of the j-th candidate expert:

$$\beta_{ij} = \frac{B_{ij}}{\sum_{j=1}^{m} B_{ij}} \tag{5}$$

The complex coefficient of the competence has been calculated as follows:

$$K_j = C_c K_{cj} + C_a K_{aj} \tag{6}$$

where, Cc and Ca - coefficients of the "importance" of chosen estimation methods, both of them have an equal importance for our research so we admit Ca = Cc = 0.5.

As a result of questionnaire assessed, the degree of impact of wood aesthetic properties to the decorativeness is also determined by the weight coefficients,

$$V_i = \frac{B_{si}}{\sum_{i=1}^{n} B_{si}} \tag{7}$$

where n - quantity of criteria,
Bsj - individual expert assessments of wood decorativeness factors aggregating into group assessment:

$$B_{si} = \sum_{j=1}^{m} B_{ij} K_j \tag{8}$$

where m - quantity of experts.

RESULTS AND DISCUSSION

Expert applicants were offered to rang self-assessment questionnaire criteria according to importance in the column "Self - assessment" (Tab. 1) using a 5-point scope to assess their ability regarding given criteria and impact of their experience and qualification to reliability of judgments (Tab. 2)

Tab. 1 Self-Assessment.

№	Criteria of Self-Assessment	Weighting Coefficient
1.	Cognition of characteristics of wood structure and properties	0.15
2.	Cognition of wood aesthetic properties characteristics	0.17
3.	Ability to select of harmonious color - texture combinations	0.17
4.	Woodworking skills	0.16
5.	Skills of creating artistic compositions	0.21
6.	Trends tracking of wood treatment and consumer preferences of wood species	0.14

Tab. 2 Reliability of judgments.

№	Questionnaire	Weighting Coefficient
1.	Experience of work as a designer (yes / no)	0.21
2.	Experience of wood treatment (yes / no)	0.23
3.	Arts education (yes / no)	0.20
4.	Experience of wood products design (yes / no)	0.20
5.	Experience of participation in expert groups (yes / no)	0.16

According to the results of experts' questionnaire, we computed a weighting coefficient and used it for getting complex coefficient of competence.

Expert group should include candidates who get the highest value of complex coefficient of competence, for the considered group $K \geq 0{,}0369$.

Sixteen experts were selected in the issue of research; they took part in the study of wood decorative properties. These properties are color, texture, stippling and glaze. stippling and glaze are related parameters that largely depend on a method of treatment and finishing. Color and texture depend on structure and chemical composition, so the assessments are more valuable for decorative properties.

Color is characterized by hue, lightness and saturation (purity) (Rybin 2005). However, the main characteristic property of wood is structure, so often it is difficult to identify color and characterize it with the only dominant wavelength because of multicolor texture, some valuable wood species distinguish with a combination of three or more colors and their shades in texture, so it is advisable to include into color description "combination of colors" as well.

Wood texture is defined as the natural pattern of material surface, formed by shearing parallel or perpendicular to grain (RYBIN 2005, UGOLEV 2004, etc.). The texture ox feel of the wood surface is the result of the difference between the dimension of the pores, and the width and quantity of rays. Timbers which have wide vessels or broad rays are coarse textured, and those with narrow vessels and with thin rays are fine textured (LINCOLN 1986). In different cuts of the same logs can be different texture. In our system we will examine all feasible cuts and kind of texture. Wood species which have a similar texture of pattern can have different value for creating an art object.

All of these theoretical statements were examined by experts who determined value of decorativeness factors and their influence to full assessment (Table 3), Experts estimated factors from 1 to 5 grades.

Tab. 3 Value of wood aesthetic properties factors.

Factors	Definition	Group Assessment	Weight Coefficients
COLOR			
Hue	the degree to which a stimulus can be described as similar to or different from stimuli that are described as red, green, blue, and yellow (RYBIN 2005)	2.70	0.16
Lightness	Lightness (sometimes called value or tone) is a property of color. or dimension of a color space, that is defined in a way to reflect the subjective brightness perception of a color for humans along a lightness–darkness axis. A color's lightness also corresponds to its amplitude.	2.26	0.13
Saturation (color purity)	The saturation of a color is determined by a combination of light intensity and how much it is distributed across the spectrum of different wavelengths. The purest (most saturated) color is achieved by using just one wavelength at high intensity	2.61	0.16
The combination of colors	Monochrome and polychrome color combinations on wood cut	3.04	0.18
TEXTURE			
The figure	The surface pattern on a timber, results from the interactions of several natural features. They include the difference in density between earlywood and latewood cell; the quantity of growth rings; the natural pigments and markings in the structure; the reaction of the tree to the effects of tension or compression due to external forces during its life; contortions around knots, swollen butts or limbs, and the stunted growth of burrs or burls. These features, combined with a variety of grain types, and the method of cut, produce the figure (LINCOLN 1986)	3,30	0,20
Contrast	Images differ in extent and type of contrast. The contrast can be formed with color or lightness. The first one occurs when the same color is surrounded by another colors, and the second changes impression because of lightness, it depends on ambient background lightness	2.77	0.17

As can be seen from the above, color combinations (from the group that characterizes color), pattern and its contrast (which were assigned to the texture parameters) have the greatest meaning, as they have the highest amount of Weighting Coefficient.

Thus, qualimetric evaluation system of wood aesthetic properties which takes into account factors of wood decorativeness and grade their influences to the overall assessment can be lumped together:

$$Wd = \Sigma Ti * Wi + \Sigma Ci * Wi, \quad (9)$$

where Ti - point rating of texture factors, Ci- point rating of color factors, Wi-weighting coefficient of the i-th factors.

CONCLUSION

This approach will provide a quantitative assessment of the qualitative variable and determine the artistic value of a specific timber sample and allow to predict the artistic value of wood products; which is achieved with using of the collective evaluation of expert

opinions and correction factors in the decorativeness complex assessment calculation. So the parameters, which have received the highest values of weighting coefficients for the group assessment, will have the greatest impact to the decorativeness evaluation of wood. But it is still necessary to reach more accurate data to form the assessment system and research how results of this assessment correlate with the opinion of consumers.

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