

WEB-GRAPHICS

1	Graphic file formats.....	2
1.1	Supporting graphics by Web browsers.....	2
1.2	The GIF file format.....	2
1.2.1	Compression.....	2
1.2.2	Interlaced GIFs.....	3
1.2.3	The Indexed Color mode.....	3
1.2.4	Transparency.....	3
1.2.5	Animated GIFs.....	4
1.3	The JPEG file format.....	4
1.3.1	Compression.....	4
1.3.2	Progressive JPEGs.....	6
1.3.3	Animated JPEGs.....	6
1.4	The PNG file format.....	6
1.4.1	Compression.....	6
1.4.2	Results:.....	6
1.5	The FlashPix (FPX) file format.....	7
1.5.1	Quality and performance.....	7
1.5.2	Viewing FlashPix images.....	8
1.6	Conclusion.....	8
2	Colors on the Web.....	8
2.1	Color management systems.....	8
2.2	Colors supported by browsers.....	9
2.3	Colors in Web design.....	9
2.3.1	Color perception.....	9
2.3.2	Compatibility of colors.....	10
2.3.2.1	Begin with the Hue.....	10
2.3.2.2	The Value and Saturation.....	10
2.3.2.3	Results.....	11
2.3.3	File size and color.....	11
2.3.3.1	Reducing palette.....	11
2.3.3.2	The Color Lookup Tables (CLUTs).....	11
2.3.4	Optimum sizes for graphic files on the Web.....	11
2.3.4.1	Creating miniatures.....	11
2.3.4.2	Alternative text.....	12
2.3.4.3	Low resolution files.....	12
3	Preparing images for WWW.....	12
3.1	Your first step.....	12
3.2	Scanning.....	12
3.2.1	Scanning modes.....	12
3.2.2	Scanning sizes.....	13
3.2.3	Arranging the image.....	13
3.2.4	Graphic file format.....	13
4	Not only images.....	13
4.1	Background graphics.....	13
4.2	Titles.....	13
4.3	Text.....	14
5	Conclusion.....	14
6	Appendices.....	15
6.1	Shareware.....	15
6.2	Web Resources.....	15
6.3	CD-ROM.....	15

In this paper, we have used the material issued by well known Web designers: Dmitry Kirsanov, Artemy Lebedev, Matt Straznitskas and others. Notes, additions, comments are welcomed at (Irina Shumilova <irinash@aiha.sovintel.ru>).

1 Graphic file formats.

1.1 Supporting graphics by Web browsers.

In contrast to the HTML standard supported by all types of Web browsers, there does not exist any standard for graphic formats. The World Wide Web was intentionally developed as an open space incorporating a large variety of co-existing graphic standards. Obviously, the WWW designers aimed at the best, but failed as usual. Also, modern Web browsers support various types of plug-ins. This technology was developed by Netscape Corporation as a means for increasing the capacities of Web browsers. Yet plug-ins proved unable to resolve the problem, since the plug-in technology involves the installation of a software that enables the user to run the corresponding files through the use of his Web browser. Though all widespread plug-ins are available for free download on the Web, the users may not want to install them on their PCs. Fortunately, the Web browser manufacturers restricted the number of graphic formats. Yet this number continues to increase.

1. GIF stands for Graphics Interchange Format (file extension is .gif.)
2. JPEG stands for Joint Photographic Experts Group (file extension is .jpg.).
3. XMB is a format used under OS UNIX. It is commonly used at universities and research laboratories where PCs of very high performance run high speed applications.
4. A new format is presented by PNG – Portable Network Graphics (file extension is .png). Compared to GIF or JPEG, it has some considerable advantages.
5. FlashPix (FPX) is still another new format. It was developed by the Life Picture company and does not require any special plug-ins or Web browser updates. Yet its use requires some special software to run on the Web server.

1.2 The GIF file format.

GIF is the most popular graphic format on the Web. GIF was first designed in 1987 for the use in CompuServe, one of the first non-commercial online networks. The users of that network disliked the necessity to unpack image archives stored in CompuServe file libraries every time they wanted to view them. The solution was obvious: the format itself must contain well compressed graphic data. The applications intended to process that format should contain a built-in unpack algorithm. Nowadays most of the graphics on the Web is stored in the GIF format

1.2.1 Compression.

The GIF file format acquired its popularity because of its powerful ability to compress graphic data. It uses the Lempel-Ziv Welch algorithm. According to LZW, a series of N similar octets are compressed in a single one multiplied by N, in other words, GIF replaces a number of octets (say, pixels of the same color) by only two of them: in our example, the first octet gives the number of times the color is repeated, the second octet gives the color itself. That is just the

reason for referring to LZW compression scheme as Loss Less (as opposed to Lossy): though the data are compressed, the unpacked graphics is absolutely similar to the source file.

