AESTHETIC PERFORMANCE OF DIFFERENT WOOD SPECIES – VISUAL INTERACTION OF HUMAN BEING AND WOOD (BY ANALYZING THE COLOUR AND THE TEXTURE OF WOOD SEPARATELY)

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ABSTRACT

The paper deals with the issue of the visual performance of wood – the interaction of a human being and the visual perception of a wood surface. In order to analyze the human approach to a wood surface a new test method was developed. We assessed the impression of a wooden surface to test persons in two independent steps. One approach was the evaluation of a sample of pure wood-based colours without any texture. The second step was the evaluation of various wood textures by showing black & white photos of wood textures. The following wood species were tested: spruce, beech and ash, whereas the preferences of separated colour (wood colour tone without texture) were also investigated for maple and walnut in order to analyse the preferences for light/medium/dark tones of wood. As a general hypothesis we stated that the pure wood colour without any texture does not get the utmost appreciation by human beings, but superposing wood colour and wood texture exhibits the unique and delicate appearance of wood which is widely appreciated. In our study we could prove this hypothesis to a high extent.

Key words: colour of wood, wood texture, visual perception, preferences

INTRODUCTION

Various phenomena of an interaction of wood and the human being have not yet been explored sufficiently. Several research studies coincide the fact that we have inborn some behavioural and emotional preferences and we know how to overcome them through the conscious thinking of our left hemisphere (Tolja, 2010).

Since ancient times the material wood accompanied mankind due to its superior material properties but in many cases also because of its aesthetics and the aesthetic performance of wood is mainly based on colour and texture. These two features are the main target of our current study.

THE COLOUR OF WOOD

Due to its chemical composition the material wood absorbs and reflects light. The spectrum of this physical interaction may range from almost white (e.g. maple) to almost black (e.g. heartwood of black ebony). The mechanism of coloration of wood is intensely discussed by Hon and Minemura (2001). Due to the lignin and the various extractives the wood colour varies around a yellowish-brownish hue (based on the spectrum of lignin) and reddish, greenish as well as blue, pink and purple hues.

By assessing the surface appearance of wood, the colour of wood is additionally affected by the various wood textures as shown by Fellner et al. (2006). This super-

imposition of wood colour and wood texture provides the unique and delicate broad spectrum of wood appearance.

There is no perfectly homogenous and reproducable colour appearance of wood and all inhomogeinities and growth patterns cause significant colour differences/irregularities. Ruz, et al. (2005) quote 10 categories of defects/irregularities such as birdseye and freckle, bark and pitch pockets, wane, splits, blue stain, stain, pith, dead knots, live knots and holes. Additionally wood is prone to a photo-induced discoloration and the various wood species undergo different amounts of photo-induced discoloration from darkening to fading as shown and classified by Oltean et al. (2010).

When assessing an unevenly coloured surface Ware (2009) states that the visual system has a strong tendency to segment smoothly changing colours into regions consisting of the unique hues, this effect is called *colour segmentation*. As wood colour is often seen as a given fact from nature, there are only a few approaches on a stringent colour assessment of wood and a analysis of consumer perception of a wood surface appearance.

According to Heller (2008) the brown colour is most popular for wood wall-panelling and ceilings. Many people take brown carpets for cosy living. On the other hand a pure single brown colour is often despised. For 29 % of women and 24 % of men brown is „the colour that they dislike most“. Only a few people were voting brown as their favourite colour: 2 % of women and 1 % of men. No other colour is declined as much as brown. Many people associate brown colour spontaneously with excrement and dirt. The colour has a negative association. As a psychological impact Heller (2008) states on the other hand, that brown as colour has a positive affect in space, it is the colour of rustical materials such as wood, leather, raw wool. Rooms with brown furniture, brown carpets appear more narrow, but also create a feeling of belonging. Brown rooms look cosy also because the colour brown has an ideal microclimate – it is the colour of warmth, but it is not hot.

Arnheim (1974) states that by itself, shape is a better means of identification then color not only because it offers many more kinds of qualitative difference, but also because the distinctive characteristics of shape are much more resistant to environmental variations.

