

REMI

Re-Engineering the Moving Image

Issue #1



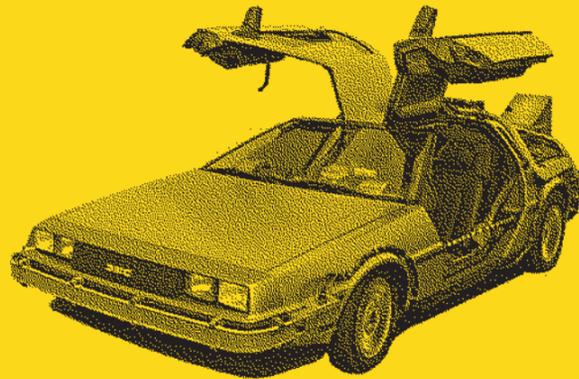
the artist-run film lab makers manual

EDITORIAL

The magazine you hold in your hands contains an overview of what has happened during the REMI project. Our intention is not to fully document the past two years of experiments, discussions and fun(!), but primarily to inspire you to make your own work.

The future of the medium is in these hands; the film equipment hoarding do-it-yourselfers, the home-experimenters and self-skilled film artists. Those inspired by the pioneers, the professionals and the future, from which we go forth: Back to the Future.

– Esther Urlus



COLOPHON

Re-Engineering the Moving Image magazine is produced in the context of REMI a two-year European cooperation project run by the artist film labs Mire (Nantes, FR), WORM.Filmwerkplaats (Rotterdam, NL) and LaborBerlin (Berlin, DE), focused on the creation, preservation and circulation of technical knowledge of analogue film in order to support its use as a creative medium.

Images and texts have been gathered, harvested, illegally used, replenished and inspired by a plethora of found sources including those of Nicolas Rey, Richard Tuohy, Matt MacWilliams, Lindsay McIntyre, Kevin Rice, Robert Schaller, Dagie Brundert, Zach Hart, Tomaz Burlin and many many others. Thank you all.

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INTRODUCTION

In an era of perpetual technological change, photochemical film practice is largely considered a thing of the past. On the margins of mainstream production, however, a vibrant community of artists – globally dispersed but united through a shared passion – is fighting for the continuation of an art form whose material properties and distinct mechanical processes cannot be replicated by digital means. DIY in approach and anarchistic in spirit, this ever-expanding community represents a politics of resistance – a devoted and forceful opposition to the capitalist narrative of progress that tells us film is dead.

Driving the photochemical film movement today is a desire to re-invent and rediscover, to explore what film is and can be. As Walter Benjamin argued, it is at the point of becoming outmoded that an object or technology realises its true potential, releases ‘revolutionary energies’, and takes up new critical positions in relation to the present. This is not to say that

artists who work with celluloid are nostalgic – they are, rather, drawn to a medium that in a world of digital data and virtual platforms offers the potential for bodily engagement, mechanical interventions and chemical transformations. This is an artistic practice, but it is also a different way of sensing, seeing and being in the world that is grounded in a physical and material awareness.

In many bathrooms, kitchens and artist-run labs around the world, film is enjoying a second life, freed from the profit-motivated interests of the commercial film industry. Knowledge and recipes are shared, equipment is exchanged, and an alternative community is built that will sustain a new era of photochemical practice whose means of production are in the hands of cultural workers.

– Kim Knowles, Edinburgh International Film Festival / BEEF, Bristol



INGREDIENTS OF THE COLA DEVELOPER RECIPE BY DAGIE BRUNDETT

RE-EXPLORING UNEXPLORED PATHS

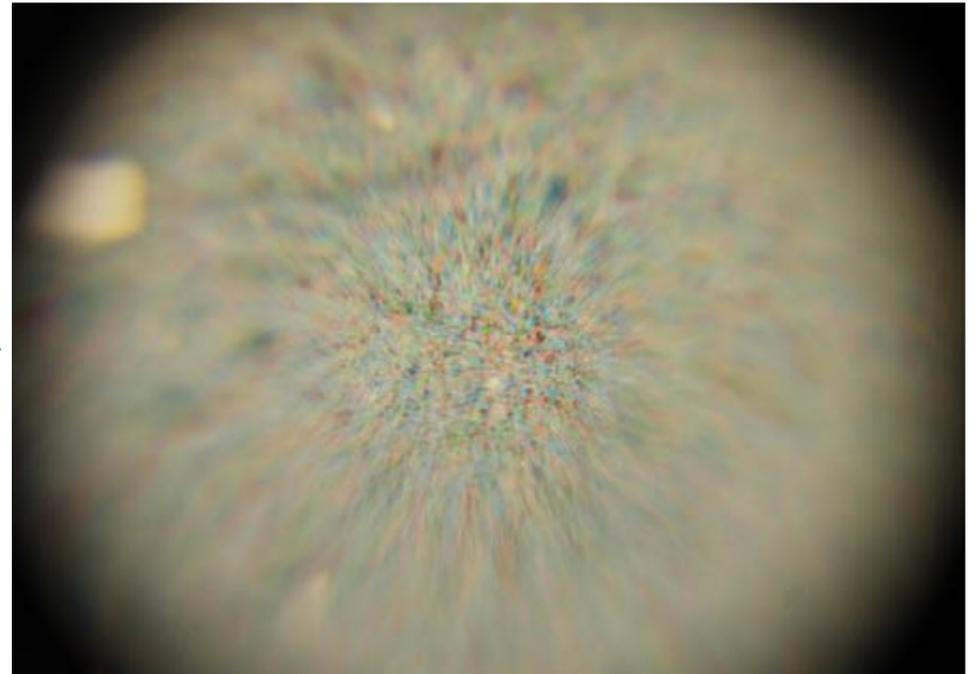


UV LIGHT, PICTURE BY ROBERT SCHALLER

Today, more than one hundred years after its invention, the potential for innovation in the medium of motion picture film is immeasurable. Led by film artists who, through practical experiments and research into publications on early cinema and photography techniques, have begun to produce their own means to create films.

The following part introduces emulsion recipes, DIY solutions and other tricks of the unofficial trade, inviting readers into the experiment.

AUTOCHROME STARCH (TEST 1 OF HANDMADE EMULSION
PRIMITIVE COLOUR SEMINAR ROTTERDAM)



It's a good time to be an artist working with analogue. The commercial film industry has in large part moved on and in so doing left behind 'large bones' of its former body in the form of laboratory and other bits of once precious equipment – industrial equipment that was until recently used for generating money and thus virtually inaccessible to artists. More than ever, we now have the opportunity to explore the whole apparatus of cinema. But we usually only have some bones or even just pieces of bone and we have to make a working fleshed-out body. New digital stuff really helps with this. With 3D printers we can fashion missing parts, or whole new parts, that can make the beasts live again. Okay, perhaps not in the technically perfect way their makers intended, but functional (and sometimes newly functional), opening up this equipment – equipment that is just as much a part of the apparatus of cinema as projectors and cameras – to artistic exploration.

Computerisation and computer-based sensing and control has been around for a long time. But what has changed is the price and size, as well as the literacy required to use them. Computerisation combined with 3D printed parts

and other new, or newly cheap digital components like small stepper motors, RGB LED arrays, linear actuators, solid state relays, rotary encoders, etc., etc., make it possible to bridge gaps in machines, or to replace whole missing machines. Where once synchronous projectors required mechanical linkages that were cumbersome and rare, we can now synchronise projectors just fine, using improvised digital setups with sensors and relays. Optical sound recorders which were once slaved to magnetic playback units can now be masters to slaved laptops. Film editing machines which once relied on now scarce sprocketed magnetic audio tape can be synchronised with sound from a pc during film editing. And on it goes. And with computer based fabrication and control we can build in new options and continue to artistically unpack, analyse and explore the analogue realm. We can advance on what was previously possible with film and film technology. This is a good time to be an artist working with analogue film.

– Richard Tuohy
Nanolab, Melbourne

SUBBING LAYER

by [Lindsay McIntyre](#)

95 ml. distilled water

5 gr. 250 bloom(hard) photo gelatin

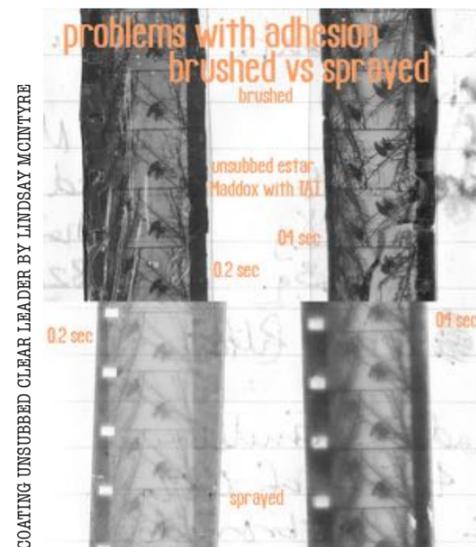
I use Photographers' Formulary,
I'm sure others would do.

15ml. of ethyl alcohol

Or denatured alcohol/everclear

3 drops of Photoflo 200 (Kodak)

This is a subbing recipe that I made to coat handmade emulsion on clear leader (one that has no existing commercial preparations, aka subbing layer, whatsoever). Trying to coat unsubbed clear leader is rather difficult (see the picture below). Pre-subbing helps make the emulsion adhere to the base. The recipe is designed to coat tri-acetate base, but also works on estar base to some degree (with estar, processing will be a more delicate procedure). The best results are had by spraying the subbing layer onto the base with an airbrush or house paint sprayer (HPLV- high pressure low volume). This step can be done in the light. It may work with a mini madbox, brush or other coating system too. In that case, slightly less alcohol might be called for, but the alcohol serves a couple of purposes in the solution (it thins the emulsion and acts as a surfactant which helps bridge the gap between the physical properties of gelatin and the base) so it shouldn't be omitted altogether. The subbing layer must be absolutely dry (usually for a full day or more) before any attempt is made to coat an emulsion on top of it. The end results are definitely delicate and I wouldn't try to run it through a projector, but it produces some really interesting results with occasional emulsion lifting, which I love!



Trying to coat unsubbed clear leader is rather difficult. Pre-subbing helps make the emulsion adhere to the base.

HANDMADE B&W EMULSION RECIPE

by [Lindsay McIntyre](#)

SOLUTION A

Distilled water, ml	45
Knox food, Gelatin, gr	6,25
Potassium Bromide, gr	25
Potassium Iodide, ml of 15% solution*	5,5

*15% Iodide solution = 15g in 100ml of distilled water

SOLUTION B

Distilled water, ml	157,5
Silver Nitrate, gr	20

SOLUTION C

Distilled water, ml	42,4
Knox food Gelatin, gr	16,25

SOLUTION D

Potassium Bromide, ml of fresh 0.8% solution	4,5
--	-----

Total Volume for shredding, ml	250,4
Total Gelatin for shredding, gr (Gelatin concentration)	22,5 9%

In red darkroom light.

COOK:

Swell gelatin. Heat to 50 degrees. Add Iodide and bromide. Heat solution A and B to 70 degrees. Add half of B to A as a dump. Then add approx 5-7 mL each 40 sec for 10 minutes, stirring by hand for 10 seconds after each addition. Remove from heat. Stir constantly and cool quickly in an ice bath (after 5 minutes at 60 degrees, after 10 minutes at 50 degrees, after 15 min at 45 degrees). Replace to heat when at 45 degrees and hold at 45-50 degrees for 15 minutes, still stirring constantly by hand. At 30 minutes post-silver addition, solution C (at 45 degrees) is added. Stir an additional 2 minutes by hand. Cool quickly in ice water bath and refrigerate for a day.

WASH:

'Noodled' and washed in four 30 minute baths. First three baths are tap water at 8-10 degrees. Last bath is distilled water at 3 degrees. 2 hours total. Noodles placed in a new stainless steel container for reheating.

Sensitizing and digestion: add Solution D to cold noodles before remelting. Digest at 60 degrees C for 90 minutes stirring by hand every 5 minutes. Cool to coat. I spray coat but brushing works equally well from my tests.

NOTE:

Some of the better results I got were using two parts of this same emulsions together – the base emulsion was digested for 60 minutes and the top layer was digested for 90 minutes. The 90 minute emulsion seems to be about 20 ASA but fogs a tiny bit. The 60 minute emulsion is about 10 ASA and very clean and the 90/60 emulsion seems to be about 12 or 16 ASA and really clean and sharp. Adding TAI just before coating to the 90 minute emulsion seems to lower the fog but also the speed so I opt not to use it and just use either the 90 or the 90/60.

MADDOX IV-II HANDMADE B&W EMULSION RECIPE

Designed during a seminar at [WORM Filmwerkplaats](#), Rotterdam (27 – 1 July 2016)

SOLUTION A

Distilled water, ml	62
Gelatin, Disactis-250 Bloom, gr	6,25
Potassium Bromide, gr	25
Potassium Iodide, ml of 15% solution*	5

15% Iodide solution = 15g in 100ml of distilled water

SOLUTION B

Distilled water, ml	150
Silver Nitrate, gr	20

SOLUTION C

Distilled water, ml	60
Gelatin, Disactis-250 Bloom, gr	20

SOLUTION D

Sodium Thiosulfate, ml of (hyppo) 1% solution	3
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Total Volume for shredding, ml	277
Total Gelatin for shredding, gr (Gelatin concentration)	26,25 9,5%

All in red dark room light

EMULSIFICATION @ 60 C:

- Quick pour of approx. 50% of solution B into solution A (we did not measure the exact amount)
- Hold at temperature for 10 min with constant stirring (magnetic stirring at 800 RPM)
- After 10 minutes we added 3ml at 20 second intervals (continues dripping – drop wise) over a total of 17 minutes until solution B was completely poured

- We gradually adjusted the stirring until 1100 RPM at the end
- Hold at temperature for another 15 min
- Cool quickly and refrigerate till set

WASHING:

- We noodled the emulsion with a fly screen (worked easier to break up the emulsion beforehand)
- We washed with ice water 5x for 5 minutes in tap water (between 1 – 3 C) and then 1x for 5 minutes in distilled water (between 1 – 2 C) (minimal stirring)

RIPENING:

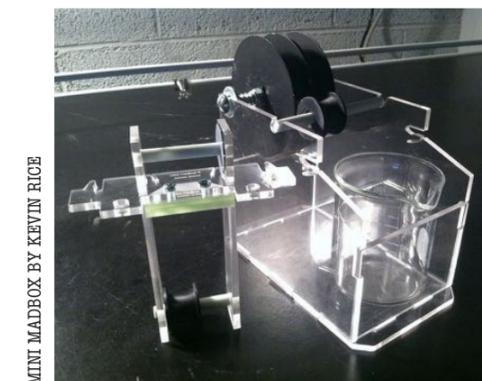
- Weighed emulsion
- Raise the temperature to 60 C
- We added Solution D (3 ml of a 1% Sodium Thiosulfate (hyppo) solution)
- Hold at 60 C for 90 minutes without stirring cool down the emulsion to 28 C and added Photoflo 200 (10ml per 100 ml of emulsion)
- We then coated on the Mini-Maddox

RESULT:

- Coat was even
- No visible pepper stains

MINI MADBOX EMULSION COATING DEVICE

by [Kevin Rice](#) (Process Reversal, Denver)



The Mini Madbox is an entry level emulsion coating system aimed at providing a readily available and easy-to-use solution for filmmakers and educators interested in experimenting with emulsion making, but who see coating as a barrier of entry to the process (i.e. time consuming, costly, inconsistent results, etc.) Its construction and design allow for fairly consistent coatings of photosensitive emulsions onto a variety of

different supports for motion picture, including acetate or polyester leaders slit and perforated for 8mm, 16mm and 35mm.