1.2.2 Interlaced GIFs.

When you load a graphic file from the Web, the screen is usually refreshed from top to bottom. The interlaced GIF presents an alternative way to load images. The different parts of the graphic file will be simultaneously displayed. The interlaced GIF is stored row-by-row in several steps. Beginning with its top part and the first pixel row, the interlaced GIF stores first each eighth row skipping seven. The second step consists in storing each fifth row, i.e. the middle of the empty interval, and so forth. The process stops when all pixel rows of the file have been stored.

Figure

step 1 (rows 1, 9)
step 2 (rows 5,13)
step 3 (rows 3, 7, 11)
step 4 (all other rows)

When the image is loaded through the use of a Web browser, it is displayed in a similar way. Since its different parts are loaded simultaneously, the user can conceive it before the loading process has been completed. (You may find an example of interlaced GIF at [http://www.rainorshine.com/index.ssf?\\$\\$WHICHMAP=todtemp470x300&\\$\\$MAPTITLE=U.S.+24+Hour+Forecast](http://www.rainorshine.com/index.ssf?$$WHICHMAP=todtemp470x300&$$MAPTITLE=U.S.+24+Hour+Forecast); an example of slow GIF loaded row-by-row at <http://mapmak.mecom.ru/MAPS/HTML/MAP01.HTM>). Sure, the use of the interlaced mode makes sense only for large files, when loading becomes time-consuming.

1.2.3 The Indexed Color mode

The GIF file format is restricted to 256 color palette. That means that, after conversion to the GIF format, the file will contain only 256 colors or less independently of the initial number of colors in that file. The reason of this restriction consists in that the GIF format was developed for network connections of low performance. Since each color included in the graphic file carries some extra-data, the reduced number of colors implies a smaller file size and speeds up loading. When, however, two or more areas of different colors are too close to one another in the color pattern that forms the image, the human eye naturally mixes them to make a single color. Thus the restricted 256 color GIF palette can yield a large range of colors.

1.2.4 Transparency.

The effect of transparency consists in rendering invisible one or more colors of the graphic file, thus enabling other colors to be visible through them. The information concerning transparent colors is stored in the GIF file. When a Web browser reads such file, it simply ignores areas marked as transparent and applies no color to them. Any color you have made transparent thus becomes invisible. Any background color, graphics, text placed behind the foreground image will be visible through the transparent areas of the graphic file.

1.2.5 Animated GIFs.

You are certainly familiar with animated GIFs. Banners, rotating balls, movies are all examples of the GIF animation technology. When this format was created in CompuServe, it featured the little known ability to save several images in the same file. These pictures are displayed consequently, as in an animation movie. The designer is free to define the delay before loading the next image. Short delays correspond to high reproduction rates, large ones – to low reproduction rates. (For example, <http://www.chat.ru/~gragall/> is an interesting animated page and is interesting even irregardless of animation issues; <http://www.circusnikulin.ru/> is an animated GIF). For the GIF animation, the number of frames, i.e. different images, strongly influences the resulting file size.

GIF Movie Gear is a program for creating animated GIFs. It is very useful for creating very small files and is the best existing GIF animation tool. (<http://kucha.rinet.ru/adnload/nt/dlgifmovnt.html>).

Gif Construction Set is a special utility for combining several GIF images in a single file and displaying them in the form of an animation movie. (www.mindworkshop.com/alchemy/alchemy.com).

1.3 The JPEG file format .

The JPEG file format is a compression standard developed for decreasing the size of graphic files that contain gradient colors and shades. It should be used primarily for pictures and graphics with complicated shade and light effects and for 3D graphics.

The only widespread graphic format whose compression rate undoubtedly exceeds the compression rate provided by the GIF format is JPEG. However, JPEG owes its impressive results to technologies that are not quite legal, so to say: storing files in this format results in a lower image quality. It should be noted that the JPEG technology yields a considerable size advantage, while the quality lowering is only weakly perceivable by the human eye.

The ability to store full color pictures (16 million colors, i.e. true color mode) is still another advantage of JPEG compared to GIF format restricted to 256 color palette.

1.3.1 Compression

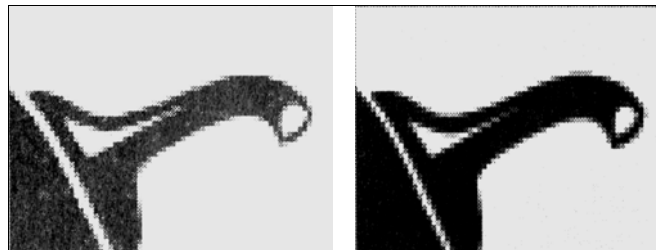
The JPEG compression totally preserves the black and white version of the picture and the most part of the color information. The color information is partly lost whence the name of the JPEG compression scheme – Lossy. This feature is especially strong for high compression rates and results in a low resolution or a random distribution of pixels.

