The Filter Factory Programming Guide

November 29th, 1997

Contents

0. About this document

Although you may distribute this document freely, its contents are not allowed to be completely or partly reproduced for commercial purposes without permission. Should you want to publish all or parts of this docuemnt, please contact me or the author mentioned in the tutorials. Copyright 1996-7 by Werner D. Streidt, Stuttgart, Germany. This document is a guide to programming your own image filters with the plug-in Filter Factory in Adobe Photoshop, Adobe Premiere or Photoshop Plug-In compatible programs (see following chapter).

1. What is Filter Factory?

Filter Factory (FF) is a plug-in for Adobe Photoshop 3.0x (Macintosh and Windows) and above created by Joe Ternasky. The main idea of FF is to let users create their own filters and effects with an internal programming language (which resembles C) and compile them as separate plug-in files. These programs support Filter Factory filters:

Mac:	Adobe Photoshop 3.0.x	PC:	Adobe Photoshop 3.0.x
	Adobe Illustrator 7.0		Fractal Design Painter 4.0.x 32-bit (no alpha channels)
	Macromedia Freehand 7.0		ASC Paint Shop Pro 4.0 32-bit*
	Adobe PhotoDeluxe 2.0		Adobe Illustrator 7.0
			Macromedia Freehand 7.0

**

**(no alpha channel support, also, it needs MSVCRT10.DLL to work with 56k old-fashion FF filters (means FF from PS 3.04) (msvcrt10 is free) and both MSVCRT10.DLL and PLUGINS.DLL (latter copyright by Adobe, a part of PS 3.05) to work with 48k filters made by FF from PS 3.05) Ilyich, the Toad*

These programs do not support Filter Factory filters:

Mac:	Adobe Premiere 4.0 (has its own Filter Factory)	Macromedia xRes 3
	PixelPaint Pro 3.0	Ray Dream Designer 4.0
	Debabelizer 1.6.5	Deneba Canvas 5.0

1.1 Where can I find Filter Factory (newest versions)?

The Filter Factory plugin comes with every version of Photoshop 3.0x and above. The newest version for Windows is the one included in the Photoshop 3.0.5 CD-ROM. It is located in the Goodies/Ffactory directory/folder of the CD-ROM. If you don't have the Photoshop CD-ROM version you can get the freely distributable file FFACTORY.ZIP in the Filter Factory Compendium page, `http://pluginhead.i-us.com`

1.2 Where can I find this document?

Copies of this document will be available at the following pages in the Web:

Werner D. Streidt Page - `http://www.fhd-stuttgart.de/~ws01/fffaq.htm`
Alf's Filter Factory Compendium - `http://pluginhead.i-us.com/ffc.htm`
PC Resources for Photoshop - `http://www.netins.net/showcase/wolf359/fffaq.htm`

1.3 Where can I post my ideas, questions, etc?

The Filter Factory Discussion Group (FFDG) was created to be a forum for discussion of everything related to FF.

a) To subscribe to FFDG, send mail to `majordomo@aurdev.com` with

```
subscribe ff
```

in the *body* of the message.

b) To unsubscribe, send mail to `majordomo@aurdev.com` (NOT to `ff@aurdev.com`) with

```
unsubscribe ff
```

in the *body* of the message.

c) If you ever need to get in contact with the owner of the list, (if you have trouble unsubscribing, or have questions about the list itself) send email to `<owner-ff@aurdev.com>`.

d) The basic goal of the list is to be a catalyst for discussion about anything related to Filter Factory and for the free exchange of ideas. This group intends to to be very focused on this specific topic.

The groups rules as of February 1997 are:

1. Stay on topic
2. No selling of services or wares
3. No flames
4. If you take, give something back
5. Do not mail files to the list.

If you are here just to grab filters, you don't need to be on the list. We maintain a WWW-site that will have all of our filters/creations posted. We will eventually have an archive available as well.

To send a filter in, we are suggesting the following format:

```
r: xxxxxxx

g: xxxxxxx

b: xxxxxxx

a: xxxxxxx

Category:
Title:
Copyright:
Author:
Filename:

ctl[x]:
```

Some description on what the filter is supposed to do, what you hoped it would do, what you plan for it to do, etc... would also be helpful. This format makes it easy for discussion of the code, cross platform implementation, and reproduction on our website.

1.4 Where can I find codes, filters, sample pics in the Internet?

The FFDG Homepage is located at `http://pluginhead.i-us.com`

I have a collection of almost all codes, ideas and discussions posted in the FFDG. You can download it directly with `http://www.fhd-stuttgart.de/~ws01/zip/fftext.zip` (currently 95,5 KB).

There is also a Gallery collection of FF-created plug-ins at:
`http://www.netins.net/showcase/wolf359/adobepc.htm`
under the Plugins section. Galleries are added as plugins are created and posted to the FF Mailing List.

Alfredo Mateus' site has a FF compendium with plenty of filters and samples:
`http://pluginhead.i-us.com/ffc.htm`

Tatsuya Sasaki shows some interesting codes dealing with FF:
`http://www.kt.rim.or.jp/~takinami`

Believe it or not, a Filter Factory CD-ROM has been already published with filters all over the place! For more infos, look into: `http://pluginhead.i-us.com/ffcdform.htm`

2. Programming Filter Factory

Section 2.2 can be used as a reference for FF commands, variables, constants, etc. Section 2.3 is a collection of tutorials to get you in the mood and maybe to clarify the correct use of commands and learn correct code strategy.

2.1 Where can I find documentation about FF?

The only official documentation available is included in the Photoshop 3.0x CD-ROM in the `Goodies\Ffactory` directory. `FFACTORY.PDF` describes the language with some samples. `FFTUTOR.PDF` has two small tutorials. In the `Goodies\Ffactory\Trnsexpl` directory is another tutorial `(README.PDF)` which deals with Transparency. The official documentation is also included in the `FFACTORY.ZIP` file described in 1.1. You should read at least the `FFTUTOR.PDF` or/and this document in order to completely understand what Filter Factory can and cannot do. Other tutorials can be found in this document. If you know some other sources with information for Filter Factory, please contact me (*see 4.1 Contacting the authors*).

2.2 Basics

The following section will help you understand the way Filter Factory works. We will start with basics in pixel-based and vector-based programs and images, what is RGB, grayscale, etc. Then we will commence with FF Basics. Finally, we will do some troubleshooting, see FF's limitations and input/output.

2.2.1 Photoshop images (pixels vs. vectors)

If you have never worked with graphic programs before (we doubt it), we will supply you here with information about graphics, pixels, etc. There are two different kinds of graphic programs:

a) Drawing programs
b) Painting programs

Drawing and painting are not synonyms. Drawing programs are vector-oriented programs. Usually you use predefined objects such as lines, circles, rectangles, etc. and combine them on your worksheet (the worksheet's width and height are usually measured in inches or millimeters). You can assign each object an individual color, filling, thickness, etc. This means you can edit each object without losing information, even if the objects are 'hidden' behind others. The good thing about vector-based graphics is that you can scale them into any size you want without losing information like in pixel-based graphics; each object's data is a mathematical information - scaling the picture only rearranges the mathematical information. If you could zoom into these drawings till infinity, you would not notice any jaggies (as aliasing is called). Typical programs are Corel DRAW!, Adobe Illustrator or Macromedia Freehand.

Painting programs are pixel-based programs. Images edited here are usually scanned pictures or painted with different tools. Tools are available to manipulate your image in any way you want. You can use brushes, selections, smudge, eraser, paintbucket, etc. Your image's width and height are always measured in pixels - the painting program helps you by telling you how wide/tall your image will be when printed. Each pixel contains an intensity information and all pixels have the same width/height. Depending on your image the pixels contains grayscale or color information. Another possible information is an alpha value, giving the pixel a transparency option. This is great when compositing two or more images into one (e.g. clipping a person from an image and putting him/her into another background). The difference to the vector-based picture is that once you paint over a pixel, the original pixel information is gone. Scaling an area of an pixel-based image is problematic. Scaling down means that the area width is lessened, thus the new area is composed by less pixels from the original area. Some pixels get lost. Scaling up means that the area width is greatened, thus the new area is composed by more pixels from the original area.

New pixels have to be 'invented', in Photoshop this is called interpolation. Typical programs are Adobe Photoshop, Corel Photopaint and Fractal Design Painter.

There are also some graphic programs in the market which can combine vectors and pixels, but we won't be needing information about these. Let's check the paint programs a bit more. As I said, each image is composed by pixels. For example a common image size has a width of 640 pixels and a height of 480 pixels. Normally you say the image is 640x480 pixels big (or small :-)). In order to be able to work with the pixels, you need their adresses. This is solved by a cartesian coordinate system. x will give you the horizontal position and y will give you the vertical position of the pixel. The origin (0/0) of the coordinate system is on the top left of the image. The biggest values for x and y would be in our image (639/479). ??? Did I say 639 and 479? Yes! This is because the origin is also a part of our image, meaning x can have a value from 0, 1, 2, 3, ..., 637, 638, 639 (a *total* of 640 pixels). Another common image size would be 800x600 big and you can address all the pixels between 0/0 and 799/599, inclusive.

By the way, Photoshop (and several other programs) also works with vector-based objects. Huh? Yup, in case you never worked with them, I am talking about paths... (oh, those). Paths can be seen as line objects which can be connected altogether. Ideal for clipping and for effects.

2.2.1.1 RGB, Grayscale and other color spaces

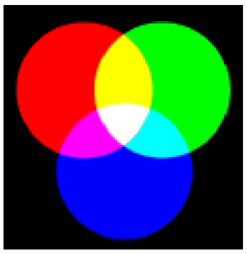
As I said, each pixel has a intensity information. Let's view a grayscale image. We need different intensities in order to have some brightness and contrast information. We need this information so we (better: our eyes) can recognize what is happening in the image (e.g. a house, a flower, a person). We also need this to see plasticity (in our minds) in the picture - which is solved by highlights and shadows. An object with a shadow will tell us it is over another object, thus appearing to be nearer. In the computer we need a place where we can put the information for each pixel. Some guys decided that since the computer smallest information 'booth' containing lots of information is a byte ('Lots' means that a byte (8 bit) can have 256 values, don't laugh, some decades ago, it *was* 'lots'!), then why not give each pixel a byte? In fact, it works just like that. When viewing a grayscale image, you will probably say that a byte for each pixel is just fine. Ok, each pixel can have a value between 0 and 255, inclusive, being 0 no intensity at all (Black) and 255 sunflare-intensity (white). Everything in between would appear to be a gray tone (64 dark gray and 192 light gray).

Note 1: For the math wizzes reading this, how many bytes would it take to compose a 640x480 image? Let's see, we have 640 x 480 pixels = 307200 pixels. Each pixel being 1 byte big gives us 307,200 bytes! A Kilobyte is an amount of 1024 bytes. 307,200 / 1024 = 300 KB.

Note 2: Remember watching a B/W TV? Actually, you did not watch black *and* white, you watched black, white *and* the different grays... So you watched grayscale TV!

Now, let's take a colored image. This is a bit more complicated. The color television, the computer monitor and a scanner work all with RGB. Red, Green and Blue. Some of you might ask me, "Oh yeah, smarty, well, what about *YELLOW*???" Thing is that the colors are mixed in an additive way depending on their wavelength (this works only on ray emitting objects such as the computer monitor). Look what the mixing of RGB will result to:

no mix:	Black
red + green:	Yellow
red + blue:	Magenta
green + blue:	Cyan

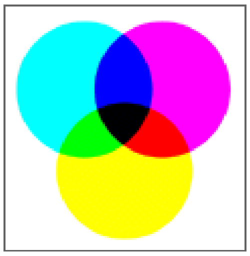


If we had only one byte for the three channels, we would have to split the bits up as in 8 bits for 3 channels. Since it does not sound good and today we have lots of power and lots of memory, let's give each pixel 3 bytes (total of 3 x 8 bits = 24 bit), one byte for red intensity, one byte for green intensity and one byte for blue intensity. Would you like to know how many colors you can see on your monitor? Let's define the colors as channels, thus having three channels R, G and B. Combining all of them would mean to multiply the total available intensity of each channel: 256 x 256 x 256 = 16,777,216 colors (in words: 16 million)!!! Wow, you say that's cool. Well, not really, do you think you (better: your eyes) can differ all of them? Or eyes can only detect 5 million combinations or even less. But that should not disturb us. We should be thankful we have the ability to see at all! Well, we know how to do color, but what about gray tones? Give each channel the same intensity (e.g. R/G/B, respectively: (60/60/60), (128/128/128)) and voila, we've got a gray tone! 0/0/0 would result into black and 255/255/255 would result into white.

There are also following color spaces: CIE Lab, HSB and CMYK.

CMYK ist used in the printing technology, i.e. when you prepare your image for print. You need the colors Cyan, Magenta, Yellow and Black. With these colors you can print almost any color you can think of (no, no gold... :-)). Color is made up of pigment and the pigment reflects or absorbs light. Because it absorbs certain wavelengths of white light we talk of subtractive mix:

No mix	white (in case we're printing on white paper)
Cyan + Magenta	violet (Blue)
Cyan + Yellow	green
Yellow + Magenta	red
all three	theoretically Black, but as this mixture gives the image a dirty tone and has not much contrast, black is printed on the image to greaten the contrast



HSB deals with Hue, Saturation and Brightness. To see more of this effect, experiment in Photoshop with Hue/Saturation (CTRL-U). While Hue gives us the color, saturation tells us the color amount (no saturation: grey image, full saturation: Technicolor :-)) and brightness returns the overall brightness of a color (black to color to white).