According to Weigl, Kandelbauer at al. (2009), the motivation for staining of wood depends on socioeconomic, geographical, ecological, aesthetical, scientific or even other considerations. Consumers are often interested in using wood because of its appealing material properties but they are not satisfied with the range of the native colour spectrum or the inhomogenity of the surface appearance.

Based on Kotradyova et al. (2009), in the current approach we suggest that the colour tones of wood can be distinguished in three categories: *light, medium and dark.*

Dark – walnut, wenge, ebony etc.

Associations – traditional, serious, conservative, tradition, heavy, exotic,

Medium – cherry, oak, beech, ash, pear, plum, apple tree, pine, larch, teak,

Association – vivid appearance, life, optimism, fruitfulness, maturity, belonging

Light – maple, birch, hornbeam, poplar, spruce,

Association: smart, elegant, light, airy, minimalist, modern

TEXTURE

According to Wagenführ (1996) and Hoadley (2000) wood texture comprises the

appearance of a wood surface which is created by wood machining and various anatomical patterns, growth features, optical effects and wood failures and defects as well.

A number of studies have investigated the consumers´ perception of *character markings on furniture surfaces* to determine marketing opportunities for such wood products.

On a general level Broman (2001) surveyed Swedish consumers on their visual perception and preferences regarding wood surface containing knots. The interviews (n= 215) were conducted at Skellefea Wood Festival in Northern Sweden. Broman (2001) found in his study whose objective was to understand and describe how people see and evaluate visible wood „defects“ (such as knots) in a given wood surface. The respondents judged the wood surfaces based on a general impression rather than evaluating single surface features like knots. Preferences for knotty surfaces were strongly connected with the physical bled of this feature. The respondents favoured wood surfaces with a „balance“ between a degree of harmony and activity in order to avoid a state of disharmony. The impression of disharmony was connected with a bad overall blend of wood features lamella with different colour/texture or a cluster of large knots.

The result of the study suggested that consumers do not reject wood surface with „defects“ at any rate. Instead, wood surfaces may contain a rather large amount of activity-creating wood features (such as knots), if these activity-creating features are well balanced across the surface (fig. 1).

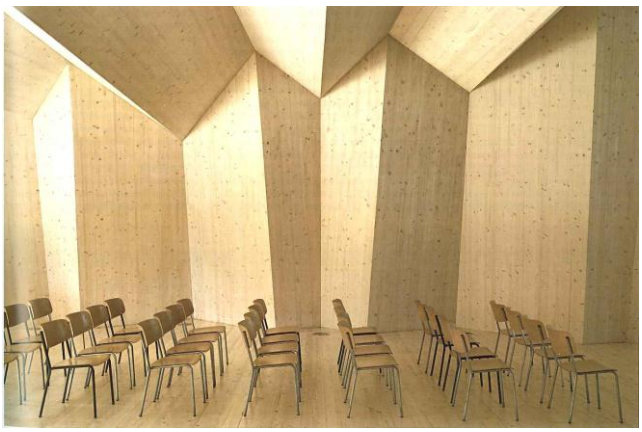

Fig. 1. Knots are creating certain pattern on big planes of wall-panelling, even when irregular, the overall appearance is balanced thanks to random harmony (Chapelle St. Loup in Pompaples, Photo: Milo Keller in Detail 10/2010).

Bowe and Bumgardner (cit. in Oberwimmer, 2007) investigated US consumers´ perception of several wood species in order to determine if word-based and appearance-based evaluations of furniture boards differed. There was evidence that the evaluation of the wood species was positively influenced when respondents had identified wood species correctly.

OBJECTIVE OF THE STUDY AND METHODOLOGICAL APPROACH

The main objective of the current study was to assess the approach of respondents to the pure „wood-based“ colour and the texture in two different evaluation steps. To prevent a preference according to branding, we decided to carry out the test without providing the names of the wood species the colour was generated from. And then we did the same test with a control group which

was provided with the names of the specific wood species that the colour was derived from. This should give us new information on how the aesthetic appearance of wood in generated by a test person.

