

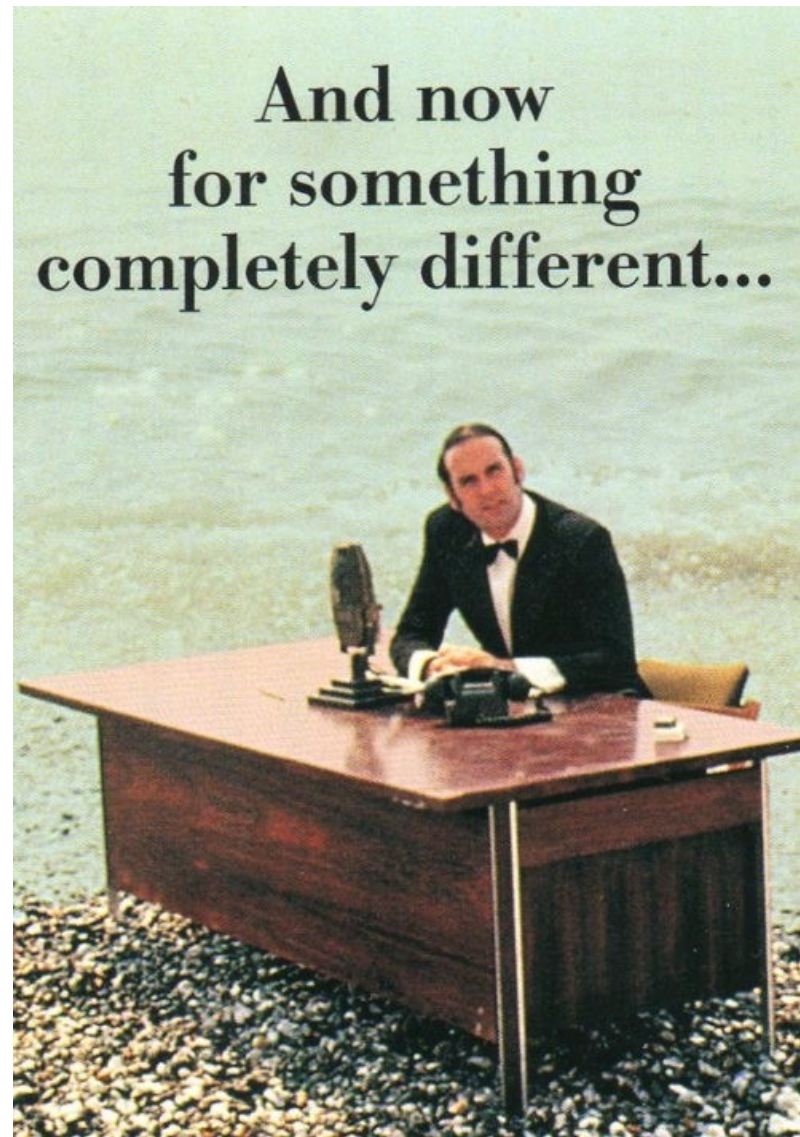
# Homebrewing for Hackers

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# What to expect?

- Here to share our interests with the community
- A break from the technical stuff
- Honestly, we are just as surprised as you are that this talk got accepted...
- Sorry no zero days...
  - You would think ;)