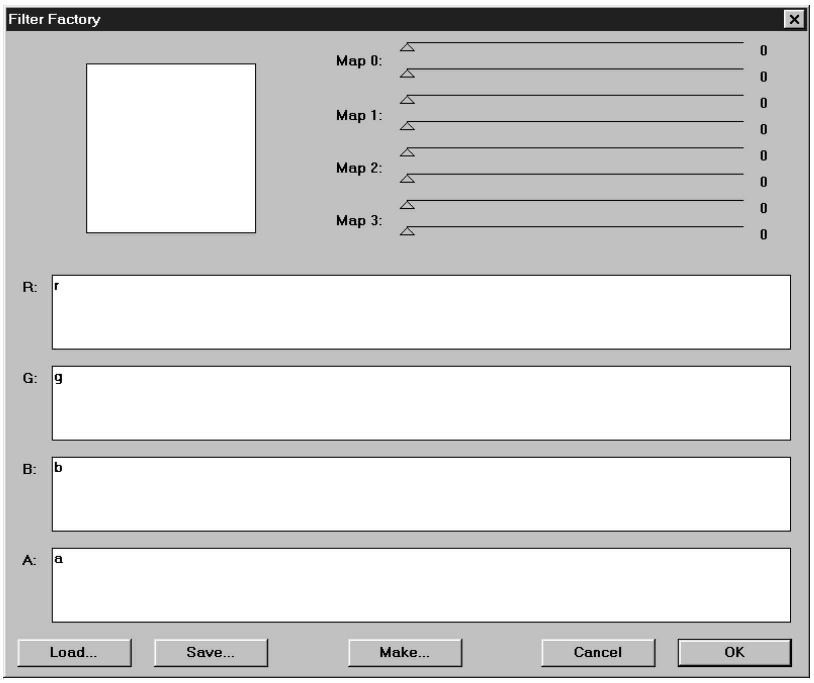
2.2.1.2 The Alpha Channel

Having three channels ought to be enough when working with single images. But, a new channel was created, the alpha or transparency channel. With this channel, layers could be introduced in Photoshop. Each pixel uses another byte for the alpha channel, and the intensity of the alpha value gives the opacity of the pixel. 0 would be no opacity (full transparency) and 255 would mean full opacity (no transparency). With transparency, compositing gets easier and better. With Photoshop's layer capabilities, you have a perfect tool to composit your images. With Filter Factory, you not only have the possibility of modifying/creating RGB data, but also alpha data.

2.2.2 FF basics

When FF is activated to modify/create your image, it will start by scanning each pixel, from left to right, from top to bottom. You will be creating an algorithm which will always depend on the pixel position. It does not matter if you use the actual pixel information (in this case, you would be modifying your image) or overwrite it with another value (and here you would be creating a new image). In FF you can't create loops, meaning you have to create a very compact code as one line. Multiple commands are not allowed either (one exception: get & put (see 2.2.6 Functions)). Remember that a pixel can only have a value between 0 and 255, inclusive. If the code returns a number bigger than 255, the pixel will contain the value 255, if it's less than 0, the pixel will contain the value 0. One other thing you have to understand is that FF always returns integers. FF is also case sensitive, meaning that x and X return two different values. You can include spaces and carriage returns without affecting the code. You will only get an error if you have a typo in your code (see 2.2.8). By the end of this document and while you experiment, you will surely be understanding all of this properly.

This is what happens when you click on `Filters -> Synthetic... -> FF`:



```
r
```

```
g
```

```
b
```

```
a
```

On the upper left side you can see a preview window.
On the upper right side you can see eight sliders.
In the middle there are 3 or 4 coding areas (depending if your image has transparency; if it doesn't, you are probably working on a background layer with r,g,b. if it does have transparency you will see r,g,b,a). This is where you type in your code. Notice that FF already puts on startup the variables r,g,b (and a) on their respective channel coding areas.
On the bottom you can see buttons (*see Input/Output 2.2.10 for more details*).

2.2.3 Constants

Constants are numbers you can use in FF. Examples are -5, 2, 55, 1000, 10+5, 55/2 etc. If you like to work with hexadecimal values, you should prefix the number with 0x, for example 0xaa, 0xf65, etc. One thing you should know is that Filter Factory understands and works internally with integers.

2.2.4 Variables

Variables are numbers which constantly change in their value. When you use variables, they will return values. Following variables and their return values can be used in the FF-code:

r	Returns the red channel value of the current pixel, regardless of the code are this variable is used in
g	Returns the green channel value of the current pixel, regardless of the code are this variable is used in
b	Returns the blue channel value of the current pixel, regardless of the code are this variable is used in
a	Returns the alpha channel value of the current pixel, regardless of the code are this variable is used in

All of the above return a value from 0 to 255

c	Returns the channel value of the current pixel in the current channel Would be the same as typing either r, g, b or a in their respective coding areas or using src(x,y,z) (see 2.2.6.a)
x	Returns the x-coordinate (horizontal position) of the current pixel x can be an integer from 0 to X-1
y	Returns the y-coordinate (horizontal position) of the current pixel y can be an integer from 0 to Y-1
X	Returns the image width X can be an integer from 1 to 30,000
Y	Returns the image height Y can be an integer from 1 to 30,000
i,u,v	Returns the i,u,v values of the current pixe in YUV space i can be an integer from 0 to 255 u can be an integer from -56 to 56 v can be an integer from -78 to 78
z	Returns the channel index of the current pixel in the code area z can have a value from 0 to 2, depending in which code area this variable is used in 0 means red, 1 means green, 2 means blue and in your alpha channel you will get 1
Z	Returns the total amount of channels Z can be an integer either 3 (r,g,b) or 4 (r,g,b,a)
d	Returns the angle (direction) of the current pixel from the center of the image d can have an integer from -511 to 512 (see 2.2.6.b *Polar coordinates*)
dmin	Returns 0
D	Returns the total amount of angles within the image D is always 1024
m	Returns the magnitude (distance) of the current pixel from the center of the image m can be an integer greater than 0
mmin	Returns 0
M	Returns the total amount of magnitudes in the image M is an integer half the diagonal size of the image

2.2.5 Operators

Following operators can be used in the FF-code:

Arithmetic operators:

+	Adds two numbers, variables,...
-	Subtracts second number from the first,...
*	Multiplication
/	Division
%	Modulo

When dividing a number from the other, you always have a remainder from 0 upwards. The modulo operator returns the remainder. For example, 10 % 3 would return 1, 15%5 returns 0, 22%19 returns 3.

All of the above operate on signed 32-bit integers (numbers between 2e-9 and 2e9).

Logical operators:

&& Logical AND (between two expressions)
returns 1 if both expressions equal 1, else 0

|| Logical OR (between two expressions)
returns 1 if one or both expressions equal 1, else 0

!	Logical NOT (for use with one expression at the right)
==	Equals to (between two expressions)
!=	not equal to (between two expressions)
>	greater than (between two expressions)
<	less than (between two expressions)
>=	greater than or equal to (between two expressions)
<=	less than or equal to (between two expressions)

All of the above will return a 0 or 1, meaning:
0 false
1 true

Logical operators can be best used with conditional operators

Example: r==5 will return 1 if the red pixel value equals 5, else
will return 0 if the red pixel value does not equal 5

Bitwise logical operators:

&	bitwise AND (between two expressions)
|	bitwise OR (between two expressions)
^	bitwise XOR (exclusive OR) (between two expressions)
~	bitwise NOT (before one expression)

Shifting operators:

<<	shifts left
>>	shifts right

these operators 'move' the bits of a value to the right or left. This is described by a logical shift. b<<3 will take the blue value of the pixel and shift it 3 times to the left. If the value was 30 (binary 00011110), for example, the result is 240 (11110000).

Conditional operator:

? :	question mark and colon

This could be seen as a IF...THEN...ELSE condition. First, you create a condition (e.g. r>120 means: is the red value greater than 120?) before then question mark. If the condition is true, the code before the colon is executed. If the condition is false, the code after the colon is executed.

a) Example: r>120 ? r-50 : r+50

Above example will test the red value of the current pixel if it is greater than 120. If it is, the intensity is lowered (r-50), if the value is less than or equal to 120, the intensity is pushed up by a value of 50.

b) Nesting (Condition in a condition) is allowed

r>120 ? (g<120 ? r+10 : r-10) : (g<120 ? r+20 : r-20)

If the red value of the current pixel is greater than 120, then the green channel is tested if less than 120. If it is not, then the red value is lowered by 10. This means that the amount changed in the red channel depends on the green channel value.

	r > 120 ?			
	Yes		No	
	g<120 ?		g<120 ?	
	Yes	No	Yes	No
Execute	r+10	r-10	r+20	r-20

c) More conditions

(r<120 && x>120) ? 50 : 100 is put in the green coding area

If the red channel value is less than 120 AND the pixel position is greater than 120, then the green channel value is set to 50, otherwise set the green channel value is to 100.

Comma (,) operator

The comma separates two or more algorithms, evaluates both but returns the last.This is mostly used when working with the get and put functions. One or more put-functions save the algorithm's return code into an internal memory, whereas the get-function load the saved numbers into memory again. For example, when part of the code is used many times, you can put the code into memory once and load it with the get function many times.

2.2.6 Functions

This is getting pretty interesting, don't you think? Now it'll get much better and a bit more complicated. If you are a novice to FF, I would advise you to experiment with each function separately in order to fully understand what it does. We will try to explain each function in this section and in the tutorial sections thoroughly, so you can start experimenting without doubts right away. The variables used here are only placeholders, it does not mean that the functions only work with them.

a) Normal functions

abs(a)

returns the absolute value of a. If a=-50, a value of 50 is returned

add(a,b,c)

adds a and b together, compares the result with c and the lesser value is returned

cnv(m11,m12,m13,m21,m22,m23,m31,m32,m33,d)

The convolver is similar to the Custom Filter in Photoshop. Each pixel and its eight neighbouring pixels are evaluated to get a new result. The map looks like this:

```
m11 m12 m13
m21 m22 m23
m31 m32 m33
```

The target pixel is the one in the middle (m22). Each m??-value is multiplied with the pixels corresponding to the map (this is called weighting), all values are added together and divided by d (normally is d the total amount of the weigths).

```
cnv(0,1,0,1,4,1,0,1,0,8)     blurs your picture
cnv(1,1,1,0,0,0,-1,-1,-1,1)  neon kind of effect
```

ctl(i)

see 2.2.7 Sliders, returns an integer between 0 and 255

dif(a,b)

subtracts b from a and returns its absolute value

get(i), put(v,i)

FF has internally 256 memory cells, where you can save and load values.
put(v,i) will evaluate the expression v and store the result in cell i.
get will return the result in cell i.

```
r:    put(src(X-x,Y-y,z),0),get(0)
g:    get(0)
b:    get(0)
```

As you can see, the image is mirrored horizontally and vertically, whereby the values are taken from the red channel and stored in cell 0. Finally, all code areas request the value of cell 0. Note that your image will turn grayscale (because the red channel values were stored, and the green and blue channel values were ignored).

max(a,b)

returns the larger value, either a or b

min(a,b)
returns the lesser value, either a or b

mix(a,b,n,d)
works like this: a*n/d + b*(d-n)/d
The two input values (a,b) are combined with the fraction n/d.
If the fraction is close to 0, values near to b are returned.
If the fraction is close to 1, values near to a are returned.
If the fraction is close to 1/2, the average of a and b is returned

rnd(a,b)
returns a random number between a and b, where a > b

scl(f,il,ih,ol,oh)
the scale function maps the value or function f from its normal range (il, ih) to a new range (ol,oh)
scl(r,0,255,100,200) will evaluate the red channel value of the current pixel. According to the scale function, values near 0 will become 100 and values near 255 will become 200. Respectively, a value of 128 will turn into 150.

sqr(x)
returns the square root of x

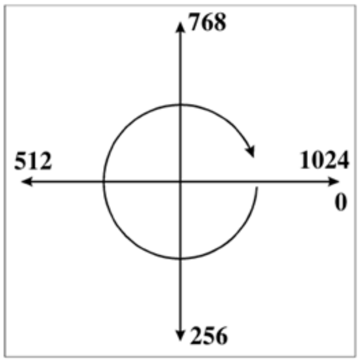
src(x,y,z)
returns the channel pixel value in coordinates x,y in channel z, whereby the return value equals an integer between 0 and 255; src(400,200,c) will return the pixel value at 400/200 in the current channel and src(x,y,z) equals the variable c (see 2.2.4)

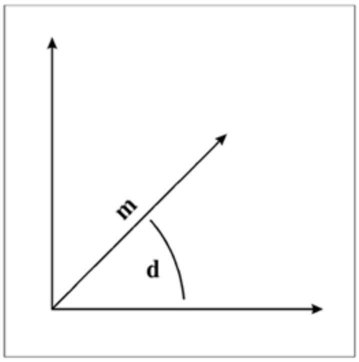
sub(a,b,c)
difference between a and b (absolute value), compares the result with c and the greater value is returned

val(i,a,b)
see 2.2.7 Sliders, returns an integer between a and b

b) Polar coordinate functions

Before explaining the functions, you should have some knowledge on polar coordinates.
As you know, cartesian coordinates have the origin on the top-leftmost pixel of our image (0,0). The origin of polar coordinates is in the center of the image (X/2, Y/2).
Cartesian coordinates are defined by a horizontal position (x) and a vertical position (y). Polar coordinates are defined by an angle (d for direction) and a magnitude (m) (radius or distance from the origin, i.e. from the image's center).





Notice that the angle d can be any positive or negative integer (0 inclusive). A value of 1024 means a full rotation, while multiples of 1024 (2048, 3072, 4096, etc) mean multiple rotations. The magnitude m can be an integer from 0 to M (half the diagonal image size). There are ways to convert cartesian into polar coordiantes and vice-versa.

Cartesian-polar conversion:

This means we have the x and y coordinates and convert them to d and m, i.e. horizontal/vertical to direction/magnitude conversion. Let's say we have the coordinates (3/4). Let's make a pythagoran triangle from the origin: We move from (0/0) to (3/0) to (3/4). The magnitude (distance) of the pixel from the origin is represented by the triangle side (hypotenuse) (0/0) to (3/4). Direction is the angle of this line to the x-axis (horizontal axis). The length of the hypotenuse (distance or magnitude) is the square root of the addition of x squared and y squared. The angle (direction) is the arctan when dividing y by x. This means our distance is 5 and the angle 53,13°.