The second stage was to give the same test to a control group of 12 people from the same group and with named testing sheets. The second control group was an international group of architects and designers consisting of 21 respondents.

Based on previous research projects (Oltean e al. 2008, Oltean et al. 2010) and an ongoing project an average colour according to the CIE-L*a*b* colour system was generated for three wood species: maple, beech, ash, walnut and cherry (fig. 2). For this wood colour reproduction clear-coated wood surfaces were used.

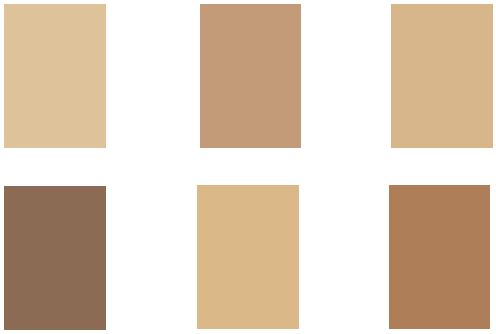

Fig. 2. Generated color from maple, beech, ash, walnut, spruce and cherry

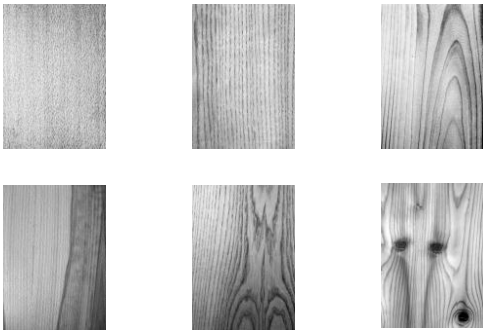

Fig. 3. Black & white pictures of the texture of regular and irregular variations of beech, ash and spruce

Additionally beech samples with different staining from natural (reference) to whitened and darkened were prepared for a specific assessment within one wood species.

By assessing the texture, preferences textures as black & white photos where shown to the respondents in order to avoid an interaction with a colour preference (fig. 3). Regular and irregular textures from the wood species to be tested where generated. The study was carried out by 130 respondents from Austria and 30 from an international group.

In all cases respondents have used an intuitive method of expression, just by giving a cross on the scale, which was later evaluated by a proper linear range and their choice was transformed into exact numbers between „0“ and „10“. In our questionnaire on the colour assessment we have asked respondents about their impressions „unpleasant/very pleasant“, „cold/warm“ and „artificial/natural“. Concerning the texture we have asked just about sympathies with scaling from extreme unpleasant to very pleasant.

RESULTS

The results about preferences on the „pure“ wood colour of the wood species tested, are shown in fig. 4 in three categories „sympathy“, „warmth“ and „naturalness“.

The results of the evaluation of the texture of spruce, ash and beech, each with a regular and irregular version, are given in fig. 5. Within a specific wood species (here beech), the natural appearance was assessed with higher scores than any staining such a whitening, darkening or staining according to another wood species (ash or walnut) (fig. 6). Comparing the assessment of the pure regenerated wood colour and the natural wood surface appearance there is a distinct preference for the natural wood surface (fig. 7).

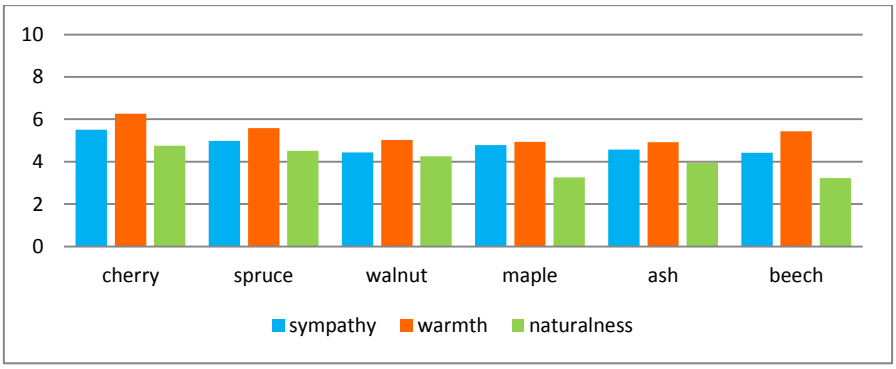

Fig. 4. Evaluation of different colours of wood species according to sympathy, warmth and naturalness