This phenomenon accounts for the fact that editing graphic files and storing them in JPEG is not recommended. Even if you choose the best quality for JPEG, the resulting image will have losses and further editing will not be possible. Multiple storage of a file in JPEG during editing leads to irretrievable quality losses!

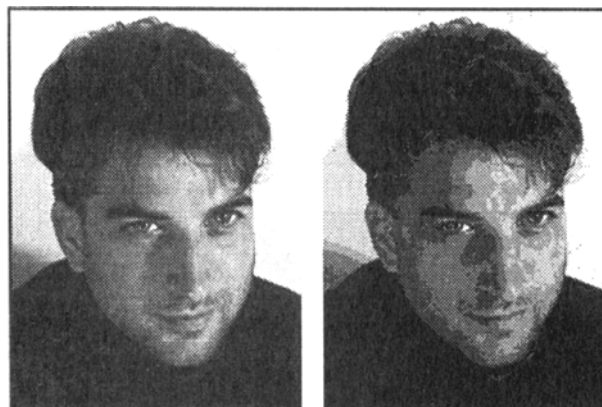
In contrast to the GIF compression scheme analyzing files row by row, JPEG divides image into areas with close colors. As a result, if you apply the JPEG file format to “sharp” graphics with large monochrome areas, you will obtain a low quality. The GIF file format will meet such needs better and besides, it provides a significantly higher compression rate.

The JPEG format is commonly recommended only for pictures where the quality lowering due to its compression technology is not very noticeable. A more correct approach suggests to divide all pictures into two categories: «artificial», that contains contrast color changes and large areas filled with uniform, «flat» colors, and «natural», characterized by soft changes and alternating patterns without sharpness. The pictures created with use of PC, that is, logos, text headings and so forth, obviously belong to the «artificial» category, while scanned pictures and drawings to the «natural» category. The exceptions are also possible, however.

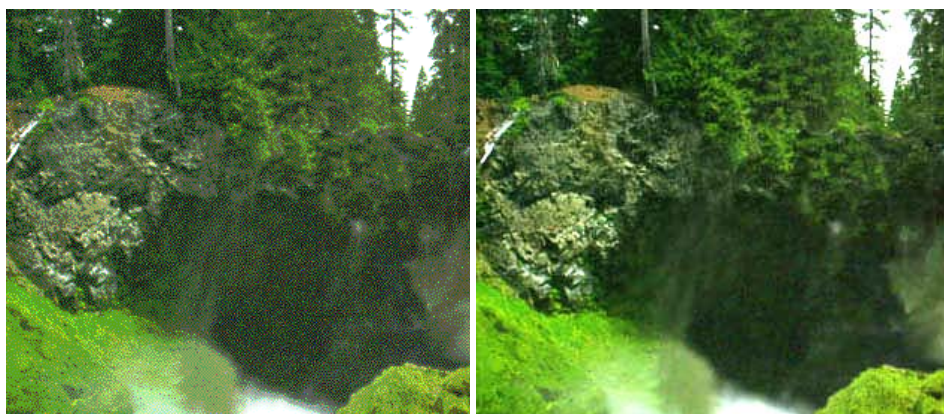
The JPEG format is not recommended for most of the «artificial» pictures: garbage and fringing that accompany sharp color changes are too obvious. From the other hand, the GIF format may definitely spoil a beautiful picture, embedding it into its 256 color palette. As a result, the (not very distinct) boundary between «artificial» and «natural» images coincides in most cases with the border between GIF and JPEG possessions. Fairly «artificial» images may also look quite pretty in JPEG, especially if they are small and have dark colors. Your taste and eye are the best judges here, while the criterion, in case of doubt, is provided by the size of the resulting file (before comparing the file sizes we recommend you to read the above material on how you may sometimes significantly shrink a large GIF file. Here is a “sharp” graphic example.



However, JPEG is an outstanding tool from the standpoint of compression when you have to handle graphics with a large color range, as is the case of a portrait, for instance.



or of a landscape.



In contrast to GIFs, JPEG files cannot be saved in indexed color mode. Rather, you should save them in RGB mode. It is useful to explore various compression rates and find a set of parameters that provide the best quality/size ratio for each JPEG file.

1.3.2 Progressive JPEGs

The progressive JPEG files are similar to interlaced GIFs in that they define the method of displaying JPEG graphics at loading. Instead of loading from top to bottom, the progressive JPEGs load different parts of the graphic file simultaneously. The user can see the graphic contents before the loading process has been completed.

Only the most recent versions of Web browsers, however, support the progressive JPEG standard.

