SEASONAL CHANGES OF DOMINATING HUES IN LANDSCAPES CLOSE TO NATURE

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Fig.1 The Hungarian Academy of Technical Sciences in Budapest.

Fig. 2 Showing the modified NCS-atlas.

I wondered as an artist and as a filmmaker, how the colors of a natural landscape change during a seasonal cycle in our temperate climatic zones, the zones of summer-green forests.
I looked for some literature and I was astonished: There was virtually none. This knowledge – about the fundamental color facts in the world we live in – can't be found in every library. This was surprising to me.
Over the course of a whole year I compared chips of a modified NCS-Atlas with landscape's colors. I used the method of optically direct comparison. It works well with the sun behind you and the same light illuminating the samples and the landscape – using color constancy, the low metamerism of the NCS-samples and of the natural surfaces as well. So my results are close to inherent surface colors, integrating the effects of atmospheric blurring into the results.
I started the observations in 2003 in the Heuckenlock Nature reserve near Hamburg (Germany). This region consists out of softwood forests - willows and poplars - and reed, a landscape close to nature. This means there are almost no interventions by man.
Later on I observed a beech-forest – the most dominating forest of central Europe – I will add some examples from these observations too.

So I can invite you now for a walk through the natural color sequence of a year:

In winter-time the Heuckenlock landscape is dominated by yellowish browns of G90Y to Y50R, an average of about Y25R – compared with NCS samples. This average hue is characteristic for limited vegetation – here limited by temperature.

The average hue of winter-time is close to the average hue of the soil: Y20R here with R85B the average in the sky (Fig. 3). Is it coincidential that this basic color accord of the world we live in is a complementary couple of colors?

Fig. 3 The average hue of the soil and the average hue of sky.

In winter time in Heuckenlock the chromaticness of the surfaces is about 10% in NCS. Achromatic inherent colors do not occur. The natural world is not gray even in wintertime! But when snow falls the chromaticness does in fact becomes lower.

In pre-spring trees mobilize vitality again. Red increases a little because the reddish buds expand before leaves spread out. Especially in the beech-forest, which generally shows more reddish values than the softwood forest, this can

be perceived as a “purplish brown“. I can give an impression by this (Fig. 4). Compared optically direct with NCS samples this color is not more reddish or purplish than Y80R. (Fig. 5). Let’s remember this!

Fig. 4 A sample appearing purplish brown in front of a Y25R-background.

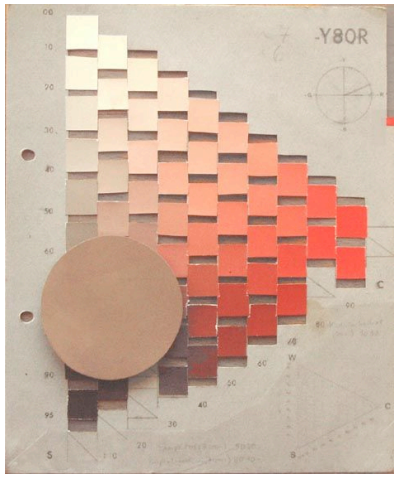

Fig. 5 The same sample with the NCS-atlas-page Y80R.

The first Willow leaf green showed up as 5030-G90Y. It was in the distance mixing optically with the brown of he bushes, but it was G90Y perceived as green!

In early spring most of the bushes and trees spread out their leaves. Here are the hue sequences of willows and poplars in Panorama Heuckenlock 2003 til 2004:

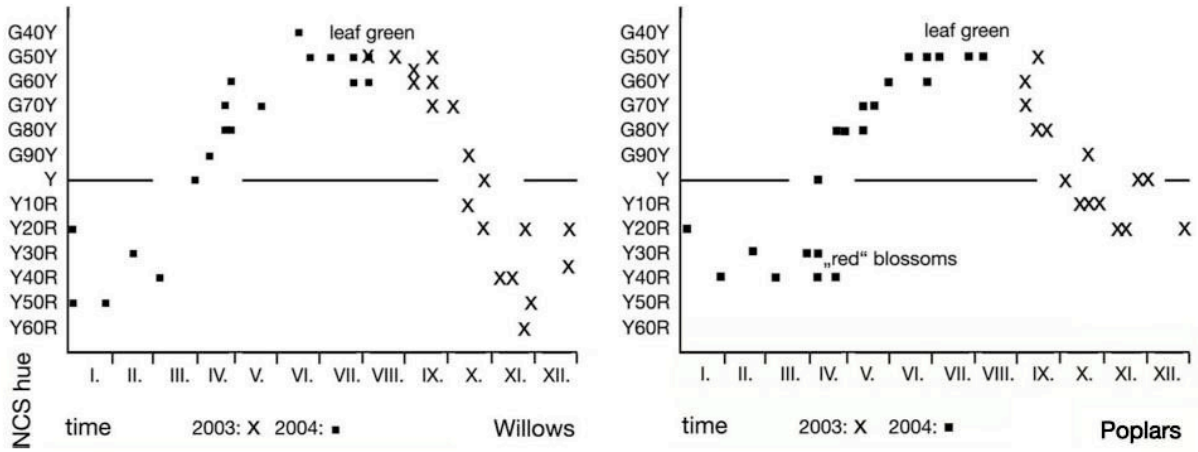

Fig. 6 Hue sequences of willows (left) and poplars (right) (Hering 2007).

Leaf green you find displayed at the top, the reddish hues at the bottom and the timeline from January (at the left) to December (at the right).
The trees perform sinus-like curves.

A single window in time – a cut or slice from this sequence – is known to botanists as a phenological aspect. The field of knowledge ascertaining in which order the phenomena occur during a year is called phenology. Therefore I call, what I'm doing color phenology.

The greening reaches its maximum at the end of July. The hue of completely developed photosynthetically active land plants is very distinctly G40Y to G50Y (Fig. 7).

Fig. 7 G45Y with R40B color accent.

This leaf green hue is at least in summer-time somehow our unique green outdoor. If the hue is only a very little more blueish, it is astonishingly precisely registrated as blue-green.

Look how the NCS-hue Green (G) appears in front of this beautiful walls outside with their Y20R: Blue-green!

Surprizingly the complementary of the almost monochromatic hue of summer-time appears in the blossoms of *Lythrum salicaria* and *Epilobium hirsutum* with R40B.

In early autumn the direction of the changes shifts to yellow or even further towards red slowly but surely. The average hue of the landscape moves through G60Y and G70Y. On the whole the vegetative processes (leaf burst, coloration and fall) influence the landscape's colorfulness more than generative processes (blossoming and fruit ripening).

High autumn is a time of high chromaticness and of broad ranges of hues displaying at the same time.

Fig. 8 Color accord of a beech-forest in the end of October 2005.

This color accord of a beech-forest I observed in late October 2005 varies the basic trichord of vegetation coloring: leaf-green, yellow and orange-brown. The landscape's average hue changes now from the greenish side of yellow to the reddish one. In the softwood-forest of Heuckenlock colors are merging into the low chromaticness of winter-time at the hue of Y20R already. The beech-forest goes in late autumn more far to Y40R.

Let's summarize the seasonal color movement:

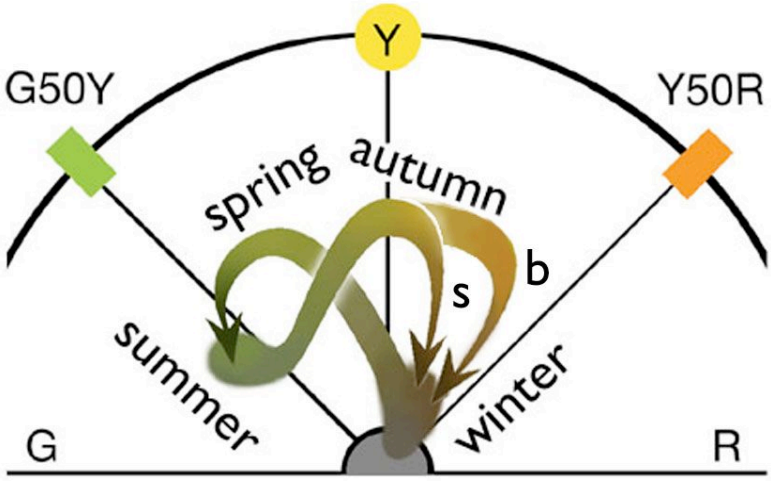

Fig. 9 Schematic seasonal pendulum movement of softwood (s) and beech-forest (b).