# Zero Day: Hacking Derbycon Talk Abstracts

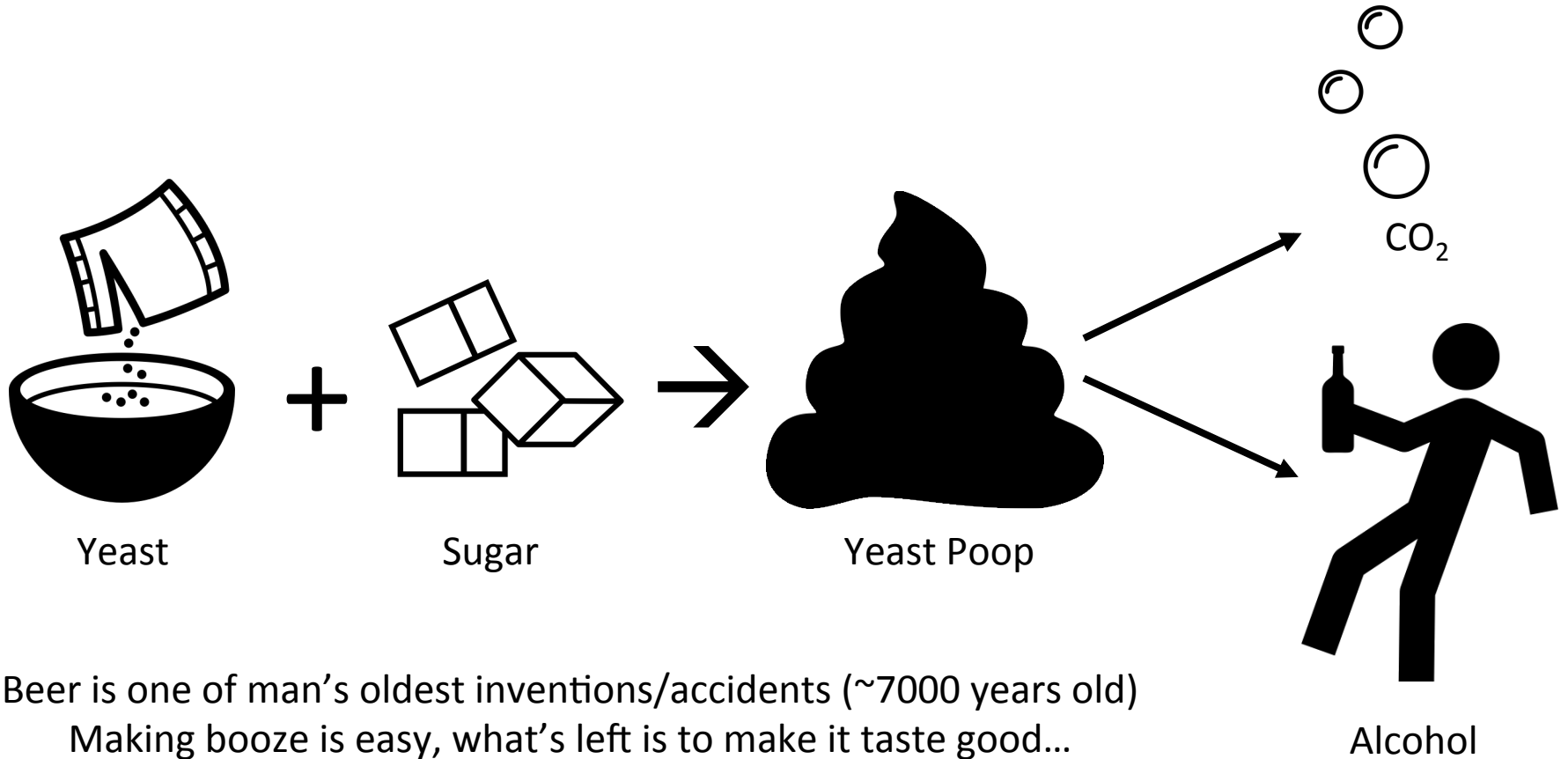
- Tell people you will give them beer for attending
- Name drop *int 0x80*
  - *Hey int 0x80 we just met you and this is crazy, but here's our talk, rap for us maybe?*
- Spend time thinking about *all* parts of your submission
  - Outline section is important too!
  - Here's ours:  
<https://www.notehub.org/2015/9/20/derbycon-50-homebrewing-for-hackers-talk>
- Don't rule out stable talks! Less competition?
- Demo something
- Better yet, open source something you demo
- Give out free stuff 😊
- Use Unicode like a *‡* (levitating boss)
- Say “yes” to Derbycon hugs (regardless if you want them)
- Don't be shy, just submit a talk and see what happens

# Talk Overview

1. Learn to make booze
2. History and legal fun
3. BrewLog project



# Beer Chemistry 101



Beer is one of man's oldest inventions/accidents (~7000 years old)  
Making booze is easy, what's left is to make it taste good...

# Disclaimer

- We are not beer experts! We are just hobbyists.
- Lots of people have lots of opinions on best practices, many people online disagree fiercely
- Always room to improve, probably better ways of doing things
- Here's what we've been doing lately...

# Step 0 – Open a beer and get organized

Bonus points  
for brewing  
with a friend!



# Step 0 – Open a beer and get organized

- Gather any equipment you might need
- Good beer starts with good ingredients
  - Time to visit your Local Homebrew Store (LHS)!
- Extract kits are easy and make great beer
  - All grain kits will require more equipment
  - Brew in a Bag (BIAB)





# Step 0 – Extract Kit Contents

Extract kit contents:

- Instructions
- Crushed grains
  - Barley
  - Wheat
  - Oats, Corn, Rye, etc.
- Liquid Malt Extract (LME)
- Dry Malt Extract (DME)
- Hops (bittering and aromatic)
- Priming sugar
  - Not used till later



# Step 1 – Sanitization!

- Make sure your equipment is clean!
- Don't use soap, it can ruin the head on your beer. Use a chemical sanitizer. Star San is awesome because it's a no rinse solution.
- Don't use abrasive cleaning pads, they may leave scratches that could harbor bacteria in the future.