1.3.3 Animated JPEGs.

In contrast to GIFs, JPEG files do not allow to include more than one picture in a file. The animated JPEGs are thus not very common on the Web. If a Web designer wants to reproduce a sequence of JPEG files in the same place of a Web page, he may make use of a scenario or a loaded Java application. The Java applet may be time-consuming during initialization and running on a slow PC, however. Besides, though the most recent Netscape and Microsoft versions do support the Java standard, the older browsers, especially those from the commercial online service America Online, do not.

Hence, though GIFs do not always provide the best graphic quality, this format is far more reliable for animation purposes.

1.4 The PNG file format

In 1994, the Unisys company, the developer of the GIF compression technology, announced its intention to introduce payments for all developers of the software that supports GIF. The expenses arising from the use of the GIF format, and the JPEG format drawbacks resulted in demand of a new graphic format that would be free and enhance the GIF and JPEG formats.

The development efforts resulted in the creation of the Portable Network Graphics, PNG, format. Though the PNG format is still not very common for the Web, many image editing tools feature the ability to store files in that format.

The specification of the PNG format includes some new very interesting possibilities. Among them the automatic color correction provided for the port to other platforms, and the effect of variable transparency.

1.4.1 Compression.

The common opinion asserts that PNG provides a better compression than GIF. As for all compressed data formats, the efficiency, however, depends mostly on the quality of the encoder of the image editing software. Similarly to GIF, PNG presents a Loss Less compression scheme. That means that all the color information stored in the source file will be present after the picture has been decoded in the Web browser window. Contrary to GIF, the PNG files are not restricted to 256 color palette. The PNGs can be generated from images either in RGB mode or in indexed color mode, while JPEGs cannot.

And, since PNG is a real Loss Less format and supports the creation of RGB files, the size of those files exceeds the size of the corresponding JPEG files.

Browsers that support the PNG graphics are not currently widespread. The most recent versions of Netscape and Microsoft Internet Explorer, Mosaic, however, can already provide Web pages with PNGs.

1.4.2 Results:

- PNG implements an open, not patented scheme for data compression that yields better results than GIF does.

- In contrast to GIF with its 256 colors at maximum, PNG allows to store full color pictures with 24 and even 48 bits per pixel.
- PNG implements a largely more efficient interlacing (that should be rather called “interpixelling”) algorithm. It is sufficient to point out that the first step in PNG, giving a general description of the image, takes up one sixty fourth of the source file compared to one eighth in GIF, while the image view is much better for PNG.
- PNG allows to store a full information on the degree of transparency at each point of the image under the form of the so-called alpha-channel. Every pixel of the PNG file, irregardless of its color and location, can have any degree of transparency, from zero (full opacity) to an absolute invisibility.
- To smooth the differences in display brightness between different PC types (and, correspondingly, between their pictures), PNG allows storing in the file the initial brightness coefficient for the display with use of which the image has been created. That enables Web browsers, before displaying an image, to tune its brightness in order to adapt it to specific characteristics of the videosystem (the so-called gamma correction).

The only disadvantage that PNG might have in comparison to GIF is its incapacity to store several pictures in a single file and to create any kind of animation.

1.5 The FlashPix (FPX) file format

The FlashPix file format first appeared in 1994 under the name of IVUE and represented a format for the Live Picture image editor. In 1995, the companies Kodak, Microsoft, Hewlett Packard, Adobe and others joined their efforts with Live Picture, in order to turn IVUE in a standard graphic architecture that would permit a fast handling of complicated pictures without applying any hardware of superhigh performance. Though that format is relatively recent, hundreds of existing products, from digital cameras to scanners and image editing tools, do support it.

FlashPix is created so that it can support some applications running on old-fashioned PCs (even those having 8 Mb of RAM), and enhances the capabilities of viewing image details and editing high resolution images.

Although the FlashPix file format is not yet commonly adopted on the Web, it is a standard adopted by the Digital Imaging Group (DIG) who focuses on digital images.

1.5.1 Quality and performance

Try to imagine that you have a good airborne picture of your city. If you scan it at a resolution of 600 dpi, the picture will be too large and its loading – time-consuming. The FlashPix technology resolves that problem.

The FlashPix file can simultaneously store several versions of the same image with different resolutions. All these versions are divided into square and not crossing parts.

That enables applications to choose a resolution that would be suitable to specific user requirements. Changes, information on layout, and other information on how to use the picture are stored under the form of a small scenario separately from the picture.

When you store an image in FlashPix, a set of images is generated for different resolutions that are hierarchically arranged later. Digital Imaging Group, the format developers, illustrate its underlying idea as a pyramid with the image made at the highest resolution at bottom and the one made at the lowest resolution at top of it. When the browser displays an image, it selects the most suitable version to the size of its current window.

The FlashPix files have still another undeniable advantage: when the user scales a part of the image up, the pixels located beyond the displayed area are not loaded in PC memory. That enables users to change FlashPix files using a relatively small amount of RAM.