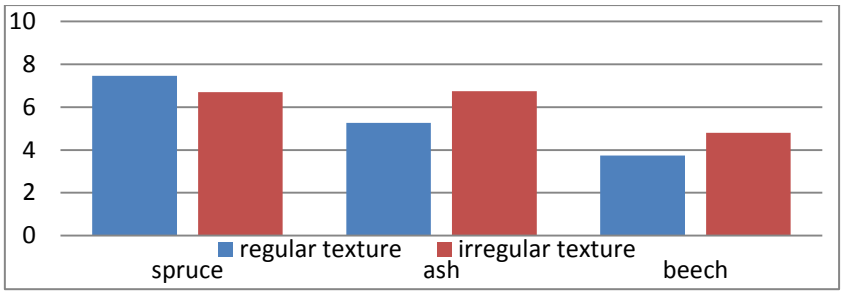

Fig. 5. Evaluation of texture of spruce, ash and beech, each species with a regular and irregular version

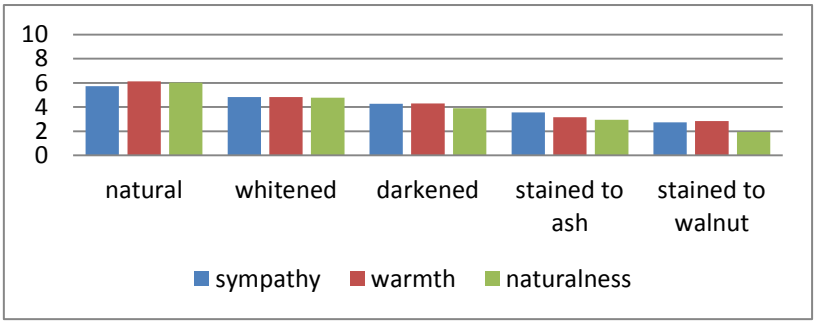

Fig. 6. Evaluation of different tones of stained beech.

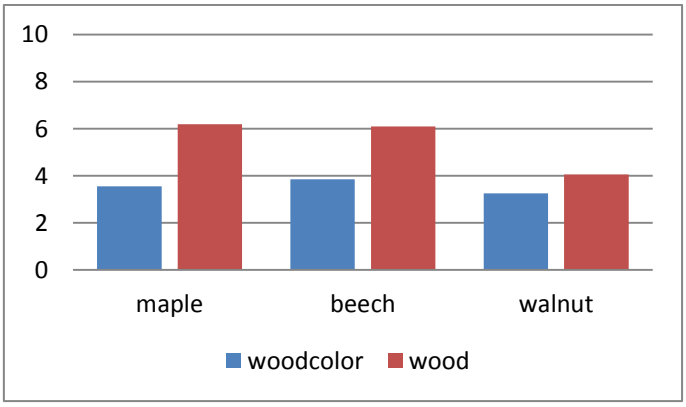

Fig. 7. Comparison of preference of the pure generated colour of wood and the photo of the same wood species, for maple, beech and walnut.

In a last one test we asked about preferences of the specific photos of the following wood species, ash, spruce and beech. Among preferences expressed by sympathies of the single wood species, the most popular was spruce (fig. 8).