The low chromaticness of wintertime with an average hue of Y25R in softwood and Y40R in beech-forest swings in springtime with low chromaticness through the yellow sector of the color circle and reaches its maximum chromaticness in high spring, when the foliage is freshly unfolded with about G70Y. The spring-movement becomes slow and reaches its target at the hue of G45Y. Now during the summer green becomes darker and

lower saturated. Then the autumn-movement starts accelerating again. The average hue of the landscape passes with high chromaticness through the yellow sector again and falls back to the winter-status.

I can confirm Karin Fridell Anter's in "The Nature's Palette", that the colors of vegetation and soil display only at the yellowish half of the NCS-Color cycle with very few exceptions (which are blossom-colors). I would even could go more further: In the Heuckenlock Nature reserve the range of statistically relevant data – about 90% of all data – displayed between the hues Y50R and G40Y.

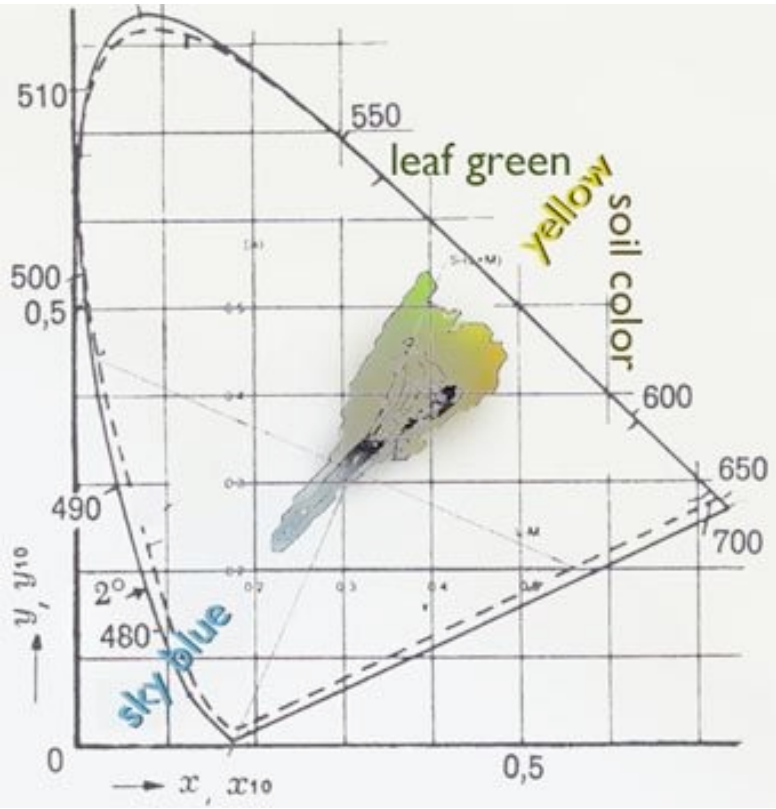

Fig. 10 Data of natural scenes from Webster & Mollon (1997).

The psychologists of perception Michael A. Webster and John Mollon aquired some data of natural scenes in a Sierra meadow in Nevada, a monsoon influenced landscape in India and a pine-forest in Washington representing a spectrum of possible natural scenes.. The range of their data plotted in the CIE-diagram of 1931 (Fig. 10) forms a long triangular shape pointing with its stretched peak to the blue of the sky. At the complementary yellow broader side the vegetation colors seem to perform the seasonal change from the maximum of lush vegetation. At the complementary yellow broader side the vegetation colors perform the seasonal change from the green maximum of lush vegetation to reddish soil and stone colors of arid zones and limited vegetation.

The strange thing is that the strictly limited area, where color stimuli in

landscapes close to nature occur, does not appear that limited in every day life. – Why should that be the case?

