An unsharp mask is a very faint positive, made from a negative, for the purpose of printing the mask and the negative together after they have been precisely registered to a sandwich. There are two reasons to do this; the first being contrast control and the second being an increase in apparent sharpness.

Unsharp masks have been used for some time to control the contrast in slide film when creating a print. They can also be used for black-and-white negative film when the film has an excessively high contrast due to overdevelopment. The mask would have no density in the highlights, but would have some density in the shadows. Fig.9 shows how the additive densities will result in a lower overall contrast when the mask is sandwiched with the negative.

However, this article is not about using an unsharp mask to rescue an overdeveloped negative, but to utilize this technique to increase the apparent sharpness of the print. A word of warning may be appropriate at this point. This is not for every negative, but more importantly, it is not for every photographer. Some may not be willing to spend the time involved, because it is a labour intensive task to prepare a mask.

The technique is very similar to the menu called "Unsharp Mask", in the popular image software Adobe Photoshop™, but usually takes several hours to execute in the darkroom. The masks need to be carefully planned and exposed with the enlarger light, then developed and dried. Then it needs to be registered with the negative to a sandwich and printed. Batch processing several masks together does cut down on the time involved.

Despite the workload, I would not be surprised if you would never print an important image without a mask again, once you have seen the dramatic difference it can make. Many fine art photographers are making masks for all their important images and some don't even print them straight any more, because few images look better printed straight. You may be less committed, but I hope this article will encourage you to try it out.

Photo © Ralph W Lambrecht

Unsharp masking

Contrast Control and Increased Sharpness in black-and-white, by Ralph W Lambrecht

How it is done

We will start with the selection of an appropriate film to generate a mask. Specially dedicated masking film is either not available anymore, hard to come by or very expensive. For this reason, I am now proposing to use either Ilford Ortho Plus when in Europe, or Kodak T-Max when back home in the USA. Other film will probably do fine, but I have not tested them. Ortho Plus from Ilford has the advantage of allowing to be handled under a strong red safelight, but it is unfortunately not available in the USA. I use 4 x 5 sheets exclusively to make masks for all film formats and see little reason to store masking film in different sizes. To me, it is easier to handle and store than the smaller film sizes.

The enlarger should be set up to allow for an even illumination to the entire baseboard with an empty negative carrier in place. A copy frame is helpful to hold the negative and the mask. Mine is made of plastic and has a grey foam backing with a hinged glass cover. Just a piece of 1/8" glass however will do if no copy frame is available. Place the mask film, supported by a black piece of cardboard, into the middle of the open copy frame. Make sure that the emulsion side of the masking film is facing up as in fig.1. Then place the negative on top of the masking film, again with the emulsion side facing up. Close the cover or hold the sandwich down with the glass.

Top: North door of the church of St.Mary of Buttsbury, Essex.

The precise exposure may require some testing, but I have given you a starting point, for the two films mentioned, at the end of this article. Fig.1 also shows how during the exposure, the light is passing through the emulsion of the negative first and then needs to pass through the base of the

continued over page...

negative to reach the emulsion of the mask. This base has a typical thickness of about 0.18 mm (7 mil) and it also diffuses the light slightly. This effect is responsible for the creation of a slightly unsharp mask. The thicker the base, the more the light will be diffused and the mask would get increasingly unsharp. Ironically, the unsharp mask is responsible for the sharper image when printed later as a sandwich, and I will explain later why that is the case. It is common practice to use clear plastic spacers, available from art supplies stores, between the negative and the mask to increase the effect, but I find that it looks unnatural. Therefore, I am not using spacers anymore. However, you may want to experiment with clear plastic sheets of 0.1-0.2 mm (4–8 mil) thickness, to find the effect you prefer. After the exposure, process the mask as you would any other film. The developing times mentioned at the end of the articles are starting points and they work well for me. I use a Jobo processor with constant agitation and your times may differ if you use a different method. Fig.2 shows the negative and the mask for the cover photo.

The negative and the mask are sandwiched, as shown in fig.3, in order to print them together. Relatively expensive pin registration equipment is available from several sources to do so, but I have never used any of them. Aligning the negative and the mask manually on a light table, with a bit of tape and a loupe, works well with a bit of patience and I suggest you try it first. You may decide that masking is the way to go and then the purchase of such equipment may be a wise investment.