# Step 1 – Sanitization!

- Anything that comes in contact with the beer after the boil step must be sanitized.
- You want your chosen strain of yeast to win, not something from the wild (it may make the beer taste skunky).
- **Sanitization is the most important step for good beer!**



# Step 1 – Sanitization!

- **Protip:** If you ever end up getting sucked into a time vortex and end up having to live in the middle ages, don't drink the water, you are probably safer drinking beer or wine...
  - Why???



Go home Doctor, you're drunk...

# Step 2 – Steeping the Grains

- Fill the pot with good tasting water (avoid adding chlorine)
  - 5 gallon batch: 2-3 gallons
  - 1 gallon batch use 1 gallon of water
  - More water results in better hop utilization and less darkening of the wort, which will make better beer
  - Some water will evaporate off, but also need to be careful of boil overs
- Heat the water to around 155°F (not boiling!)
- While you wait for the water to boil, make the smart person read the instructions!
- **Protip:** Create a timeline and label the hops in the order they will be added
  - Ben messed up the hop ordering last time because he skipped this step ☹️



# Step 2 – Steeping the Grains

- Pour your grains into the muslin grain bag



# Step 2 – Steeping the Grains

- Tie off your grain bag to the side of the pot (so you can easily take it out later).
- Steep grains for 15-30 minutes @ 155°F
- Now you basically have tea. Give it a taste!



# Step 4 – The Boil

- Remove the grain bag and discard
- Bring your pot to a boil
- Meanwhile if you have any LME let it warm up in some hot water





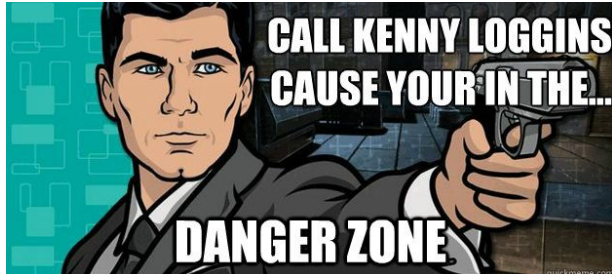
# Step 4 – The Boil

- As soon as the pot reaches a boil, remove it from the heat!
- Add your LME and DME
  - Stir well to avoid scorching on the bottom of the pot
  - Stir until fully dissolved
- You now have wort!



# Step 4 – The Boil

- Return pot to heat, and bring wort to a boil
- Watch out for boilovers!
  - Very messy and hard to clean...
  - Trust us...
- Boil for 1 hour



# Step 4 – The Boil

- Add your hops
  - Bittering at ~45 minutes remaining in the boil
  - Aromatic ~10 minutes remaining in the boil
- A food scale is handy for measuring



# Step 5 – Cooling and Aerating Wort

- Cool your wort as fast as possible to below 80°F
  - Using a wort chiller, or
  - A sink full of ice
- Remember anything that comes into contact with wort at this point must be sanitized!



# Step 5 – Cooling and Aerating Wort

- Aerate the wort
  - Pouring between two clean buckets, or
  - Stirring vigorously, or
  - Using a tank of pure oxygen, or
  - Using an aeration stone
- Pour the aerated wort into the primary fermenter



# Step 5 – Cooling and Aerating Wort

- Using sterile water, top off the wort to just under the target volume
  - Don't add too much water!



# Step 5 – Cooling and Aerating Wort

- Remove a sample and take a hydrometer reading
  - Measuring how much sugar is in our wort
- Add small increments of water to fermenter until target starting gravity, aka original gravity (OG), is reached



# Step 6 – Pitching the Yeast

- Pitch the yeast
  - Pour in a yeast starter, or
  - Add yeast started in a small bowl of sterile water for 15 minutes, or
  - Simply dumping in the contents of the dry yeast packet into fermenter
- No yeast = No beer





# Step 6 – Pitching the Yeast

- Seal fermenter with an airlock
  - Fermenter is not rated for any pressure, so need to release CO<sub>2</sub>!
- There is a potential the airlock liquid may accidentally get into the fermenter, so use:
  - Star San, or
  - Clear grain alcohol



# Step 7 – Fermentation

- Keep the fermenter in a dark area between 65-72°F
- Signs of active fermentation will be visible within the next few hours to a few days depending on the yeast
- Primary fermentation completes in 7-14 days
  - Look for no visible signs of fermentation
  - Stable hydrometer readings over a few days
- You now have (flat) beer!