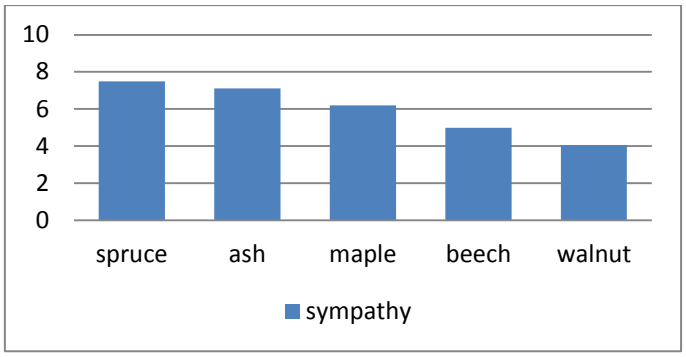

Fig. 8. Preferences expressed by sympathies of the single wood species

DISCUSSION AND CONCLUSION

From our study we can state that preferences of the pure generated wood colour are remarkably lower than the natural appearance of a wood surface combining colour and texture. Wood texture in greyscale appearance is appealing to respondents in a positive way. We can conclude therefore, that the aesthetic performance of wood is significantly influenced by texture.

REFERENCES

1. Arnheim, R. 1974. Art and Visual Perception: A Psychology of the Creative Eye. University of California Press, Berkeley, U.S.A.
2. Broman O.N. 2000. Means to measure the aesthetic properties of wood: S 13, 65.
3. Ebner, G. 2011. Ästhetische Wirkung von Holzoberflächen, BOKU, Bachelorarbeit.
4. Hall, E. 1989. Beyond culture, Anchor books, New York, ISBN 0–385–12474–0.
5. Fellner, J., Teischinger, A., Zschokke, W. 2006. Holzspektrum: Ansichten, Beschreibungen und Vergleichswerte (Wood Spectrum). proHolz Austria, Wien, ISBN 3–902320–31–1.
6. Heller, E. 2008. Wie Farben wirken, Rowohlt Taschenbuch Verlag, Hamburg, ISBN 978 3–499–61960–1.
7. Hoadley, B.R. 2000. Understanding Wood. A Craftsman´s Guide to Wood Technology. The Taunton Press, Newtown CT.
8. Kotradyova, V. et al. 2009. Furniture Design (Dizajn nabytku), STU Bratislava, p. 281, ISBN 978–80/22 –3006–8.
9. Oberwimmer R. 2007. Public Opinion / Consumer Attitudes on Forest Products and Forest Industries in the UNECE Region, Diploma work, BOKU.
10. Oltean, L., Teischinger, A., Hansmann, C. 2008. Wood surface discolouration due to simulated indoor sunlight exposure. Holz als Roh und Werkstoff 66: 51–56.
11. Oltean, L.; Teischinger, A., Hansmann, C. 2010 Visual classification of the wood surface discolouration due to artificial exposure to UV light irradiation of several European wood species a pilot study, Wood Research; 55(3): 37–48.
12. Perez, C. 2005. A neurofuzzy color image segmentation method for wood surface defect detection. In: Forest Products Journal, 04/01/2005, ISSN: 0015–7473.
13. Pike, G., Edgar, G. 2005. Perception. In: Cognitive Psychology, Oxford university press.
14. Schillinger, E. 2010. BIOOD. In: Holzoberflächen in der Fassadengestaltung, Tagunsband
15. Stingl, R. 2011. Farbmessungen von heimischen Hölzern, Institut für Holzforschung, Universiät für Bodenkultur, personal consultation.
16. Tolja, J. 2010. Lectures and Workshops within the course Body Conscious Design, Faculty of Architecture STU Bratislava.
17. Wagenführ, R. 1996. Holzatlas. 4. neubearb. Aufl. Fachbuchverlag Leipzig, Carl Hanser Verlag, München, Wien.
18. Ware, C. 2009. Visual Thinking for Design, Morgan Kaufman Publisher, Burlington, ISBN: 978–0–12–370896–0.
19. Weigl, M. Kandelbauer, A., Hansmann, Ch., Pöckl, J., Müller, U., und Grabner, M.. 2009. Handbook of natural colorants, Application of Natural Dyes in the Coloration of Wood, Wiley, p. 412, ISBN 978–0–511992, www.detail.de/rw_5_Archive_En_HoleHeft_235Ergebnis-Heft.htm.