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DIY Film Processes: A Look at Experiments and Guides of Amateur Film Manipulation

With film labs increasingly shutting down, it has become difficult and pricey for filmmakers and photographers to continue to shoot on film. Though artists and lovers of the film craft have long experimented with the medium, with the elimination of industry type resources, it has become more relevant, in fact, to learn how to hand process your own film. In order to keep the craft alive, there has been some resurgence for amateur film communities to come together and share such experiments and techniques in the form of do-it-yourself videos, blog entries and forums. However, there is a lack of academic sources covering this topic. That being said, this paper will serve as an overview of amateur film techniques and hopefully contribute to filling this gap that exists between academia and the topic. More specifically, the research will cover diy emulsion, processing and tinting/toning, with a more prominent focus on processing.

Part 1: DIY Emulsion

The Unblinking Eye is an example of a blog format that contains many diyrecipes, one of which pertains to making a simple silver-based photographic emulsion suitable for coating on glass or film, which will be outlined for the purpose of introducing the topic of manipulating film from your own home, as an alternative to industry made materials. The ingredients required are gelatin, potassium bromide, potassium iodide and silver nitrate. The equipment needed includes film or glass plates, metal plates, a plastic stirring paddle, a cheesecloth, gloves, a safelight with light red filter (Kodak 1A for reference) and two glass beakers of one-liter and four-liter,

respectively (or equivalent stainless-steel bowls)[1]. A mechanical stirrer is mentioned as a useful but not essential tool. Here is a review of the accessibility to the required ingredients: one can generally find gelatin at a grocery store, potassium bromide[2] and iodide[3] can both be found online for about fifteen dollars on average and silver nitrate[4] is also sold online for about ten dollars for ten grams. That being said, it is cheap to acquire the necessary ingredients and therefore, for evaluative measures, cost-effective. One would then have to have a proper dark room set up to proceed with the seventeen steps[5] towards making film emulsion. The first step is to dissolve the 10g of gelatin in 360 ml of warm distilled water. Then, to dissolve the potassium bromide and potassium iodide, one would have to add 32g of bromide and 0.8g iodide to the gelatin solution and stir until dissolved. The next step is to heat the mixture to 130ºF (55º C). Here, it is suggested to surround the solution with a warm water bath so that the temperature be maintained. It is then time to turn out the regular lights, turn on the red safelight and put on gloves to proceed to make the silver nitrate solution by dissolving 40 grams of silver nitrate in 400 ml of distilled water. What follows is known as the precipitation stage and involves adding the silver nitrate solution slowly to the gelatin solution at a rate of 20 ml every 30 seconds for a total of 10 minutes, stirring constantly. The slower the silver nitrate is added, the larger the silver halide grains produced; and the larger the grains, the faster the emulsion. Ten minutes later,

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[1]Buffaloe, Ed. *Instructions for Making a Simple Silver-Based Photographic Emulsion Suitable for Coating on Glass or Film*. www.unblinkingeye.com/Articles/Emulsion/emulsion.html.
[2]s://www.amazon.com/Potassium-Bromide-Tamper-Sealed-Bottle/dp/B00B9CO2TS/ref=sr_1_1_sspa?ie=UTF8&qid=1511030523&sr=8-1-spons&keywords=potassium+bromide&psc=1
[3]https://www.amazon.com/iOSAT-Potassium-Iodide-Tablets-130/dp/B00006NT3A
[4] https://www.amazon.com/Silver-Nitrate-Glass-Bottle-Purity/dp/B00HUU2LPK/ref=sr_1_1_sspa?s=hpc&ie=UTF8&qid=1511030750&sr=1-1-spons&keywords=silver+nitrate&psc=1
[5]Buffaloe, np

allow the temperature to cool down from 130ºF to 104ºF to ripen the mixture. This process allows for the size of the silver grains to grow and for the emulsion speed to increase. Then, soak 40g of gelatin in distilled water for about 20-30 minutes until softened and then pour off the excess water. It is then time for emulsification, which is achieved by combining the softened gelatin to the silver nitrate solution and mixing thoroughly before letting the mixture cool and set (two to four hours). The next step is to strain through the cheesecloth. To do so, place the emulsion in a square of cheesecloth and fold the cloth over it, holding the emulsion in a pan of cold water before twisting the cloth so that the emulsion is squeezed through its pores (making a sort of spaghetti-like gelatin extraction). This step ensures that excess silver salts will be removed. Then, extract the excess salts (halides) by placing the shredded emulsion in a large beaker and pouring 3 liters of cold water (below 68ºF) onto the shredded emulsion. Let it sit for 2.5 minutes and then pour off 2 liters of the water and add 2 liters of fresh water. The washing process must then be repeated 5 times using cold water before pouring off the excess. The following step requires melting the emulsion by heating it back to 130ºF for 15 minutes, and then slowly cooling it to 104ºF; the after-ripening does not increase grain size so much as it does increase the speed of emulsion. We are now entering the final steps, beginning with coating. Following the appropriate quantitative recommendations for each plate size, pour the emulsion onto the glass and spread it in a uniform way. Then, place this coated glass on a level cold metal plate until the emulsion sets and is ready to be placed in the dark to dry. It is then recommended to make the first test exposure at 1/30 second at f/8, adjusting as necessary before developing in an active developer such as Kodak D-8[6]. See figure 1 for an example of this type of emulsion by

[6]Buffaloe, np

Terry Holsinger.