# Step 8 – Secondary Fermentation

- Avoid aerating the beer after fermentation!
  - May create a cardboard or vinegary taste ☹️
- Optional re-racking to secondary fermenter
  - Use a siphon to transfer (rack) the beer to a secondary fermentation vessel for aging
  - Leave the “trub” and “krausen” behind
  - During conditioning the yeast will eat the more complex sugars and harsh flavors will smooth out
  - 2 weeks to 6 months or more
- Optional secondary additions
  - Oaking
  - Fortification
  - Fruit additions
  - Dry Hopping

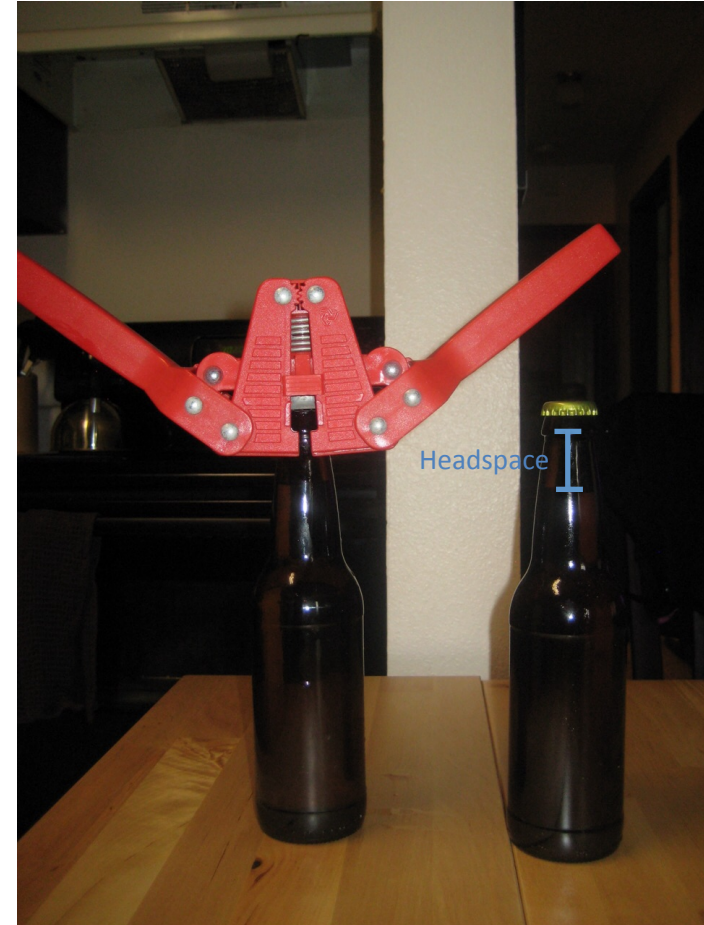


# Step 8 – Secondary Fermentation

- Take another hydrometer reading to measure Final Gravity (FG)
- Use OG and FG to compute Alcohol by Volume (ABV)
- Basic Formula
  - $ABV = (OG - FG) * 131.25$
- Alternate Formula
  - $ABV = (76.08 * (OG - FG) / (1.775 - OG)) * (FG / 0.794)$
  - More accurate for higher gravity beers
  - Difference is within a tenth of the basic formula
  - Relationship between gravity and ABV is not perfectly linear, so these equations are just approximates

# Step 9 – Carbonating

- Bottling
  - Natural carbonation using yeast + priming sugar (2-3 weeks)
  - Cheaper if you have the bottles laying around (5 gallons = ~35-45 bottles)
    - Can't recap twist-offs
  - More work to sanitize
    - Chemical sanitizer, dishwasher, oven
- Kegging
  - Forced carbonation using compressed CO<sub>2</sub> (1-3 weeks)
  - Less work than bottling, no risk of “bottle bombs” from too much sugar
  - Beer on tap!



# Step 10 – Rinse and Repeat

- Save your bottles
- Rinse
- Brew again!