Polar-cartesian conversion:

Now we have d and m and want to convert these to x and y. Let's say, we have the magnitude (distance) 5 and the angle (direction) 233,13°. The cosine of the angle is the division of the x-length by the magnitude. In order to get x, we multiply the cosine of the angle with the magnitude. The sine of the angle is the division of the y-length by the magnitude. In order to get y, we multiply the sine of the angle with the magnitude. This means x is (5 * cos(233,13))= -3 and y is (5*sin(233,13°))= -4. Our pixel's coordinate is thus (-3/-4).

c2d(x,y)
: This returns the direction (angle) of the pixel at (x/y) from (0/0). Mathematically, this is the arctan after dividing y by x. Values returned are integers from -512 to 512.

c2m(x,y)
: Returns the magnitude (distance) of the pixel at (x/y) from (0/0). Mathematically, this adds the squared values of x and y and returns the square root. The values returned are integers from 0 to M*2.

cos(x)
: Remember trigonometry and terms like amplitude and wavelength? Let's picture a full wavelength from 0 to 1024. The value returned is an integer between -512 and 512, Macintosh FF returns an integer between -1024 and 1024. Cos(0) returns a full amplitude (512), while cos(256) returns 0, cos(512) returns -512 , cos(768) returns 0 again and cos(1024) returns 512. Input values greater than 1024 restart the cosine wave.

r2x(d,m)
: This returns the x-coordinate at a polar coordinate (d/m).

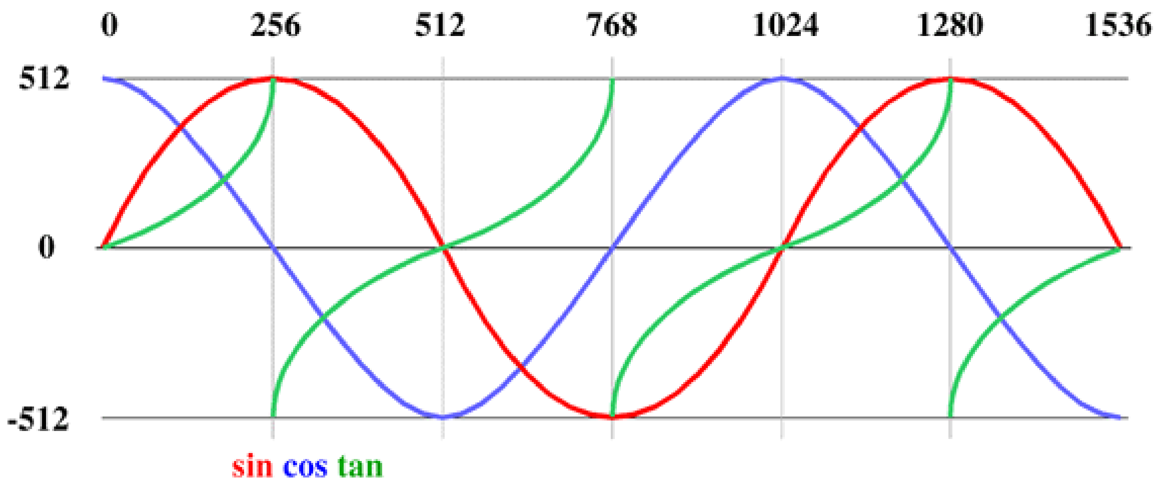
r2y(d,m)
: This returns the y-coordinate at a polar coordinate (d/m).

rad(d,m,z)
: This function resembles the src(x,y,z)-function in cartesian coordinates. rad(d,m,z) returns the pixel value m pixels at an angle (direction) of d from the origin. Using rad(d,m,z) is the same as using src(x,y,z) or simply c.

sin(x)
: Works the same as cos(x), returns an integer between -512 and 512, Macintosh FF returns an integer between -1024 and 1024. Sin(0) returns 0, sin(256) returns 512, sin(512) returns 0, sin(768) returns -512 and sin(1024) returns 0.

tan(x)

Works almost like cos(x) and sin(x), returning an integer between -512 and 512, Macintosh FF returns an integer between -65535 and 65535 (instead of going to infinity :-)). tan(0) returns 0, tan(256) returns 512, tan(257) returns -512, tan(512) returns 0, starting all over again.



2.2.7 Sliders

Creating filters with one option is boring. Sliders were included to give user input ability. There are eight sliders you can use in FF, they are refered to as controllers. The command is actually a function and you can access a slider with the function ctl(i), where i is a value from 0 to 7 and the value returned is an integer between 0 and 255. When creating a filter with the Make... button, you can assign each slider a name (see 2.2.10.3 Creating a new plug-in).

Now you might say, having slider values between 0 and 255 won't be helping you much. Maybe you'll need more values or less. No problem, with the val(i,a,b) function, you can give the slider i the range from a to b (b can be lesser than a). Note that ctl(i) and val(i,a,b) are two different functions which returns ranges from a slider.

ctl(2)	will return an integer from 0 to 255, depending on the slider 2 setting
val(2,-128,128)	will return an integer from -128 to 128.

When creating the filter (with a val(2,-128,128)) with Make... you'll be pretty shaken because when the user accesses the filter, all slider values still range optically from 0 to 255, although internally, slider 2 *will* return a number between -128 and 128. You might say you're not WYSIWYGing (What You See Is What You Get) :-(Let's hope future versions of FF will relieve us this pain.

2.2.8 What's that darn yellow caution sign? (Duh)

While typing in the code, you might encounter a yellow caution sign appearing and disappearing. This sign tells you simply that the code you typed as of your last keypress has a syntax error. Either you have a typo in your code or your code cannot be used like you wanted it to work. Check out the parenthesises, the commas, the upper- or lowercase functions/variables.

Pressing CTRL-Z (PC) will undo your last typing in the boxes. Pressing TAB will get you in the next text box. You can cut and paste text to and from the clipboard using shift-delete and shift-insert (CTRL-C and CTRL-V work too).

You might also encounter that your code is correctly typed, but your filter does not give you the results you expected. Check the values you are giving to your code, for example ctl(20) won't help much, because there is no slider 21 (you have just got eight, isn't that enough? :-)).

2.2.9 Limitations

FF works with Adobe Photoshop and all Adobe Photoshop plug-in compatible programs. Should you have trouble with some programs, feel free to contact me in order to inform others about this. If you know the solution to a problem, please inform me as well.

Image Types

Filter Factory works only with RGB files. In RGB it only works if all 3 channels (or 4 including Alpha) are activated. This is not completely true anymore as it is possible to hack FF so it will work in all modes.

Memory Problems

Filter Factory is a very memory-hungry program. To make it worse - it can only make use of physical memory. So even if you have 1GB of virtual memory it doesn't help if the image you want to filter is bigger than about 50% of your available RAM. So if you have a memory problem make sure that the clipboard is empty, no snapshot is in memory and no other images are opened, then perhaps you have a chance. Or you try to do it in two or more selections.

Precision

Filter Factory calculates with integer mathematics. Probably this speeds everything up, on the other hand it has some side effects. It also depends where you place your constants and variables. For example, use the following codes on all channels in a 512 x 200 RGB-image: 2*x/3, then 2/3*x. While the first code creates a blend, application of the second code reveals you a black image (since 2/3 is a number smaller than 1, thus 0 and Filter Factory only understands integers). Especially on filters that use circles or sine-functions you will discover those wonderful stairs that give you the jaggy look (also called aliasing). Sorry, there is no way to solve this problem other than to apply a blur after applying the FF filter.

Sliders

The sliders do always show values between 0 and 255, no matter what the filter needs it for. So even if you need something like -180 to 180 it shows 0 to 255. Also, the resolution is never higher than 256 steps.

Random Function

This one is not very random. Actually it uses a lookup table that is always the same. So if you produce two layers of noise and overlay them with the difference mode you'll see black. A better method to get random numbers is to use pixel values from the image itself, but this works only as long as the image isn't too simple. Example:
src(scl(r,0,255,0,X),scl(g,0,255,0,Y),b%2)

From Joe Ternasky's keyboard:

"The Factory limits the length of the expressions to 1K each, for no really good reason. Programmers just love powers of two, and I'm no exception. It also places limits on the length of the generated code. These limits are different for different processor architectures (68000, PowerPC and 80x86). You're running up against the generated code limit, again for no reallygood reason.

One way around this is to eliminate common sub-expressions (via the get/put functions and the comma operator) or to move part of your expression into the alpha field. In either case, if you can evaluate part of the expression separately then this intermediate value can be placed into an anonymous variable (via put) and then read back where it's needed (via get). Anything else that you can do to simplify the expressions would also help, but you've probably already tried that."

Preview

The preview window, also called proxy, (see image page 8) varies its size on Windows and Mac versions, so when creating codes you will be seeing effects which look okay in the preview but have a different effect in the large image. You can correct this by using the X and Y variables (see tutorial section 2.3.4 Code optimization).

2.2.10 Input/Output

Well, you can work with FF, but you are tired of typing the codes again and again. Although it's rather self-explaining while you experiment with the input/output options, the explanations follow anyway. You have three input/output options. The first two deal with your code data and the third creates your plug-in.

2.2.10.1 Saving your code

Saving the code is fairly easy. You see the second push button in the left corner? Pressing it will give you a window asking you for a name for your code data file, whose extension is .AFS. If you experiment a lot with code data, then create a new directory (for example FFCODE or AFS) and save all your code data there. There is one slight problem. If you type in the code from someone in the FFDG; save the code as AFS and delete the mail, you will forget the author's name in two weeks time. Then you have a problem with the filter and don't remember how it works. Who can you contact? Notice the problem? Create a `README.TXT` with maybe a small note to each AFS file you saved. This will save you time to look desperately for the author.

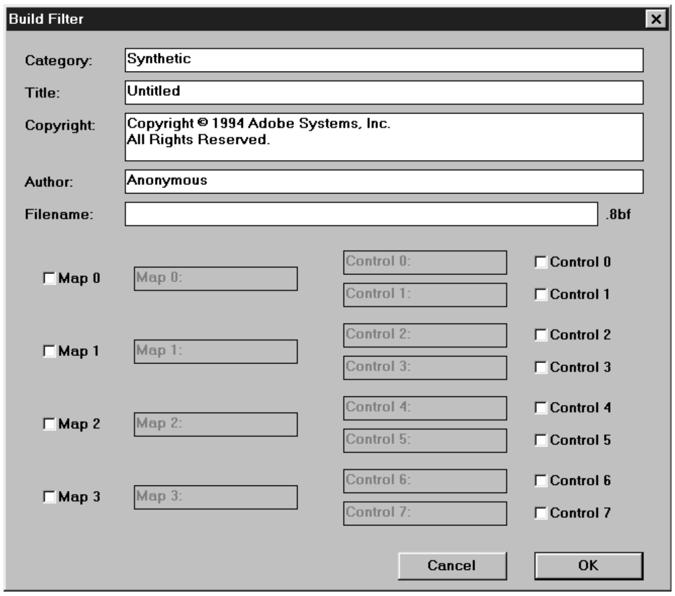
2.2.10.2 Loading the code

Loading the code is easier. Simply press the Load... button and look in the directory where you saved or copied the .AFS file(s), load it and now you're on your own...

2.2.10.3 Creating a new plug-in

This is a bit complex, but still easy enough. Let's say you found the filter of your life and want to access that filter in your filter menu. First, check the syntax (no yellow caution signs around?) and the correct filter execution (i.e.

you experimented from the FF code window and it worked as expected). Next, press the Make... Button. Now the-re's a nice window called 'Build Filter'.


Build Filter

Category: Synthetic
Title: Untitled
Copyright: Copyright © 1994 Adobe Systems, Inc.
All Rights Reserved.
Author: Anonymous
Filename: .8bf

☐ Map 0 Map 0: Control 0: ☐ Control 0
Control 1: ☐ Control 1
☐ Map 1 Map 1: Control 2: ☐ Control 2
Control 3: ☐ Control 3
☐ Map 2 Map 2: Control 4: ☐ Control 4
Control 5: ☐ Control 5
☐ Map 3 Map 3: Control 6: ☐ Control 6
Control 7: ☐ Control 7

Category is what you first see when you click on the filter menu. It can be a completely new name, a name where you can relate it to (blur filter, stylize, whatever...) or the name suggested by the author who created the filter.
Title is the actual name of the filter. Give a name that will tell a Photoshop-newbie right away what it does. Or use the name the author suggests.

Copyright is obvious. Type the copyright (if you are the author) or type the one suggested by the author.

Filename is the name of the plug-in. Just type the name, not the extension (on the right side of the edit window you can see '.8bf'. FF automatically creates an .8bf-filter (you just have to supply it with a name) and saves it in your plug-in directory. In the Mac version of FF it will ask you the folder where you want to save the plugin.

If the filter you are creating uses sliders or maps, you have to check the map or slider number. After checking the checkbutton you can assign a name to it. Use a name that will tell the user what the map or slider does (e.g. 'radius', 'line color', 'amplitude', ...). Notice you can't assign Map 0 *and* slider(s) 0 or/and 1. This is because the map works with the slider values. You can assign Map 0 and a slider>1.

Now all you can do is press either Cancel or OK. Pressing OK will create the plug-in and save it in your plug-in di-rectory. You must however, exit Photoshop and restart it in order for it to recognize the new plug-in(s).

Note: You might encounter some problems when trying to access a filter. This might happen if you did not assign the a channel a value. Always remember to include the a: (alpha channel) code. If the plug-in doesn't care about transparency in your images, use the code:

a: a   in your alpha channel.

2.2.10.4 Converting from .8bf to .afs

There are some utilities in the net which will deconvert .8bf files (filters created with Filter Factory only) to source code files (.afs) files. I have tried the following:

`FFDECOMP.EXE` is a MS-DOS utility which will deconvert a .8bf into a .afs and into a .txt file. You can find it at: `http://johann.simplenet.com`

The second program is called Plug-In Manager for Adobe Photoshop. If your Photoshop has problems with the thousands of filters you have in your plug-in directory/folder, then this could be the solution. You can turn on/off filters individually, move them to other categories and it will also deconvert plug-ins created by Filter Factory. You can find it at: `http://johann.simplenet.com`

2.3. Combining everything together (Tutorial section)

Well, we've learned so far what FF can do, what values it will return, its limitations and I think we're ready to roll! In the following sections, solutions are given by explaining the objective. Then the code is given to each channel. Should you encounter the format: r,g,b: then you simply have to type the code in all three coding areas, r, g and b. If a slider is used, its function is mentioned after the code. You might encounter different ways to create a filter. Note that there is no difference between them, else stated otherwise.

2.3.1 Simulating program solutions

Here we will try to simulate functions already built in in Photoshop. This might give you a better understanding of basic image data manipulation.