Fig 1: Holsinger, Terry. “Print from a Glass Plate Negative Using a Handmade Silver Bromide Emulsion.” *Unblinking Eye*, www.unblinkingeye.com/Articles/Emulsion/emulsion.html.

Hand Made Film, an online resource, has also published a silver gelatin emulsion recipe[7] that will be used in comparison. The main difference is that this one only uses potassium bromide (no potassium iodide is required). It also calls for gelatin and silver nitrate. The steps themselves are quite similar but seem to be simplified. For example, this resource does not

[7]Schaller, Robert. “Silver Gelatin Emulsion.” *Handmade Film Institute*, www.handmadefilm.org/resources/technicalResources/processes/emulsionMaking/silverGelatin/silverGelatinEmulsion.html.

include the filtering step wherein the cheese cloth comes into play. This presumably means that the excess silver salts will not be extracted, which might have an effect on the overall look of the piece of art.

Because of the "do-it-yourself" nature of these guides, as was previously mentioned, the publications are generally amateur or in the form of blog entries. However, this also means that there are forums in which the community try film processes out and share their results; as is the case with Conor Peterson's entry on Photrio[8], which is a response to the previously detailed Unblinking Eye process. In fact, this forum discussion has led to some useful conclusions that allow for evaluative measures to be taken. For starters, it takes about eight hours to complete the recipe (including a break during which the emulsion needs to set)[9]. This specific forum contributor outlines each step with added comments on their personal experience, which is quite helpful. Specifically, he is not a chemistry student, but is simply a photography enthusiast, and has run into some difficulty running the process, but felt confident that the result was acceptable. That being said, the do-it-yourself film emulsion recipes can be done at an amateur level for cheap. However, although people with little experience have tried to do it, it would seem that some predisposed chemistry knowledge and substantive photographic experience is required, and that the process itself is quite laborious, requiring about 8 hours to undertake.

Part 2: DIY Processing

Amongst these amateur processing techniques arises a category that perhaps is of the most intriguing nature as well as the most common type of experiment: alternative processing.

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[8]Peterson, Conor. "Notes on and an Account of 'Making a Simple Photographic Emulsion.'"*PHOTRIO,* 15 Oct. 2006, www.photrio.com/forum/threads/notes-on-and-an-account-of-making-a-simple-photographic-emulsion.23076/.

[9]Peterson, np

Through research, it has become clear that the most common experiments utilize food as substitutions within the developer step of the process. First, in order to better understand how food substitutionswork, here is a look at the general principles of developer compositions. Typically, a developer is made up of four different components: the developing agent, the accelerator, the restrainer and the preservative.[10] The developing agent's purpose is to reduce the silver halides to metallic silver. In other words, the developer bath is a step that involves giving the matter all the electrons it wants. Because the solution is of basic PH, it has a surplus of electrons and thus wants to get rid of some. This is achieved withthe use of reducing agents from within the developer that transmit electrons into the conduction band and reduce ionic silver to atomic silver. The accelerator's job is to create a chemical environment that is favorable for the reducing agent by making the developing solution more basic in order to help electrons detach. The restrainer, on the other hand, stops the image from developing too quickly[11].Then, the stop bath is achieved by inducing an abrupt change in the PH, which is provided by its acidic solution[12]. Because the solution is acidic, it means that it has a surplus of protons that it gets rid of, rendering the matter neutral. Then, the fixation step involves washing out the silver salts that were not exposed. These are light sensitive, so exposure to light creates more metallic silver and will make the image darker and darker[13]. The final step is the wash bath, which removes the fixer from the film.

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[10]Witten, Nicole Marie. "The Chemistry of Photography. " *Https://Scholarcommons.sc.edu/Cgi/Viewcontent.cgi?Article=1085&Context=senior_theses*, 2016, scholarcommons.sc.edu/cgi/viewcontent.cgi?article=1085&context=senior_theses. P.5

[11]Witten, 6

[12]Kennedy, Nora. "The Chemistry of Silver Image Formation and Deterioration." 20 Nov. 2017, New York, The Metropolitan Museum of Art.

[13]Kennedy, np

Perhaps the food processing method that seems to be the most widespread within this alternative category is achieved with caffenol.Most of the caffenol recipes that are online seem to only be comprised of a reducing agent (or two) and an accelerator. In many cases, caffenol is the primary reducing agent and vitamin C, the second. This is commonly referred to as caffenol-c processing. The explanation for using two reducing agents, as many commercial developers do, is that the combination results in super-additivity; meaning that the reduction potential of two developers is greater than just the sum of the two.This results in the speeding up of the developing time without compromising the tonality of the photographic image[14]. A common caffenol recipe consists of the following ingredients: water, washing soda, vitamin C and instant coffee[15](with quantities varying). The washing soda acts as an accelerator, making the solution basic, or alkaline. More specifically, in water, washing soda reacts by having the sodium and carbonate components dissociate. The carbonate ion then removes a hydrogen atom from the water, leaving hydroxide ion behind, which in return, lowers the pH level of the solution. The formula is explained as follows: $Na2\ 2+ + CO3\ 2- \rightarrow HCO3 - + OH-$[16].It is suggested to let the solution stand[17] for a few minutes (about five minutes total), to clear out microbubbles before entering the stop bath stage, which, as previously explained, is a process that prevents the developing agent from reducing all of the grains of silver halide. Then, the fixer is used to dissolve these unreduced silver halide molecules left on the paper after the development process. If these grains are not removed, the process of reduction can continue with sunlight and eventually degrade the overall image. This degradation would appear as a purple hue as well as a