# Soda, Wine, Spirits and More!

- Root Beer
- Wine, Mead (honey wine)
  - Actually less ingredients than beer!
  - More need to manage PH and health of the yeast
- ~~Distilled Spirits~~

# Prohibition – The Nobel Experiment

- Sentiment was that drinking was a nationwide scourge
  - Intense lobbying by the Anti-Saloon League, Women’s Christian Temperance Union, other “dry” advocates
- Congress ratified the Eighteenth Amendment on January 16, 1920
  - Prohibition began on January 17, 1920
  - Banned the “manufacture, sale or transportation of intoxicating liquors”
  - Not actually illegal to drink...
  - Allowed for scientific, industrial, religious uses
- Most thought it was just for “hard” liquors
  - Volstead Act was created to enforce prohibition
  - Brewing .5% ABV or higher was made illegal

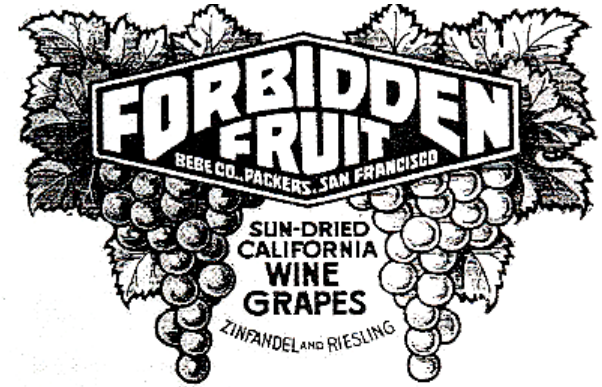




# Prohibition – Getting Creative

What do you sell to survive as an alcohol business during prohibition?

- Anheuser-Busch
  - Soft Drinks (same equipment to make root beer!)
  - Brewer’s Yeast, Malt Extracts
- Wine Vineyards
  - “raisin cakes” with warnings
  - Do not let raisins soak in water
  - Do not let juice sit in a jug for 21 days
  - Otherwise fermentation may occur



## Directions for Making Three Gallons

**S**OAK five pounds of California Dried Wine Grapes in cold water. After 12 hours run the liquid off and keep for later use.

Crush the grapes in a small mill or meat-chopper. The pulp is then soaked in water and pressed. Repeat this once more.

Put all the juices in a three-gallon crock, fill with water to the top, add two pounds of sugar and let ferment at a temperature of 55° to 65° Fahrenheit for one week.

Skim off and siphon into a cask or 3 gallon demijohn.

Cork with a vent hole bung, (a bung with a hole bored through, allowing the excess gas to escape, at the same time preventing the entrance of air), and keep fifteen days for after-fermentation.

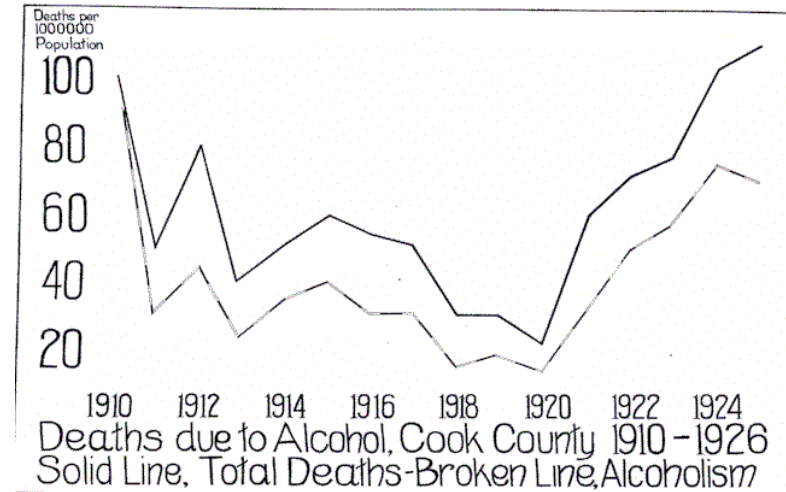
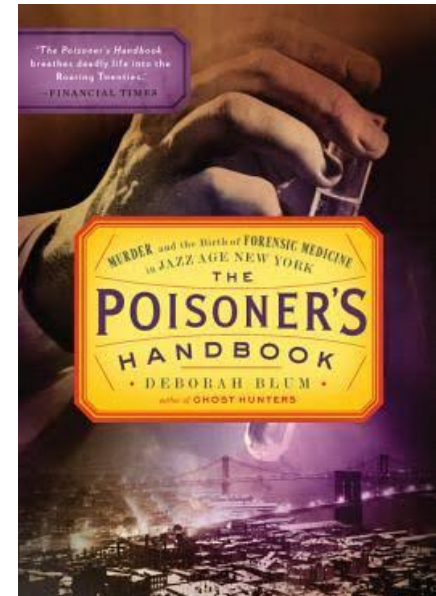
Add the beaten whites of two eggs for clarifying.