Invert the image

```
r:      255-r
g:      255-g
b:      255-b
a:      a
```

we could also use:

```
r,g,b:  255-c
a:      a
```

Mirror the image horizontally

```
r,g,b:  src(X-x-1,y,z)
a:      a
```

Mirror the image vertically

```
r,g,b:  src(x,Y-y-1,z)
a:      a
```

Turn the image about 90 degrees clockwise *(attention: works good only on squared images)*

```
r,g,b:    src(y,X-x-1,z)
a:        a
```

Turn the image about 90 degrees counter-clockwise *(attention: works good only on squared images)*

```
r,g,b:    src(Y-y-1,x,z)
a:        a
```

Turn the image about 180 degrees

```
r,g,b:    src(X-x-1,Y-y-1,z)
a:        a
```

Desaturate the image *(turn it into RGB-grayscale)*

```
r:        put((76*r+150*g+29*b)/256,0),get(0)
g,b:      get(0)
a:        a
```

or simply:

```
r,g,b:    i
a:        a
```

Photoshop has some built-in calculation possibilities. These are the basic mathematical ideas:
(Note: I assume two images with equal image sizes. Here, x and y represent each a pixel in each image at the same coordinates. An example is brought in section 2.3.3.1 *Modifying colors*, Tutorial A)

darken
: min(x , y) (remember? the lesser the value, the darker the pixel)

difference
: abs(x - y)

hard light
: y < 128 ? (2*x*y/255) : 255-2*(255-x)*(255-y)/255

lighten
: max(x , y)

multiply
: (x * y) / 256

overlay
: x < 128 ? (2*x*y/255) : 255-2*(255-x)*(255-y)/255

screen
```
    255 - ( (255-x) * (255-y ) / 255 )
```

soft light
```
    c2 < 128 ? 2*scl(c1,0,255,64,192)*c2/255 : 255-(2*(255-scl(c1,0,255,64,192))*(255-c2)/255)
```

2.3.2 Creating new images (tutorial section)

Please note that if you're typing in the codes, don't forget to type in also the code for the alpha channel:
a: a (See 2.2.10.3)

TUTORIAL A: Creating blends

a) Linear blends

Please work with a 512x512 RGB picture for this tutorial.
When examining our pixel values in a blend, we see that the values are consecutive. Let's say, we have a grayscale image and we want a horizontal blend from black (0) to white (255). We could use the pixel positions (x,y) in order to create a pixel value for a blend. Let's create a black to white blend in an RGB image:

```
r,g,b:  x
```

Yes, that's it. Problem is, if our image or selection width is greater or less than 256, then we would get a not quite complete blend. So, we need also the image's width information (X). In order to create a smooth blend from left to right in any image, we would use this code:

```
r,g,b:  x*255/X
```

or

```
r,g,b:  scl(x,0,X-1,0,255)
```

Now, let's say we need multiple blends. A way to do it is with the MODULO operator. Try this:

```
r,g,b:  x%256
```

While the pixel position rises, we get consecutive numbers... 0, 1, 2, 3, ...254, 255, and now it starts all over again... 0, 1, 2, 3, 4, 5... Thus, we have two (512/256) black to white blends in our image. Do you need more blends? No problem.

```
r,g,b:  x%128*2
```

Now we have four blends (512/128), but because the maximum value the modulo operator can return is 127, we have to multiply it with 2 (127*2=254), so we can see a nice contrast blend. You could use also following code:

```
r,g,b:  scl(x%128,0,127,0,255)
```

If you watch the maths while doubling the amount of blends, you would get following "law":

x % (256 / no of blends) * no of blends

The code for it with slider 0, where we control the amount of blends:

```
r,g,b:    x%(256/ctl(0))*ctl(0)
```

Nice, huh? Now, if you want - with one filter - be able to create either horizontal or vertical blends, use slider 1 to control the blend movement:

```
r,g,b:    ctl(1)<127 ? x%(256/ctl(0))*ctl(0) : y%(256/ctl(0))*ctl(0)
```

Problem is, the amount of blends is not the value selected in slider 0. Now we also need the image's width (X). Remember we used following code for a blend in an image any size?

```
x*256/X
```

Now we want two blends. If we multiplied the code with 2 (result would be a value from 0 to 512) and use here our modulo operator (so we can have blends from 0 to 255):

```
r,g,b:    (x * 512 / X) % 256
```

If we want four blends, we'd need following code:

```
r,g,b:    (x * 1024 / X) % 256
```

Check out the math law for use with a slider, so the user can input his desired number of blends:

```
r,g,b:    (x * 256 * ctl(0) / X ) % 256
```

If you want white-black blends instead of black-white, use:

```
r,g,b:    255-(x*256*ctl(0)/X)%256
```

Again, if you need the possibility of selecting either horizontal or vertical blends, use slider 1, too:

```
r,g,b:    ctl(1)<127 ? (x * 256 * ctl(0) / X ) % 256 : (y * 256 * ctl(0) / Y ) % 256
```

ctl(0)	exact amount of blends
ctl(1)	horizontal/vertical blending

This one combines everything together:

```
Name:   Blender (V/H)
r,g,b:
(ctl(1)<127)?
(ctl(2)<127?(x*ctl(0)*256/X)%256:255-(x*ctl(0)*256/X)%256):
(ctl(2)<127?(y*ctl(0)*256/Y)%256:255-(y*ctl(0)*256/Y)%256)
```

ctl(0)	exact amount of blends
ctl(1)	horizontal/vertical blending
ctl(2)	black-white / white-black blending

It's pretty ok with this blending and stuff, but they are all black & white..."I need color!!!". Well, all right. We can dispose now of the black-white / white-black blending method, leaving a black-white blending only:

```
r,g,b:    ctl(1) < 127 ? (x*ctl(0)*256/X)%256 : (y*ctl(0)*256/Y)%256
```

ctl(0)	exact amount of blends
ctl(1)	horizontal/vertical blending

We will use the 6 available sliders for our blend coloring. In order to do that, we will use the scl(a,il,ih,ol,oh)-function. We know that the resulting values are integers between 0 (il) and 255 (ih). If you examine the red channel code, you'll see that the lowest value is turned into the slider 2 value and the highest value is turned into the slider 3 value.

```
Category:   Neology
Title:       HV-Blender
Copyright: (c) 1996 by Werner D. Streidt
            100526.16@compuserve.com
Author:     Werner D. Streidt
Filename:   nhvblend.8bf

r:    scl((ctl(1)<127?(x*ctl(0)*256/X)%256:(y*ctl(0)*256/Y)%256),0,255,ctl(2),ctl(3))
g:    scl((ctl(1)<127?(x*ctl(0)*256/X)%256:(y*ctl(0)*256/Y)%256),0,255,ctl(4),ctl(5))
b:    scl((ctl(1)<127?(x*ctl(0)*256/X)%256:(y*ctl(0)*256/Y)%256),0,255,ctl(6),ctl(7))
a:    a
```

ctl(0)	No. of blends
ctl(1)	horizontal / vertical blending
ctl(2)	red amount of starting blend value
ctl(3)	red amount of ending blend value
ctl(4)	green amount of starting blend value
ctl(5)	green amount of ending blend value
ctl(6)	blue amount of starting blend value
ctl(7)	blue amount of ending blend value

Pretty neat, you think? Well, we can do another kind of blending...

b) Radial blending

How do we do that? Remember there is a variable called magnitude m (or distance from the image/selection center)? Use again here a 512 x 512 RGB pic.

```
r,g,b:    m
```

This will give us a radial blend from innerly black to outter white. Let's use multiple blends with m % 256 , but as we can't see much, let's give it more blends:

```
r,g,b:    m * 8 % 256
```

And because it's so cool using sliders for blend amount and coloring, let's jump right into it (you should know why after the linear blending tutorial):

Category: Neology
Title: Rad-Blender
Copyright: (c) 1996 by Werner D. Streidt
100526.16@compuserve.com
Author: Werner D. Streidt
Filename: nrdblend.8bf

```
r:      scl(m*ctl(0)%256,0,255,ctl(2),ctl(3))
g:      scl(m*ctl(0)%256,0,255,ctl(4),ctl(5))
b:      scl(m*ctl(0)%256,0,255,ctl(6),ctl(7))
a:      a
```

ctl(0)	Blend amount
ctl(2)	red amount of starting blend value
ctl(3)	red amount of ending blend value
ctl(4)	green amount of starting blend value
ctl(5)	green amount of ending blend value
ctl(6)	blue amount of starting blend value
ctl(7)	blue amount of ending blend value

c) Rotational blending

To have the blends rotate around the center like a helicopter propeller, we have to work with the angle (direction) d. Problem is, d returns values from -512 to 512, so we can scale it from 0 to 1024. Then we use our modulo %256 and finished.

```
r,g,b:  scl(d,-512,512,0,1024) % 256
```

To make a user controlled amount of blends, we'll have to change the last term in the scl function. The above function gives us four blends. So, it should read as follows:

```
r,g,b:  scl(d,-512,512,0,ctl(0)*256)%256
```

And because it' so nice using sliders for blend amount and coloring...

Category: Neology
Title: Rot-Blender
Copyright: (c) 1996 by Werner D. Streidt
100526.16@compuserve.com
Author: Werner D. Streidt
Filename: nrtblend.8bf

```
r:      scl(scl(d,-512,512,0,ctl(0)*256)%256,0,255,ctl(2),ctl(3))
g:      scl(scl(d,-512,512,0,ctl(0)*256)%256,0,255,ctl(4),ctl(5))
b:      scl(scl(d,-512,512,0,ctl(0)*256)%256,0,255,ctl(6),ctl(7))
a:      a
```

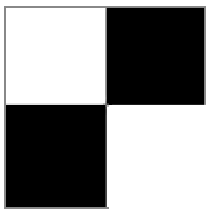
ctl(0)	Blend amount
ctl(2)	red amount of starting blend value
ctl(3)	red amount of ending blend value
ctl(4)	green amount of starting blend value

ctl(5)	green amount of ending blend value
ctl(6)	blue amount of starting blend value
ctl(7)	blue amount of ending blend value

TUTORIAL B: Creating Checker tiling

Did you always want to create a checkered tiling in Photoshop. Yes, there are ways, but too complicated. I'll show you how to create them with a filter.

Let's take a 2 x 2 field (10 x 10 pixels). It would look like this:



We have two different fields: A white one and a black one. The first line (y=0) gives us 255 (white) for the first 5 pixels (0 < x < 5) and 0 (black) for the last 5 pixels (4 < x < 10). The modulo operator returns with x % 10 in a large image and according to the pixel positions, the values 0,1,2,3,4,5,6,7,8,9,0,1,2,3,4,5,6,7,8,9,0,1,2,3,....

Now, we have to check if we're filling the pixels with white or black. This can be done with the following code:

```
r,g,b: (x % 10) < 5 ? 0 : 255
```

I can also work with boolean maths. If I simply use

```
(x % 10) < 5
```

then FF would return a 1 if true or 0 as false. Multiplying it with 255 would return values either 0 or 255:

```
((x%10) < 5 ) * 255
```

Ok, what's with y? The same code idea:

```
(y % 10) < 5
```

How to combine both? We could use the exclusive OR (XOR) idea:

	x < 5	x > 4
y < 5	0	1
y > 4	1	0

The code would be the following:

```
((x % 10) < 5 ) ^ ((y % 10 ) < 5 )
```

Now the whole thing multiplied with 255 returns the values 0 or 255:

```
(((x % 10) < 5 ) ^ ((y % 10 ) < 5 )) * 255
```

That's a boy... Problem is, the first checker cell is black and not white. There are two possible solutions for this. The easy one:

```
(((x % 10) > 4 ) ^ ((y % 10 ) < 5 )) * 255
```

and the boolean one:

```
(!((x % 10) < 5 ) ^ ((y % 10 ) < 5 ))* 255
```

Phew, that's it! Adding sliders is another challenge:

a) Sliders represent pixel values

Let's say that with the sliders, we tell FF how thick each checker cell (in pixels) is. As you noticed from the code:

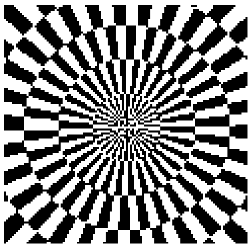
```
((x % 10) < 5 )
```

the first number represents the width of two cells and the second number the width of one cell. Thus, our code with a slider would look like this:

```
(!((x %( ctl(0)*2)) < ctl(0) ) ^ ((y % (ctl(0)*2) ) < ctl(0) ))* 255
```

Note: There is a radial kind of checker tiling you should try:

```
(!((m %( ctl(0)*2)) < ctl(0) ) ^ (((d+512) % (ctl(0)*2) ) < ctl(0) ))* 255
```



b) Sliders represents the total amount of cells in a row/column

This one's a bit tougher. The slider setting has to be converted into a cell width/height. Thus, dividing the width (X) of the image with the cell amount (ctl(0)) would be the following code: X/ctl(0). Let's say the image is 512 pixels wide and we have a slider setting of 8. X / ctl(0) = 512 / 8 = 64. The cell is 64 pixels wide. The complete code would be:

```
Category:   Neology
Title:       Checkered Tiling
Copyright: (c) 1996 by Werner D. Streidt
             100526.16@compuserve.com
Author:      Werner D. Streidt
Filename:   nchecker.8bf

r,g,b:      (!((x %( X/ctl(0)*2)) < (X/ctl(0))) ^ ((y % (Y/ctl(0)*2) ) < (Y/ctl(0))))* 255
a:          a

ctl(0)      Cell amount in a row/column
```

Note: You'll notice that you'll get in some occasions cell parts which don't belong there. This is due to the fact that the image's width and/or height is not a multiple of the slider setting. To visualize this problem create a new RGB image (500 x 500) and another RGB image (512 x 512) and use the filter with a setting of 8. The problematic image is the 500 x 500, because 500 divided by 8 results into 62,5.

2.3.3 Modifying images (tutorial section)

In the last chapter, we learned how to create our own images. In the following we will modify existing images. With Filter Factory you can change the pixels' values (2.3.3.1), thus changing the image's color appearance or you can also change the pixels' positions (2.3.3.2).

2.3.3.1 Modifying colors

TUTORIAL A: Effects with blending

The blenders you learned above are quite nice, you say. Well if you haven't tried it yet, load an RGB-image, create a new layer, create some blends with above filters from 2.3.2. and use multiply to combine your image with the blends. Instead of doing that, I'll show you how to do it much better. I showed you in 2.3.1 how to simulate Photoshop functions/calculations. Let's take the multiply calculation:

```
(x * y ) / 256
```

x and y are not the coordinates, but represent a pixel of two equal sized images. Let's see this in two grayscale images. In image 1, pixel at (100/100) has a value of 255 (white) and in image 2, the pixel on the same coordinate (100/100) has a value of 100. Calculating with multiply would result into (255 * 100) / 256 = 99,6 or 99.