[14]Witten, 6
[15]"Recipes." *Caffenol*, www.caffenol.org/.

[16]Witten, 9
[17]"Recipes." *Caffenol*, www.caffenol.org/.

loss of detail. That being said, a typical fixer is sodium thiosulfate. In the case of "do it yourself" experiments, a household replacement for a fixer is ammonia[18]. The solubility is explained as follows: "the complex ion formed between ammonia and silver ions is more stable, causing the formation of more ions and the dissolution of more silver halides."[19] See figure 2 for an example of the effects of ammonia fixing (on the left) and no fixing on the right.

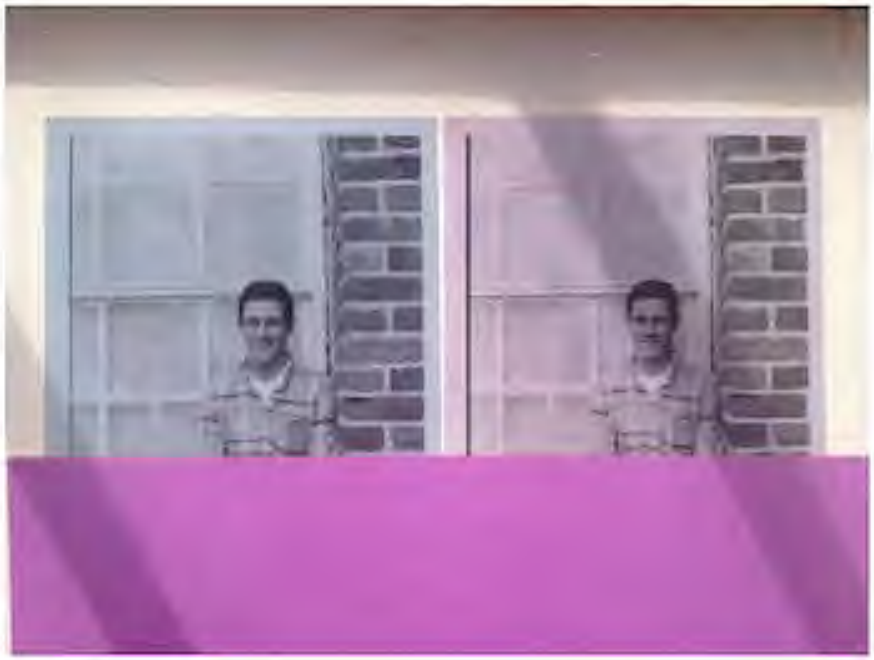

Fig.2 Witten, Nicole Marie. "The Chemistry of Photography.", University of South Carolina Scholar Commons, 2016, https://scholarcommons.sc.edu/cgi/viewcontent.cgi?article=1085&context=senior_theses

This person has exposed both photos in the sun to demonstrate the degradation that occurs when no precautionary fixing is in place. As previously mentioned, a purple hue appears on the photographic image. A final wash in water is then required in order to rid the paper of the fixer (which, itself can cause yellow degradation to the photo). This caffenol process is synthesized by many in the form of Youtube tutorials, which, perhaps serves as a comment on

[18]Witten, 10
[19]Witten, 10

the advent of digital technology opening doors across a multitude of cyber platforms through which a community of film developing enthusiasts can experiment, share results and contribute to a film processing evolution. A video that does well at transferring this information in a step-by-step method is Processing Film WithCaffenol[20] by Ross den Otter. This online community not only has taken shape in the form of experimenting and scientific researching, but also has opened doors for artists to showcase their work, as is exemplified in a case of moving images of experimental nature with Chris Gavin's super 8 film: Wall of Death[21], which showsThe Ken Fox Wall of Death Hell Riders performing their stunts in Enfield, Connecticut. The result, though somewhat grainy, makes for a rather interesting looking piece of work, and stands as a testimony for the effectiveness of caffenol processing.

It seems that coffee merely serves as a starting point for the diy film processing community to begin experimenting with. In fact, chutney (a vegetable relish constituted by peppers, tomatoes aubergines and spices) has been used as a developing agent as well. This ingredient simply replaces instant coffee as a developer in the recipe, which still calls for water, washing soda and vitamin C. Perhaps less of a popular option, the results of this experiment can be found on the Caffenol website (a community driven hub for film developing recipes), and are detailed as "messy but effective"[22] and can be seen in figure 3, below.