1. Attach a spool of the coating material (e.g. clear 16mm leader) to the threaded bolt on the rear of the Mini Madbox.
2. Under safe light, insert the vessel containing the emulsion into the front compartment of the Mini Madbox
3. Conduct a simple threading procedure by inserting the "coating arm" into the vessel, forcing the coating material into the emulsion, and attaching the "coating arm" to the Mini Madbox
4. Draw the coating material through the Mini Madbox by hand and attach to the drying rack
5. Coat the material by simply drawing it through the Mini Madbox by rotating the drying rack. As the film is drawn through, excess emulsion is removed from the "base side" of the coating material, ensuring economy of use. What is left is a nice, even coat on one side of the coating material. Care must be taken, however, to ensure the film does not become over lapped on the drying rack during the coating process. Therefore, it's recommended that coating occurs with two users: one who monitors the taking up of the film on the drying rack, and another who hold and positions the Mini Madbox.

3D PRINTABLE CONTACT PRINTER DEVICE FOR TORCHLIGHT

by [Matthew McWilliams](#)
(AgX Boston Film Collective)

The initial idea for the 3D printable contact printer snoot came from a prototype made by Ethan Berry at ANYEYE. The idea was to buy a cheap LED flashlight, that seems to be available at every hardware store or supermarket in the area, and make contact prints with it. One would use it by holding it in a position about 1 inch above a motorized 16mm sync block that is holding bi-packed unexposed negative or print stock on the bottom and some source material like a processed negative or reversal on top. His prototype included a

handmade paper mask that was taped onto the front of the flashlight so that the light would only expose the film in a small slit running perpendicular to the direction of the film. I based my design on this concept.

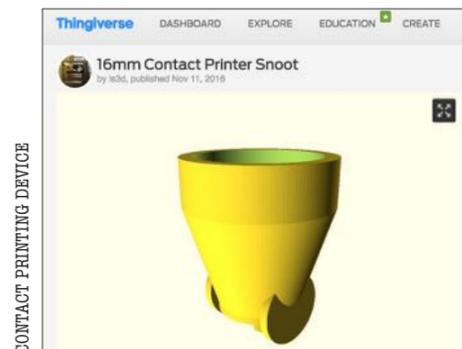
The model (16mm Contact Printer Snoot) is available for free to download on [thingiverse.com](#) and is customizable to a specific diameter flashlight if you cannot find one that is exactly 1 inch (I've found plenty of diameter variation in the types of flashlights in this style). Find more free open source tools, parts etc. for 16mm are available at [sixteenmillimeter.com](#).

When using the snoot, gels and diffusion can be inserted in front of the flashlight to control exposure, alter colour and to experiment with other techniques.

A slight modification I made to my own snoot was to add small strips of felt taken from the inside of 35mm still cannisters. This allows me to press the snoot against the film while it passes through the sync block without worry of plastic scratching my original material.



CHEAP LED FLASHLIGHT



CONTACT PRINTING DEVICE



STILL FROM VIDEO TUTORIAL

AN AUTOCHROME PROCESS TRY-OUT

Made during the Hand Emulsion Primitive Colour Seminar at [WORM Filmwerkplaats](#), Rotterdam. (27 June - 1 July 2016)



FWP AUTOCHROME ATELIER

WITH: [Anja Dornieden](#) and [Juan David Gonzalez](#) (LaborBerlin, DE), [Robert Schaller](#) (Handmade Film Institute, USA), [Josh Lewis](#) (Negativland, USA), [Kevin Rice](#) (Process Reversal, USA), [Alex MacKenzie](#) (Iris Film Collective, CAN), [Lindsay McIntyre](#) (CAN), [Esther Urlus](#) (Filmwerkplaats, NL) [Chloe Reyes](#) (EPC, USA), [Maxime Fuhrer](#) (LABO BXL, BE), [Noëlie Martin](#) (l'Abominable, FR)

One of the topics of the Handmade Emulsion Primitive Colour Seminar was re-engineering the Autochrome process, an early colour method invented by the Lumière brothers. Try-outs of substitutes were made (on some of the originally-used, difficult to find, or toxic, chemicals.)

The Autochrome is a direct positive (additive) colour photography process invented by the Lumière brothers in 1903. Autochrome plates were created by coating a sheet of glass with microscopic potato starch grains dyed red, green, and blue. These formed a screen of colour particles. Carbon or lamp black was applied over the plate, filling in the spaces around the starch grains. Then a (panchromatic) silver gelatin emulsion was applied over the colour screen. When the plate was exposed, the base side was turned toward the subject being photographed, and the colour screen acted as a filter over the emulsion. The as B&W reversal developed plate rendered a positive colour image with delicate colour qualities.

INGREDIENTS:

- Potato starch
- Food dyes
- Art dyes
- Chemical dyes
- Carbon powder
- Estar-based clear leader with subbing layer.



FOOD DYE WITH POTATO STARCH

FOOD COLOURANT (Badia Food Colours and Easter egg dyes):
- Red - Green - Blue

- 7 ml of colourant for 7 g of potato starch
- Reduce (heated) on hot plate until all water evaporated temperature at 35 degrees Celsius.
- Each coloured starch is reduced and then grounded to the finest possible powder with a mortar and pestle. Then three colours are combined and ground again together to achieve best even combination of colours. When the mixture has proper distribution of colour it has a dark grey tone.

ART PIGMENT:

- ULTRAMARINE BLUE 100 GRAM PB29 (V.O.F. VERFMOLEN 'DE KAT):
2 grams for 7 g of potato starch + 6 ml of distilled water
- REMBRANDT WATER COLOUR ALIZARIN CRIMSON RED 326 (SERIES 2):
2.6 grams for 7 grams of potato starch + 6 ml distilled water
- REMBRANDT WATER COLOUR PHTALO GREEN 675 (SERIES 2):
2.6 grams for 7 grams of potato starch + 6 ml distilled water
- Chemical Dyes (for microscopy)
- Methylene Blue (powder)
2 grams for 7 g of potato starch + 6ml of distilled water
- Brilliant Green (C.I. 42040) (for microscopy)
2 grams for 7 g of potato starch + 6ml of distilled water
- Rhodamine B
- Varnish



VARNISHING

1ST VARNISH (Maddox Style Recipe Replacement) R1A

Liquid latex 0.75 g
Methyl Ethyl Ketone 50 ml

1ST VARNISH (Maddox Style Recipe Replacement) R1B

Liquid latex 0.375 g
Acetone 25 ml

2ND VARNISH (Maddox Style recipe replacement 1) R2A

Kryolan Collodion 2.2 g
Etos nail polish remover (ethyl acetate based) 4.6 g

2ND VARNISH (Maddox Style recipe replacement 2) R2B

Kryolan Collodion 2.2 g
Acetone 4.6 g

2ND VARNISH (Maddox Style replacement 3) R3

- Failed; cracks. It's rigid. Needs to be flexible.
Kryolan Collodion

1ST VARNISH (Acrylic Replacement)

Winsor & Newton Galeria Acrylic Mediums
Matt Varnish
TriArt mfg glazing medium
- Failed starch doesn't stick to film base

2ND VARNISH (Acrylic Replacement) - Failed

Winsor & Newton Galeria Acrylic Mediums Matt Varnish

1ST VARNISH (Spray Glue Replacement)

4 Art Studio Lijmspray 400 ml can

2ND VARNISH (Oil Paint Varnish Replacement)

Talens Dammar Varnish Matt (75 ml bottle)

1ST VARNISH (Fixative Replacement)

Spectra Fix Fixative
- Too watery, no adhesion properties.
Talens Charcoal Fixative 75ml bottle
- No adhesion properties.

2ND VARNISH (Sprayed On Film Replacement)

Lukas Sprühfilm Matt

1ST TEST

Food Colourant Potato Starch
Carbon powder
1st varnish - Acrylic glazing medium
2nd Varnish - Kryolan collodium

Strip of 16mm film with potato starch mixed with RGB food colourants. Pressed once between two pieces of cardboard and with a strip of 35mm as protective surface. Then used carbon black powder to fill in

gaps. Pressed twice. Used acrylic glazing medium as 1st varnish and kryolan collodium as second varnish.



REMARKS: Collodium holds the starch but cracks. Glazing medium does not hold starch onto base. RGB starch mixture was too dense on the 16mm base. Too many layers of starch stacked on top of each other. For it to work we must create a single layer of evenly distributed RGB grains that is still translucent to the eye.

2ND TEST

Food Colourant Potato Starch
1st Varnish Studio glue spray
2nd Varnish Dammar Oil Paint Varnish
Coating on Subbing layer

Favouring green. Pressed through two metal plates. Increase colour recognition to the eye after pressing. Colour clumping and gaps in the RGB lattice.

WATER RESISTANCE TEST 2: Strip of 6 frames place in water. Dye loss after 1 minute. Considerable green dye loss after 4 minutes. Low water resistance. After 20 minutes most colour is lost. Probably not appropriate for use with chemistry.

3RD TEST

Art Pigment Potato Starch
1st Varnish Studio Glue Spray
2nd Varnish Lukas Spruhfilm
Sub Layer coating

After mixing RGB Ultramarine Blue was too strong. Overcame the green and red. Used Studio Glue Spray as first varnish. Came out looking almost totally blue.

4TH TEST

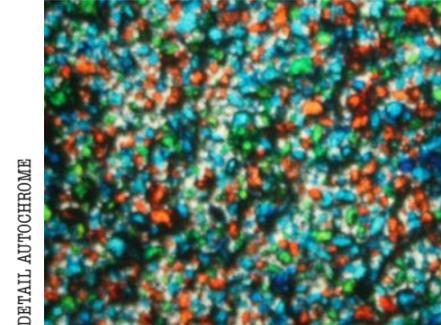
Red, Green: Art Pigment
Blue: Food Colourant
1st Varnish Studio Glue Spray
2nd Varnish Lukas Spruhfilm
Sub layer coating

Still favoring blue. Better dispersion of colour lattice. Less clumps.

WATER RESISTANCE TEST 1

Small strip of 6 frames with coated lattice put in water for 5 minutes. Starch coating holds well without any colour loss. Good hold up until 45 minutes. Left

in water for 1 hour and 20 minutes. Starch solution still holds. Water turned light blue. After looking at strip through magnifying glass the starch grains were bigger. Some water impregnation after prolonged submersion.

**5TH TEST**

RGB Food colourant new distribution
1.5 g of Red and Blue
0.75 g of Green
Sub layer coating
1st Varnish Studio Glue Spray
2nd Varnish Lukas Sprühfilm
2nd Varnish Dammar Oil Paint Varnish
Best colour distribution. Glue spray as 1st Varnish on all strips.

When glue spray is left to set for 2 to 3 minutes before applying RGB starch mix, you obtain more white gaps on the base and more clumping of colours.

Best coating obtained by applying the RGB starch mixture immediately after applying the glue on the base while it's still wet. Apparently when left to set, the glue starts to clump together and gaps form on the base.

Made strips with either Lukas and Dammar varnish as second varnish. Dammar varnish dries slower.

5A Dammar varnish
5B Lucas varnish
5C Lucas (best lattice)

6TH TEST

RGB Food colourant new distribution
1.5 g of Red and Blue
0.75 g of Green
Base side coating

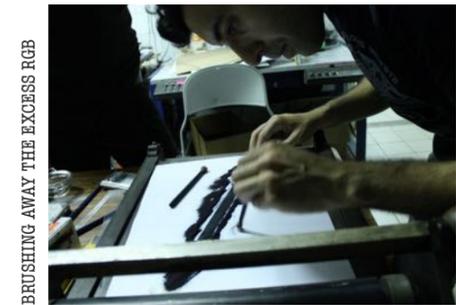
3 strips. Coating done on the base side to leave subbing layer free for panchromatic emulsion.

7TH TEST

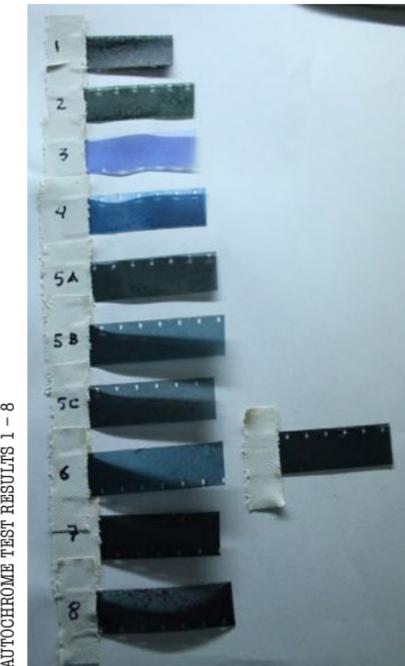
RGB Food colourant new distribution
1.5 g of Red and Blue
0.75 g of Green
Base side coating
Carbon black pigment fill

Carbon black powder added to strip after pressing RGB lattice. Considerably less translucent after

adding powder. After pressing a second time, the translucency improved but still quite dark.

**8TH TEST**

RGB Food colourant new distribution
1.5 g of Red and Blue
0.75 g of Green
Base side coating
2 metre test strip for panchromatic coating. No carbon black fill.