Let's take the following code:

```
r,g,b:    ctl(1)<127 ? (x * 256 * ctl(0) / X ) % 256 : (y * 256 * ctl(0) / Y ) % 256
```

ctl(0)	exact amount of blends
ctl(1)	horizontal/vertical blending

Remember, we are creating a certain amount horizontal or vertical blends, overwriting the image's data. Now let's combine the code with our image:

```
code * channel value / 256

r,g,b: (ctl(1)<127?(x*256*ctl(0)/X)%256:(y*256*ctl(0)/Y)%256)*c/256
a: a
```

Yes, that's it! Now try using the other blending and tiling methods and experiment with other calculations.

TUTORIAL B: Adding borders to your images

There are different possibilites of creating interesting borders in your images. Let's start very simple with a black border in the 5 outmost pixels. Since we have four borders, we have to check FF's position while scanning the image:

```
r,g,b:    (x<5 || x>X-6 || y<5 || y>Y-6 ) ? 0 : c
```

The code would say: IF we are on a x-position less than 5 (0, 1, 2, 3, 4) OR on a x-position greater than X-6 (in an 20x30 image greater than 14: 15, 16, 17, 18, 19) OR on a y-position less than 5 OR on a y-position greater than 24 (Y-6) THEN fill these pixels with black (0) ELSE use the original pixel value (c).

Let's add a slider for the border thickness (notice that the parenthesis before the question mark aren't needed; this is because all || (OR) are of higher priority than the ?):

```
r,g,b:    x<ctl(0) || x>X-1-ctl(0) || y<ctl(0) || y>Y-ctl(0)-1 ? 0 : c
ctl(0):   Border thickness (in pixels)
```

An interesting feature would be to invert the border and reuse the filter with different border thicknesses. The code to invert the border would look like this:

```
r,g,b:    x<ctl(0) || x>X-1-ctl(0) || y<ctl(0) || y>Y-ctl(0)-1 ? 255-c : c
```

Ok, back to our original code. Black is nice but boring, users want colors, so sliders are needed:

```
r,g,b:    x<ctl(0) || x>X-1-ctl(0) || y<ctl(0) || y>Y-ctl(0)-1 ? ctl(z+1) : c
ctl(0):   Border thickness (in pixels)
ctl(1):   Red value for border
ctl(2):   Green value for border
ctl(3):   Blue value for border
```

Notice how I used ctl(z+1)? The slider value depends on the channel value.

TUTORIAL C: Cutting around

Do you know the Cutout Filter from Alien Skin? Well I created a cutout filter for the poor Photoshopper :-). The idea is to create a shadow on the left and top of the image or selection and move the image data (in the selection) by a certain amount of pixels. The effect would be like having two equal images, one above the other, while the top one has a cut out area, so you can view the bottom image.

To be able to do this, I have to apply four different codes, depending on:

a) am I applying the left shadow
b) am I applying the top shadow
c) am I applying no shadow
d) am I applying both shadows (top + left)

And on all of them, I am moving the pixels by a slider value, which is automatically my shadow amount.

To make things easier, my shadow is 10 pixels wide/high. The first thing I do is to test if I am on section c) (apply no shadow):

```
(x>9 && y>9) ? c : (cont)
```

If I am, use the current pixel value, or ELSE... Now I'd like to test if I am on section a) (apply the left shadow):

```
(x<10 && y>9 ) ? ... : (cont)
```

If I am, I would have to use with the 'multiply' idea (see section 2.3.1): multiply the blend with the pixel informati-on and divide by 255. Because my x value depends only from values between 0 and 9 inclusive, I have to use the scale function:

```
scl(x,0,9,100,255) * c/255
```

The above code will create a 10 pixel wide blend from 100 to 255 in the first ten pixels while using image data as well. So my complete code for section a) looks like this:

```
(x<10 && y>9 ) ? scl(x,0,9,100,255) * c/255 : (cont)
```

Now let's check section b) (apply the top shadow), which is the same as a), only with the y coordinates:

```
(x>9 && y<10) ? scl(y,0,9,100,255) * c/255 : (cont)
```

The last part (section d) apply both shadows) has to combine both shadow blends and the image data under it. On a 5 x 5 blend, the top-left part should look like this (without multiplying it to the image data):

```
0   0    0    0    0
0   64   64   64   64
0   64   128  128  128
0   64   128  196  196
0   64   128  196  255
```

The function for this is min(x,y), which will return the lowest of both values:

```
min(scl(x,0,9,100,255),scl(y,0,9,100,255))
```

Combined with the image data:

```
min(scl(x,0,9,100,255),scl(y,0,9,100,255))*c/255
```

Now we got all parts, all we have to do is combine them all in one code:

```
(x>9 && y>9) ? c :
(x<10 && y>9 ) ? scl(x,0,9,100,255) * c/255 :
(x>9 && y<10 ) ? scl(y,0,9,100,255) * c/255 :
min(scl(x,0,9,100,255),scl(y,0,9,100,255))*c/255
```

Now, that was cool, huh? You ask me why I use a blend from 100 to 255. If you use 0 instead of 100, you'll get a strong shadow. If you use a greater number than 100, the shadow is a bit softer. (You could let the user manipulate it with a slider) All we need now is to add the slider to specify the shadow's width, which will also offset the image or selection by the specified amount. The code to offset the image data would be to change all c variables (using c is the same as using src(x,y,z)) to src(x-ctl(0),y-ctl(0),z).

Ok, here's the complete code:

```
r,g,b:      (x>ctl(0)-1 && y>ctl(0)-1) ? src(x-ctl(0),y-ctl(0),z) :
(x<ctl(0) && y>ctl(0)-1 ) ? scl(x,0,ctl(0)-1,100,255) * src(x-ctl(0),y-ctl(0),z)/255 :
(x>ctl(0)-1 && y<ctl(0) ) ? scl(y,0,ctl(0)-1,100,255) * src(x-ctl(0),y-ctl(0),z)/255 :
min(scl(x,0,ctl(0)-1,100,255),scl(y,0,ctl(0)-1,100,255))*src(x-ctl(0),y-ctl(0),z)/255
a:          a
```

You can now change the blending if you like and for each color:
Category: Neology
Title: Shadowcaster
Copyright: (c) 1997 by Werner D. Streidt
100526.16@compuserve.com

Author: Werner D. Streidt
Filename: nshadow.8bf

```
r:      (x>ctl(0)-1 && y>ctl(0)-1) ? src(x-ctl(0),y-ctl(0),z) :
(x<ctl(0) && y>ctl(0)-1 ) ? scl(x,0,ctl(0)-1,ctl(1),255) * src(x-ctl(0),y-ctl(0),z)/255 :
(x>ctl(0)-1 && y<ctl(0) ) ? scl(y,0,ctl(0)-1,ctl(1),255) * src(x-ctl(0),y-ctl(0),z)/255 :
min(scl(x,0,ctl(0)-1,ctl(1),255),scl(y,0,ctl(0)-1,ctl(1),255))*src(x-ctl(0),y-ctl(0),z)/255

g:      (x>ctl(0)-1 && y>ctl(0)-1) ? src(x-ctl(0),y-ctl(0),z) :
(x<ctl(0) && y>ctl(0)-1 ) ? scl(x,0,ctl(0)-1,ctl(2),255) * src(x-ctl(0),y-ctl(0),z)/255 :
(x>ctl(0)-1 && y<ctl(0) ) ? scl(y,0,ctl(0)-1,ctl(2),255) * src(x-ctl(0),y-ctl(0),z)/255 :
min(scl(x,0,ctl(0)-1,ctl(2),255),scl(y,0,ctl(0)-1,ctl(2),255))*src(x-ctl(0),y-ctl(0),z)/255

b:      (x>ctl(0)-1 && y>ctl(0)-1) ? src(x-ctl(0),y-ctl(0),z) :
(x<ctl(0) && y>ctl(0)-1 ) ? scl(x,0,ctl(0)-1,ctl(3),255) * src(x-ctl(0),y-ctl(0),z)/255 :
(x>ctl(0)-1 && y<ctl(0) ) ? scl(y,0,ctl(0)-1,ctl(3),255) * src(x-ctl(0),y-ctl(0),z)/255 :
min(scl(x,0,ctl(0)-1,ctl(3),255),scl(y,0,ctl(0)-1,ctl(3),255))*src(x-ctl(0),y-ctl(0),z)/255

a: a
```

ctl(0)	Shadow width
ctl(1)	Red intensity
ctl(2)	Green intensity
ctl(3)	Blue intensity

Now, had I given you the above code, could you decode it back to know what it actually does? I think with lots of time and good decoding tactics. I also have problems when trying to decode available codes!

TUTORIAL D: Mosaic Filter

This would normally go into "Simulating program solutions", but there are some new features included. This tutorial is a modified email to the Discussion Group by Ilya Razmanov about mosaics.

For this we need the modulo operator (see, this MODULO is getting quite popular in image synthesis!) and the source function:

```
r,g,b:  src(x-x%10,y-y%10,z)
a:      a
```

Above code would result into blocks of ten pixels width and height. The source is always the pixel in the top-left corner. While we are moving further from it away, the modulo helps us getting the first pixel (in the 10 x 10 block) as source.

Now, we want to give the user more freedom with block size, let's add a slider:

```
r,g,b:  src(x-x%ctl(0),y-y%ctl(0),z)
a:      a
```

Of course, you could use another slider for the block height.

Let's say we want to add a border around each block. We would have to check if a certain value is reached according to x and y position and Modulo:

```
r,g,b:    (x%ctl(0)==0 || y%ctl(0)==0) ? 0: src(x-x%ctl(0),y-y%ctl(0),z)
a:        a
```

A nice feature would be adding a border color with slider values (changing the 0 with ctl(z+1)):

```
r,g,b:    (x%ctl(0)==0 || y%ctl(0)==0) ? ctl(z+1): src(x-x%ctl(0),y-y%ctl(0),z)
a:        a
```

ctl(0)	mosaic block size
ctl(1)	border color (red)
ctl(2)	border color (green)
ctl(3)	border color (blue)

TUTORIAL E: Weaving the image

Weaving a picture is not so complex as it sounds. A weave pattern is a neverending pattern on the image, so we can work on its smallest possible area, an 2 x 2 area.

A	B
C	D

The tiles A and D are equal, in them we create a vertical black-white-black blend. Tiles B and C are a horizontal black-white-black blend. Let's say each tile is 8 pixels wide and 8 pixels high, giving us a rendering area of 16 x 16. First, I want to check if FF is in area A or D. This is done with

```
(x<8 && y<8) || (x>7 && y>7)
```

I will have to create a vertical black-white-black blend into the areas A and D, so because it is composed by two blends (black to white and white to black), I'll have to check again if I am already passing half the tile height, in our case the tile height equals 8. The blend is created with the modulo operator. The highest value in our case a 4, so in order to get a good blend from black to white, we have to multiply it with 64; 64 * 4 = 256:

```
y%8 < 4 ? (y%8+1)*64 : (8-y%8)*64
```

The first modulo operator returns 1, 2, 3 and 4, then multiplying it with 64. the second modulo operator returns after being subtracted with 8 the values 4, 3, 2 and 1, then multiplied with 64. In both cases, FF returns us the values 64, 128, 192, and 255. The same is done with the horizontal values. So, we first check if we are dealing with areas A and D and apply the vertical blending if necesary, otherwise the horizontal blending is applied.

I have also included two put-functions, to keep the values in two cells in memory.

```
R:
put(x%16,0), put(y%16,1),
(get(0)<8 && get(1)<8) || (get(0)>7 && get(1)>7)?
(y%8)<4?(y%8+1)*64:(8-y%8)*64:
(x%8)<4?(x%8+1)*64:(8-x%8)*64
```

```
G,B:
(get(0)<8 && get(1)<8) || (get(0)>7 && get(1)>7)?
(y%8)<4?(y%8+1)*64:(8-y%8)*64:
(x%8)<4?(x%8+1)*64:(8-x%8)*64

A:   255
```

Let's take a slider to tell FF which tile size we want. We have to change all numerical values above with a slider value. In above example, the tile size was 8 x 8. Every 8 is changed to ctl(0), every 7 to (ctl(0)-1), 16 into (ctl(0)*2) and 64 into (256*2/ctl(0)).

