

Sensation Limits in Colour Sudoku Systems

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Abstract : Tour In The Borderland Of Colour Differences Interestingly, enigmatic game programs drove us (students and myself) towards the research on the limits of perceptible differences. At the moment the investigation – compared to the expected outcome – has just begun. Our first objective was to compare colored spots with an apparently irregular, but discreetly regular even form to those with an incidentally even form and the appearance of irregularity. The evaluation, adjusting of the scale of colored spots would be the next objective, and among these trying to approach certain limits of perception. On the other hand it is very important for us to unravel problems of balance in pictures. I expect the expected results from the evaluation of these tests (in first person singular, because I feel, that the students are interested in the research in other fields) I think, that by the time of the conference I will have been able to produce results of interest, maybe remarkable results.

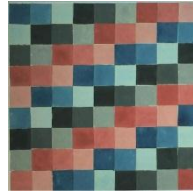
Keywords: *color, pattern, harmony*

1 Introduction

Examination of the colour palette taking shape according to irregular and regular evenness.

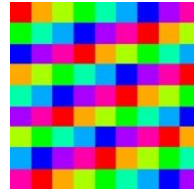
1.1 Form – Placement Types

1.1. Instinctively formed appearance resulting regularity. **Irregular**, because some of the colours concentrate on certain parts only.

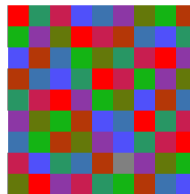


1.2. The spectacularly regular rhythm of the Sudoku-principle¹.

Irregular, because without a very detailed examination, if you take a brief look only, you can see the gaps in the rhythm of the placement of the identical colours.



1.3. The regular dispersion based on the Sudoku principle. The scale of the irregular effect is the pawn of **regularity**.



1.4. Instinctively (automatically) composed distribution of the colours trying to achieve **regular** dispersion.



1.4.1. Our experience, that both modes (1.3. and

¹ The Sudoku principle: If a surface consisting of $9 \times 9 = 81$ units is completed absolutely, every sign out of 9 can be found only once in every column and every row (su), and in every block ($3 \times 3 = 9$ units) out of 9 blocks the sign can be found only once, too.

1.4.) are **similarly spectacular** from an esthetical point of view, seems to be confirmed.

2 Questions on Colours

Connections between colours were examined on the basis of the solutions of my students assignments at university. Spring term 2011 – colour Sudoku – 43 sheets, filled in during the lessons and homework, most of them can be evaluated. Autumn term 2011 – balance of colours – 56 sheets, filled in during the lessons and homework, the distribution of colours of 22 sheets could be interpreted in a satisfactory way.² Spring term 2012 – balance of colours – 62 sheets, filled in during lessons, can be expected till the beginning of April 2012, not evaluated yet.

2.1. Forms of scales. 2.1.1. Scales of saturation – this effected the most difficult visual differentiation. (fig.1.). 2.1.2. Scales of brightness – in most cases it was confused with the scales of saturation, simple conceptions appeared. (fig.2.) 2.1.3. Scales of hue – di chrome (mainly complementary diad) and polychrome (9 degrees of hue) scales – the easiest cases of visual differentiation. (fig.3.)



fig.1. scales of saturation

fig.2. scales of brightness

fig.3. scales of hue

² There are 4 sheets based on the regular sudoku principle, 2 sheets „half-sudoku“: regular according to the columns and rows, and 1 sheet nearly „3/4-sudoku“: only in blocks of 3X3 some examples of irregularity can be found.

3 My Examinations on the Monitor

In our range of discerning colours we can only keep in evidence the relations of colours that bear a stimulus threshold, which effects a feeling of difference in our apparatus for the conception of colours as well, a temporary change of material or energy should come to existence.

So between two colours, for example the colours with the signs as follow:

R: 0, G: 255, B: 0 and R: 60, G: 255, B: 60;
(fig.4.)