1.5.2 Viewing FlashPix images

Immediately after the FlashPix format appearance, viewing images stored in that format required a special plug-in from Live Picture. Live Picture sells now both a Java applet and an Image Server. As a result, the Web designer is given the possibility to configure a FlashPix file in such a way as to make it appear in the browser window as an ordinary image map. Each time the user clicks on a specific image part, the Image Server or the applet calls that specific part of that image.

However, Image Server is not a very cheap software; and it would be useful if you persuade your IS Provider or the organization it is sponsored by to purchase and install that software on his Web server.

The information on Image Server is available at www.livepicture.com.

1.6 Conclusion

The PNG and FlashPix formats are undoubtedly very interesting and promising; nonetheless a considerable time is still required for Web browsers and Web servers to support those formats everywhere. Besides, it is strongly recommended to the users to substitute their software for newer versions.

As a result, irregardless of a rapid growth of the Web during the second part of the last decade, in most cases you have only two choices: GIF or JPEG. GIF is still the most useful format for Web graphic and animation files, while JPEG is better suitable to “artistic” images.

I hope the information on new technologies regarding graphic problems was useful and interesting for those who are concerned about these problems.

2 Colors on the Web

The color notion is much more complicated for the Web design than it seems at first glance. Some of you might have already encountered the phenomenon consisting in that your Web images look too dark, although they have looked quite nice at your display. Or maybe you know something about strange color shifts when viewing Web images.

Consider some approaches to building images with colors that are unchangeable for all browsers, operating systems, and hardware.

2.1 Color management systems

All of you certainly know what the color is (or maybe guess, or think that you know from school physics courses ☺).

As for the combination of PC hardware and software responsible for displaying onscreen colors, it is referred to as *color management system*. All such systems operate in a similar manner, but each of them displays colors in a slightly different way.

In reality, the computer color means the color depth. If your monitor displays up to 256 colors, it is said to operate in 8-bit color mode. Not way back, the PCs had 1-bit monitors, and each pixel had only two states: on or off. The existing PCs can operate in 24-bit mode or even higher which corresponds to more than 16 million colors.

Mode (the number of bits)	1	2	3	4	5...	8...	16...	24...
The number of colors	2	4	8	16	32	256	65 536	16 777 216

2.2 Colors supported by browsers

Customarily, the color management system reserves at least 40 colors for the system software. Example: the navy blue used by Microsoft for window titles. Subtracting 40 colors from 256-color palette of 8-bit system leaves only 216 colors for applications analogous to Web browsers. The number 216 is thus the number of colors available to Web designers. Showing an extraordinary unanimity, Microsoft and Netscape adopted the same 216-color palette for applying in their Web browsers. This palette is based, however, on purely mathematical ideas. As a result, it contains a relatively large number of blue and green colors and insufficient number of red colors. In addition, most of these colors are too dark and cannot be used as a text background. Yet building images outside the palette increases the possibility of displaying your Web page inappropriately.

2.3 Colors in Web design

Though the capabilities of the 216-color palette are restricted, the professional designers have found ways to enhance it. Besides, applying JPEG file format, for example, excludes the use of 216-color palette.

There exists a notion of “safe palette”, that is, a set of colors reproduced appropriately by Web browsers. It may be downloaded from the Web at <http://www.design.ru/free/colors/>. Or, as one may easily see, the RGB values of all colors supported by browsers are 0; 51; 102; 153; 204 or 255, the corresponding hexadecimal values being 00; 33; 66; 99; CC; FF. This arises from the fact that all safe colors are built from 0%; 20%; 40%; 60%; 80% or 100% combinations of red, green, and blue. That simple formula yields all the color palette supported by browsers.

For those who are interested – you may calculate all color values manually (through the use of Windows Calculator in the Scientific mode and the Hex/Dec switch). A straightforward rule is helpful: the 216 colors of this palette result from combining the red, green, and blue components who may take only 00, 33, 66, 99, CC, and FF hexadecimal values (or 0, 51, 102, 153, 204, and 255 decimals). Each of the three components thus may take six different values, and combining them provides $6^3 = 216$ possible colors.

2.3.1 Color perception

The perception of a color by the human eye depends by its nature on that color form and size and on what that color environment is.

The number of hues perceptible by the human eye decreases with decreasing color size, and most of the colors become too dim and dark, especially if their initial brightness and saturation were not set to maximum. In practice, that leads to the necessity to select more bright and primitive colors for small elements, and to take a sufficient area (say, the background of a whole page) if it is necessary to show the beauty of some dark tint.

Any two colors physically close to one another are slightly differently perceived compared to when they are separated. The artists know well that the physical objects are related between them by complicated color relations: they interchange reflections (reflected light) and colored shades.