So, the code will look like this:

```
R:
put(x%(ctl(0)*2),0), put(y%(ctl(0)*2),1),
(get(0)<ctl(0) && get(1)<ctl(0)) || (get(0)>(ctl(0)-1)&&get(1)>(ctl(0)-1))?
(y%ctl(0))<(ctl(0)/2)?(y%ctl(0)+1)*(256*2/ctl(0)):(ctl(0)-y%ctl(0))*(256*2/ctl(0)):
(x%ctl(0))<(ctl(0)/2)?(x%ctl(0)+1)*(256*2/ctl(0)):(ctl(0)-x%ctl(0))*(256*2/ctl(0))

G,B:
(get(0)<ctl(0) && get(1)<ctl(0)) || (get(0)>(ctl(0)-1)&&get(1)>(ctl(0)-1))?
(y%ctl(0))<(ctl(0)/2)?(y%ctl(0)+1)*(256*2/ctl(0)):(ctl(0)-y%ctl(0))*(256*2/ctl(0)):
(x%ctl(0))<(ctl(0)/2)?(x%ctl(0)+1)*(256*2/ctl(0)):(ctl(0)-x%ctl(0))*(256*2/ctl(0))

A:      255

ctl(0)  Tile size
```

It works okay, the blend should not go as far to the center of each tile. So, wth another slider, we can control how deep the blend starts from the tile edge to the center, a fall-off control, you could say. That's why I left the 256*2/ctl(0) as is and did not change it into 512/ctl(0). The more I multiply, the faster I get values of 255 or above. The problem is, I have now three possible areas in a tile. It starts with a small black-white blend, stays white a while and finally a white-black blend. So the second code of the blend I have to check if I am in a non-blend area or in the white-black area. The reason I am doing this is for the ultimate filter, where the blends are combined with the image underneath, thus creating the weave pattern over an image. Let's check the vertical blend:

```
(y%ctl(0))<(ctl(0)/ctl(1))?(y%ctl(0)+1)*(256*ctl(1)/ctl(0)):(y%ctl(0)>(ctl(0)-1-ctl(0)/ctl(1)))?(ctl(0)-
y%ctl(0))*(256*ctl(1)/ctl(0)):255
```

Slider 0 is the tile size and slider 1 is the brightness fall-off. The code before the ? checks if I am in the first boundary. If I am, the black-white blend is applied. If not, I check now if I am in the second boundary. If I am, the white-black blend is applied. If not, white (255) is applied. The whole code for this:

```
R:
put(x%(ctl(0)*2),0), put(y%(ctl(0)*2),1),
(get(0)<ctl(0) && get(1)<ctl(0)) || (get(0)>(ctl(0)-1)&&get(1)>(ctl(0)-1))?
(y%ctl(0))<(ctl(0)/ctl(1))?(y%ctl(0)+1)*(256*ctl(1)/ctl(0)):(y%ctl(0)>(ctl(0)-1-ctl(0)/ctl(1)))?(ctl(0)-
y%ctl(0))*(256*ctl(1)/ctl(0)):255:
```

```
(x%ctl(0))<(ctl(0)/ctl(1))?(x%ctl(0)+1)*(256*ctl(1)/ctl(0)):(x%ctl(0)>(ctl(0)-1-ctl(0)/ctl(1)))?(ctl(0)-
x%ctl(0))*(256*ctl(1)/ctl(0)):255

G,B:
(get(0)<ctl(0) && get(1)<ctl(0)) || (get(0)>(ctl(0)-1)&&get(1)>(ctl(0)-1))?
(y%ctl(0))<(ctl(0)/ctl(1))?(y%ctl(0)+1)*(256*ctl(1)/ctl(0)):(y%ctl(0)>(ctl(0)-1-ctl(0)/ctl(1)))?(ctl(0)-
y%ctl(0))*(256*ctl(1)/ctl(0)):255:
(x%ctl(0))<(ctl(0)/ctl(1))?(x%ctl(0)+1)*(256*ctl(1)/ctl(0)):(x%ctl(0)>(ctl(0)-1-ctl(0)/ctl(1)))?(ctl(0)-
x%ctl(0))*(256*ctl(1)/ctl(0)):255

A:      255

ctl(0)  Tile size
ctl(1)  Brightness
```

The following code changes the values returned by slider 1. I saw that slider values greater than 20 won't give much more effect, so I changed all ctl(1) into val(1,0,20).

```
R:
put(x%(ctl(0)*2),0), put(y%(ctl(0)*2),1),
(get(0)<ctl(0) && get(1)<ctl(0)) || (get(0)>(ctl(0)-1)&&get(1)>(ctl(0)-1))?
(y%ctl(0))<(ctl(0)/val(1,0,20))?(y%ctl(0)+1)*(256*val(1,0,20)/ctl(0)):(y%ctl(0)>(ctl(0)-1-
ctl(0)/val(1,0,20)))?(ctl(0)-y%ctl(0))*(256*val(1,0,20)/ctl(0)):255:
(x%ctl(0))<(ctl(0)/val(1,0,20))?(x%ctl(0)+1)*(256*val(1,0,20)/ctl(0)):(x%ctl(0)>(ctl(0)-1-
ctl(0)/val(1,0,20)))?(ctl(0)-x%ctl(0))*(256*val(1,0,20)/ctl(0)):255

G,B:
(get(0)<ctl(0) && get(1)<ctl(0)) || (get(0)>(ctl(0)-1)&&get(1)>(ctl(0)-1))?
(y%ctl(0))<(ctl(0)/val(1,0,20))?(y%ctl(0)+1)*(256*val(1,0,20)/ctl(0)):(y%ctl(0)>(ctl(0)-1-
ctl(0)/val(1,0,20)))?(ctl(0)-y%ctl(0))*(256*val(1,0,20)/ctl(0)):255:
(x%ctl(0))<(ctl(0)/val(1,0,20))?(x%ctl(0)+1)*(256*val(1,0,20)/ctl(0)):(x%ctl(0)>(ctl(0)-1-
ctl(0)/val(1,0,20)))?(ctl(0)-x%ctl(0))*(256*val(1,0,20)/ctl(0)):255

A:      255

ctl(0)  Tile size
ctl(1)  Brightness
```

The last step is to combine the pattern with the image with the multiply idea: c1*c2 / 256. I simply added the *c/256 to the blends and changed the 255 to c.

```
Category:  Neology
Title:     Digital weaver
Copyright: (c) 1997 by Werner D. Streidt
           100526.16@compuserve.com
Author:    Werner D. Streidt
```

Filename: ndigweav.8bf

```
R:
put(x%(ctl(0)*2),0), put(y%(ctl(0)*2),1),
(get(0)<ctl(0) && get(1)<ctl(0)) || (get(0)>(ctl(0)-1)&&get(1)>(ctl(0)-1))?
(y%ctl(0))<(ctl(0)/val(1,0,20))?(y%ctl(0)+1)*(256*val(1,0,20)/ctl(0))*c/256:(y%ctl(0)>(ctl(0)-1-
ctl(0)/val(1,0,20)))?(ctl(0)-y%ctl(0))*(256*val(1,0,20)/ctl(0))*c/256:c:
(x%ctl(0))<(ctl(0)/val(1,0,20))?(x%ctl(0)+1)*(256*val(1,0,20)/ctl(0))*c/256:(x%ctl(0)>(ctl(0)-1-
ctl(0)/val(1,0,20)))?(ctl(0)-x%ctl(0))*(256*val(1,0,20)/ctl(0))*c/256:c

G,B:

(get(0)<ctl(0) && get(1)<ctl(0)) || (get(0)>(ctl(0)-1)&&get(1)>(ctl(0)-1))?
(y%ctl(0))<(ctl(0)/val(1,0,20))?(y%ctl(0)+1)*(256*val(1,0,20)/ctl(0))*c/256:(y%ctl(0)>(ctl(0)-1-
ctl(0)/val(1,0,20)))?(ctl(0)-y%ctl(0))*(256*val(1,0,20)/ctl(0))*c/256:c:
(x%ctl(0))<(ctl(0)/val(1,0,20))?(x%ctl(0)+1)*(256*val(1,0,20)/ctl(0))*c/256:(x%ctl(0)>(ctl(0)-1-
ctl(0)/val(1,0,20)))?(ctl(0)-x%ctl(0))*(256*val(1,0,20)/ctl(0))*c/256:c

A:      255
```

ctl(0)	Weave size
ctl(1)	Shadow

2.3.3.2 Pushing them pixels around

TURORIAL A: Waving around

a) A simple horizontal/vertical sine wave distortion

I know, there are some filters which would do the job in Photoshop (Ripple, Wave, Glass, Ocean ripple), but since this is a tutorial for people to learn to do effects, I'll put it in anyways. The objective is to put a (horizontal and a vertical) sine movement in the image (without wrapping).

To get information from neighbouring pixels we would need the src(x,y,z) function. The x and y values have to be changed with sinus values (sinus returns also negative values, remember?). The horizontal displacement (x) depends on its vertical position (y). Therefore we would have to use the basis src(x+sin(y),y,z). Let's say the cycle length is 4 pixels; y-pixels 0 to 3 have to return the values 0,512,0,-512. To convert this for our needs:

```
src(x + sin (y*1024/4), y, z)
```

Using the above code doesn't give nice results. Ok, now the amplitude: We have the possibility of getting values (according to our cycle length) between -512 and 512. Dividing the values by 512 would return us values between -1 and 1. Dividing the values by 256 would return us values between -2 and 2. This means we have to use smaller values in order to get greater amplitude values: sin(?)/(512/?) Our code would then look like this (with sliders as cycle lengths and amplitudes):
x + sin(y*1024/ctl(0)) / (512/ctl(2))

Now, for a complete filter:

Category: Neology
Title: Sinus-Waves
Copyright: (c) 1996 by Werner D. Streidt
100526.16@compuserve.com
Author: Werner D. Streidt
Filename: nsinwav.8bf

```
r,g,b:    src(x + sin(y*1024/ctl(0)) / ( 512/ctl(2)),y + sin(x*1024/ctl(1)) / ( 512/ctl(3)),z)
a:        a
```

ctl(0)	Horizontal cycle width (in pixels)
ctl(1)	Vertical cycle width (in pixels)
ctl(2)	Horizontal wave amplitude (in pixels)
ctl(3)	Vertical wave amplitude (in pixels)

b) Doing the same with polar coordinates

In Photoshop, you can't do this effect :-). Actually, that is only half the truth. Indeed you have the zigzag filter with around center option. This makes kind of a sine wave along the angle lines witha certain amplitude (strength). With our filter, you can also make a sine wave around the center of the picture. I think I need not explain the why's and how's, because I simply changed src(x,y,z) with rad(d,m,z).

Category: Neology
Title: Polar-Waves
Copyright: (c) 1996 by Werner D. Streidt
100526.16@compuserve.com
Author: Werner D. Streidt
Filename: npolwav.8bf

```
r,g,b:    rad(d+sin(m*1024/ctl(0))/(512/ctl(2)),m+sin(d*1024/ctl(1))/(512/ctl(3)),z)
a:        a
```

ctl(0)	Angle cycle width (in pixels)
ctl(1)	Magnitude cycle width (in pixels)
ctl(2)	Angle wave amplitude (in pixels)
ctl(3)	Magnitude wave amplitude (in pixels)

TUTORIAL B: Offsetting the image (I)
by Alfredo Mateus

Alf's Power Toys - A Filter Factory Tutorial

Channel Offset

Let's start with a very simple filter. All this filter does is displace your picture in the x or y direction, with sliders for each channel and each direction. You could do the exact same thing on the Offset filter in Photoshop. The big difference is that there you would have to go to the Channels palette and pick the channel you want to offset and repeat the filter three times, if you want to modify all three channels.

This filter is based on the src(x,y,z) function. The src function returns the value for the pixel located in the (x,y) coordinates in the channel z. For Photoshop (0,0) is located in the upper left corner of your picture.
Also, the R,G and B channels have z equal to 0, 1 and 2, respectively. So, if you enter in FF:

```
src(0,0,z)
```

it will replace every pixel of your picture with the value of the first pixel. Try this out, zooming in the left corner of the picture and using the dropper and the info palette. So, if you enter src(x,y,z) this will not change the picture at all. For each pixel at position (x,y) it returns the value of itself. This is the same as using c in an expression.

What if I want the value of the neighbouring pixel? src(x+1,y,z) will displace the whole picture 1 pixel to the left. What happens when you get to the last pixel in a row, and you don't have a x+1 to get the value from (x is greater than the image's width)? In this case, the source pixel will equal the last available pixel (X-1). So src(x+10,y,z) will result in a streak of horizontal lines in the last 10 pixels. In this respect this is different from the Offset filter where you have the Wrap Around option.

In order to displace the image with slider values we would use:

```
src(x+ctl(0),y+ctl(1),z)
```

This will get the value of the slider 0 (ctl(0)) and displace the image to the left and the value of slider 1 (ctl(1)) and displace the picture upward. What if we want to go to the other direction?

```
src(x+((ctl(0)-128)*X/128),y+((ctl(1)-128)*Y/128),z)
```

When the slider is in the middle value (128), there is no displacement. Taking the slider to the right or left will cause displacement to opposite directions. We are multiplying with X/128, so that a maximum slider setting (0 or 255) returns us the fartherst (leftmost, rightmost) available pixels in our image. Another, more elegant way to do this is to use val instead of ctl:

```
src(x+val(0,-X,X)-1,y+val(1,-Y,Y)-1,z)
```

val takes the value of the slider and scales it between the two parameters, in this case the dimensions of the picture (X and Y).

All right, all we have to do now is place different sliders for each channel:

```
r: src(x+val(0,-X,X),y+val(1,-Y,Y),z)
g: src(x+val(2,-X,X),y+val(3,-Y,Y),z)
b: src(x+val(4,-X,X),y+val(5,-Y,Y),z)
a: a
```

The control names are:

```
ctl[0] = Red Horizontal
ctl[1] = Red Vertical
ctl[2] = Green Horizontal
ctl[3] = Green Vertical
ctl[4] = Blue Horizontal
ctl[5] = Blue Vertical
```

Now, as a homework, make the radial version of this filter using the rad function. You will get the Channel Spin filter.
As I said above, this filter will not wrap around the image. Let's see if we can get this into Filter Factory and we will have a very good Offset filter and maybe more.

The Wrapper (New Filter!)

This is my way to wrap an image. Mario has a filter to wrap an image completely in the middle (displacing half the dimensions in each direction). That was the Slipthrough filter. See also tutorial c for an equal filter. The Wrapper does it in an interactive way.

From the filter above we see that after displacing an image too much we get a portion of the image where it can't get info and so it repeats the edge pixel (which is one of the options in the Offset filter). This portion of the image is where we want to have the opposite end of the picture repeated. Let's see, if we displace the picture with src(x+val(0,0,X),y,z), the portion which gets the pixel repeated is given by X-val(0,0,X). Using the question mark we can select what filter factory will do in each area:

```
x<X-val(0,0,X)?src(x+val(0,0,X),y,z):src(x-(X-val(0,0,X)),y,z)
```

For x in the left of the repeated pixel area, it displaces the image just like before. For the repeated pixel area, it will place the info from the area that got bumped out to the left. We got wrapping! Let's try this for the vertical direction:

```
y<Y-val(1,0,Y)?src(x,y+val(1,0,Y),z):src(x,y-(Y-val(1,0,Y)),z)
```

Now, a little trick (I am pretty sure that Mario invented it) to get both in the same filter: the mode control.

```
ctl(2)<128?x<X-val(0,0,X)?src(x+val(0,0,X),y,z):
src(x-(X-val(0,0,X)),y,z):y<Y-val(0,0,Y)?src(x,y+val(0,0,Y),z):src(x,y-(Y-val(0,0,Y)),z)
```

ctl(2) is the mode control. If the slider is to the left of 128 it activates the horizontal wrapping. Greater than 128 we get vertical wrapping. I like both at the same time (which you can't get with the Offset filter (at least not without using two layers...). The final filter:

```
Name: The Wrapper
Category : Alf's Power Toys
Copyright: 1996 Alfredo Mateus
Author: Alfredo Mateus

r,g,b:
ctl(3)<85?   x<X-val(0,0,X)?src(x+val(0,0,X),y,z):src(x-(X-val(0,0,X)),y,z) :
ctl(3)<170?  y<Y-val(1,0,Y)?src(x,y+val(1,0,Y),z):src(x,y-(Y-val(1,0,Y)),z) :
mix(y<Y-val(1,0,Y)?src(x,y+val(1,0,Y),z):src(x,y-(Y-val(1,0,Y)),z),
x<X-val(0,0,X)?src(x+val(0,0,X),y,z):src(x-(X-val(0,0,X)),y,z),ctl(5),255)
a:          a

ctl[0] = Horizontal Wrapping
ctl[1] = Vertical Wrapping
ctl[3] = Mode
ctl[5] = Mixing
```

I have tried the mixing of wrapping in both directions and if you have a tileable texture to start with, you'll get an interesting effect.
There are many other filters using the src function. This is but a very small idea of what you can do with it. If you found this too simple, great, you are past the beginer's level. You should be creating your own filters soon! If you

have any questions, send them to the list. Comments are welcome, it may seem clear to me but completely weird to somebody else. FF codes (normally more complex than these, like Mario's...) have a way to be impenetrable sometimes...