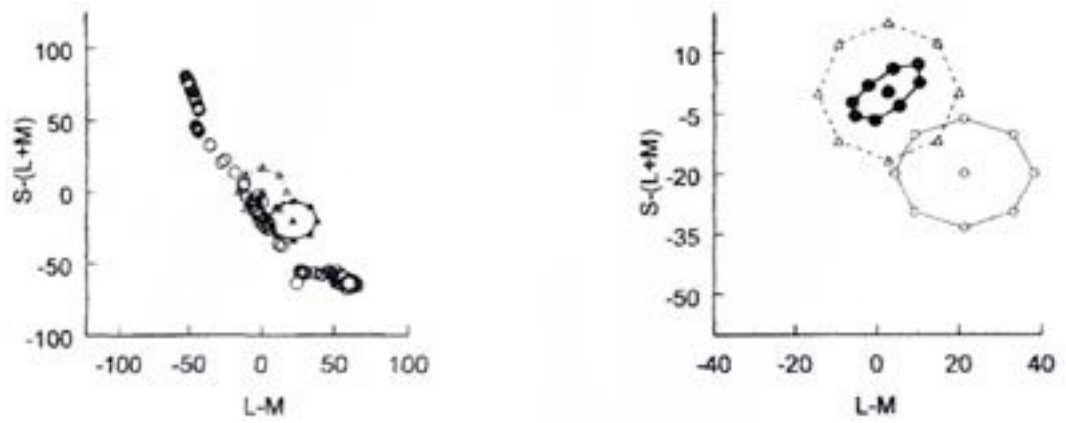

Fig. 11 Chromatic adaptation of the Sierra meadow data (Webster & Mollon 1997).

Webster & Mollon show us (Fig. 11) here the main-line of their color data from the Sierra meadow: A line from sky-blue to soil-yellow. The data are plotted in the McLeod-Boynton color space. Long wavelength versus middle at the bottom and short wavelength versus long and middle at the left.

In an experiment at the video screen colors of the natural scenes were shown in a rapid sequence followed by a stimulus color. It had to be matched in a not adapted part of the visual field afterwards.

The stimuli colors shown in filled shapes and the matches in dotted lines.

A shift happens from the dominating yellow towards blue. The effect on our perception is that the low chromatic yellow appears to be neutral.

What also happens is that the matches become biased and take on an elliptic shape.

The effect on our perception is that the yellow-blue-axis is reduced in its chroma and the colors appear to be more red and green.

We can't stress enough, how important such processes are for our feelings of color outdoor.

Why did the beeches appeared „purplish brown" although it was an almost orange-red hue of Y80R compared with NCS-samples.

To understand the hue assignment outdoor I can propose right now only a very simple model:

We shift the centre of a color circle towards the dominating hue, that means we shift the neutral gray out of the centre (Fig. 12).

Fig. 12 Pointing at the neutral gray shifted towards blue. (Photo Verena M. Schindler)

Adaptated to a dominating hue of Y20R the neutral sample NCS-N will appear blueish.

Our beech-forest's „purplish brown" is positioned in the plane of the NCS-hue Y80R (Fig. 13), but we will assign the hue radially from the new soil-gray centre. So it will point at about R20B or R15B. It appears to be purplish.