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[20]Den Otter, Ross, director. *Processing Film WithCaffenol*. *Youtube*, 18 Feb. 2017, www.youtube.com/watch?time_continue=33&v=JfmJ9uNuqzw.

[21]Gavin, Chris, director. *Wall of Death : Super 8 Film, Coffee Processed / DIY Digitized*. *Vimeo*, 2013, www.vimeo.com/69736803.

[22]Bele, Tina. "Chutney Developer – Ajvarol." *Caffenol*, 20 Jan. 2015, www.caffenol.org/2015/01/20/chutney-developer-ajvarol/.

Figure 3Bele, Tina. “Chutney Developer – Ajvarol.” *Caffenol*, 20 Jan. 2015, www.caffenol.org/2015/01/20/chutney-developer-ajvarol/ .

It is difficult to judge the effectiveness of this method as an outsider, as the effect of the photo can only be determined by its author. However, not having any context for it, it would seem that the overall result is an image that is less clear than that of a coffee processed one.

In fact, the list of alternative developers continues, following the food trend. The next method that will be explored is referred to as “Beerol”. In this experiment, the recipe is different than that of caffenol. The main developer, here, is beer. Interestingly enough, for this experiment, many photographers have chosen to turn the beer can itself into a pinhole camera, which is not something that will be discussed in this paper. The recipe calls for the beer to be

around 86°F before being poured into a bowl and mixed with washing soda and vitamin C[23]. The processing procedure that is required is the same as was outlined previously with the caffenol example. In fact, it seems that most people from within the community who are trying out these alternative methods of photo processing are simply substituting the main developing agent for another food based component. An example of the results of the Beerol process is shown in figure 4. This developer seems to be quite effective and, for evaluative matters, more successful than the chutney process.

[23]Team, Format. "A Guide to Developing Film in Beer." *Format - The Online Portfolio You Deserve*, Format Magazine, 16 Mar. 2017, www.format.com/magazine/resources/photography/how-to-develop-film-in-beer.

fig 4 Team, Format. “A Guide to Developing Film in Beer.” *Format - The Online Portfolio You Deserve*, Format Magazine, 16 Mar. 2017, www.format.com/magazine/resources/photography/how-to-develop-film-in-beer.

The final more popular food oriented process that will be explored is Wineol, which, perhaps quite obviously, involves the use of wine as developer. Here, however, the process differs a little bit from the Caffenol experiments on a practicality level due to the fact that wine is more viscous in nature than coffee. This means that it does not wash off the paper as easily, and thus, requires more water stop baths (with water replacements, each time) in order to prevent contamination of the fixer and to get most of the developer off. In terms of the overall look of the image it produces, however, it is very similar to the caffenol results. This is probably due to the

fact that both share the same chemical components responsible for development[24]; caffeic and ascorbic acid. That being said, insofar as diy home developing goes, coffee is the easier and cheaper option. In the same vein, some people have used beetroot juice as developer, with similarly successful results. See figure 5 for example.

Fig 5. Unknown. "Rote BeeteKann Man NichtNur Essen." *Analog/Digital-Ganz Egal !*, 1 Jan. 1970, analogdigital-ganzegal.blogspot.de/2015/02/rote-beete-kann-man-nicht-nur-essen.html.

As a final example of alternative film developer that is less common than the use of food based products is the Tylenol developer. It would seem that though this process is less easy than caffenol, it has the potential to produce sharper images. The recipe also calls for sodium sulfite, sodium hydroxide and water. Its broad lines are as follows: Stir the sodium sulfite into the water until dissolved, and then stir the sodium hydroxide into the water as well. The solution will

[24]Witten, 14

increase in temperature, which is when the crushed tablets of Tylenol should be mixed into it until dissolved. Return the solution to room temperature by placing the measuring cup in cool water before adding the distilled water as needed to make 250 ml. Cap and let sit for a minimum of 72 hours, after which crystals will have formed at the bottom of the bottle before use[25]. That being said, though the solution takes much longer to make because of the 72 hours of sitting time, it is not much more complicated. See figure 6 for example.

[25]"Homebrew Rodinal." *DIY RODINAL - Dr.frankenfilm*, www.drfrankenfilm.com/diy-rodinal/4575179217.

Fig 6. dkeating2, and Instructables. “Home Made Rodinal Developer From Tylenol, Drain Opener and Sodium Sulfite.” *Instructables.com*, Instructables, 21 Sept. 2017, www.instructables.com/id/Home-Made-Rodinal-Developer-From-Tylenol-Drain-Ope/.

To close off alternative developer ingredients within the processing technique is a grittier recipe written up by TL Frederik. Ingredients include one pack of Kodak D-19 and 3.8 litres of urine x2[26] and are followed by an outline of steps. Though this recipe does not include visuals to support its experiment, the author does provide this disclaimer: “processing in urine tends to boost the contrast of black and white reversal film (almost like a “glossy” 16mm), especially if the urine samples are collected from the morning voids of heavy drinkers, where potency is greater.”[27]Suffice to say, the tone of this recipe is very much humorous and perhaps not even a true testament of an experiment that was questionably practiced. However, it does serve as a comment on amateur processing practices to show that anything from food to urine can be used as a developer.