TUTORIAL C: Offsetting the image (II)

Let's move our image around for a while. If we want to move our image 40 pixels to the right and 30 pixels downwards, we have to tell FF to put in the current pixel position the pixel value 40 pixels from the left and 30 over it:

```
src( x - 40, y - 30 , z)
```

In the coordinates between 0/0 and 39/29 FF will take the pixel values from 0/0 (because negative values are valued to 0 in FF) and repeat the edge pixels. But I'd like to wrap around. We have to first check the limits (in the following example for the x-coordinate):

```
(x < 40 ? X-39 +x: x-40 )
```

Is FF evaluating pixels 0 to 39, then it uses pixels from the right side of the image to wrap around. Is FF evaluating pixels in x-coordinates above 39, then it takes the pixel values from the pixel 40 pixels left (ok, read that again... :-)). Coding that for the y-coordinates, too will result to:

```
r,g,b:    src(( x<40 ? X-39+x : x-40), (y<30 ? Y-29+y: y-30), z)
```

With slider 0 we control the horizontal movement, with slider 1 we control the vertical movement:

```
r,g,b:    src(( x<ctl(0) ? X-ctl(0)+x: x-ctl(0) ), ( y<ctl(1) ? Y-ctl(1)+y: y-ctl(1) ), z)
```

What I'm getting at is the creation of a half wraparound for web images which are seamless. You would use this filter to wrap around the image and edit the edges for seamless tiling. We exchange the slider functions with X/2 and Y/2, respectively:

```
r,g,b:    src(( x<X/2 ? X-X/2+x : x-X/2), (y<Y/2 ? Y-Y/2+y : y-Y/2), z)
```

X - X/2 gives X/2, so here's my Turnaround filter:

```
Category:   Neology
Title:      Turnaround
Copyright: (c) 1996 by Werner D. Streidt
            100526.16@compuserve.com
Author:     Werner D. Streidt
Filename:   ntrnarnd.8bf

r,g,b:    src(( x<X/2 ? X/2+x : x-X/2), (y<Y/2 ? Y/2+y : y-Y/2), z)
a:        a
```

no sliders

Note: Use images with even width and length proportions. Even if you can use the Photoshop internal offset filter, try both filters with on selections. PS' offset filters knows negative image information, FF doesn't, you may get interesting effects. A nice thing is that this works also great on selections, FF only uses the selection info - Photo-shop's Offset Filter uses the whole image info. Try both filters with and without selections...

TUTORIAL D: Seamless tiling

The idea of the seamless tiling is to take part of the image, mirror it horizontally and vertically.

As an example:

```
r,g,b: src(x%100,y%100,z)
```

will fill your image with the 100 x 100 tile in the upper left of your image. If you want to change the width and height with sliders:

```
r,g,b: src(x%ctl(0), y%ctl(1),z)
```

ctl(0) tile width
ctl(1) tile height

You can change the idea of using always the upper left corner for tile data:

```
r,g,b: src(x%ctl(0)+ctl(2), y%ctl(1)+ctl(3),z)
```

ctl(0) tile width
ctl(1) tile height
ctl(2) horizontal offset
ctl(3) vertical offset

Now look what this baby does:

```
r,g,b: src(x%200<100?x%200:200-x%200-1,y%200<100?y%200:200-y%200-1,z)
```

It will take your 100 x 100 tile, mirror it sideways and mirror it downwards, thus creating a whole seamless tile pic.

And now with sliders for tile width, height and x/y offset:

Category: Neology
Title: Tiler1
Copyright: 1997 Werner D. Streidt http://www.fhd-stuttgart.de/~ws01
Author: Werner D. Streidt
Filename: ntiler1.8bf

```
r,g,b:
src(x%(ctl(0)*2)<ctl(0)?x%(ctl(0)*2)+ctl(2):(ctl(0)*2)-x%(ctl(0)*2)-1+ctl(2),
y%(ctl(1)*2)<ctl(1)?y%(ctl(1)*2)+ctl(3):(ctl(1)*2)-y%(ctl(1)*2)-1+ctl(3),z)
a: a
```

ctl(0): Tile width
ctl(1): Tile height
ctl(2): Horizontal offset
ctl(3): Vertical offset

2.3.4 Optimizing the algorithm

This section will help you with code optimization, which, at times, coud be a real blessing for your code.

TUTORIAL A: Preview window corrections
by Mario Klingemann

When you start programming FF-filters one of the first things you might be wondering about is that the final result looks somewhat different from the small preview. This doesn't happen with color manipulation filters, but whenever there is a distortion I'll bet you encountered it.

Why does this happen and what can be done about it? The reason for this effect is, that FF scales down the original image for the preview and does all its the calculations for that preview with the measures of the small image you see in the window. That means that X is not 768 for example, but just 150 (this value varies from system to system). The problem occurs when you start moving around pixels. src(x-ctl(0),y,z) with ctl(0) set to 50 will shift the image 50 pixels to the right. In the preview this is almost 30% of the image, but in the final result, if you have an image that is 1000 pixels wide, it is just a small hop.

But there is of course a solution. You will have to scale the values of the sliders so they give you different results on the small and on the original image. Luckily this is pretty easy. Just replace the ctl(0) with val(0,0,X). That's it. If you fiddle around with y take val(0,0,Y) or val(0,-Y,Y) or val(0,40,5*Y) - as long as there is X,Y or M inside it will look right.

It gets a bit more complicated if it comes to the sin and cos functions. They will always return a result between -511 and 512 whatever you put in. So what I do is to convert their input in a way that I will always get a whole phase or a multiple of it. Therefore I use one of my favorite command:

The scl-function

I use this one in almost all of my filters because it is so comfortable. You put in a value that comes in a certain range and you'll receive something in a range that you need. Of course you could do that by adding and dividing, but in my opinion it is much easier and furthermore I don't trust the integer mathematics FF uses. If you divide something you'll always loose information as 5/3 in FF is 1 and not 1.6666. The scl command won't give you a different result, but somehow I hope the internal calculations are better that the external (probably not).

So what about this sin thing. We know that to get one sin phase we need to feed the function with the values from -511 to 511. x will never become negative and especially in the preview never get over 200.

Just for repetition here is the scl function as I read it:

scl([input value],[minimum expected input value],[maximum expected input value],[minimum output value], [maximum output value])

What we know is that x goes from 0 to X. Voilà, let's scale it: sin(scl(x,0,X,-511,512)).

if you want two phases, just multiply:

sin(2*scl(x,0,X,-511,512))

if you want to vary it use ctl()

sin(ctl(0)*scl(x,0,X,-511,512))

As you see you are allowed to use the normal ctl command here.

If you don't want the whole phase for some soft gradient for example you'll have to reduce the output of the scl function:

sin(scl(x,0,X,-254,255)) or sin(scl(x,0,X,-64,64))

As you see I prefer fractions of 2: 512, 256, 128, 64...

Oh I almost forgot. sin produces values from -511 to 512 but pixels accept only values from 0 to 255. Well, it's just another scale:

scl(sin(ctl(0)*scl(x,0,X,-511,512)),-511,512,0,255)

Yes of course (sin(ctl(0)*scl(x,0,X,-511,512))+511)/4 is the same, but scl is much easier to understand and easy to play around with it for experiments with variations of your final filter.

Tutorial B: Random values
by Mario Klingemann

There are a lots of filters where you might be in need of random values. So what you might say, I have got the rnd function that does it. Well for some basic noise rnd might be enough, but for my taste even for that it is too limited. Why? Because it is not random. Actually it is the same chain of numbers all the time. Test it. Create a simple noise filter, like in R,G,B: rnd(0,255). Apply the filter to one layer, add a second layer and apply the filter to that one again. Turn on Difference Mode on the upper one. What do you see? Black. Because every pixel in both layers has the same values. But that's just for noise.

What do you do if you need a random value that works for a certain area of your image and not just on one pixel? Use the put command? Perhaps this would work, but you just have 256 possible variables that you can use. No, we have to create our own random function that works for all our needs. I just show you one way, but after you understood this you'll be able to create your own.

If there is enough code and stack space I prefer to use the tan funtion for that. It creates huge values what is important for us. The idea is to create a huge number and just take a part from it. To have a different value on every pixel we need to introduce something that changes with every pixel. There are some varaibles to choose from:

r g b i u v x y m d.

I wouldn't go for the color information as a black start image wouldn't produce very random results (but perhaps on some occasions it could be useful). I normally use x and y or, when working with radial filters m and d. The most basic random function would be tan(x*y) but as you see it is not good enough yet. Perhaps we should start tuning the output.

Let’s say we want RGB noise so we just need values from 0 to 255. Choose your weapons:

& or %: tan(x*y)&255 or tan(x*y)%255

Stop, % doesn't take care of the negative numbers so we need to add something:

abs(tan(x*y))%255
That looks better, but you can still see some repetitive patterns. That's where the huge number thing comes in:

(tan(x*y)*42)&255

Of course you can take any number you like. But there is still something missing. The upper and the leftmost line are not random enough. That's because either x or y are 0 there. No problem just add something:

(tan((x+1)*(y+1)*42)&255, better perhaps (tan((x+10)*(y+13))*42)&255

Again you are free to add whatever you like. In my eyes that's a pretty good noise, but we are not finished yet. Until now the noise is the same for every image, but perhaps you don't like it like this but prefer a little variation. Let's introduce a "Random Seed" slider:

(tan((x+10)*(y+13))*(42+ctl(7))&255

Here we are: our homemade random function. Feel free to add more variations:

(tan((5*x)*(y+13)*sin(x))*(42+ctl(7)))&255
(tan((5*x)*(y+13)*sin(cos(x)))*(42+ctl(7)))&255

But the best and most important thing is yet to come: The random function for areas that are bigger than 1 pixel. How about this:

(tan((5*x%val(0,0,X))*(y%val(1,0,Y)+13)*sin(x%val(0,0,X)))*(42+ctl(7)))&255
(tan((5*x%val(0,0,X))*(y%val(1,0,Y)+13)*sin(cos(x%val(0,0,X))))*(42+ctl(7)))&255

Tutorial C: Variations
by Mario Klingemann

It is pretty easy to make some variations of a filter when the normal version works. I have some simple rules that I try most of the times:

∫ If something works with x and y it also works with m and d. All you have to do is to replace every x with m, every y with d and the same with X and Y (on the sliders for example). Sometimes it is necessary to use d+511 or abs(d) instead of a simple d, as d produces negative values. Also you have to watch out that the scaling of d is different to that of Y. scl(y,0,255,1234,43525) would become scl(d,-512,512,1234,43525). If you have a very big filter this doesn't work sometimes as m and d need more internal stack space and you'll just see the ! sign even if the code has no errors. In this case try to use as few m and d as possible by using put(m,0),put(d,1) in the beginning,

∫ A texture can be a fine displacement map. If you have created a nice texture generator, especially one with smooth gradients you can make a distortion filter out of it. Let's say you have a beautiful function that produces shades between 0 and 255 (that's what texture generators normally do). What we need is just a grayscale version of it. Put the result into an empty variable:

  put([fantastic code],9)

  Now comes the distortion thing:

  src(x,y-scl(get(9),0,255,-val(7,0,Y),val(7,0,Y)),z)

If you want to have control over the horizontal distortion, too try this:

```
src(x-scl(get(9),0,255,-val(6,0,X),val(6,0,X)),y-scl(get(9),0,255,-val(7,0,Y),val(7,0,Y)),z)
```

But you can spice up the look even more by introducing some shading. You already have the shades in get(9) all you have to do is to merge it with the src results. Depending on how much stack space you have left there are different methods. One of the easiest (but not best) is to simply add the shades:

```
src(x,y-scl(get(9),0,255,-val(7,0,Y),val(7,0,Y)),z)+get(9)-128
```

Watch that I subtracted 128 to correct the brightness. To get just the shadows I use the classic multiply method:

```
src(x,y-scl(get(9),0,255,-val(7,0,Y),val(7,0,Y)),z)*get(9)/256
```

For just the highlights I take the screen mode:

```
255-(255-src(x,y-scl(get(9),0,255,-val(7,0,Y),val(7,0,Y)),z))*(255-get(9))/256
```

My current favorite is an average of both. But as it is pretty long this doesn't work if the rest of your code uses already lots of stack space. As I have to do 2 calculations I save the src result in a variable:

```
put(src(x,y-scl(get(9),0,255,-val(7,0,Y),val(7,0,Y)),z),10), ((get(9)*get(10)/256)+(255-(255-get(9))*(255-
get(10))/256))/2
```

∫ If something works on the whole image it also works on small tiles. At least for filters that use x and y (for m and d it's a bit more complicated). Actually you just put the following code on the beginning:

```
put(val(7,0,min(X,Y)),0),put(x%get(0),1),put(y%get(0),2)
```

Now replace every x in your filter with get(1), every y with get(2) and every X or Y with get(0). If you want to control the height and the width of the tiles individually the code loks like this:

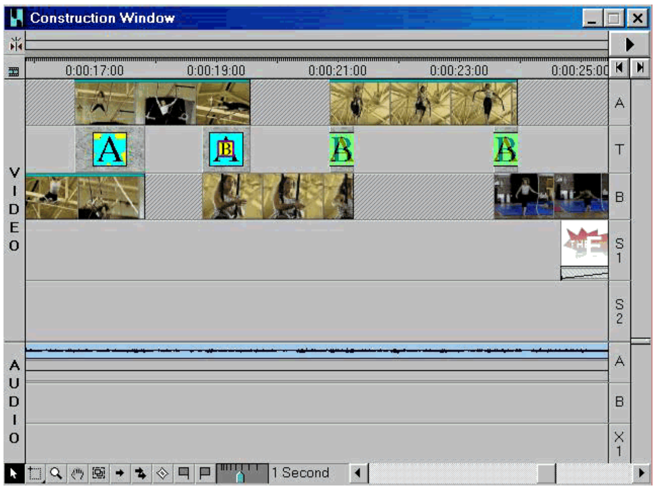
```
put(val(6,0,X),0),put(val(7,0,Y),1),put(x%get(0),2),put(y%get(1),3)
```

Accordingly x becomes get(2), y becomes get(3), X becomes get(0) and Y becomes get(1).