**FINAL REMARKS:**

Lumière Brothers varnish replacement recipes proved to be too difficult and inefficient. Chose to find 21st century replacements for both varnishes. Settled on two spray on varnishes.

1st varnish: spray on glue.
2nd varnish: spray on film.

Lumière Brothers Patent | Photographic plate for colour photography
US 822532 A | <http://www.google.com/patents/US822532>

See next page for "Appendix: The Original Autochrome Process According to the Metropolitan Museum of Art"

APPENDIX: THE ORIGINAL AUTOCHROME PROCESS ACCORDING TO THE METROPOLITAN MUSEUM OF ART

- Selecting the starch grains
- Autochrome starch grains were in the range of 10 to 20 microns in diameter. Resolution of the image is not critical for the present experiment. A separation by flotation will be done to avoid larger grains².
- Fill a large container with 2 liters of distilled water and 78 grams of potato starch.
- Stir vigorously. Allow it to set for 18 minutes. The majority of grains are deposited in the bottom, while the smaller particles remain in suspension. Using a plastic tube, siphon the intermediate layer as best as possible (avoiding being too close to the top or the bottom).
- Filter this solution using a Büchner funnel covered with filter paper, recovering a few grams of starch grains. Rinse these in ethanol and air dry.
- After dry, gently pestle the grains in a mortar to separate lumps.

TINTING OF STARCH GRAINS

Dilution of the dyes in distilled water will be done according to original dilutions in autochrome plates:

ORANGE-RED GRAINS:

Distilled water	100 ml
Erythrosine	14,8 g
Rose Bengal	2,6 g
Tartrazine ¹	9,7 g

GREEN GRAINS:

Distilled water	100 ml
Ammonia	9 g
Tartrazine	21 g
Patent Blue ¹	0 g
Sodium Sulfate	21 g

VIOLET-BLUE GRAINS:

Distilled water	100 ml
Crystal Violet	7 g
Malachite Green	1 g

Tartrazine was used in different concentrations both in the orange-red (19,7g) and in the green grains (21g); the concentration for this experiment will therefore be the approximate average – 20g.

In the case of the dyes present in the green dye (tartrazine and the patent blue) ammonia and sodium sulfate are added so the ionic environment provided by the starch would adsorb the colors.

TINTING:

The selected starch grains are mixed to its mass equivalent in dye-saturated solution. The solutions so far are:

1. Water	100ml
Erythrosine	14,8g
2. Water	100ml
Rose Bengal	2,6g
3. Water	100ml
Tartrazine	20g
Ammonia	9g
Sodium Sulfate	21g

4. Water	100ml
Patent Blue	10mg
Ammonia	9g
Sodium Sulfate	21g
5. Water	100ml
Crystal Violet	7 g
6. Water	100ml
Malachite Green	1 g

The ratio in the original recipe was of starch to dye is:

- 2,2g dye to 3g starch for the orange (Erythrosine, Rose Bengal, Tartrazine)
- 2,24g to 3g starch for the green (Patent Blue, Tartrazine)
- 2,25g dye to 3 g starch for the blue-violet (Crystal Violet, Malachite Green)

In the present experiment the dyes are individually added to the starch. The ratio will be maintained as above, except for Tartrazine of which an average value will be used (2,27g).

- Stir the mix for 30 minutes to one hour until there are no white starch grains. This is done at room temperature, except for Crystal Violet and Malachite Green which need to be at 30°C using a double-boiler. Strain the solution through Whatman filter paper and air dry.

PREPARATION OF VARNISH LAYERS

First varnish:

Toluene	100g (87ml)
Natural rubber	1,5g

Dissolve the rubber in toluene for 24 hours.

Add:

5,8 ml of the 10% solution of dammar residue in toluene (see second varnish) – this solution is obtained from the mixture described in the second varnish (ethyl acetate and dammar) after rinsing with 60ml of ether and let dry. Make a 10% solution in toluene³.

Second varnish:

In a container, add:
Ethyl acetate 300ml
Dammar gum 28,8g

Let dissolve for 24 hours, stirring occasionally. An insoluble residue is left in the bottom. Recover this residue using filter paper. Use the residue for first varnish.

Add to the filtered solution:
Nitrocellulose 7,2g

Stir until complete dissolution (few days) and add:
Castor oil 4,536g

Strain using filter paper.

INFORMATION ON DYES USED FOR THE EXPERIMENT

1. CI #:	19140
Name:	Tartrazine
Family:	Azo

Other Names:	Acid Yellow 23
CAS#:	1984-21-0
Supplier:	Fluka/ Sigma-Aldrich
Name given by supplier:	Tartrazine
Solubility:	0.5gr/ 10ml* 42025
2. CI #:	
Name:	Malachite Green
Ortho-chlorinated Family:	Triarylmethane
Other Names:	Setoglaucin,
Basic Blue 1	
CAS#:	None
Supplier:	Salor/ Sigma-Al- drioh
Name given by supplier:	Rhoduline Blue
6G	
Solubility:	No known value*

3. CI #:	42061
Name:	Patent Blue
Family:	Triarylmethane
Other Names:	Acid Blue 3
CAS#:	5836-49-0
Supplier:	Fluka/ Sigma-Al- drioh
Name given by supplier:	Patent Blue V
calcium salt	
Solubility:	Water soluble*

4. CI #:	42866
Name:	Crystal Violet
Family:	Triarylmethane
Other Names:	Basic Violet 3
CAS#:	548-82-9
Supplier:	SIAl/ Sigma-Al- drioh
Name given by supplier:	Crystal Violet
Solubility:	0.01-0.1gram/ 100 ml at 18.5°C*

5. CI #:	45430
Name:	Erythrosine
Family:	Xanthene
Other Names:	Acid Red 61
CAS#:	568-83-8
Supplier:	National Aniline & Chemical Co.
Name given by supplier:	Erythrostrin, Bluish (Iodin Eosin)

6. CI #:	45440
Name:	Rose Bengal
Family:	Xanthene
Other Names:	Acid Red 94
CAS#:	632-89-9
Supplier:	Aldrich/ Sigma-Aldrich
Name given by supplier:	Rose Bengal
Solubility:	100mg/ml*

* Data provided by Sigma-Aldrich technical services based on their experiments.

* Tartrazine was used both in the red-orange and the green grains.

The Autochrome dyed grains mixing ratios from 1930. Ratio mass of starch in mg/for solution in mg

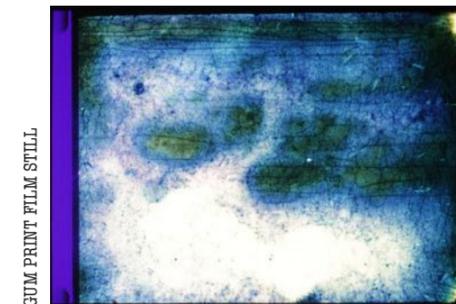
Orange grains	1.3
Green grains	1.54
Blue-violet grains	1.33

ALTERNATIVE EMULSIONS

Most of our attention in the REMI project went to the process of making silver gelatine emulsions. So let us now turn our attention to re-create some non-silver, historic processes. Invented during the latter half of the 19th century, these older processes include gum-bichromate printing and cyanotype, among others.

GUM PRINTING

by Robert Schaller
(Handmade Film Institute, Colorado)



GUM PRINT FILM STILL

Instructions for Gum Printing in still photography can easily be found online. Doing it on clear film leader (subbed or with commercial gelatin, as for coating silver emulsion) is essentially the same, and standard procedures for coating, exposure, and “developing” can be readily figured out. For coating on film, I would add these pointers:

1. As a sensitizer, use a saturated solution of Ammonium Dichromate in distilled water. Ammonium Dichromate is the most sensitive of the dichromate salts. How much Ammonium Dichromate this is can be estimated by looking at the Ammonium Dichromate entry on Wikipedia, which gives solubility at various temperatures. The temperature you care about is whatever the room temperature is, where you'll be working.
2. Use transparent pigments, not opaque or semi-transparent ones. Light has to pass through film! Consult a resource for water colour painters. A good one is 'Blue and Yellow Don't Make Green' by Michael Wilcox, which is, of course, out of print, but it's a good example.
3. Using a 14 Baum commercial Gum Arabic solution is a real time saver. You use it as-is. It is used by commercial printers, and can be found where they buy supplies. Or you can mix it yourself; instructions are easily found online.

4. Use a ratio of 2 parts Gum solution to 1 part Dichromate sensitizer.
5. Use the same number of grams of pigment as 1/10 of the milliliters of Gum solution used. For instance, if you use 10ml Gum, use 0.1g pigment.
6. Feel free to work in white room light, preferably not too bright Tungsten light rather than fluorescent. Once you've coated the film, you need to hang it in a dark place. Once it's dry, it's sensitive to UV light (sunlight being the most readily available source), but short periods in room light are fine. It will degrade over time regardless of exposure due to a “dark reaction,” so try to use coated film promptly.

Getting everything to work will require significant trial and error, and will depend on things like coating humidity and temperature, registration of negatives, etc., but the process is fun and ultimately rewarding. Be sure and keep careful notes as you proceed, so that you can build on successes and learn from failures!

CYANOTYPE

by Robert Schaller



CYANOTYPE PRINT ON SILK

Prepare some clear leader with gelatin, either by fixing unexposed film (b&w print film or other film with a clear base) or by coating your own gelatin on subbed leader. Make sure it's dry before going on!

Mix two solutions:

SOLUTION A	
Water, @~20°C	100ml
Ferric Ammonium Citrate	25g

SOLUTION B	
water, @~20°C	100ml
Potassium Ferricyanide	10g

- When ready to coat, mix solutions A and B together in equal volumes. Immerse the clear

film in it, and leave it for long enough that the gelatin soaks up the cyanotype solution.

- One effective technique is to cram the film in a Mason jar of cyanotype solution, put the lid on, and shake it gently for a few minutes.
- Probably an even more effective technique would be to load the clear film on a Lomo tank spiral, and then fill the tank with cyanotype solution and shake it gently for several minutes.
- Once the film is coated, hang it in a dark place to dry. Note that it is not (very) light sensitive when wet, and can be manipulated in not terribly bright white (indoor) light. Once it is dry, it becomes light sensitive, so where ever you hang it needs to be dark when you leave it.
- Once the film is dry, lay it out on a portable rigid surface (a sheet of glass is good) and lay whatever objects or “negatives” you’d like to print on top of it. This can be done in white room light, particularly Tungsten, as it’s really only sensitive to ultraviolet light.
- Expose outdoors in full sun for up to 30 minutes. Ten minutes is a good place to start. You want to overexpose a bit, as the “development” will tend to make the image thinner.
- Remove to a dimmer indoor light, remove the objects or negative. Prepare two water baths with warm (~30°C) water if you are using film with commercial coating, or cold (<20°C) if it’s your own gelatin coating. Immerse the film in the first (hereafter known as the “Dirty” bath), for five minutes. Most of the yellow Ferricyanide in the unexposed areas will wash out here. You can keep this dirty bath for future use when you do this process again; it will collect all the most potentially harmful waste that you don’t want to put down the drain.
- Note that alkaline or hard tap water has been known to damage the image. If you have doubt about your water quality, use distilled water throughout!
- Move it to the second bath (the “clean” bath). Let it soak until all the yellow washes out. Depending on temperature, this should take somewhere between 5 and 15 minutes more.
- Once the film is thus “developed,” you can take the optional step of putting it in a bath of 0.3% Hydrogen Peroxide (that is, the Hydrogen Peroxide you can buy at the drug or grocery store, diluted 1:9 in water). This will make the

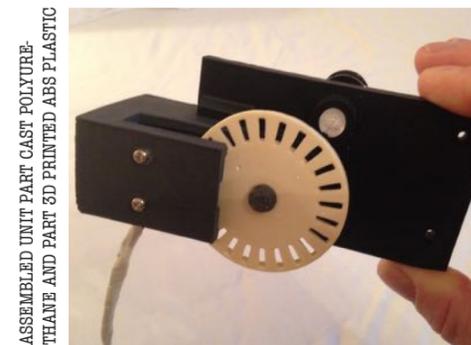
blue immediately darker, raising the contrast and improving the image. The Hydrogen Peroxide accelerates the oxidation of the Prussian Blue that forms the image that exposure to air would do eventually without it.

For further investigation, Mike Ware’s website is a good place to start: http://www.mikeware.co.uk/mikeware/New_Cyanotype_Process.html

DIGITAL SOUND SYNC UNIT FOR 16MM PROJECTORS

By [Nanolab, Melbourne](#)

Optical sound on 16mm is the standard way of reproducing sound on film. Virtually all projectors can play optical sound. This printed soundtrack is inseparable from the film – you can’t get the picture without the sound. To make an optical soundtrack you have to have access to an optical sound recorder to make the negative. Very few of the artist run film labs have these. And then, sound on 16mm is always mono and some projectors, especially portables, can give you pretty crappy sound. And you can’t project super 16 with sound.



ASSEMBLED UNIT PART CAST POLYURETHANE AND PART 3D PRINTED ABS PLASTIC

So, here is a little sound synchroniser you can clamp to pretty well any projector. It allows you to play back a digital sound track in perfect sync with the film. It’s frame accurate. If the projector runs slow or fast or changes speed, so does the sound. It works on the idea of a rotary encoder. A rotary encoder is a way of counting the rotations, or part rotations, of something that rotates, like a sprocket wheel. Usually a rotary encoder has a light source and a light sensor and an encoder wheel with holes cut in it. The wheel is connected to the same shaft as the rotating thing you want to keep track of. As the rotating object rotates, so does the encoder wheel. And, as the encoder wheel rotates, the light hits the sensor whenever it lines up with one of the holes in the wheel. All you then need to do to keep

track of the rotation of the encoder wheel, (and hence, keep track of the thing it is attached to), is something that will count the number of times the light hits the light sensor. Thank God for computers!

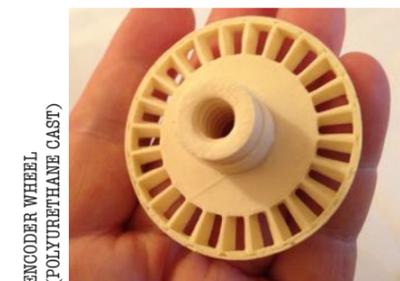
You can buy ready made rotary encoders. But for this project, we decided to make our own in order to keep the price down. Easy enough with a 3D printer, at least in theory. It does however use a commercially produced digital light sensor (though we could have just used a light sensitive resistor). It also needs something to connect that sensor to a computer – some kind of computer interface with a so-called ‘analogue input’. Most of the units we have built so far use a USB ‘dongle’ from a company called Phidgets as the computer interface, but there are a number of possible options, including a cheaper Arduino setup.