What a difference

The lead image shows the north door of St.Mary of Buttsbury in Essex, one of my favourite English churches. The original negative density required a paper grade of 2.5 and, being taken with a 4 x 5 camera, produced a rather sharp image. The image reproduced in this article was printed including the mask and it reduced the contrast of the sandwich to the point that a paper grade of 4.5 was necessary. The result is significantly sharper then the print from the negative alone. The enlarged details of figs.4 and 5 demonstrate the difference well. I doubt that I actually have to tell you which one was printed with the mask in place.

In order to be fair to the original image, and in order not to generate unrealistic expectations, it must to noted that the difference is much more obvious when the two techniques are compared side-by-side. The original print is very sharp in its regular size of 11 x 14, but the masked negative produced a print of increased local contrast, clarity and sharpness.

Why it works

It might interest you why unsharp masks work, now that we know how it is done and what a difference it can make. I am aware of two governing phenomena for unsharp masks to increase sharpness. You have probably noticed the first

Fig.1: Negative and unexposed masking film are placed, emulsion side up, on top of the base-board. The carefully planned exposure will create a faint and slightly unsharp positive called the unsharp mask. An optional plastic spacer may control the degree of sharpness.

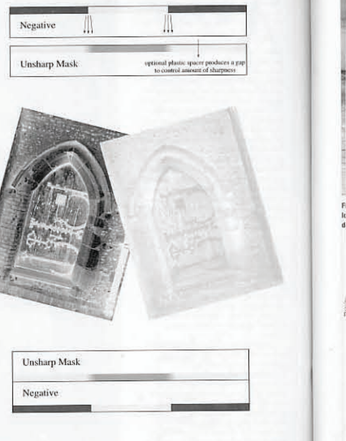

Fig.2: Negative and unsharp mask will be printed together as a precisely registered sandwich. This will reduce the overall contrast of the negative, but increase edge sharpness and local contrast of the print.

Fig.3: The registered sandwich is placed into the negative carrier and printed together with the emulsion side down. The increase in required paper contrast and this "edge effect" create a sharper image.

Fig.4: The two examples here show a detail of the brick-work to the left of the church door. The one on the left was printed with the negative alone – the one on the right was printed with both negative and mask as a sandwich. The increase in local contrast and edge sharpness is minute, but clearly visible. Grade 2.5 was used for the straight print but increased to 4.5 for the sandwiched image to compensate for the reduced contrast.

Fig.5: These two examples show a detail of the lower right hand side of the church door. Here the difference in sharpness is clearly visible between the (left) negative and (right) sandwich prints.

All photos © Ralph W Lambrecht

Fig.6 (above) & 6a (below): A negative printed onto a low contrast paper creates a modest difference in tonal density between shadows and highlights.

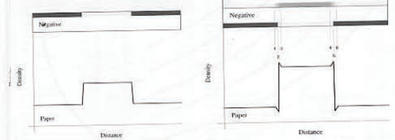

Fig.7 (above) & 7a (below): A negative printed onto high contrast paper creates an increased difference in density between shadows and highlights – which makes the image appear to look sharper!

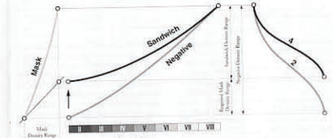

Fig.8 (above): A higher contrast paper is required when the negative is printed with the mask together as a sandwich. Additionally, the "fuzzy" edges of the unsharp mask increase the density difference and create an "edge effect".

Fig.9 (above): A typical negative has a high density range and requires a paper grade 2 to print well. A mask can reduce the shadow density while not affecting the highlight density. The resulting sandwich will print well on a higher grade while raising local contrast and sharpness.

phenomenon is your regular darkroom work already. A print just looks sharper when printed on a higher contrast paper. Figs.6 and 7 are trying to demonstrate this effect in form of an example and a diagram. In both cases, the same negative was printed onto paper of different contrast range. The same effect can be observed when the highlights are printed darker. This is similar to using a higher contrast paper, because the increased exposure causes the density in the darker highlights (Zone VII) to increase quicker than in the brighter highlights (Zone VIII) due to their relative location on the toe of the characteristics curve. In either case, the result is either a local or an overall contrast increase.

The second phenomenon is explained in fig.8 and I simply like to refer to it as the "edge effect". You can see the negative and the mask sandwiched together. Looking at the unsharp density and reading from left to right, there is a relatively high density up to point 1, responsible for a relative low density in the print. That changes at point 1, because the fuzzy edge in the mask is causing the sandwich density to increase up to point 2 and the print density is lower than the adjacent highlights. Of course at point 2 things change again, because the sharp negative edge is now switching to the shadow area and the print density increases sharply. However, the fuzzy mask has not yet reached its highest density until point 3 where the print density will finally settle. The reverse effect can be observed from point 4 to point 6, at which the print reaches the final highlight density again. In conclusion, when using an unsharp mask a higher paper grade is required, due to the contrast reducing effect of the mask, which then creates an "edge effect" at the boundaries of highlights and shadows. Both phenomena work together to increase the apparent sharpness of the print.