Bottle, then immerse bottles with the mouth only projecting in a large vessel of water. Loosen the corks and heat the water to a uniform temperature of 180° Fahrenheit. Then remove the bottles, cork and seal tightly and place in an inverted position in the cellar.

# Prohibition – Dangers

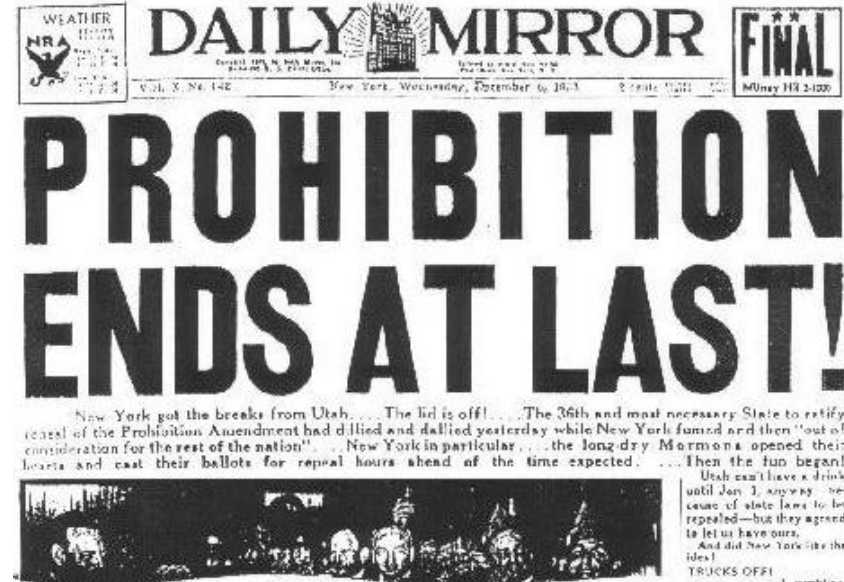
Will drinking homebrew make me go blind?

- Wood alcohol (methanol) is incredibly toxic to humans (metabolizes into formaldehyde)
  - Made by distilling wood
  - Tastes just like alcohol (ethanol)
  - Used as a denaturing agent for industrial ethanol
  - Was produced and sold underground during the prohibition as booze
- Chemists game of denaturing and renaturing industrial alcohol
  - If you were wealthy you drank with the chemists
- During prohibition there was only an underground market for the “hard stuff”
  - If you drank something bad, you drank a lot of it...
  - Drinking rose to record levels during prohibition (including women and children)



# Homebrewing Today

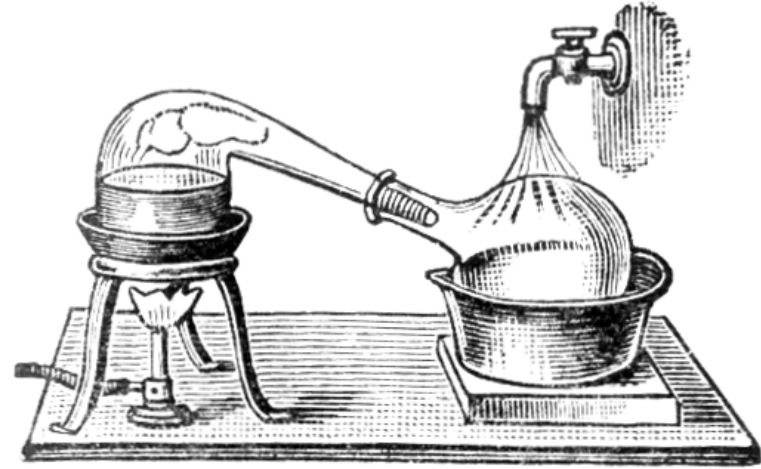
- [Brewing is legal in all 50 states!](#)
  - State laws vary widely
  - Alabama and Mississippi legalized homebrewing in 2013
  - Limit 100 gallons per year per person, up to 200 gallons per household
  - Homebrew cannot be sold
- [Need a license to own or operate distillation equipment](#)
  - Subject to taxation
  - Apparently not too hard to get a license...