The various prototypes were designed by our friend and fellow lab member Carl Looper, a wiz at both 3D illustration and also programming. After we had refined the prototypes a few times, we began making moulds of the 3D printed parts in silicon and then casting the parts in those moulds in polyurethane or epoxy – plastic basically. Casting in plastic is much faster and more predictable than 3D printing (which can sometimes be temperamental), even if the results are a tiny bit rough.



SPROCKET WHEEL (3D PRINTED ABS PLASTIC)

The biggest challenge was to make a viable sprocket wheel on a 3D printer. A sprocket wheel has to be pretty exact. Our results from casting weren’t precise enough. 3D printed parts can themselves be a bit rough (after all, the printer works in pixels rather than continuously). So we smoothed out the 3D printed plastic by immersing the printed parts in acetone vapour, which basically melts the plastic ever so gently.



ENCODER WHEEL (POLYURETHANE CAST)

Carl’s software varies the playback of the digital audio file as needed in order to follow the speed vagaries

of the analogue projector. The computer makes tiny adjustments to the playback rate of the sound, keeping it in sync. The computer is a slave to the projector; if the projector stops, the sound stops. If it starts again, so does the sound.

SETTING UP

The unit is clamped (using a small G-clamp) to the supply arm of the projector. Anywhere on the arm will do. The film is then threaded around the roller and sprocket wheel of the sync unit, before going in to the projector in the normal way. For the purpose of lining up the digital soundtrack and the film, a zero mark was placed on the film leader. This ‘zero frame’ is a known distance from the exact frame you want the sound file to start on. We usually put the zero mark 100 frames from the first frame of sound, but it could be any number of frames, just so long as you know how many. For convenience, we then number several frames leading up to that zero frame, counting backwards. Usually, we’ve been numbering from about 20 frames before the zero.

As I say, that’s just for convenience. The thing is, you have to thread the projector in such a manner that you know, and hence the computer can know, what frame is currently in the film gate when you first turn it on, and thus how many frames it needs to count before it starts playing the sound. If you have numbered say 20 frames down to the frame marked zero, then it makes threading pretty easy; once you thread the film, as long as any one of those numbered frames is in the gate, you are right. You just have to look in the film gate to see which of those numbered frames is currently in the gate.

You then simply type two numbers into two boxes on the software screen; the frame number in the gate (which will be a number between say 20 and 0), and the number of frames from the zero frame to the frame the soundtrack is to start on. With the numbers typed in, and the audio file loaded, the ‘lock computer and projector’ button is clicked and the computer now waits until the projector is turned on and the requisite number of frames before the first frame of sound has passed, and then the soundtrack begins, in perfect sync with the picture.

A great benefit of using digital sound (apart from cost) is that you can have stereo (or multichannel) tracks. It’s nice to get away from the limitation of mono with optical 16mm. You are also no longer dealing with the low-fi limitations of optical sound. And, because the sound is separate from the film, you can change your mind about the soundtrack to your film at any time. What is more, it allows you to have a synchronised sound track with camera original film material, or with edited work prints, or with tests or workshop films, or with films for specific exhibition situations.

OTHER POSSIBILITIES

Beyond sound synchronisation, there are many directions these same encoder units can be used to interface the analogue projector to the digital realm. For instance, using two of these units would allow you to lock two projectors (or however many) together, making them frame accurate interlock projectors. This is done by using the computer to drive solid state relays that turn the power off for a few milliseconds or whatever is necessary to slow the faster projector(s) down to the speed of the slowest projector. Basically, having bridged the analogue/digital gap, almost anything can be slaved to a projector via a computer. Other devices, other projectors, other instruments, lights, anything really that can be activated by a computer can be slaved to the projector with cues to turn on or off or follow any other instructions all according to whatever pre-arranged script you can construct, and all in sync with exact frames of film images. Indeed, beyond synchronising sound, scripting is the key. From the computer's point of view, the reel of film becomes an external clock which can then be used to trigger digital events and hence real world events. And these virtual and real world events will correspond exactly with the analogue film strip. Its pretty cool really. Possibilities are endless.

OPTICAL SOUND MACHINES

Summary by Esther Urlus
(WORM Filmwerkplaats, Rotterdam)

In the history of sound in experimental film, one of the most important creative practices is the use of sound tracks created by images. But image generated optical sound is also the origin of a number of sound machines.

The first practical sound-on-film systems were created almost simultaneously in the USSR, USA and Germany. Most of the inventions that led to optical sound-on-film technology employed the use of an electric lamp, called an exciter, shining through a translucent waveform printed on the edge of a film strip. When the light shines through the film, it is read by a photosensitive material and fed through a processor that converts the photovoltaic impulse into an audio signal that is then amplified through a speaker.

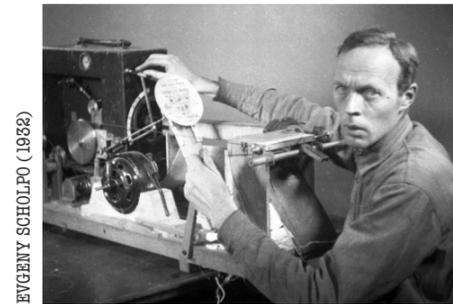
The fact that the optical sound track is equivalent to the electro-acoustic signal makes it possible to synthesize sounds by means of tracing the appropriate waveforms directly or exposing them onto the soundtrack through stencils. As a result, optical sound as a photoelectric sound synthesis process was not only relevant for the development of the sound film but also

played a significant role in the construction of different electronical musical instruments.

OPTICAL SOUND MACHINES

There are several different techniques depending on the technology employed, but all are a consequence of the sound-on-film technology and based on the creation of artificial optical polyphonic sound tracks on transparent film.

VARIOPHONE

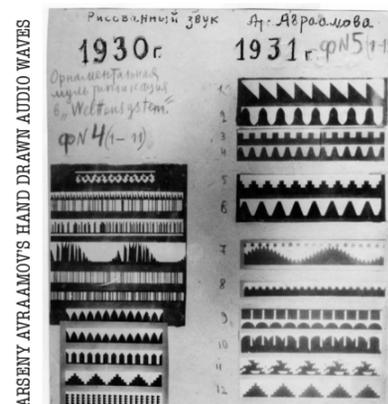


EVGENY SCHOLPO (1932)

The Variophone was developed by Evgeny Scholpo in Leningrad in 1930 at Lenfilm Studio Productions, together with composer Georgy Rimsky-Korsakov. The Variophone was an optical synthesizer that utilised sound waves cut onto cardboard disks rotating synchronously with a moving 35mm movie film while being photographed onto it to produce a continuous soundtrack. Afterwards this filmstrip is played as a normal movie by means of a film projector. Being read by photocell, amplified and monitored by a loudspeaker, it functions as a musical recording process.

ORNAMENTAL SOUND

Early artistically motivated experiments with sound include the experiments made by the Russian Futurist Arseny Avraamov from 1930 onwards. Avraamov developed methods of first drawing waveforms of geometric profiles and ornaments in larger formats by hand, before then scaling them down photographically on an animation stand to fit the narrow audio track of the film material and in this way synthesize sounds.



ARSENY AVRAAMOV'S HAND DRAWN AUDIO WAVES

Oskar Fischinger's statements, first published in 1932, were quite similar: "Between ornament and music persist direct connections, which means that Ornaments are Music. If you look at a strip of film from my experiments with synthetic sound, you will see along one edge a thin stripe of jagged ornamental patterns. These ornaments are drawn music – they are sound: when run through a projector, these graphic sounds broadcast tones of a hitherto unheard of purity, and thus, quite obviously, fantastic possibilities open up for the composition of music in the future".

THE WELTE LIGHT-TONE (1936)



WELTE LIGHT-TONE GLASS DISK

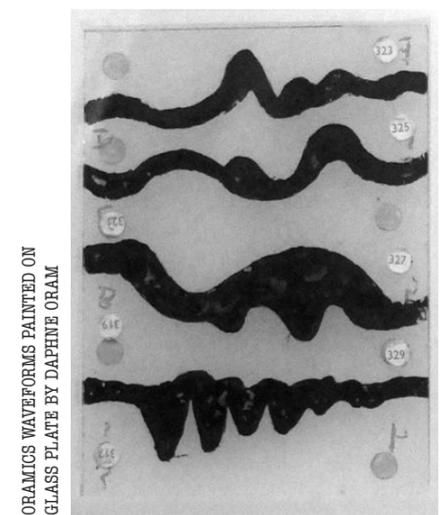
An electro-optical tone generator designed by Edwin Emil Welte in Germany. The instrument's sound generation unit consisted of 12 glass disks which were printed with 18 different looped waveforms in concentric rings. The glass 'tone wheel' disks were rotated over a series of photoelectric cells, filtering a light beam that controlled the sound timbre and pitch. The resulting combinations of tones gave 3 different timbres for all the octave registers of each note on the keyboard.

ORAMICS

The technique of Oramics 1959 was developed by pioneering British composer and electronic musician Daphne Oram at the BBC Radiophonic Workshop, in England. It consisted of drawing onto a set of ten synchronised strips of 35mm film which covered a series of photoelectric cells that in turn generated an electrical charge to control the sound frequency, timbre, amplitude and duration. This technique was similar to the work of Evgeny Scholpo's "Variophone" some years earlier in Leningrad and in some ways to the punch-roll system of the RCA Synthesiser. The output from the instrument was only monophonic relying on multitrack tape recording to build up polyphonic textures.



DAPHNE ORAM (1925 - 2003)



ORAMICS WAVEFORMS PAINTED ON GLASS PLATE BY DAPHNE ORAM

OPTIGAN

In 1971 toy manufacturer Mattel released the Optigan (short for "optical organ), an organ-like synthesizer whose sound library was stored on interchangeable 12 inch clear acetate "program discs". Each program disc was encoded with 57 concentric optical 16mm tracks that spun on a turntable inside the machine.



OPTIGAN AT WORM, ROTTERDAM

EXPANDING FILM COMMUNITIES



RYDE WHITE SÉANCES CONCORDE

Over the last century individual filmmakers working with film as an artistic medium have connected and pooled their limited resources. Over time, this impulse has led to the creation of shared spaces, cooperatives, collectives and independent film labs, which propose alternative models of organisation to that of the film industry. Today these active communities have a decisive role in the preservation of film's sustainability.



BASIC MAINTENANCE OF PROJECTORS

THE NETWORK OF artist-run film labs that started in Europe in the mid-1990s was collaborative and open to new-comers from the start. In 1995, Atelier MTK organised a meeting in Grenoble of those filmmakers who had processed films with them during the first year that they existed. Not only had MTK taught a series of filmmakers the use of their laboratory equipment, but they also helped them set up their own labs in the towns from where they came. It was both a way to expand the practice and not be the only artist-run film lab around. They could have seen things differently but instead MTK set the tone for a movement that followed: at least half a dozen new DIY labs popped up and, in the absence of email and websites, a fanzine called "L'Ebouillanté" was established as a means of knowledge-sharing and equipment trade.

Almost immediately, the necessity to bring together the filmmakers physically to exchange and watch the films they had produced together led to the first "lab meeting," set up by Geneva's Cinema Sputnik in 1997. It was followed by "Pellicula et basta!" in Grenoble in 2000, Cinema Nova in Brussels in 2005, Klubvizija in Zagreb in 2011 and Mire in Nantes in 2016, with the addition of partial network gatherings organised by festivals such as TIE in Colorado in 2013. For each meeting, the network seemed to have expanded two- or three-fold, and new labs appeared in unexpected places. Instrumental to that growth was the decision at the lab meeting in Brussels

to start a website called filmlabs.org to share technical resources, make the network more visible and promote the films stemming from it. Today, filmlabs.org lists 42 laboratories, of various scale and ambition, over four continents, and the associated mailing lists are active with hundreds of filmmakers using them to communicate with each other. When the REMI project was set up and the 2016 Nantes lab meeting occurred, filmlabs.org was used to reach out to the different labs and filmmakers behind the labs, resulting in more than 150 participants from about 25 countries.

In 2016, another initiative emerged within the network, one that encompasses many other players than just artist-run film labs. A website, [filmprojection21](http://filmprojection21.com), was launched, dedicated to those who care about photochemical film projection. The website includes filmmakers, artists, producers, archivists, distributors, programmers and audience members. Whether involved in the festival network, the archival world, contemporary art, independent venues, or all kinds of film-making, these individuals assert the importance of building a future for photochemical film projection and intend to share resources toward that goal. Yet another dimension of organising collectively for analogue film.

– Nicolas Rey
L'Abominable, Paris

BAINS ARGENTIQUES AT MIRE, NANTES (FR) – REMI'S INTERNATIONAL FILM LABS MEETING 4 – 9 JULY 2016

Bains Argentiques brought together nearly 80 labs drawn from 5 continents, for a week of exchange and discussions about the state of the art of film. An opportunity for artists, technicians, professionals and amateurs to meet, share ideas and resources and to think collectively about the network's future perspectives.

DISCUSSIONS:FUTURE OF WORKING ON FILM

Moderator: Josh Lewis
[Negative lab, US]

NETWORK ORGANISATION

(practical matters: cheap film, access to equipment, exchange platform...)

Moderator: Richard Tuohy
[Nanolab, AUS]

LABS STRUCTURE AND SUSTAINABILITY

Speaking about structuration. Exchange New/older labs.

Moderator: Pip Chodorov [Re-voir, FR/Space cell, KO] + Douglas Ur-bank [Agx Film Collective, US]

FILM LABS NETWORK AND THE ARCHIVAL WORLD

Moderator: Tiago Ganhão [ANIM Cinemateca Portuguesa, Pt] + Nicolas Rey [L'abominable, Fr]

HOT STUFF (Current and urgent concerns about film: making ownstock, laser undertitles etc...)