If the neighboring colors have approximately the same brightness, they are inclined to interchange their color and saturation. For example, the dim blue put close to bright green acquires a greenish tint and becomes slightly more bright; as for the green, it partly loses its

brightness and also shifts towards the blue. These effects are the most pronounced when one color surrounds the other and «supress» it.

Close to the boundary of two adjacent colors an opposite trend appears: the colors seem to reject one another, try to persist in their original properties, the more dark color acquires a still more dark edge close to its lighter neighbor, while the latter becomes more bright in the area bordering the boundary. Such an influence of the colors over one another, resulting in enhanced contrast between them, is the most expressed when the adjacent colors differ strongly in brightness. A bright white background makes almost all sufficiently dark colors look black, a dark or black background enhances primarily the intensity of bright and saturated colors, while dark or not saturated colors look fairly pale.

2.3.2 Compatibility of colors

The Color compatibility is one of rare domains of design where almost each amateur has its own opinion. A professional designer knows that colors are many more numerous than seven and that two «green» colors may differ from one another as strongly as black and white do and uses general principles more voluntarily than ready prescriptions, though in many cases even these principles cannot substitute the intuition and experience.

The opposite and reciprocally additional principles are especially important for selecting a right color: these are the principles of *unity and contrast*. The unity principle requires that the applied colors are as close as possible, ideally, merge in a single color. That may really work: similarly to a woman who chooses a hat that would be of the same tone as gloves, the designer restricts the color range of a composition to a low number (usually not exceeding 3 or 4) of colors, each of them being used for a few elements.

Many professional pages are implemented in a single color range. For example, the dark tones of the main color serve as a background, lighter tones apply to the text, saturated ones to decorative elements. (www.idoe.com). A correct solution of this kind, however, requires a rather professional approach. Because of this, if you are not sufficiently experienced, it would be better to apply a well known prescription: use a minimum number of colors, but try to select contrast ones.

How then should you choose a good combination of contrast colors? What does define the contrast between them?

In the HSV system, the color is decomposed into three components: Hue – Saturation -- Value

2.3.2.1 Begin with the Hue.

The first rule is simply formulated: you should never choose the hues (colors) located too close to one another in the hue circle: the dissonance between them will be very sharp to the eye (just as the dissonance between musical notes that are half a tone apart does not sound pleasant to the ear). From the other hand, the directly opposite hues are unlikely to form a harmonic pair: the green and the magenta, or the red and the blue usually look too heterogeneous (only the dark blue and the yellow are fairly compatible). Maybe the most compatible and nicely contrast pairs are formed by colors that are separated by some moderate distance.

The two other parameters are easier to choose.

2.3.2.2 The Value and Saturation.

The difference in value and saturation of two hues is easily discernible, yet it is perceived as something secondary in comparison with the difference in the main hues. It then would be reasonable that the hues differ strongly in one of these parameters thus saving the contrast between them, and would be similar in the second parameter that would preserve the color solution from decomposing. If the color unity and dialog are not very important to you, you may apply the opposition of all the three color components: instead of enhancing the contrast, an

increase in the number of strictly opposite aspects weaken it, reducing the unity of different elements. And vice versa: if you want to emphasize the color interaction by unifying them with a very tight contrast, you should use two parameters for unification, and one of them (the value is the best) for opposition purposes.

Now it must be clear why the white and especially the black are highly compatible with most of the other colors. The absence of the hue and saturation components from these colors makes the observer to perceive them as a bright or dark modification of their adjacent color. In reality, that implies applying the technique of two common and one opposite parameter that corresponds to an almost perfect combination of the unity and contrast principles.

2.3.2.3 Results

The above advices may prove very helpful to you, but they are of little use without exploratory work and experience of your own. There exists a large variety of beautiful color sets that cannot be described by the above formula. From the other hand, a great number of disagreeing color pairs are prepared in strict accordance with the rules. In addition, the color choice depends strongly on what type of elements the given colors are intended to.

2.3.3 File size and color

When your work is intended to Web, it is important that the created files are as small as possible in order to make the page loading less time-consuming. The size of a color file may be shrunk by at least two methods. First, when you create an image, you may reduce *the number* of colors. Second, you may reduce the color *set* used for the given image.

2.3.3.1 Reducing palette

Since each color in a graphic file carries an additional information, the reduction in number of colors used in the given file results in lowering the image quality. That makes necessary a reasonable equilibrium between the reduction in the number of used colors and preserving high image quality.

2.3.3.2 The Color Lookup Tables (CLUTs)

The second way to shrink the graphic file size consists in reducing the number of colors in the Color LookUp Table (CLUP). CLUP represents invisible files stored together with GIFs. They contain a color library used for image building. The larger the number of colors in CLUP, the larger the size of the resulting graphic file.

An optimized CLUP should contain *only* colors needed for image building.