- 21<sup>st</sup> Amendment (1933): Repeal Prohibition
- 20<sup>th</sup> Amendment (1933): Presidential term ends Jan.
- 19<sup>th</sup> Amendment (1920): Women Vote
- 18<sup>th</sup> Amendment (1919): Prohibition

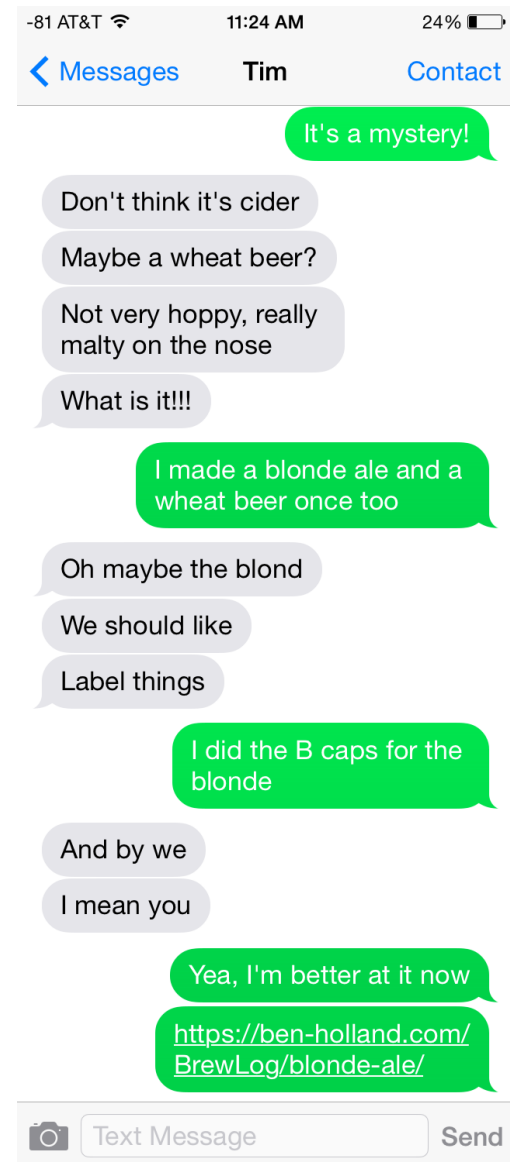
# Legal Challenge

- If you can't legally “distill” alcohol, how else could you create hard liquor?
  - Not legal advice! You could probably still get in trouble...
    - <https://homebrew.stackexchange.com/questions/2813/distillation-legality>
  - Freeze Concentration ~15-90%
  - Artificial Yeast Selection ~20-25%

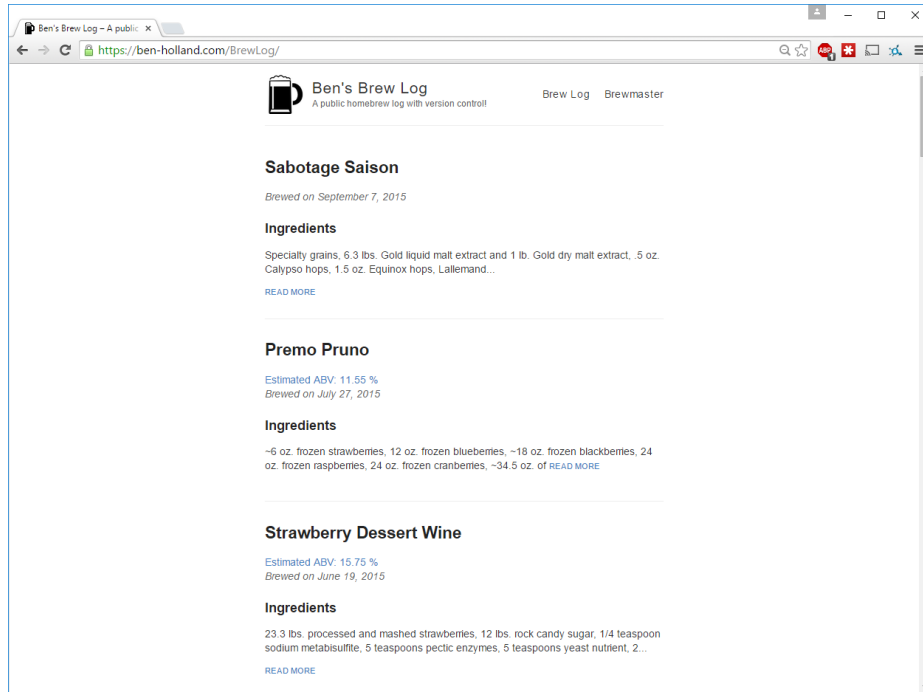


# BrewLog

- “We need a better system”
- BrewLog
  - Publicly log homebrew measurements
  - Automatically computes alcohol content
  - Version controlled (git)
  - Free web hosting (Github Pages)
  - Deploys in ~5 minutes (just fork and edit project)
  - Simple to edit (Markdown)
  - Clean/simple theme (Jekyll-Now)
  - Supports custom domains (CNAME records)
  - Customizable