Moderator: Nicolas Rey
[L'abominable, FR]

EQUIPEMENT EXCHANGE IN THE NETWORK

Moderator: Nadine Taschler
[Filmcoop Wien, AUT]

EVOLUTION OF FILMLABS.ORG

Moderator: Nicolas Rey, Fred Piet
[L'abominable, FR], Maxime Fuhrer
[Labo bxl, BE]

ANALOG IN THE DIGITAL ERA

– Public round table

Speakers: Kim Knowles [BEEF, Edinburgh International Film Festival, Aberystwyth University, UK], Katia Rossini [Cinéma Nova, kino-climates.org, BE], Adriana Vila [Craterlab, ESP], Nicolas Rey [L'abominable, FR], Richard Tuohy [Nanolab, AUS]

WOMEN GROUP DISCUSSION

Frédérique Menant [Etna, FR]

FILM IN COMMUNITIES

Moderator: Ryder White
[Iris Film Collective, CAN]

DIY CHEMISTRYALTERNATIVE E6 PROCESS

(see page 27)

SOLUTION & FILM STORAGE

(see page 29)

Moderator: Rebecca Erin Moran
[Kinosmidja, ISL]

HOW TO ORGANIZE A FILMLABS MEETING: Feedbacks andPerspectives of a Future One

Speakers: Carole Thibaud,
Aurélie Percevault [Mire, FR]

CHILDREN BOOKS ABOUT PHOTOCHEMISTRY/ FILMMAKING

Moderator: Alex Moralesová
[Labodoble, CZ]

PRESENTATIONS:BOLEX AS A CONTACT PRINTER

Instructor: Richard Tuohy

LABS PRESENTATION

2 min introduction of each attending lab.

Moderator: Carole Thibaud
[Mire, FR] & Nicolas Rey
[L'abominable, FR]

DIY EQUIPMENT

Moderator: Richard Tuohy

BASIC MAINTENANCEOF PROJECTORS

Instructors: Roger Beebe [Ohio state University, US], Ethan Berry [Anyeye, US], Richard Tuohy [Nanolab, AUS]

LOMO TANKS FOR BEGINNERS

Instructor: Richard Tuohy [Nanolab, AUS]

HANDMADE EMULSION: feedback from WORM Filmwerkplaats & MTKHandmade Emulsion PrimitiveColour Seminar/State of research

(see page 9)

Speakers: Esther Urlus [Filmwerk-plaats, NL], Kevin Rice, [Process reversal, US], Etienne Caire [MTK, Fr], Maxime Fuhrer [Labo Bxl, BE], Lindsay McIntyre [FAVA, CAN]

OPTICAL AND DIGITALSOUND IN PROJECTION

Speakers: Laura Major
[Colorlab, US] and Nicolas Rey
[L'abominable, FR]

WORKSHOPS:LASER PRINTING ON FILM

Instructor: Roger Beebe
[Ohio state University, US]

RECONDITIONINGSUPER 8 CARTRIDGES

Instructors: Tomaz Burlin
[Etna, FR] & Andrea Saggiomo
[Ark film lab, FR]

SUPER 8 CAMERA ASCONTACT PRINTER

Instructor: Stéphane Racine
[Mire, FR]

B&W FLAT PRINT

(Cheap copy with print stock)

Instructor: Etienne Caire
[MTK, FR]

COLOR FLAT PRINT

(Cheap copy with print stock)

Instructor: Joyce Lainé [MTK, FR]

CONTACT PRINTERFOR BEGINNERS

Instructors: Richard Tuohy
[Nanolab, AUS] + Stéphane Racine
[Mire, FR]

COLOR CROSS PROCESSING

Instructor: Gustavo Jahn
[LaborBerlin, GE]

COLOR CROSS PROCESSINGNEGATIVE AS REVERSAL

(see page 26)

Instructor: Steve Cossman
[Mono No Aware, US]

ORGANIC PROCESSING

(see page 22)

Instructors: Jacqui Knight
and Joanna Mayes [Cinestar, UK]

PROCESSING KODACHROMEAS B&W REVERSAL IN C4

(see page 28)

Instructor: Tomaz Burlin
[l'Etna, FR]

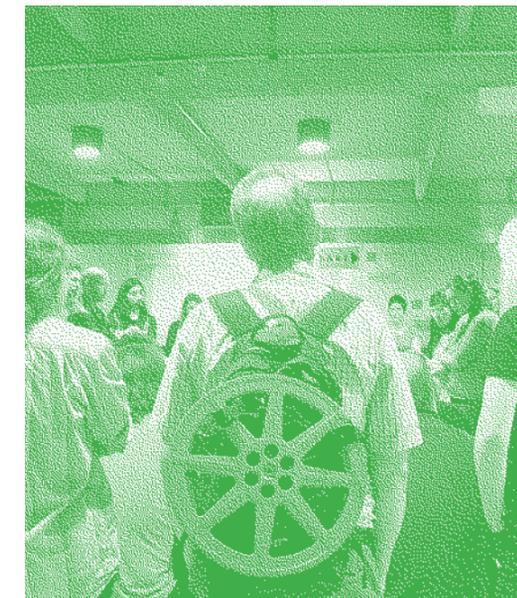
CLEANING A SPLICER

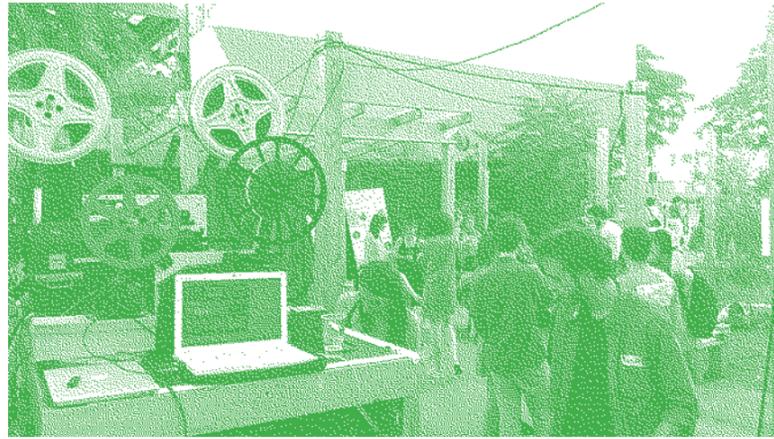
Instructor: Dianna Barrie
[Nanolab, AUS]

FAST HANDMADE EMULSION

(See page 6)

Instructor: Lindsay McIntyre
[FAVA, CAN]

IMPRESSIONS



ORGANIC PROCESSING

Recipe by Dagie Brundert

The coffee-wine-flower-tea-revolution! I have a cup of coffee, I have a glass of red wine, and I share them with my film! Coffee, beer, schnaps, tea, potatoes and blueberry juice, weed and curcuma tea: they all contain phenols which are – combined with washing soda and vitamin C – natural, non-poisonous, and easy to flush in the toilet ingredients to develop B&W film!

Basic recipe for any plant/leaves/fruit/bark/mushroom soup/tea:

- Pour 1 litre boiling water on
- 2 hand-full of any crushed plant/leaves/fruit/bark/mushrooms
- Cool down to 30°
- Press through a sieve
- Add 80 – 100 g Soda
- 20g Vitamin C
- 30°C and then develop for 15 mins.
- Pour boiling water over fruit/leaves etc., stir and crush and let the whole stuff cool down, it takes about an hour. Then the tea becomes nicely brownish and you can pour it through a sieve. Then add soda and vitamin C.

CAFFENOL:

I have been experimenting with alternatives to traditional developers that are harmful to the environment for some time. And I stumbled across CAFFENOL, a B&W negative developer! A lot of photographers have already tried it and there are various recipes and

reports circulating on the Internet!

Caffenol consists of instant coffee, vitamin C powder and washing soda. You can easily find the three of them around the corner for little money. Better buy the cheapest type of coffee, it contains the most caffeic acid which is bad for your stomach but essential for developing! Dispose the soup after use in the toilet.

RECIPE:

Water (tap water is ok)	1l
Soda	54g
Vitamin C	16g
Instant coffee	40g

20°C 15 min

CURCUMA RECIPE:

Curcuma is a fascinating root which – grated or as powder – not only gives curry that typical yellow colour but also heals shoulder inflammatories (tested it! It works!) and develops films. Curcuma contains – like many other plants – phenols. Phenols transform silver halides into metallic silver, the basis of a B&W developer. I shot a TriX film (I got up early with the cows!), developed it in curcuma soup to negative and it turned out wonderful, though a little yellowish! When inverted digitally: blueish.

RECIPE:

Water	1l
Curcuma powder	50g
Soda	54g
Vitamin C	16g

30°C 15 min

CURCUMA DEVELOPER INGREDIENTS
BY DAGIE BRUNDEBT



CHOCOLATE:

Chocolate, I thought, yummy and addictive like coffee, it's more than obvious that cocoa contains developer friendly phenols! I decided to test the eco version, the very dark, de-oiled version.

RECIPE:

Water	1l
Cocoa powder	50g
Soda	30g
Vitamin C	20g

24°C 15 min

COKE RECIPE:

Coca Cola	1l
Aspirins, grinded	10
Soda	80g
Vitamin C	16g

22°C 60 min

POTATO:

Thierry, my chemist friend, told me: "Dagie, you need to squeeze potatoes, they contain a surprisingly high amount of phenols!". I was wondering, I had thought, phenols are somehow bitter, sour, tannic...

So I bought a bag from the farmer and pressed some tubers! The result: one of the best! Wonderful blacks!

RECIPE:

Cold ressed potato juice	1l
Soda	100g
Vitamin C	20g

28°C 20 min

SEA WEED:

(the result will be a little yellowish)

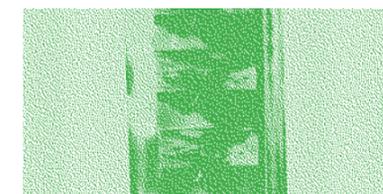
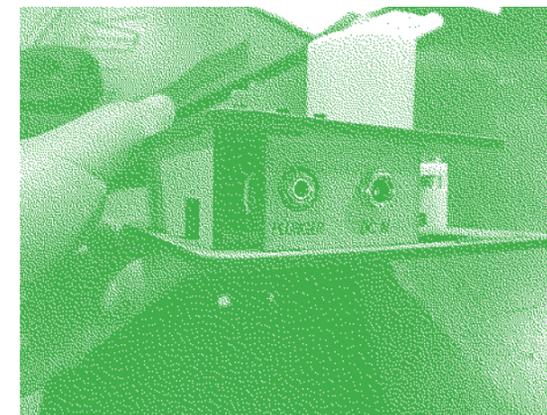
Sea Soup	1l
Soda	100g
Vitamin C	24g

35°C 15 min

COKE DEVELOPER INGREDIENTS
BY DAGIE BRUNDEBT



More recipes at: <https://yumyumsoups.wordpress.com/>

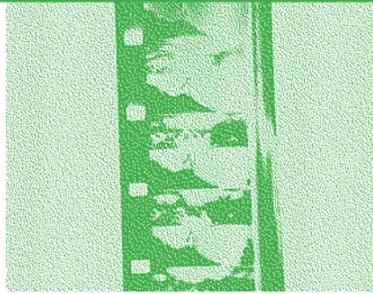




RE MI



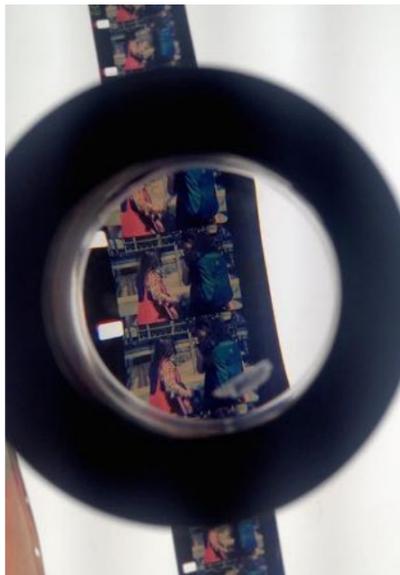
IMAGE: EUMIG NAUTICA ORIGINAL BOX COVER (1979-81)



COLOR CROSS PROCESSING NEGATIVE AS REVERSAL

Recipe by [Zach Hart](#)

Some cross processors insist upon overexposure in the camera along with push processing. I started testing this process by over-exposing by two stops in the camera and pushing two stops in the first developer. I came to realize that if I adjusted the temperature and time of the first developer enough I didn't need to overexpose in the camera. The results I've obtained with these times and temperatures are the closest to color reversal (ektachrome/velvia) I was able to achieve.



DETAIL OF COLOUR CROSS PROCESSING RESULT

NECESSARY FACILITIES:

- Dark room/slop sink
- Light tight space to load film

EQUIPMENT:

- Lomo tank – If possible a 100ft/30m Lomo tank or a 2 x 50ft/15m tank (spaghetti method in buckets works as well, but the fumes are more intense).

- Hot plate/pot/beaker – These will be used to heat the E6 chemistry up to the proper development temperatures.
- Graduated cylinders – To mix chemicals from concentrate
- Gas masks – The chemicals we are using are highly toxic and the fumes are intoxicating if breathed in without proper protection
- Heavy duty gloves – To protect the skin from coming into contact with the chemicals
- Latex gloves – To handle the film when removing the remjet backing
- Film rewind and daylight spools – To help remove the films backing
- Apron – To prevent chemistry from destroying clothing
- Chemistry containers – To hold the mixed solutions

CHEMISTRY:

I use the Tetenal E6 developing kit. This kit comes with 5 concentrates that get mixed with water to create the two developing solutions and the bleach fixer. The first developer is essentially a black and white developer, the second is a color developer with an auto fogging agent, and the bleach fix makes the positive image while simultaneously allowing it to be exposed to light. This kit is awesome and makes the reversal process much easier/faster due to the auto fogging agent in the second bath.

PROCESS USING TETENAL E6 KIT:

RINSE 3-5 minutes in warm water (± 115F/46C)

FIRST DEVELOPER – 8 min 30 sec at 115F/46C

The First Developer (FD) allows you to adjust the contrast and density of the image. By pushing the FD more you get higher contrast, but usually less saturation in the colors. If dense color saturation is what you're looking for then try and pull process in the FD. In this 1st step you are creating a black and white negative image.

RINSE – 3 min in warm water

COLOR DEVELOPER – 7 min at 112F/44.5C

The Color Developer (CD) is what adjusts the color temperature. If you are looking for more blues then try

and drop my suggested temperature up to 5 degrees Fahrenheit (± 2.8 in C). If you want more reds in your image then increase the temperature of the CD up to 5 degrees F (± 2.8 in C). After this step you will have a fogged color negative image.