2.3.4 Optimum sizes for graphic files on the Web

According to recommendations of experienced Web designers, the files containing images should not exceed 20 – 40 Kb, buttons and icons – 2 – 6 Kb.

It is useful to control the overall size of Web page files. For that, you should add the sizes of your HTML file and of all created images. It is desirable that the total size does not exceed 300 Kb. (For example, the user having the connection performance of 19.2 Kbps will wait some 2 minutes for a page of 300 Kb to be loaded.)

Besides, there exist techniques for acceleration of the Web page «perception».

2.3.4.1 Creating miniatures

With squeezing graphic file size, its image becomes poorly discernible, but is still informative. You may make that file refer to another file of a larger size that contains an image resolved just right as you see it. Whoever wants to obtain the original image will load it into memory of his PC. Other users are not obliged to wait for a large unnecessary file to be loaded.

2.3.4.2 *Alternative text.*

You may define a text to describe your image. The users will then be able to read a brief description of the image contents and decide whether they have to spend time waiting for that image to be loaded.

Defining an alternative text is considered to be polite on the Web. It is put quite straightforward:

```
<IMG SRC=image filename ALT="alternative text">
```

2.3.4.3 *Low resolution files*

You may create your file copy differing from the original in size reduced at the expense of lower resolution, for example, its black and white version.

This way, the Web browser will be able to first load that «draft» version, and after having completed the page loading, to load the original image.

It is also put straightforward:

```
<IMG SRC= original filename LOWSRC= draft filename>
```

3 Preparing images for WWW.

3.1 Your first step

Your first step is to sweep the monitor covered with thin dust layer. ☺

You should begin with printing:

- Light (yet not faded) pictures yield better results;
- You should better print on a contrast paper (if the choice is available);
- If you scan low quality pictures and hope your all-power image editing software will improve them, you will be disappointed: the law «Nothing can arise from nothing, and nothing disappears leaving nothing» (© M.Lomonosov) is still in vigor;
- In order to avoid highlights when scanning pictures, print them on mat and, if possible, on not thin paper.

3.2 Scanning

3.2.1 Scanning modes

In “automatic” scanning, the scanner finds the black and white points, and sets the contrast coefficient to unity by default. If you find pre-scanning results not satisfactory:

- change the contrast coefficient,
- define a new value for the black/white point.

A few words regarding the white point. If your picture has not any significant white area, (for example, a speckle in the pupil is the single white dot in the portrait), your scanner may ignore it and assign the white value to less white areas in the picture (for example, to light-colored face skin). If this is the case, you should choose the white point manually. If your picture has no white areas at all, you should set the white point to some reduced value so that the picture looks pleasant to you. A portrait against a dark background, for instance. If you assign a value of, say, 23% to the white point (to the same light-colored face skin), then the picture will look fairly pleasant. Things are similar for the black point.

3.2.2 Scanning sizes.

You have to define now the resulting file size (in pixels). At this point, you encounter a dilemma: the lower the image size, the less details it has, while increasing the size leads to an increase in image loading time.

- What image size and, correspondingly, scanning parameters to choose? Suppose you scan a picture of 10x15 cm (4x6 inches). The resolution of 72 dpi and the scale 1:1 yield an image of $4 \times 72 = 288$ pixels in height and $6 \times 72 = 432$ pixels in width.

3.2.3 Arranging the image

The GIF compression rate of graphic information depends strongly on how repetitious and predictable it is, but sometimes also on the image arrangement. Since in the GIF technology the image is scanned by rows, the same smooth change in colors (gradient) will be much better compressed if it is directed from top to bottom than from left to right, and the latter will be better compressed than the same gradient of a diagonal orientation.

3.2.4 Graphic file format

After having scanned your pictures, do not hurry to save them as JPEG files.

If you want to edit your graphic file in future, each subsequent saving (and they may be numerous!) of it in the JPEG file format will reduce its quality (owing to accumulation of compression losses). It would be better to store your scanned images, say, in the TIF format (with compression) and to store their copies in JPEG only after having completed image editing, still storing the original in the TIF file format.

4 Not only images

A Web page represents a mosaic of small images, icons, buttons, (banners), and text that are all put together through the use of HTML.

4.1 Background graphics

Using background graphics in building Web pages allows you to create a well recognizable style of your own.

It is intended to emphasize the common character of the page design, to unify all its elements rather than to distract from the contents.

The background images may be stored either in the JPEG or in GIF file format, depending on the image type.

The background image size should not exceed 20Kb. "The less, the better" is true for the Web.

The background images must never be transparent. Besides, you should avoid applying interlaced GIFs or progressive JPEGs.

4.2 Titles

Using graphic titles is a good way to attract attention to your page. You may complete them with graphic elements like emblems, manage font selection, and use various colors, patterns, or light-shade effects.