In addition to home developing experiments, many attempts have been made by artists before the developing stage to affect the outcome of processing. An example of this is Matthew Cetta’s photographic series entitled *Photogenic Alchemy*, for which he dipped rolls of 35mm film in household items[28] causing them to distort before having them developed. This serves as an

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[26]Frederik, TL. “A Little Urination for a Bloated Nation.” *Film Labs*, www.filmlabs.org/docs/recipes_for_disaster_hill.pdf.P.69

[27]Frederik, TL. “A Little Urination for a Bloated Nation.” *Film Labs*, www.filmlabs.org/docs/recipes_for_disaster_hill.pdf.P.69

[28]Brook, Pete. “Dunking Film in Household Liquids Is Warped Image Phototherapy.” *Wired*, Conde Nast, 2 Aug. 2013, www.wired.com/2013/08/matthew-cetta/.

example of the many ways in which the aesthetics of film can be altered at home by modifying its physical properties. See examples of Cetta's work below in figures 7, 8 and 9.

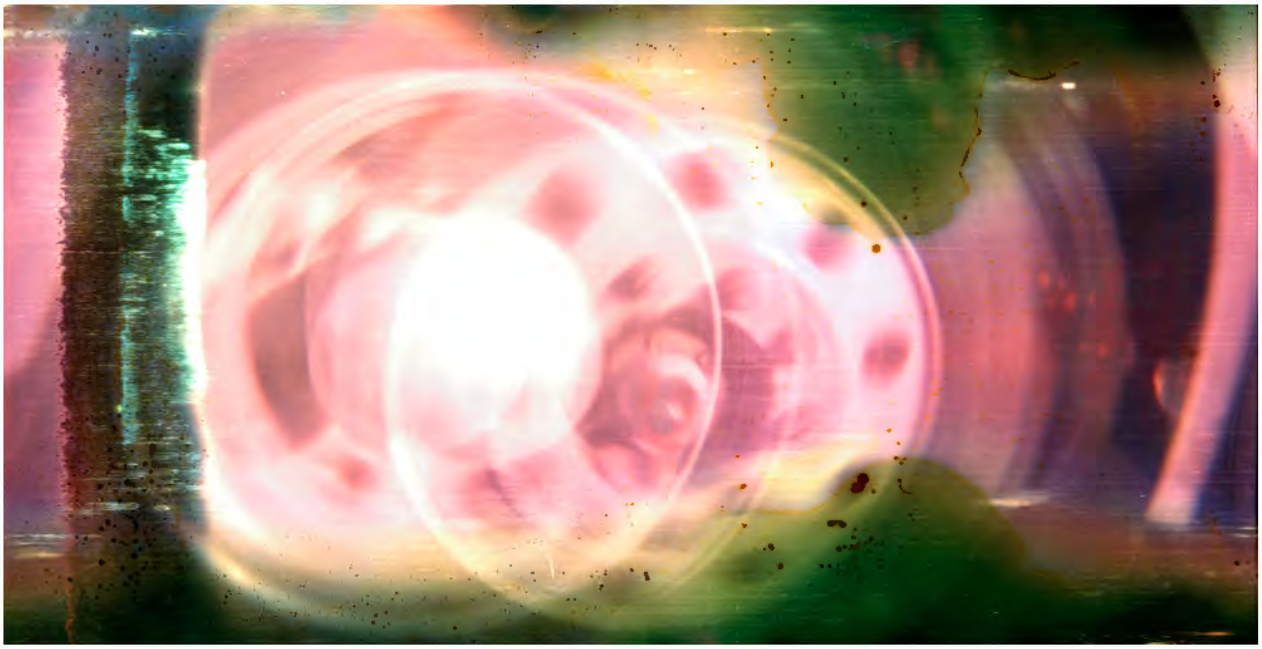

Figure 7: Cetta, Matthew. "Driveway Degreaser." *Matthew Cetta*, 2013, www.matthewcetta.com/portfolios/photogenic-alchemy/.

Figure 8: Cetta, Matthew. "Absinthe." *Matthew Cetta*, 2013, www.matthewcetta.com/portfolios/photogenic-alchemy/.

Figure 9: Cetta, Matthew. “Cough Syrup.” *Matthew Cetta*, 2013, www.matthewcetta.com/portfolios/photogenic-alchemy/.

Part 3: Experiments in Toning/Tinting

Finally, in an attempt to conclude this research paper, which, given its topic’s experimental nature, can go on for an endless amount of time and constantly be updated with time, here is an introduction to experiments in film toning. Filmmaker Helen Hill has authored a wonderful resource, “Recipes for Disaster: A Handcrafted Film Cookbooklet”[29], which outlines numerous DIY film techniques. For the purpose of this research, the following is an analysis of the toning component of the publication, written by Marty Bennett and Christina Zeidler.First, it is important to have an understanding of the way in which toning works. The principle, put simply, is that chemicals on the emulsion get loosened from the base of the celluloid to allow for the introduction of tone (colour), within the black portions of the image, effectively replacing it