RINSE – 3 minutes in warm water

BLIX – 7 Minutes at 115F/46C degrees

The Blix is bleaching out the remaining silver content in the film and simultaneously fixing the image. The temperature of this step is not as integral as the first two steps. I suggest 115F/46C degrees merely to keep it consistent and not shock the film with cold chemistry. I've obtained my best results keeping these

temperatures consistent. After completing this step you will have a color reversal image!

RINSE – 2 minutes in cool water

Backing Removal – Pass the film between two daylight spools on a rewind while gently removing the backing from the base of the film with a sponge. Six passes total rinsing all materials between each pass. After the backing has been removed respool the film back onto the lomo tank.

FINAL RINSE – 20 minutes in cool water

PHOTO-FLO – One drop in 2L distilled water in the lomo tank

DRY – Hang dry until film is dry to the touch



ALTERNATIVE E6 PROCESS

by [Robert Schaller](#)
(Handmade Film Institute, Colorado)

IN TOTAL DARKNESS!

1. D-19 with Thiocyanate (2g/l) 6 min @37°C

2. ECP2 Stop bath (Kodak SB-14), or any black and white stop bath – mix up a SEPARATE solution used only as a black and white stop bath 1 min.

IN NORMAL ROOM LIGHT

3. Reexposure – passing the film end-to-end 6 inches from a 500W bulb seems adequate n/a

4. ECP2 Developer (Kodak SD-50) 3 min @36.7°C

5. Water rinse 1 min

6. Ferricyanide Bleach (Kodak SR-27) – The temperature is important, or it won't work! 5 min @37°C

7. Water rinse – a thorough rinse is important here! 1+ min

8. Fixer (Kodak F-35c or equivalent: must be a non-acid, non-hardening fixer!) 3-5 min

9. Running water rinse 5 min



PROCESSING KODACHROME AS B&W REVERSAL IN C4

by Tomáš Burlin, l'Etna, Paris



TOMÁŠ BURLIN WORKSHOP

With C4 – B&W reversal process with D94A, R9 Dichromate Bleach, CB2 Clear and D95 include (at the end or... what suits best).

First test with 20 – 30 cm of film to set the correct time of the first and second developer. You could start with 3 min 30 sec developing time

D94A (1st developer) 2 – 5 min* 24°C

* Indicative times, to be determined after testing. In general, the more recent expired Kodachrome films require longer developing times, the older a shorter.

- Wash 30 sec 20°C
- R9 (Bleach) 40 sec 24°C
- Wash 30 sec 20°C
- CB2 (Clear) 30 sec 24°C
- Wash 30 sec 20°C
- Re-expose to light 1 min each side
- D95 (2th developer) use the same time as first developer here D94A 24°C
- Wash 30 sec 20°C
- F5 (Fixer) 2 min 20°C
- Wash with running water for 5 min

Remjet removal: In manual processing, you will have to remove the remjet after all processing is completed.

	g/l	g/2l	g/5l
D94A - 1er RÉVÉLATEUR			
• Génol (*)	0,6	1,2	3
• Sulfite de sodium	60	120	300
• Hydroquinone	20	40	100
• Bromure de sodium	7	14	35
DTOD	0,42	0,84	2,1
• Soude perle	20	40	100
BLANCH. AU PERMANGANATE			
Calgon S	20	40	100
Permanganate de potassium	2,5	5	12,5
• Acide sulfurique concentré (ml)	15	30	75
CB2 - CLARIFICATION			
Sulfite de sodium	210	420	1050
D95 - 2ème RÉVÉLATEUR			
• Génol (*)	1	2	5
• Sulfite de sodium	50	100	250
• Hydroquinone	20	40	100
• Bromure de potassium	5	10	25
• Iodure de potassium	0,25	0,5	1,25
• Soude perle	15	30	75
F5 - FIXATEUR			
Hyposulfite de sodium	240	480	1200
Sulfite de sodium	15	30	75
• Acide acétique à 80% (ml)	17	34	84
Acide borique	7,5	15	37,5
Alun de potassium	15	30	75

(*) Commencer par mettre une pincée de sulfite avant le génol

	g/l	g/2l	g/5l
D94AR - RÉGÉ			
• Génol (*)	0,9	1,8	4,5
• Sulfite de sodium	75	150	375
• Hydroquinone	26	52	130
• Bromure de sodium	1,7	3,4	8,5
DTOD	0,52	1,04	2,6
• Soude perle	34	68	170
BLANCH. PERM. - RÉGÉ			
Calgon S	24	48	120
Permanganate de potassium	12	24	60
• Acide sulfurique concentré (ml)	72	144	360
CB2R - RÉGÉ			
Sulfite de sodium	240	480	1200
D95R - RÉGÉ			
• Génol (*)	2,2	4,4	11
• Sulfite de sodium	50	100	250
• Hydroquinone	50	100	250
• Soude perle	50	100	250
F5R (F5) - RÉGÉ			
Hyposulfite de sodium	240	480	1200
Sulfite de sodium	15	30	75
• Acide acétique à 80% (ml)	17	34	84
Acide borique	7,5	15	37,5
Alun de potassium	15	30	75

• Très actif : verser doucement !

Fabrication chimie
N/B Inversible
26/12/08

REVELATEURS :
EAU DEMINERALISEE
AUTRES PRODUITS
A L'EAU FILTREE
TEMPERATURE DE L'EAU:
ENTRE 45° ET 50° C

C4 B&W REVERSAL CHEMISTRY RECIPE

After the film has been properly washed free of the Fixer. Soak the film in a solution of Borax (2 to 4 tablespoons per Liter) + Water (or sodium carbonate + water). Remove the remjet with a sponge till clean. Once removed, you will have to wash the film for at least another 2 minutes to remove all traces of the Borax solution. Then use a Wetting Agent such as KODAK Photo-Flo Solution, chamois if desired and hang up to dry.

Some thoughts on the development:

- If the image is clear, reduce the time of the D94A.
- If the image is too dark, increase the time of the D94A.
- Process should be in the dark until re-exposure.
- Do not use Stop Bath (acetic acid) for washing.
- Temperature variations should be compensated with the development time (higher temperature- shorter time, lower temperature-longer time).

SOLUTION STORAGE

Options mentioned at the [Film Labs Meeting](#)

How to keep your developer solution fresh:

Developers have a short lifespan as they oxidise. Stock solution will keep much longer if stored in a container without air that is kept in a cool dark environment. Of course you can keep the solution in tightly stoppered bottles, filled almost to the top of the neck to exclude air. But if that's not an option you can lengthen the lifespan of your solutions by displacing the air in the bottles with, for example inert gas.

Tetenal Protectan Spray: Protects developers and other photographic solutions from oxidation and so greatly extends their storage life. They contain Propane/Butane to do the job.

Nitrogen also could be a good choice. But it is lighter than Oxygen. Unless you flush a lot into the bottle, there will still be considerable amount of Oxygen left.

Or you can cover the surface of your solution with some olive oil as it would float on top of the developer. But this could cause some problem removing it before use.

Maybe the best option is to get a bunch of very small floating polypropylene balls. Polypropylene is a lightweight (floats in water), inexpensive thermoplastic. Can be used over and over again.

Fixer is exhausted by use and when it is loaded with silver.

Fix test: drop some undeveloped film cut off (using the same type of film for the test as the film you want to fix) into the fixer to see how long it takes to clear. When it takes twice as long as fresh, out it goes.

POLYPROPYLENE BALLS IN JAR



POLYPROPYLENE BALLS CLOSE-UP



FILM STORAGE

Storage and Handling of Unprocessed Film. Excerpt out of 'TECHNICAL INFORMATION BULLETIN' © Eastman Kodak Company, May 2002

Refrigerating camera films reduces the photographic effects of long-term storage, but refrigeration cannot reduce the effects of ambient gamma radiation. Naturally occurring gamma radiation increases the D-min and toe densities and also increases grain. Higher speed films are affected more by gamma radiation than lower speed films. A camera film with an EI (Exposure Index) of 800 has a much greater change than an EI 200 film. Exposed and unprocessed film that has been properly refrigerated retains the speed and contrast of the exposure conditions, but the overall D-min, toe and grain will continue to increase.

You should test camera films stored for longer than six months to ensure that the product will perform appropriately. If you must store film, a relative humidity (RH) of 50% is recommended at the following temperatures:

- For general storage, store unexposed camera films at 13°C (50°F) or lower.
- For periods exceeding six months, store unexposed camera films at -18°C (0°F) or lower.

Although very low temperatures do not damage film, you must allow sufficient time for the film to come to room temperature before loading it into a camera. Conditioning times depend on the roll size and the ambient temperature and humidity of the surrounding air. A 100 ft 16 mm roll may take thirty minutes to come to room temperature, while a 1000 ft 35 mm roll may take up to 3 hours. Use gradual warming to reduce moisture spotting and to avoid condensation on the film. Typical warm up times for 16 mm film is one hour (1) for a 14°C rise (25°F), 35 mm film is three hours (3) for 14°C rise (25°F).

Let the film warm up to ambient temperature before the can is unsealed. This will prevent any cold-induced problems.

EFFECTS OF HUMIDITY

Motion picture raw stock is packaged in taped cans. Until opened, the cans are water and vapor tight and do not require humidity-controlled storage. However, avoid storage at relative humidities of 60 % or above. Such high humidities can damage labels and cartons (from moisture and mold) and can rust the cans. Note: Keep raw stock in its original taped can until you are ready to use the film.

High humidity can promote mold growth and ferro-typing. Low humidity can create static marks when printing or cause buckling due to uneven moisture loss. Exposed film, particularly color film, deteriorates more rapidly than unexposed film.

Kodak* recommends exposing and processing all camera films soon after purchase and no longer than six months after. *Kodak is a trademark of Eastman Kodak Company.

EFFECTS OF CONTAMINANTS

Certain gases such as formaldehyde, hydrogen sulfide, hydrogen peroxide, sulfur dioxide, ammonia, illuminating gas, motor exhaust, and vapors from solvents, mothballs, cleaners, turpentine, mildew or fungus preventatives, and mercury can damage unprocessed and processed film. Keep film away from such contaminants.

AIRPORT X-RAY FOG

Airports use x-ray equipment to scan checked and carry-on baggage. Film can tolerate some x-ray exposure but excessive amounts result in objectionable fog (an increase in base film density and a noticeable increase in grain). The faster the film the greater the effects of the x-rays. Best to have the film processed where it was exposed.

LOW TECH SEE-THROUGH PROJECTION SCREEN

by Filmwerkplaats, Rotterdam

For the low tech end (and of course low budget) you can make a See-Through Projection Screen out of any window. Clean the window beforehand with some hot water and a little alcohol. Make a mixture of 1/2 buttermilk + 1/2 quark, applied thin with a foam paint roller, it will dry after approx. 20 minutes. It's charming, stays for a number of days and is easily removed with water.

It's organic and non toxic and no...
It won't start to smell.



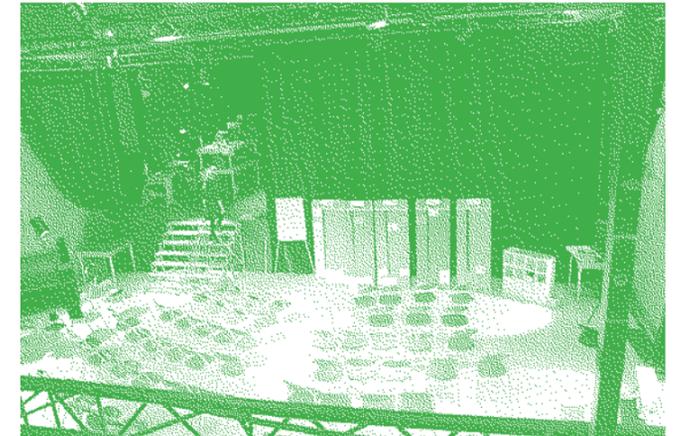
MIXING QUARK AND BUTTERMILK



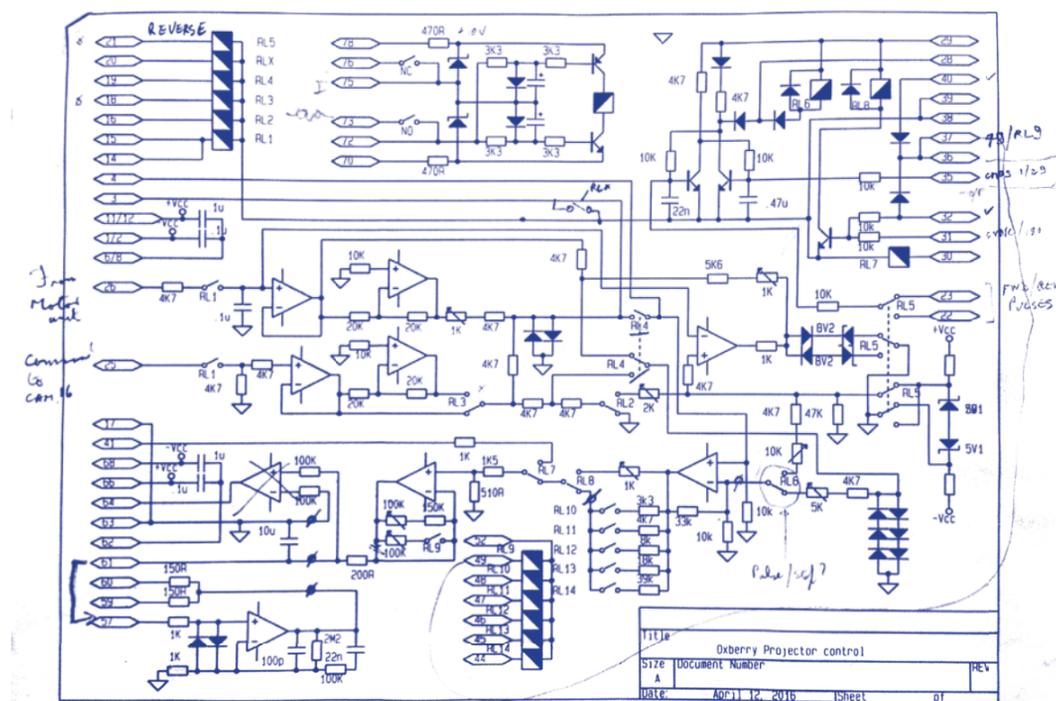
APPLYING THE MIXTURE ON A CLEAN WINDOW



SEE-THROUGH PROJECTION SCREEN RESULTS



RE-ENGINEERING THE INDUSTRY



Oxberry circuit drawing by James Rubery (JR-Electric, Rotterdam)

We can be certain that, in the near future, artist-run film labs will represent the leading standard in contemporary analogue filmmaking. During the last few decades, these labs have acquired professional, but commercially discarded, equipment from all over the globe. Now that we have access to the tools, we can move forward outside of the industry.