Planning a mask

This section of the article is aimed to guide you in the successful planning of the exposure and development of the masking film. I made a special effort to consider photographers, who are fortunate enough to own a densitometer, as well as the more traditional darkroom enthusiast, who is more familiar with paper grades. In both cases, we like to determine the original negative characteristics and then design a mask to

continued over page...

Negative Density Range	Paper Grade	Sandwich Paper Grade				
		1	2	3	4	5
1.55	0	0.25	0.50	0.70	0.85	1.00
1.30	1		0.25	0.45	0.60	0.75
1.05	2			0.20	0.35	0.50
0.85	3				0.15	0.30
0.70	4					0.15
0.55	5	Mask Density Range				

Fig.10: Negative density range and paper grades have a defined relationship. A target paper grade for the sandwich will determine the required mask density range.

change it to a desired sandwich characteristic. Figs.9 and 10 will work in conjunction to help with the understanding of the process, the evaluation of the negative and the design of the mask.

It all begins with the evaluation of the overall density range of the negative to be printed. If you have a densitometer, take a density reading of the important highlights and shadows and calculate the difference. Fig.10 will suggest a negative density range if you know the paper grade at which the negative printed well. Let's make an example and assume that you determined a negative density range of 1.05, which is equivalent to a paper grade 2 as shown in the table. Now an estimate has to be made, for how much the local contrast should be raised. This depends on the image itself, your intent for the image and you personal taste, but to raise the paper grade by two grades is standard. To continue our example, you would want to raise paper grade 2 to grade 4, which would require a mask density range of 0.35 as shown in the table.

The graphs in fig.11 will help you with the exposure and the development of the masking film. The development times are starting points and were tested with my Jobo processor and constant agitation in my darkroom. We will use the previously determined negative and mask density ranges to find the appropriate development time. You find the negative density range on the vertical axis and the mask density ranges are plotted as individual curves from 0.3 to 0.7 in 0.1 intervals. In our example, assuming Kodak T-Max 400 for a moment, picture a horizontal line at 1.05 negative density. Then, interpolate a curve between 0.3 and 0.4 to represent a desired mask density of 0.35 and estimate the intersection with that horizontal line. The conclusion should be a development time of about 7.5 minutes. The exposure index will change with the development time and the table to the right will recommend an EI of 160 for a 7.5 minute development time.

The exposure times for both films are assumed at 1/4 of a second given an EV illumination of –3.0 on the baseboard. I have used a Durst colour head with a halogen light source, no filtration and again, your conditions may vary, but it should be a good starting point. The other assumption is a negative highlight density of 1.37, my standard density for Zone VIII+1/2, and the exposure must be changed to reflect the highlight density of the target negative. Using a densitometer, this is easy since a density of 0.3 is equivalent to 1 stop of exposure. Bracketing the exposure is advisable without the use of such a tool. As you may have noticed, I have chosen to use rather short exposure times, below 1 second, to stay within the reciprocity window of the film. Therefore, I mounted one of my large-format taking lenses to my enlarger. This assembly allows me to use the shutter to get any of the typical exposure times between 1/500 and 1 second. Typical enlarger timers do not allow precise timing in this range and I suggest to use longer times of several seconds if you cannot utilize a large-format taking lens. All you have to change is the illumination by stopping down your enlarging lens and perform your own testing to get the right exposure and contrast of the mask. Be aware that the reciprocity failure of conventional films generates an increase in contrast if the film is exposed longer than 1 second. Modern T-grain films, such as T-Max and Delta, are less sensitive to this effect.

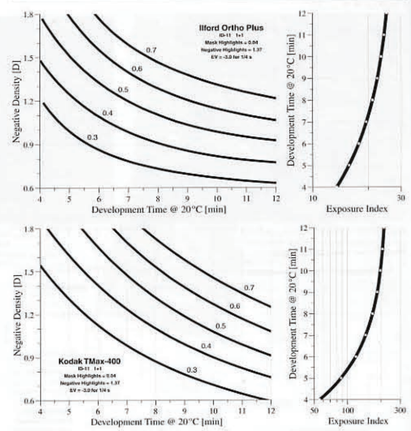

Fig.11: Planning a mask is easier with starting point values for development time and exposure index for two films. The above input variables are for negative and mask density ranges.