[29]Hill, Helen. "Recipes for Disaster: A Handcrafted Film Cookbooklet." www.filmlabs.org/docs/recipes_for_disaster_hill.pdf.

with the given color[30].Tinting, on the other hand, puts color on the entire image, acting as a type of colored filter would, in effect. In this example, the process takes place in a truly do-it yourself nature, with the lab being set up in a garage, using a garden hose for water supply, recycled yogurt containers as air tight storage and a clothes line with attached paper clips for drying[31]. The total cost was under 100 dollars for use on 600 to 800 feet of film, which is relatively cheap and accessible and mainly includes the cost of berg color-toning systems (blue, red, green, yellow, violet and an activator). It is to be noted that these toners can be used to tint or tone, depending on whether or not you add the activator, in which case the emulsion would consequentially be lifted[32]. In addition to this, they also purchased a copper and blue toner.That being said, it is definitely cost-effective in terms of amateur processes go. However, their journal entry documentation seems to hint at ineffectiveness in terms of final results. In fact, they found that they needed to add activator to every color. Otherwise, the color would not appear. The rest of their text is a vague account of trial and error, serving more, again, as a type of personal journal entry than anything else. However, what it does contribute to this research is the fact that toning is something that people do experiment with, at a cheap cost.

Another toning/tinting experiment outlined in Hill's recipe book is written by TrixySweetvittles more thoroughly and seems to be more effective, employing Vaseline in its process. The steps are as follow: first, collect a piece of film with emulsion on it to work on. Then, find something removable (like masking tape or labels) to make your resist with. Cut it into interesting shapes and put it on the film to create a pattern. The third step involves dipping

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[30]Bennett, Marty, and Christina Zeidler. "Tinting and Toning." *Recipes for Disaster: A Handcrafted Film Cookbooklet*, p. 71, www.filmlabs.org/docs/recipes_for_disaster_hill.pdf.

31 " "

32 " "

the film strip into the chosen berg color tones or tint/activator and letting it sit for an undetermined amount of time to let the film soak up the color. Rinse and dry your film before applying a thin layer of Vaseline to it. The following step involves removing the resist material, all the while being careful not to smear the Vaseline around, so as to expose the film that is underneath the resist while leaving it Vaseline free. Then, step three must be repeated another time with a different colour before rinsing it and allowing it to dry once more. The final step is to clean the Vaseline off the film with cleaner. [33] This is a method that was also used by Harry Smith in his experimental film, "No.3"[34], wherein shapes are visibly created by the chosen resist material, cut into different shapes and stuck onto the film in various patterns. These shapes and patterns appear and disappear, creating what isa lively animation. The colors sometimes bleed through the Vaseline and create some layering and dual-toning, exemplifying this simplistic recipe that was outlined in Hill's Film Cookbooklet. That being said, this at home method is effective in creating animation as well as colorful aesthetics.

In an attempt to evaluate the outlined processes, one might conclude that diy emulsion, though possible and cheap, is extremely time consuming and chemically complex, requiring predisposed knowledge and experience. Alternative processing techiques are easily accessible and cheap, and the ingredients are more user-friendly. In fact, one can follow the outlined recipes and simply replace the main developer ingredient with many type of foods in experiments. For the purpose of this research paper, however, the caffenol process has proven to be the most

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[33]TrixySweetvittles. "How to Make Pretty Batik Style Tinted and Toned Films." *Recipes for Disaster: A Handcrafted Film Cookbooklet*, p. 73, www.filmlabs.org/docs/recipes_for_disaster_hill.pdf.

[34]Smith, Harry, director. *Film No.3*. *Youtube*, 28 Sept. 2009, www.youtube.com/watch?v=7YRucxMJEzo.

successful and is followed by beer, wine and chutney. Urine is not included in this evaluation, as there are no tangible results listed within the sources. Finally, tinting and toning is geared towards the at-home film developing enthusiast who is more interested in aesthetic experiments and animation. Needless to say, the online community is thriving and extremely willing to share results and experiments, and processing itself is quite accessible a practice.

Bibliography

Bele, Tina. "Chutney Developer – Ajvarol." *Caffenol*, 20 Jan. 2015, www.caffenol.org/2015/01/20/chutney-developer-ajvarol/.

This technique outlines an experimental amateur processing technique that requires altering the developer stage of processing. This technique belongs to the food category, as do most experiments within this strand of do-it-yourself film processes and employs the use of chutney. It serves as a relevant example for this research as well as a basis for comparison with other household ingredients utilized in such techniques.

Bennett, Marty, and Christina Zeidler. "Tinting and Toning." *Recipes for Disaster: A Handcrafted Film Cookbooklet*, p. 71, www.filmlabs.org/docs/recipes_for_disaster_hill.pdf.
This section within Helen Hill's recipe cookbook pertains to diy home tinting and toning takes form in a type of diary entry. It will serve as a final section for the paper, in line with diy film processing and introducing a new category for at home experiments, showing that the list of at-home processes and accounts of such are exhaustive and can be written about extensively. It first outlines what toning as a general process involves and then outlines the actual experiment.

Brook, Pete. "Dunking Film in Household Liquids Is Warped Image Phototherapy." *Wired*, Conde Nast, 2 Aug. 2013, www.wired.com/2013/08/matthew-cetta/.