These labs provide a growing awareness of the importance of open culture-based knowledge sharing. The analogue film medium, freed from its economical profit based competition, may herald a new era. Driven by artistic freedom, it opens up a huge amount of potential, with room for total labour-intensive but new-skilled and innovative outcomes.

Now it's up to us, self-skilled film artists, to take up the challenge, to rid the medium of nostalgic doom and create new opportunities for the continued use and further development of the machinery and technology of analogue film. Let's dive deeply into what is already possible and combine that with what has not been done before.

– Esther Urlus
Filmwerkplaats, Rotterdam



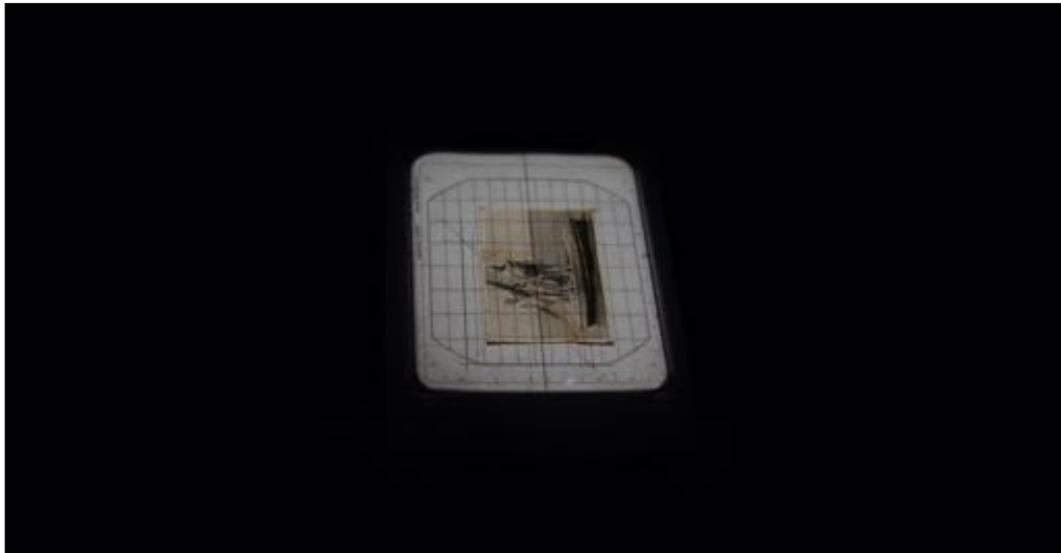
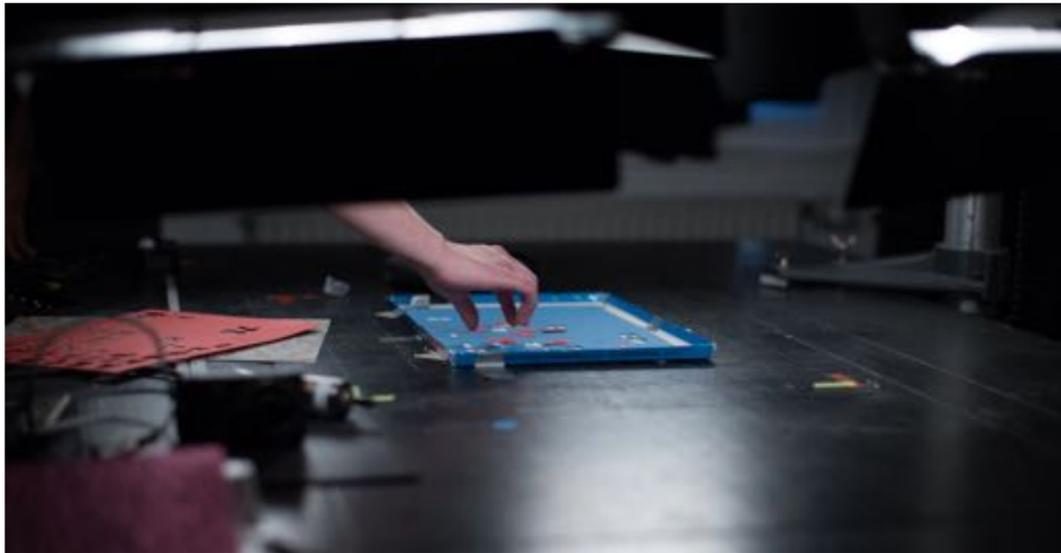
Crass animation stand at LaborBerlin

CRASS ANIMATION STAND - LABORBERLIN

In 1946 Richard Crass started the Crass Company in Berlin to produce film animation equipment. The company created an almost indestructible single frame camera and animation table that, until the early 1990's, was in widespread use in Germany and all across Eastern Europe. The camera had a wide range of applications in film and television including cartoons, advertisements and a range of optical special effects. Since they are incredibly sturdy and durable many animation stands can still be found today in good condition. Because of its design, the mechanical and electric components are very well suited for modifications that can meet a wide variety of today's current artistic applications.

Shortly after LaborBerlin was formed it received a Crass animation table as a donation. Ever since, the collective has worked to have a fully functional table with all the applications that were once professionally available. A few years ago the lab had the good fortune of receiving additional equipment from fellow independent lab, L'abominable, which helped further expand the stand's capabilities. The donations included a super-16mm camera, a 35mm camera and a rear projection unit, as well as a variety of lenses and accessories.

For the REMI project our goal was to re-activate the use of our animation by collecting and sharing the available knowledge around its many uses and capabilities. We contacted Lutz Garmsen, a local artist with extensive experience with the equipment, to teach a Master Class on the machine. For five days, Lutz and a group of eight participants worked assembling, repairing and modifying the machine to meet the needs of LaborBerlin and bring the machine to its full potential.



DEBRIE CONTACT PRINTER - MIRE, NANTES

The DEBRIE Tipro – manufactured by the French firm of André Debrie – is a step printer for black and white film. Debrie with Pathé, was from the 1900's one of France's principal manufacturers of professional film equipment and produced a wide range of different film printers. The Tipro model, which is now housed with Mire an artists run film lab in Nantes, France, was produced in the 1960's and can print both 16mm copies from a 16mm original negative by contact or reduce a 35mm original to a 16mm format by an optical process.

The Tipro is a multi-functional machine. It offers many different copying options partly thanks to its double 16mm gate. For the density grading of final prints, the intensity of the "image lamp" can be controlled via an electrical system activated by using a perforated test tape.

Before becoming part of the artist-run film lab Mire, the Tipro was used by the CNC (Centre national du cinéma et de l'image animée – (French National Film Centre) archival department. At that time, it was mainly used to make reduction copies from 35mm to double 16mm (32 mm).

After the CNC Archive stopped using these types of machines; Mire had the opportunity to acquire it, thanks to the film artist Chris Auger from Grenoble. It was then stored in several pieces for several years before being reconstructed by Thomas Chatard who worked for Mire and along with the contributions of members of the community of the artist-run film labs.

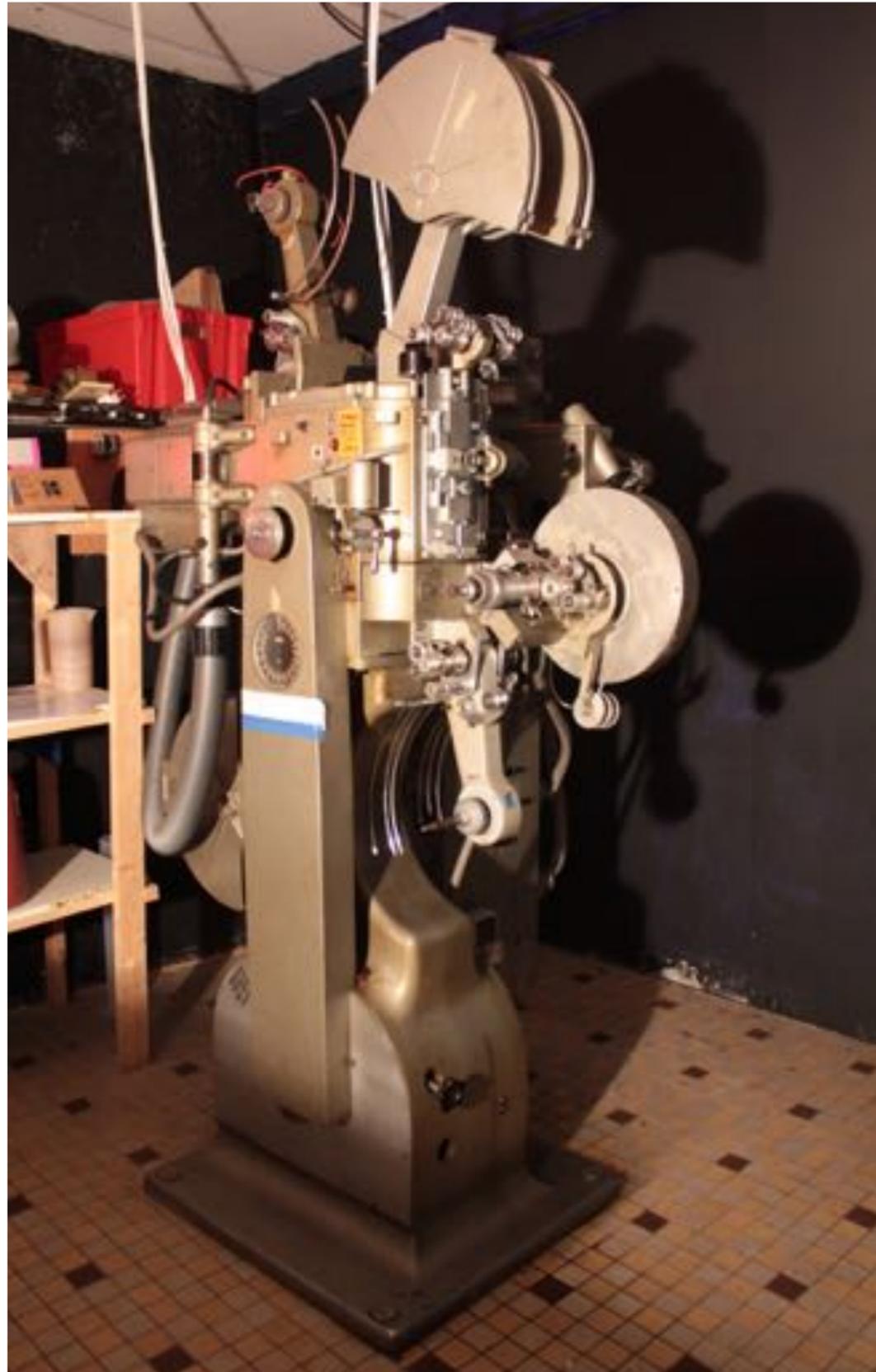
Since then, it has been used or lovingly 'misused' in various ways by different film artists in the lab: classical positive prints from B&W negative camera stock, 'creative' colour prints using filters (as the machine is conceived for B&W prints), multiple exposure works using film loops as originals, found footage including 35mm to 16mm reductions...

Recently the sound copying mechanism (for 16mm to 16mm) was repaired but has yet to be used for a project. At the time of writing these lines, a Master Class with technicians Franco Bosco and Rafael Marques from the ANIM, archival department of the Cinemateca Portuguesa is eminent.

There are still some technical mysteries as to the workings of the Debrie Tipro for us to clarify and we will probably discover a lot of new possibilities as we continue to work with it. It's a promise for future artistic exploration!



Debrie contact printer undercover at Mire, Nantes (FR)



Debie Tipro



Debie Tipro detail



Debie Tipro perforated test tape

— OXBERRY OPTICAL PRINTER — FILMWERKPLAATS, ROTTERDAM

The Oxberry Optical Printer at Filmwerkplaats was a donation from a special effects company in London. There, the printer has been purely deployed for commercial ends. It has been used for the special effects of over a hundred films including *Brazil*, *The Adventures of Baron Munchausen* (Special Effects Oscar nomination), *Aliens*, *Fear and Loathing in Las Vegas*, *Donnie Brasco* and *Twelve Monkeys*, just to name a few.

The machine is robust and in excellent condition so it can easily serve another century of film work. The massive shift to digital technology in the film industry, with special effects having moved to computers, has depreciated this machine for commercial use. Now it can serve as the perfect tool for artists and filmmakers who consider the medium of analogue film an important part of their practice.

The Oxberry Optical Printer is the cream of the crop among analogue optical printers, for manually created, special effects on 16mm and 35mm film. This device – a beast weighing about 3000 kg – will be freely available for students, filmmakers and artists making their own, handmade experimental films at the Filmwerkplaats lab. Our aim is also to offer workshops on the Oxberry so that new generations of filmmakers can learn how to work with the medium of analogue film and get familiar with one of the most versatile and precise optical printers of the world.