The elements absolutely necessary for every Web page – background, text, and hyperlinks – pose an interesting problem of harmonization of the three (or even four, including the color of "visited" links) colors that take up very different areas and play different roles in the page. Lots of pages, having very few graphic elements and a very simple composition, are quite eye-catching and easily remembered for the only reason of their color set. (www.versaware.com)

provides a good example for that). The color solution of a page includes three Hues having strictly hierarchical disposition by their Value and Saturation. Although the page design may be very simple, those Hues will give an impression of equilibrium and harmony.

4.3 Text.

The main requirement to the background and text colors consists in that they must be sufficiently contrast to make reading comfortable and easy. That contrast is provided primarily by different values of those colors, because the difference only in hue and saturation would not permit to automatically discern the text from the background. Moreover, if the text font is small, its hue and saturation differences are barely enough to render it readable (in addition, black and white output devices ignore these parameters).

It is not therefore surprising that, according to psychological tests, the black foreground and white background is an optimum choice for comfortable continued reading.

In addition to that combination, there is a countless number of others that assure a good readability of the text, but your choice of one of them should take into account the general style of the page design, compatibility of these colors, and many other, purely esthetic, factors. The unusual color solutions for Web pages fall into two large categories: dark text against light background and light text against dark background. The latter is much more common than the former (not accounting for conventional black and white pages still in the vast majority).

To render hyperlinks sufficiently outlined, they should be assigned a more apparent color than the main text, while such appearance may be achieved by various methods: enhancing hue contrast, increasing saturation, enhancing or reducing value. The visited links must communicate that they have already been in use by a less saturated color or a color closer to the main text color.

An example of well balanced color design may be found at (www.chess.ibm.com). Its light but fairly saturated background (hexadecimal # CCCC99) is very expressive, an attenuated black color (# 333333) is selected for the text. A contrast but equally attenuated blue (# 0033FF) paints the hyperlinks. Other graphic elements support that various yet harmonic set of colors.

For continued reading, a light text against dark is less comfortable than the black text against white, yet it exhausts the eye less at limited reading times, because it reduces the amount of monitor light striking the eye.

The following sites provide examples of that solution:

- Blue velour (www.verso.com). In contrast to it, the text is given by warm tones, especially yellow.
- Unusual color effect (www.bdaweb.com) is due to the total refusal from colors: the dark grey characters against black look esthetic by their calm appearance though they would look gloomy unless the bright orange of the logo and links.

5 Conclusion

At the next seminar I would like to discuss some specific procedures of applying image editing tools. Call me, please, at Irina Shumilova (irinash@aiha.sovintel.ru), Irina Carnevale (icarnevale@igc.org), or Mark Storey (mstorey@igc.org), to specify what image editing tools you would like to study and if that meets your particular needs at all.

I would also like to know your attitude to whether studying the Flash technology is warrant including in the program of the next seminar.

6 Appendices

6.1 Shareware.

LView Pro is a program featuring the ability to store files in the GIF file format with an arbitrary color depth, shrinking substantially their size. www.lview.com.

Paint Shop Pro (PSP) – In the middle of September, 1999, Jasc Software produced the next version of its image editing tool Paint Shop Pro 6. If it could be previously considered as an ordinary tool for editing raster images, now it should be dimmed as rather a Web oriented tool and besides, a best one. The trial version of this packet available at manufacturers' server takes up some 14.5 Mb which is fairly moderate compared to its monstrous competitor Adobe Photoshop. The new version features a considerable number of additions and enhancements, and the 6 referring to the version number is consistent with those changes. www.jasc.com/psp.html.

For Web animation, see <http://kucha.rinet.ru/imganint.html#moviegearnt>.

GIF Movie Gear is a program for creating animated GIFs. It is very useful for creating very small files and is the best existing GIF animation tool.

<http://kucha.rinet.ru/adnload/nt/dlgifmovnt.html>.

Gif Construction Set is a special utility for combining several GIF images in a single file and displaying them in the form of an animation movie.

www.mindworkshop.com/alchemy/alchemy.com.

Safe Color Table <http://www.design.ru/free/colors/>

6.2 Web Resources

"A Design for Those Who Are Smart" On Important and Useful in Web Design, with Ease (in Russian) <http://www.design.ru/kovodstvo/main.html>.

"Top Ten Web Design Tips" – Top rules for professional Web Designer (in English)

<http://www.design.ru/ttt/>.

Useful URLs on Web Design (in Russian and English)

<http://www.design.ru/kovodstvo/iskopaemoe.html>.

Collection of Programs and Utilities for Web design

<http://www.dir.ru/internet/graphics/index.htm>.

6.3 CD-ROM

to the book by Andy Shafran "Creating Your Own Web Pages" contains a large collection of images, examples of Web pages, audio- and videofiles, shareware versions of some HTML- and graphic editing tools, useful utilities.