This article outlines the work of artist Matthew Cetta from his series *Photogenic Alchemy*. This source is useful for research on diy film processing techniques in that this artist alters the aesthetic outcome of his work by toying with the film's physical properties before having it developed, by dipping it in household items.

Buffaloe, Ed. *Instructions for Making a Simple Silver-Based Photographic Emulsion Suitable for Coating on Glass or Film*.
www.unblinkingeye.com/Articles/Emulsion/emulsion.html.
This source is a detailed step-by-step recipe for making a silver based photographic emulsion at home. Though perhaps less experimental in nature, it is geared towards do-it-yourself methods of working with film and thus supports this community driven practice. It is an approachable resource that breaks down every step of the emulsion making, including a photo of the results for reference. For the purpose of this paper, it will be used as an introductory method to what is then the larger portion of the research, diy processing.

Filmwerkplaats. "To Boldly Go: a Starters Guide to Handmade and Diy Films." *Film Labs*, www.filmlabs.org/index.php/technical-tips/processing/
This resource is highly important to the research of the paper. It is a type of blog containing numerous ressources on do-it-yourself processes. These are categorized under different larger

topics such as theory and lab setting up, special super-8, processing tanks, practice and chemical prep and finally, processing instructions. All of the subtitles serve as links to various published information on the matter. As such, it will be used for reference throughout.

Hill, Helen. “Recipes for Disaster: A Handcrafted Film Cookbooklet.” www.filmlabs.org/docs/recipes_for_disaster_hill.pdf.
This source is a handmade recipe book containing a collection of how-to guides for experimenting with processing, toning, and handling. It was put together by filmmaker Helen Hill and is useful for the purpose of exploring various amateur techniques, specifically that of toning for the completion of the overview of processes that this paper is attempting to outline.

“Homebrew Rodinal.” *DIY RODINAL - Dr.frankenfilm*, www.drfrankenfilm.com/diy-rodinal/4575179217.
This source outlines the steps required to process film using Tylenol as a developing agent. It is of particular worth as, not only does it provide users with a step by step guide, but it also contains a how-to video as well as reasoning on why one should use this method. In addition to this, the author states it cost-efficiency at an estimate of 0.015 to 0.03$ per film, making it particularly interesting an exercise for the at home film processor.

Leite, Ricardo. “Caffenol Processing.” *Film Labs*, Dec. 2013, www.filmlabs.org/docs/citric-hydrogen-peroxide-bleach.pdf
This is an artist’s personal accounts of their experimentation with caffenol processing. It will be used as support for the caffenol section of part 2 of this research paper: diy processing. Caffenol is most probably the more popular developer agent within this stream of amateur techniques and therefore will hold quite some weight within this research. This is an extremely specific account (containing chemical charts pertaining to the results of such experiments) and therefore, might not be used as thoroughly as the more general guides or responses to guides.

Peterson, Conor. “Notes on and an Account of ‘Making a Simple Photographic Emulsion.’”*PHOTRIO*, 15 Oct. 2006, www.photrio.com/forum/threads/notes-on-and-an-account-of-making-a-simple-photographic-emulsion.23076/.
The nature of this specific source is what is most interesting for this research, as its format is a conversation within a forum. This contributor is responding to Ed Buffaloe’s “Making a SimplePhotographic Emulsion” guide, which is also included within this research paper. He is outlining his results and thoughts after having tried out the recipe within this guide and offering some alternative corrections as well as interacting with others on their queries and so forth. This proves the community driven nature of the amateur film processing techniques and therefore will be very useful to this research, in its part 1: diy emulsion.

“Recipes.” *Caffenol*, www.caffenol.org/.
Caffenol is a website devoted entirely to this subject; diy techniques pertaining to film processing. The main topic is caffenol, which is an important part of this research. However, there is also a portion of the site devoted to recipes employing various household ingredients,

shared by people from within the community. That being said, this is exactly what the research paper is about and therefore is important to the overall paper.

Schaller, Robert. “Processing with Coffee and Other Non-Toxic Substances.” *Handmade Film Institute*, www.handmadefilm.org/resources/technicalResources/processes/developing/coffee/.
As the title suggests, this is a resource pertaining to processing with coffee. Because this is an important part of the research paper and of the real-world practice trend within this alternative vein, it will serve as comparative basis to the other caffenol-centric sources. This source is less thorough, in that it rather addresses these types of processing techniques without going into specific step by step recipes. However, it does refer back to caffenol, which is a source used for this paper and thus, suggests that caffenol is a reference guide within the community, one that many people are trying and referring back to.

Schaller, Robert. “Silver Gelatin Emulsion.” *Handmade Film Institute*, www.handmadefilm.org/resources/technicalResources/processes/emulsionMaking/silverGelatin/silverGelatinEmulsion.html.
This is a recipe for amateur silver gelatin emulsion making, pertinent to part 1 of this research paper, diy emulsion. That being said, it will serve as an additional source for this section. It is fairly straight forward. Perhaps one thing that it is lacking is suggesting an estimated cost as well as where to get the proper ingredients, seeing as they are chemical by nature. Nonetheless, though it assumes a fair amount of predisposed knowledge on the part of the user, it is useful for the purpose of viewing several recipes for research.