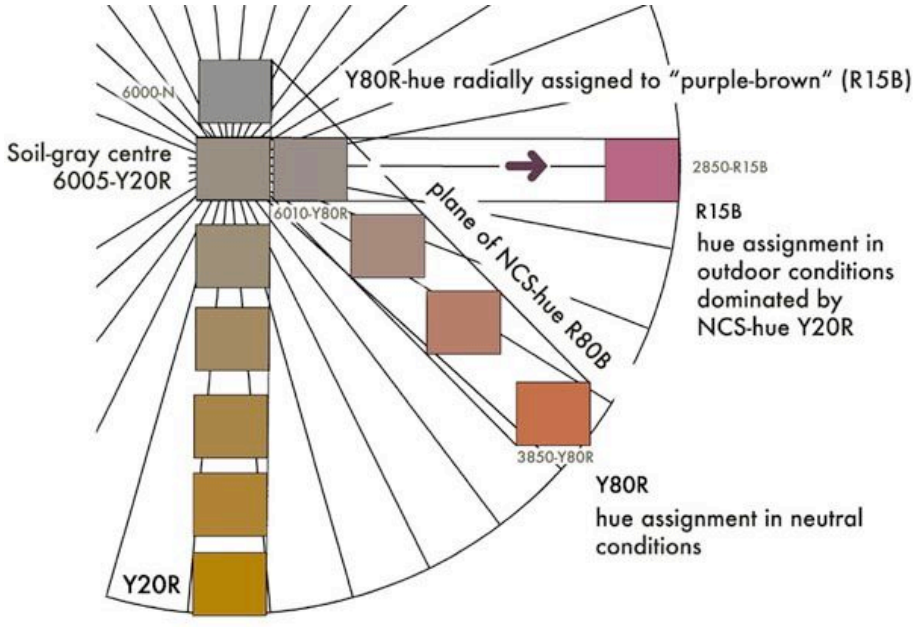

Fig. 13 Hue assignment out of the soil-gray centre in winter-time.

In the seasonal cycle the centre of the hue assignments shifts following the movement of the average hues of the landscape.

Color phenology can supply designers and architects working with color outdoor with the fundamental facts of seasonal color changes and with very specific ones according to the location in question, the specific building site. Because the world is tonal not gray, the changing dominant colors of the environment focuses our feelings towards the specific bottom shade.

Just as musicians tune their instruments before playing them, the designers can tune his color feelings to the nature of the place. The sequence of the seasonal changes could even be simulated in computer design, while doing the color drafts.

Arnold (1985) says: “Houses situated out in the open should be painted with neutral paint out of consideration for the seasonal changes of colors.“ But what is neutral out in the open? A low saturated G90Y or NCS Neutral - N? I am sure there are better choices, and Verena M. Schindler showed us some yesterday already.

Architectural design can react to the color characteristics of the site – and of course the type of reaction can be freely chosen – but it should not ignore them, because it’s the condition the architectural work is perceived in.

At last I want to add a little riddle:

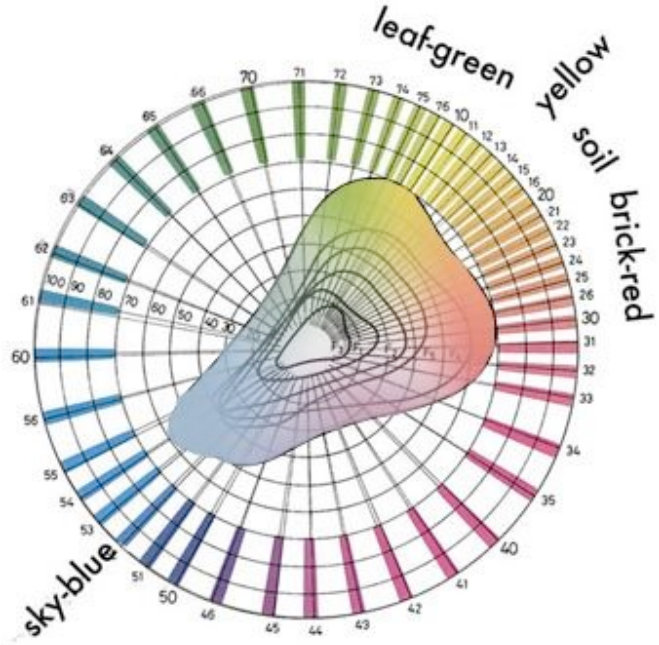

Fig. 14 What does this show?

Does this triangular shape pointing with its long end to the blue of the sky show vegetation color changes at the broader side?

It looks quite simular to the triangle shown by Webster & Mollon for color data of natural scenes (Fig. 10).

But we are in Budapest, so some will already know: It's the color preferences of women between the ages of 20 and 30 displayed by Antal Nemcsics (1993) in the Coloroid color space. It's not because young women are feeling so naturally. All people's preferences show a triangular shape, though the color red was preferred by children and men more than this.

But what does that mean?

Does it mean, the way the naturally colored world looks to us, is the way we want it to be?

Rossmäßler (according to Salisch) says: "The tree doesn't grow according to our taste; our taste grows according to the tree."

Mr. Nemcsics in his welcome-speech said: „The consonance between parts of natural and human creations is called harmony."

Yesterday at lunch Mr. Schawelka told me: „The world is not made to delight us with its harmonies."

The world is not made for us, but we – we and our perception – we are made for this wonderful world!

Bertolt Hering, Budapest, April 2007

Literature:

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