3 Filter Factory and Adobe Premiere

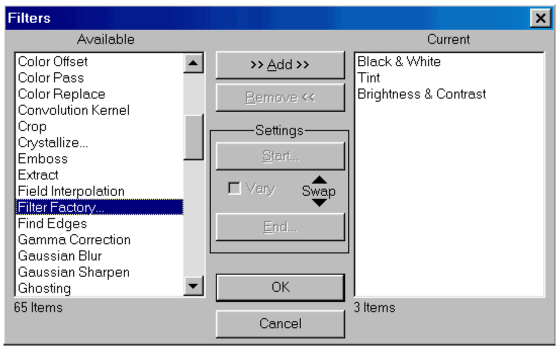
Premiere is one of the best applications for Digital Video Editing. It runs on Windows, Macintosh and Silicon Graphics workstations. Premiere is intended for editing AVI videos and Quicktime videos. You can also insert pictures, titles, sound effects and music. At the end everything is rendered to a single AVI Video (Windows) or Quicktime Movie (Macintosh).

3.1 Premiere's basic concepts of image and video manipulation



Unlike in Photoshop or other picture manipulation programs the centre of Premiere is the Construction Window with different video and audio tracks. So it is more similiar to a Midi or sound manipulation program (like Cubase or Soundforge) than to Photoshop.

The first track of the Construction Window, the A-Track, is intended for the first video sequence, the second is the T-Track where the Transitions are placed and the third, the B-Track, is for the video sequence that follows etc. Below them there are up to 99 S-Tracks where titles oder other videos can be placed for overlaying the videos on Track A and B. Last but not least there are up to 99 Audio-Tracks for placing the sound of Video A und B and mixing them with background music. (Premiere can also be used for multitrack sound mixing, although it doesn't offer the comfort of Samplitude Studio, Cubase VST, Cool Edit Pro etc.)

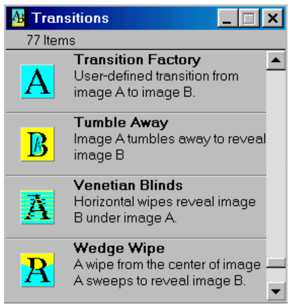


Filters are applied to a video, picture, title etc. by holding down the right mouse button above a video sequence and selecting "Filters ...". The Filters window pops up then, where you can select the available filters from a list box. Besides the display in a list box, a major difference to Photoshop is that you can apply several filters at the same time, so that the result of the first filter is used as input for the second etc. In the Settings frame there is another great feature of Premiere: you can simulate a filter with changing results without using the t and total expressions in the filter code (see 3.3.1). Firstly you have to activate the Vary checkbox. Then, secondly, by pressing the Start button the menu of a selected filter appears where you can define the start values of the sliders and by pressing the End button you can define the end values of the sliders.

Assuming that you set the start value of Slider One to 20 and the end value to 200, the start value of Slider Two to 0 and the end value to 255 and have a video containing ten frames, Premiere will automatically change the slider values when processing the video in the following way :

frame	1	2	3	4	5	6	7	8	9	10
changing value of Slider One	20	40	60	80	100	120	140	160	180	200
changing value of Slider Two	0	28	56	84	112	140	168	204	232	255

Using this feature, some great video effects can be achieved. You can also use it to create a video that shows the total range of effects of a filter. To do this with a Photoshop Filter (created with Filter Factory) you just have to convert it to Premiere by using PlugIn Commander, written by myself, or Filter Factory Converter, written by Jan Angermüller (see Section 3.5).


Transitions
77 Items
Transition Factory
User-defined transition from image A to image B.
Tumble Away
Image A tumbles away to reveal image B
Venetian Blinds
Horizontal wipes reveal image B under image A.
Wedge Wipe
A wipe from the center of image A sweeps to reveal image B.

Transitions are placed in the T-Track , as mentioned above, and adjusted in their length and position. You can apply a Transition to a single video which is almost the same as using a filter, but you can adjust what part of a video sequence is manipulated (See Section 3.3.2). Usually a Transition is applied between the beginning and the end of two video sequences, so that a transition from one scene to the other is created.

3.2 What is the Premiere Filter Factory?

The Premiere Filter Factory has the same concept as the Photoshop FF, but it is mostly used on videos (although you can also use it on pictures, e.g. for creating a special background for a title). Therefore there are two new expressions added in Premiere FF to deal with this fact.

3.2.1 What are the programming differences between Photoshop & Premiere Filter Factory?

Premiere Filter Factory has a variable called t that contains the number of the frame that is currently proccessed by the filter. In addition to that, there is a constant called total which contains the total number of frames of the currently processed video. With these code extension you can create filters that manipulate every frame of the video they are applied to differently.

Furthermore, there are many differences between both Filter Factories, some of them are errors in the Premiere Filter Factory.

- X vs. xmax, Y vs. ymax, M vs. mmax, D vs. dmax
  Instead of X, Y,M and D you can also use xmax, ymax, mmax and dmax in Premiere's FF.

- z vs. p, Z vs. P / pmax
  z from Photoshop FF has to be replaced in Premiere FF by p and Z by P or pmax.

- mix
  mix(2,1,3,4) in Premiere's FF behaves like mix(1,2,3,4) in Photoshop's FF.

- rnd
  Behaves differently in Premiere FF.

- I, U, V
  not used in the Premiere FF.

- D
  D has the value 512 in Premiere's FF while in Photoshop's FF D is always 1024.

- scl
  Behaves in some cases differently in Premiere FF.

- cnv (1,2,3,4,5,6,7,8,9,division)
  In Photoshop FF the pixels 1 to 9 in the cnv function are arranged like this:

1	2	3
4	5	6
7	8	9

  In Premiere FF the pixels 1 to 9 in the cnv function are arranged like this:

9	8	7
6	5	4
3	2	1

  Surely a bug in the Premiere FF manual, because it is described being equivalent to Photoshop FF.

- tan, sin, cos
  Behave differently in Premiere FF.

- rad
  Behaves in some cases a bit different in Premiere FF.

- src, ctl, val, r, g, b
  Behave in some cases a bit different in Premiere FF.

3.3 What is the Premiere Transition Factory?

With the Premiere Transition Factory it is possible to create Transitions between two videos using the same code as in Filter Factory. That means that there is not only one manipulation source, but two.

3.3.1 What are the differences between the Premiere Filter Factory und Transition Factory concerning programing ?

Because of two videos being used in Transition Factory as source material, there is a extension of the programming code. In order to make clear which video you mean you can use

- src0 or src1 instead of simply src
- c0 or c1 instead of simply c
- r0 or r1,g0 or g1,b0 or b1,a0 or a1 instead of simply r,g,b
- i0or i1,u0 or u1,v0 or v1 insted of simply i,u,v
- etc... (Unfortunatelly they aren't mentioned in the Premiere Manual!)

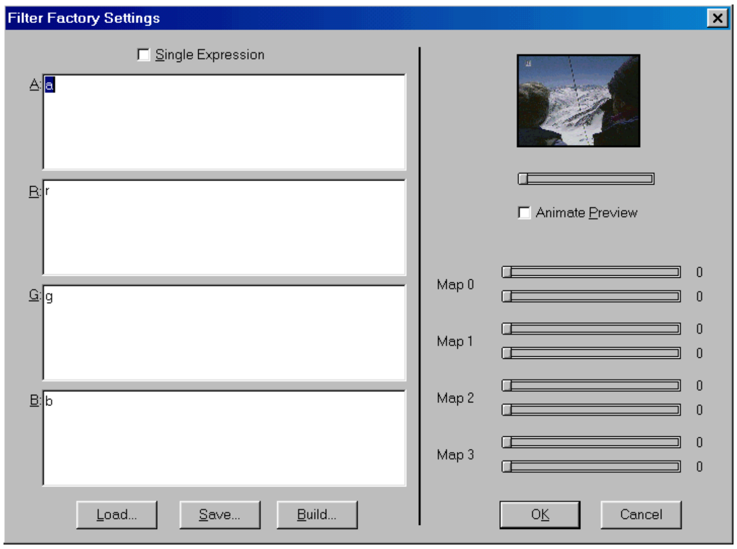
If you don't use 0 or 1 after these expressions, Transition Factory will use the video that is placed at an earlier position in the timeline.

3.3.2 Five Ways of using the Transition Factory

With the t and total and the two manipulations sources you have a lot more possibilities than with the normal Photoshop Filter Factory. There are five ways to use the Transition Factory:

- Creating a normal filter effect like with Photoshop FF No explanation needed.
- Creating a filter with changing results (by using t and total) like with the Premiere FF Look at 3.5
- Creating a filter with two images/videos as manipulation source I think some great filters could be done in this way.
- Creating a filter with changing results and two images/videos as manipulation source Even more greater effects could be achived this way! Imagine two videos melting and seperating on the basis of some waving algorithm.
- Doing a Transition between two videos (the intentional way of using Transition Factory!) Look at the Transition Factory Tutorial.

3.4 Creating a Filter or Transition in Premiere



A: a
R: r
G: g
B: b

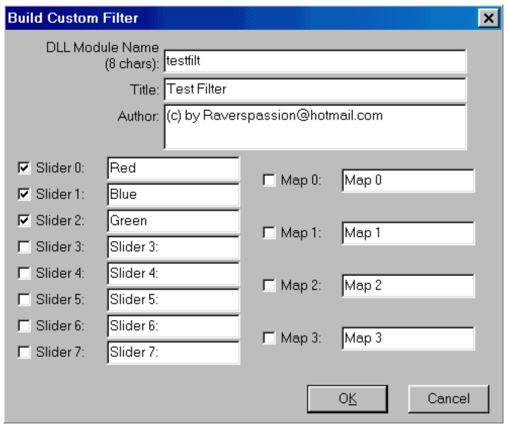
Map 0: 0, 0
Map 1: 0, 0
Map 2: 0, 0
Map 3: 0, 0

First of all, you have to press the right mouse button above a video sequence and select "Filters..." from the context menu. In the Filters dialogbox you have to select "Filter Factory ..." and following window appears:

As in Photoshop's Filter Factory there are four text fields for entering the filter code, as well as a preview and 8 Sliders above it. The Buttons "Load", "Save" and "Build" have also the same functions as in Photoshop. New is the slider under the preview and the checkbutton Animate Preview. By dragging the slider you can see the result of the filter on every frame of a video and by activating the checkbox the video is played to show the effect of your code continuously. When activating the checkbox „Single Expression" three of four code fields disappear. The code entered in the remaining field is used on all four channels (R, G, B, A).

To compile your filter you have to press "Build". The following window will pop up:

In this window you can enter the file name of the compiled .prm file (Premiere PlugIn), the name that will appear in the Filter dialogbox and a note about the author and copyright. Below it you can select which sliders or maps are to be displayed in the compiled filter.



DLL Module Name (8 chars): testfilt
Title: Test Filter
Author: (c) by Raverspassion@hotmail.com

[✓] Slider 0:	Red	[ ] Map 0:	Map 0
[✓] Slider 1:	Blue	[ ] Map 1:	Map 1
[✓] Slider 2:	Green	[ ] Map 2:	Map 2
[ ] Slider 3:	Slider 3:	[ ] Map 3:	Map 3
[ ] Slider 4:	Slider 4:		
[ ] Slider 5:	Slider 5:		
[ ] Slider 6:	Slider 6:		
[ ] Slider 7:	Slider 7:		

Transition Factory is used almost exactly as Filter Factory. The Transition Factory has to be dragged from the Transitions window to the T-Track to make the Transition Factory Settings window appear. Further differences are that you can enter a description of the transition in the Build window and that it is placed in the Transitions window showing a preview of its effect (as you can see in the third picture above!).

3.5 Premiere Filter/Transition Factory Resources

Premiere PlugIn HQ at http://www.fortunecity.com/lavendar/kane/39

- A lot of Gradient wipes and Filters, some Transitions and Boris FX Settings
- Home of the PlugIn Commander you can manage your Photoshop and Premiere PlugIns with and convert those plugs created with Filter Factory to different file formats (for example converting them from Photoshop to Premiere and back again).

Jan Angermüller's Homepage at http://members.aol.com/harahh/index.htm

- Zip with about 750 Photoshop filter codes, some gradient wipes, many Premiere PlugIns converted from Photoshop FF
- Home of the Filter Factory Converter which converts FF Filters from Photoshop to Premiere etc.

4 Acknowledgements

As more and more tips, corrections, ideas are posted, I will try to keep this document up-to-date. Without feedback and mind strength from other FFFanatics and of course, the maker of Filter Factory (Joe Ternasky) and last, but not least, Adobe for the program Photoshop, this document would have never been born. I also want to thank the support of (in alphabetical order) Steve Fisher, Harald Heim (for the Premiere chapters) Ralph Griswold, Mario Klingemann, Alfredo Mateus and Ilya Razmanov.

4.1 Contacting the authors

If you have a question about Filter Factory, about an idea for a new filter, a how-to question, then *don't* email me. This is what the FFDG (Filter Factory Discussion Group) is for. See 1.3 (Where can I post my ideas, questions, etc.?).

If you have any questions about this document (you don't understand a tutorial in here or flame me because of a spelling error), feel free to contact me:

Werner D. Streidt wstreidt@compuserve.com

4.2 Copyright