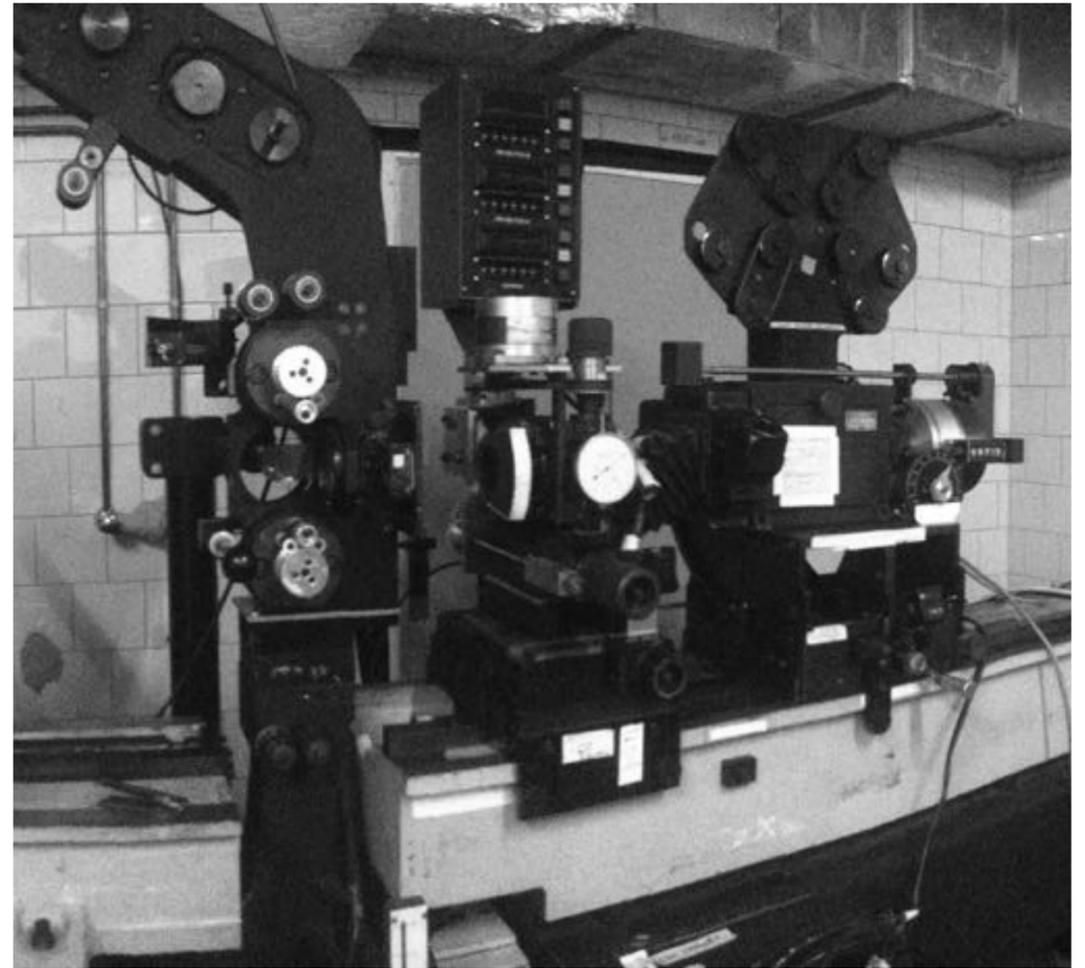
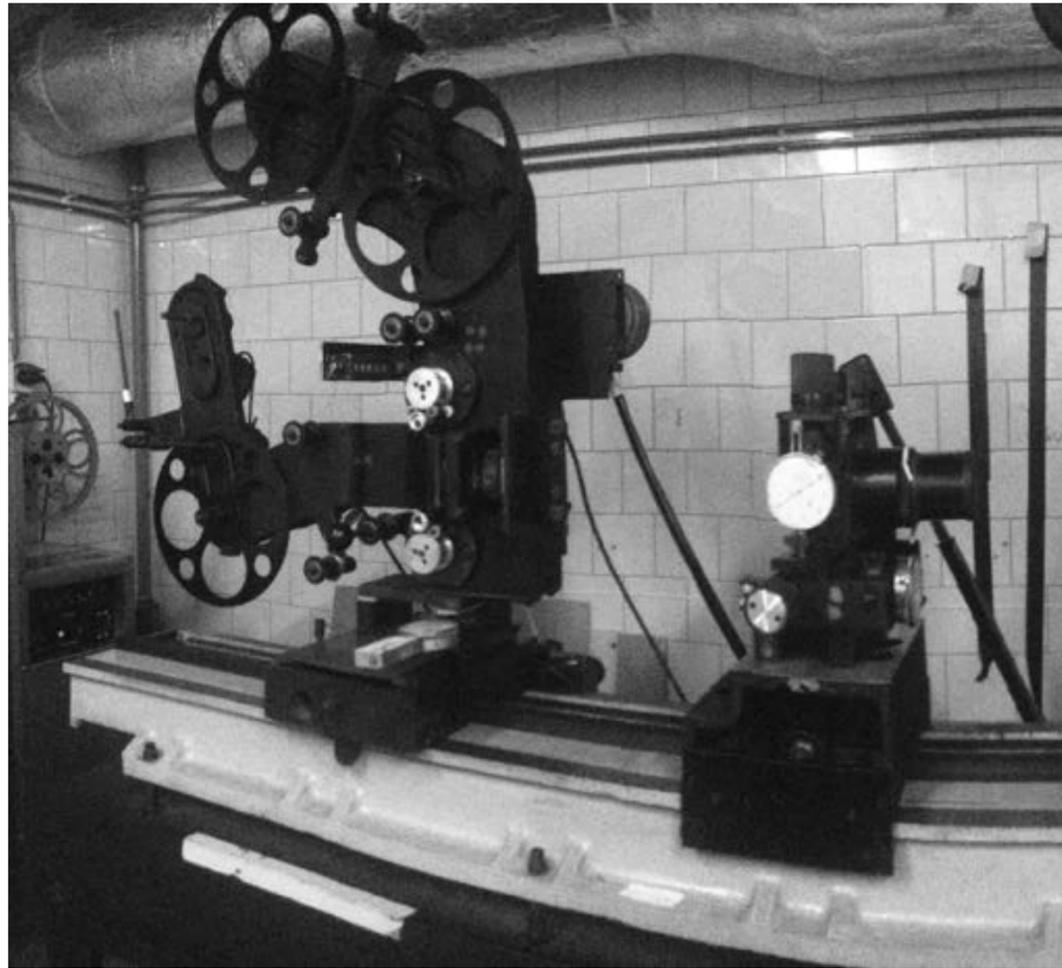
WHAT IS THE OXBERRY OPTICAL PRINTER?

The optical printer is designed for motion pictures special effects. Today, they are mostly used as an artistic tool by experimental filmmakers, for educational purposes, or for photochemical film restoration. An optical printer is a device consisting of one or more film projectors mechanically linked to a film camera. It allows filmmakers to re-photograph one or more strips of film. With special lenses for resizing and distorting material and projectors sending the film image to the camera, fade-outs and fade-ins, dissolves, slow motion, fast motion and image overlays can be easily achieved. More complicated work can involve dozens of elements, all combined into a single scene. A good example of optical printing is the “matte” work in *Star Wars* in which two or more picture elements are combined into a single, final image.

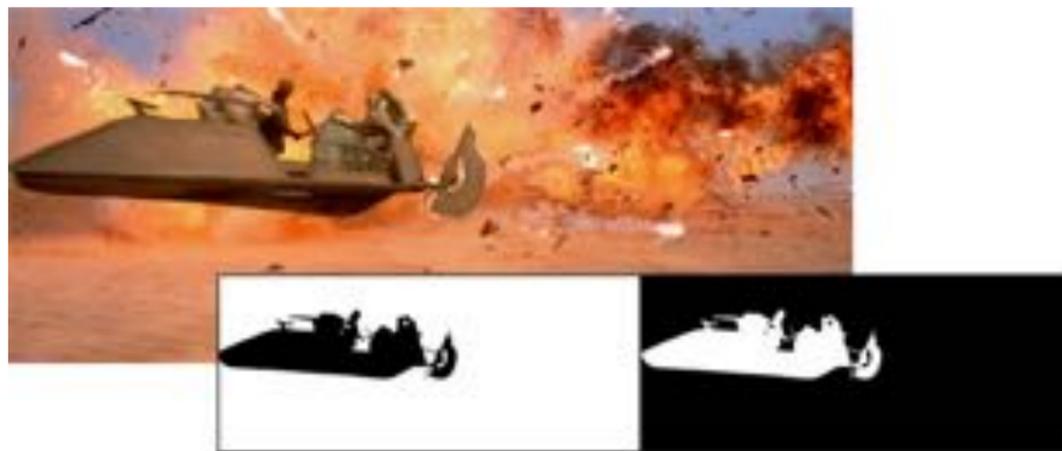
Oxberry LLC is the leading manufacturer of analog film scanners, recorders, animation tables and professional optical printers. The company is located in New Jersey, United States. Other artist-run labs with Oxberry printers are a.o: L'Abominable Paris, MTK Grenoble and Lift Toronto.



The day after (the Oxberry Optical Printer Master Class at WORM Filmwerkplaats, Rotterdam)



Panorama of Oxberry 1200



Composite shot from "Return of the Jedi" (1983). The inset shows a reconstruction of the holdout and cover mattes used for creating the shot. Screen image copyright © Lucasfilm Ltd (picture taken from our friend, the internet).



Still from TANGO (35mm, 1980) an optical printed masterpiece by Polish director Rybczynski

WHY NOT USE A ...

DENSITOMETER

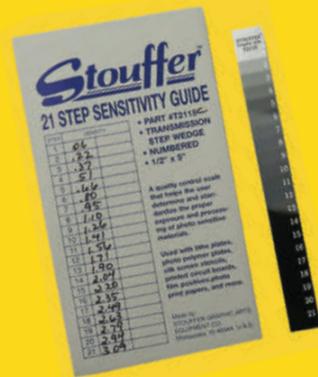
Any printing process from the most simple B&W to complex colour work will benefit from the use of a densitometer. A density metre will reduce the amount of tests, test material and... It can save time.

But what is a densitometer, anyway? There are two types, transmission and reflection. A transmission densitometer measures the amount of light passing through film or any other transparent medium. These you use for film (negatives and positives). A reflection densitometer measures the light reflected from a surface, usually paper (used for photographic prints).

Best to get a colour transmission densitometer right away. And yes, you can use a colour densitometer to measure B&W negs. No problem. For most B&W printing purposes the blue, visual or ortho channels will be OK.

Make sure that you calibrate the densitometer first. For this you will need a transmission step wedge to use as calibration standard. This is a strip of film with several steps of density and a data sheet that states the density of each step. If it didn't come with your machine you can get a 21-step wedge from a company called Stouffer (accessible here: www.stouffer.net).

STOUFFER TALLER, DENSITO STEP WEDGE



With a colour transmission densitometer the channels are likely to be a selection from:

- Status A red, green and blue (interference filters, motion picture (positive) print film and reversal/slide film)
- Status M red, green and blue (interference filters, for masked colour negatives and inter-negative film)
- Visual, white or orange button (Wratten 106 filter, an amber coloured filter that has a peak response in the green, so it is mainly green with some blue and red)
- Ortho (blue and green)
- UV

X-Rite is a good manufacturer as is Macbeth. Some good ones are the X-Rite 310 TR Color, X-Rite 320, X-Rite 810 TR

X-RITE 310 TR COLOR TRANSMISSION



SENSITOMETER

A sensitometer is an instrument for testing the sensitivity of various types of film, consisting of an apparatus for exposing successive parts of the film to a light of standard intensity at successively increasing lengths of exposure.

A sensitometer is a necessary tool for those who are home brewing their own (B&W) emulsions. Easy to find second-hand. It often comes as dual-colour (green-blue) that provides single-sided exposures and produces repeatable 21-step exposures on a film strip. It is easy to use, just place the film strip inside, then firmly press down the cover. When you hear a beep, the exposure is complete. Use for your (non sensitised) handmade emulsion the blue light and press a few times in one go as your DIY emulsion is probably of very low asa. Our first tests were exposed 16 times with the sensitometer, and processed for 3 minutes in D97. The strips were compared to a strip of Kodak 7302, which was given the same exposure.

X-RITE SENSITOMETER, MODEL 334



CINE-HOROSCOPE



ARIES: MAR. 21 - APR. 19
The Ram. A FIRE sign, ruled by MARS... If you want to show others how to do-it-themselves, maybe ask first if they appreciate your help. As we heard, your "student" is a master himself.



TAURUS: APR. 20 - MAY 20
The Bull. An EARTH sign, ruled by VENUS... You have put so much time and effort in this great film lab. Everyone is reaping the benefits of your hard labour but you're sitting at home, alone, with a broken back.



GEMINI: MAY 21 - JUNE 20
The Twins. An AIR sign, ruled by MERCURY... Hmm, your best film till now isn't being shown that much. Maybe you should just make something completely different. Something more intelligent and conceptual?



CANCER: JUNE 21 - JULY 22
The Crab. A WATER sign, ruled by the MOON... Don't you worry my love, all will be okay. Nothing will ruin your negatives. No dusty editing table, bad splices or wrong loaded tank. Yeah... really! Who could make you believe that?



LEO: JULY 23 - AUG. 22
The Lion. A FIRE sign, ruled by the SUN... While filming keep track on the light. The summer days are gone now. Choose an alternative and don't blame the stars. Because they told you so!



VIRGO: AUG. 23 - SEPT. 22
The Maiden. An EARTH sign, ruled by MERCURY... Common... what you do is not rocket science, its just B&W print stock. Let it go and enjoy the process. Stop nitpicking about two degrees difference.



LIBRA: SEPT. 23 - OCT. 22
The Scales. An AIR sign, ruled by VENUS... Decide for once what you are going to shoot! The light fades quickly and the developer is already outdated. So wham, start.



SCORPIO: OCT. 23 - NOV. 21
The Scorpion. A WATER sign, ruled by PLUTO... We know you know best and you know you know best. But they do not give a f..k about your experience or opinion. Let them DIY even when you think they will fail. Let them learn for themselves.



SAGITTARIUS: NOV. 22 - DEC. 21
The Centaur. A FIRE sign, ruled by JUPITER... It could be that you will f..k up your original camera footage, just because you are distracted when loading the LOMO tank. Don't let yourself be thwarted by your own mistake, just tell them all it's meant to be.



CAPRICORN: DEC. 22 - (JAN. 19
The Mountain Goat. An EARTH sign, ruled by SATURN... Okay.... what to do, now your actress left the set sick, the red-head lights burned all the filters, the polyester film got jammed in the camera and everyone thinks your project is haunted. You go on! Is that the best idea you have?



AQUARIUS: JAN. 20 - FEB. 18
The Man who Carries Water. An AIR sign, ruled by URANUS... Watch out for water as your very last bit of cherished ektachrome (or 7363 or...) is on the verge of extinction without ever having seen the light. Maybe better check your freezer where your raw stock is stored.



PISCES: FEB. 19 - MARCH 20
The Fish. A WATER sign, ruled by NEPTUNE... This piece of found footage you "found" is actually the lost film of your lab mate. The one that never shows up when some cleaning or maintenance has to be done. But is first in the queue when it comes to the screening of his films. Will you tell him you found it?