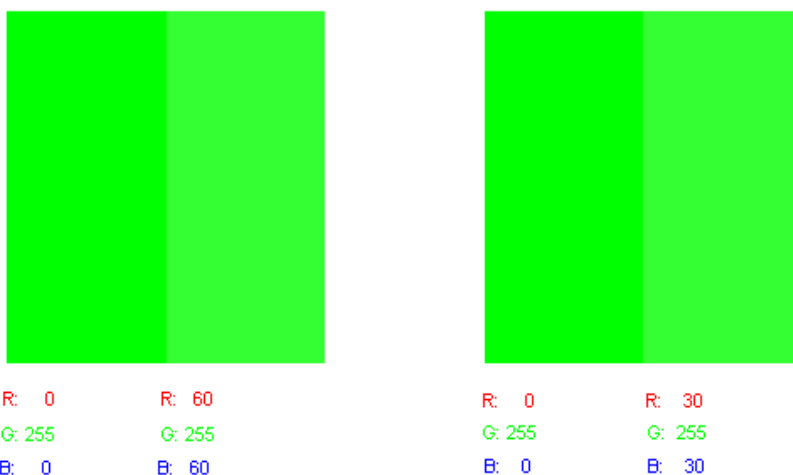


fig.4.

I could experience a difference of perception, but, if they are projected onto the screen, this difference couldn't be perceived at all. This example makes you wonder about the range of the mass of colours that can't be seen, which – metaphorically – escape into the world beyond perception across the border of perception. In order to illustrate, that this phenomenon is already known, I recite from a book written by Antal Nemcsics:

“3.1.1. “Theatre” of colours based on tests measuring the thresholds between them. The word threshold (sign: L) and its Latin pendant, the limen, basically means **border**, the border between these stimuli, which evoke the same reaction, and those, which evoke a different reaction. This difference limen (dL) means the just perceivable amplification of stimulus, in other words the just noticeable difference (JND).”¹

This means, that the perceivable differences between the colours are the range of colour stimuli, that can be characterized by the PERCEPTIONS OF COLOURS as well, while the differences of colours beyond this range of perceivable colours are ONLY the world of COLOUR STIMULI.

Consequently the question arises, where to look for the limit of perception of the differences between the 9 different colours of the Sudoku system, when I narrow down the differences between these colours.

1. It came to light, that the regular, rhythmical appearance helps to realize small differences between the colours.
2. The bigger the image and the greater the difference between the colours is, the better the perception of small differences between the colours is concealed. (fig.5, fig.6, fig.7.)

The regularity – apart from the appearance – concerning the relations of the colours is not complete, if the scales have got a final value. For example concerning the scale of saturation or brightness, because the final value (the fullest or the greyest; the brightest or the darkest) has got only one adjacent colour, the others have two they assimilate with. One has to look for the regularity in endless series (no ending), a curve returning to its beginning, the system of colour circles.

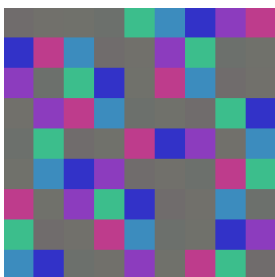


fig.5.

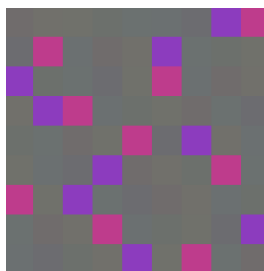


fig.6.

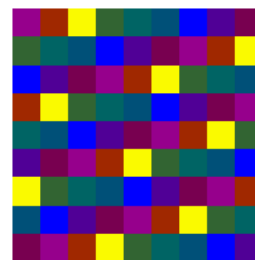


fig.7.

On the colour solid of the COLOROID Colour System the greatest saturation is at A10 between T65 and 70, at A70 it can be found at T20.

Consequently for a satisfactory approach of the SIMILAR COLOURS ACCORDING to the PERCEPTIONS OF THE COLOURS one has to reduce the saturation proportionally, if 9 colours are used and if similar grades of brightness are chosen.

Conclusions

I would like to mention, that one of my students – Zsolt Jámbor –as a member of the Scientific Students’ Society (TDK) has developed a COLOUR SUDOKU game with the help of his friend László Dienes, on their level of learning of course, it can be found at: colorsu.vacau.com.

References

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