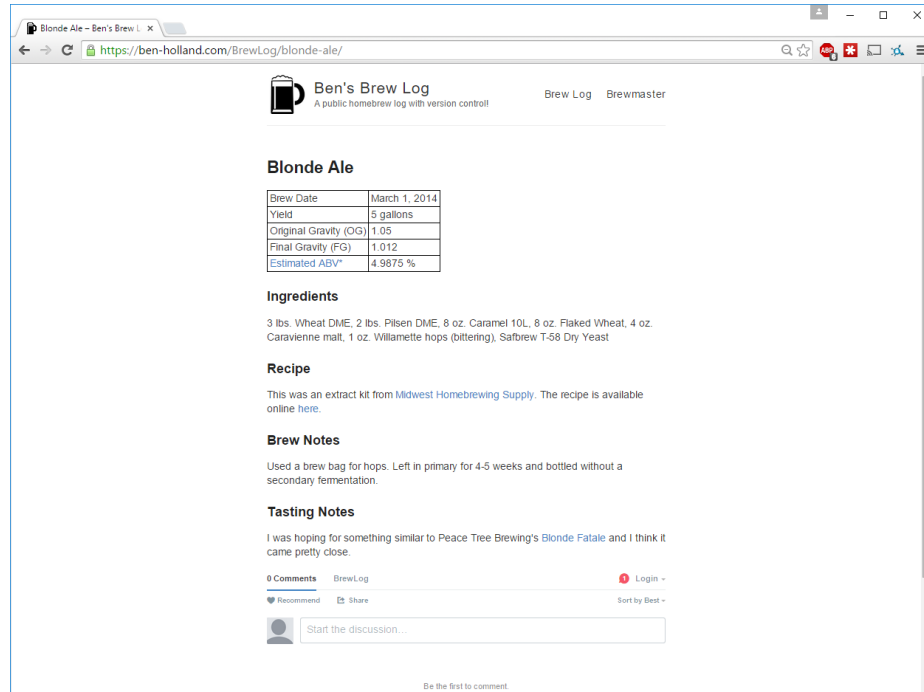


# BrewLog



The screenshot shows the main page of the BrewLog website. The header includes the site logo and navigation links for 'Brew Log' and 'Brewmaster'. The main content area lists three beer entries:

- Sabotage Saison**: Brewed on September 7, 2015. Includes an 'Ingredients' section with details on specialty grains and hops.
- Premo Pruno**: Estimated ABV: 11.55%, Brewed on July 27, 2015. Includes an 'Ingredients' section with details on frozen berries.
- Strawberry Dessert Wine**: Estimated ABV: 15.75%, Brewed on June 19, 2015. Includes an 'Ingredients' section with details on processed strawberries and yeast.



The screenshot shows a detailed view of a 'Blonde Ale' entry on the BrewLog website. The header is the same as the main page. The entry details include:

- Blonde Ale**: Brewed on March 1, 2014.
- Yield**: 5 gallons.
- Original Gravity (OG)**: 1.05.
- Final Gravity (FG)**: 1.012.
- Estimated ABV\***: 4.9875 %.
- Ingredients**: 3 lbs. Wheat DME, 2 lbs. Pilsen DME, 8 oz. Caramel 10L, 8 oz. Flaked Wheat, 4 oz. Caravienne malt, 1 oz. Willamette hops (bittering), Safbrew T-58 Dry Yeast.
- Recipe**: This was an extract kit from Midwest Homebrewing Supply. The recipe is available online here.
- Brew Notes**: Used a brew bag for hops. Left in primary for 4-5 weeks and bottled without a secondary fermentation.
- Tasting Notes**: I was hoping for something similar to Peace Tree Brewing's Blonde Fatale and I think it came pretty close.

At the bottom, there is a comment section with a 'Login' button, 'Recommend' and 'Share' options, and a text input field for starting a discussion.

Deploy your own BrewLog: <https://github.com/benjhollla/BrewLog>

# Questions?

- Thank you!
- Hacking + Brewing = Win!?
  - BruCon
  - Thotcon

Slides: [ben-holland.com/publications](http://ben-holland.com/publications)  
[amberaldrich.com/publications](http://amberaldrich.com/publications)