Frederik, TL. “A Little Urination for a Bloated Nation.” *Film Labs*, www.filmlabs.org/docs/recipes_for_disaster_hill.pdf.
This recipe from within Helen Hill’s cookbooklet serves as a nice and gritty alternative to film processing by using urine as a developer. It is an example that is useful for comparison in the diy processing section. It is to be noted that there is no visual support of this to evaluate the overall look and effect of the process, or to act as proof that this person has actually tried this and is not simply spoofing the amateur film processing scene. However, it is interesting in that it serves as a claim that really anything can be tested as a developer.

Witten, Nicole Marie. “The Chemistry of Photography.”, University of South Carolina Scholar Commons, 2016, https://scholarcommons.sc.edu/cgi/viewcontent.cgi?article=1085&context=senior_theses
This source might very well be the most important one for this research because of how thorough it is. It breaks down every step of the processing process, for lack of a better term, by explaining the purpose of each of these steps while chemically demonstrating how each of these steps work, which is quite useful for patrons, such as myself, who have never physically gone through the processing techniques and are new to the community blog-entries that assume predisposed experience. More so, it contains several visual supports exemplifying the processes and their pros and cons when put into practice, which serves as great visualization as well as comparative basis for analysis. It is also one of the very few academic sources that delve into these alternative processes.

Photographic Bibliography

Buffaloe, Ed. *Instructions for Making a Simple Silver-Based Photographic Emulsion Suitable for Coating on Glass or Film*. www.unblinkingeye.com/Articles/Emulsion/emulsion.html.

Cetta, Matthew. "Driveway Degreaser." *Matthew Cetta*, 2013, www.matthewcetta.com/portfolios/photogenic-alchemy/.
This photo was achieved by dipping the film strip in driveway degreaser before having it processed. It serves as an example of artists manipulating the filmic material prior to the actual processing steps to alter aesthetics.

Cetta, Matthew. "Absinthe." *Matthew Cetta*, 2013, www.matthewcetta.com/portfolios/photogenic-alchemy/.
This photo was achieved by dipping the film strip in absinthe before having it processed. It serves as an example of artists manipulating the filmic material prior to the actual processing steps to alter aesthetics.

Cetta, Matthew. "Cough Syrup." *Matthew Cetta*, 2013, www.matthewcetta.com/portfolios/photogenic-alchemy/.
This photo was achieved by dipping the film strip in cough syrup before having it processed. It serves as an example of artists manipulating the filmic material prior to the actual processing steps to alter aesthetics.

dkeating2, and Instructables. "Home Made Rodinal Developer From Tylenol, Drain Opener and Sodium Sulfite." *Instructables.com*, Instructables, 21 Sept. 2017, www.instructables.com/id/Home-Made-Rodinal-Developer-From-Tylenol-Drain-Ope/.
Visual support showing the results of processing with tylenol.

Holsinger, Terry. "Print from a Glass Plate Negative Using a Handmade Silver Bromide Emulsion." *Unblinking Eye*, www.unblinkingeye.com/Articles/Emulsion/emulsion.html.
Visual support for diy emulsion; photographic result of the experiment.

Team, Format. "A Guide to Developing Film in Beer." *Format - The Online Portfolio You Deserve*, Format Magazine, 16 Mar. 2017, www.format.com/magazine/resources/photography/how-to-develop-film-in-beer.
Photo achieved by using beer as a developer. Serves as a visual support for the section devoted to this topic and basis for comparison to other elements used as developers in alternative processing techniques.

Witten, Nicole Marie. “The Chemistry of Photography.”, University of South Carolina Scholar Commons, 2016, https://scholarcommons.sc.edu/cgi/viewcontent.cgi?article=1085&context=senior_theses
The photos that are identified as this source do not have specific titles, but are contained within this academic source. They serve as visual supports for chemical occurences within the film processing.

Videography

Den Otter, Ross, director. *Processing Film WithCaffenol*. *Youtube*, 18 Feb. 2017, www.youtube.com/watch?time_continue=33&v=JfmJ9uNuqzw.
Amateur video how-to guide pertaining to the processing with Cafffenol technique.

Gavin, Chris, director. *Wall of Death : Super 8 Film, Coffee Processed / DIY Digitized*. *Vimeo*, 2013, www.vimeo.com/69736803.
Example of an artistic work that was coffee processed.

Smith, Harry, director. *Film No.3*. *Youtube*, 28 Sept. 2009, www.youtube.com/watch?v=7YRucxMJEzo.
This experimental film serves as support to visualize the hand toning/tinting method employing Vaseline that is outlined in part 3 of the paper (Toning and Tinting).

Lecture

Kennedy, Nora. “The Chemistry of Silver Image Formation and Deterioration.” 20 Nov. 2017, New York, The Metropolitan Museum of Art.
This lecture at the Met was about the chemistry of photographic film processing. The presentation simplified the language and allowed for a better understanding of the chemistry behind the process, especially for someone who has never done processing themselves.