

COMP 180

Software Engineering

Chocolate

Spring 2020

Introduction

- Chocolate is the most delicious food in the universe
 - 2017 stats:
 - 15 billion pounds of chocolate eaten per year, worldwide
 - Average US consumption 9.7 lbs per person per year
 - (Compare to 19.4 lbs per person per year in Switzerland!)
 - At least \$83 billion in sales worldwide per year
- But where does this wondrous food come from?
 - And how does it work?

Theobroma Cacao

- *Food of the Gods*
 - Literal translation of scientific name
- Cacao trees grow in tropical regions
 - 70% grown in West Africa
 - There are real ethical issues to cacao farming (search the web)
- Farmers sell cacao beans
 - Cacao pods contain beans in a goopy white pulp
 - Beans + pulp fermented for a few days
 - Beans are then dried and shipped



<https://commons.wikimedia.org/wiki/File:Matadecacao.jpg>

Cacao Beans to Chocolate Liquor

1. Beans cleaned/pasteurized (steam+pressure)
2. Beans roasted (like coffee) to reach desired flavor
3. Shells removed, leaving behind *cocoa nibs* (below)
4. Nibs ground to a paste
 - Result: *chocolate liquor*
 - Not alcoholic!
 - A fluid with solids and fat
 - Two options next
 - Separate out the cocoa butter
 - Use cocoa butter in cosmetics and to make other chocolate richer
 - Make chocolate!
 - (Chocolate usually made from beans of different origins, mixed to get the right flavor)



Bitter Chocolates

- Chocolate liquor mixed with other ingredients
 - Almost always, with extra cocoa butter to make richer
 - Less desirable beans used for cocoa butter
 - Cocoa butter is deodorized before being used elsewhere
 - Note: chocolate chips have *less* cocoa butter so they keep their shape in cookies
- Pure chocolate liquor = unsweetened chocolate
 - Tastes quite bitter, not very fun to eat
 - Sometimes called “baking chocolate”
- Bittersweet chocolate = ~70% cacao, 30% sugar
 - Often has vanilla, lecithin added as well
- Semisweet chocolate = ~55% cacao, 45% sugar
 - (Also has vanilla, lecithin)

Milk Chocolate

- Problem with adding milk to chocolate:
 - Chocolate is a very dry food
 - If you add water to something dry and powdery, it clumps!
 - ⇒ If you add a little bit of milk to chocolate, it seizes
 - Becomes a sticky, clumpy mess
 - Only thing you can do is add a lot more liquid to it and make an emulsion
- 1867: Henri Nestlé develops powdered milk for infant formula!
- 1876: Daniel Peter adds Nestlé's powdered milk to chocolate to get the first milk chocolate
- (Good) Milk chocolate = ~38% cacao, plus powdered milk, sugar, vanilla, lecithin

White Chocolate

- No cacao solids!
 - That's why it's not brown
- Ingredients: Cocoa butter, powdered milk, sugar, etc.
- Look for a high cacao % amount (i.e., a lot of cocoa butter)
- Without the bitter cacao solids, white chocolate is quite sweet...

Three Chocolates



Left to right: 70% bittersweet, 38% milk, 31% white

Chocolate Crystallization

- Cocoa butter can *crystallize* into a solid in many different ways
 - Commonly referred to as I, II, III, IV, V, VI
- There's a problem in terms of taste:
 - Form I is unstable and changes to form II
 - Form II changes (more slowly) into forms III and IV
 - Forms III and IV are firm, but
 - Little “snap” when you bite into them
 - Both will “bloom” over time — (whitish) fat separates from solids
 - Form VI is good, but takes a long time to form
- ⇒ When solidifying melted chocolate, need to make form V crystals

Tempering Chocolate

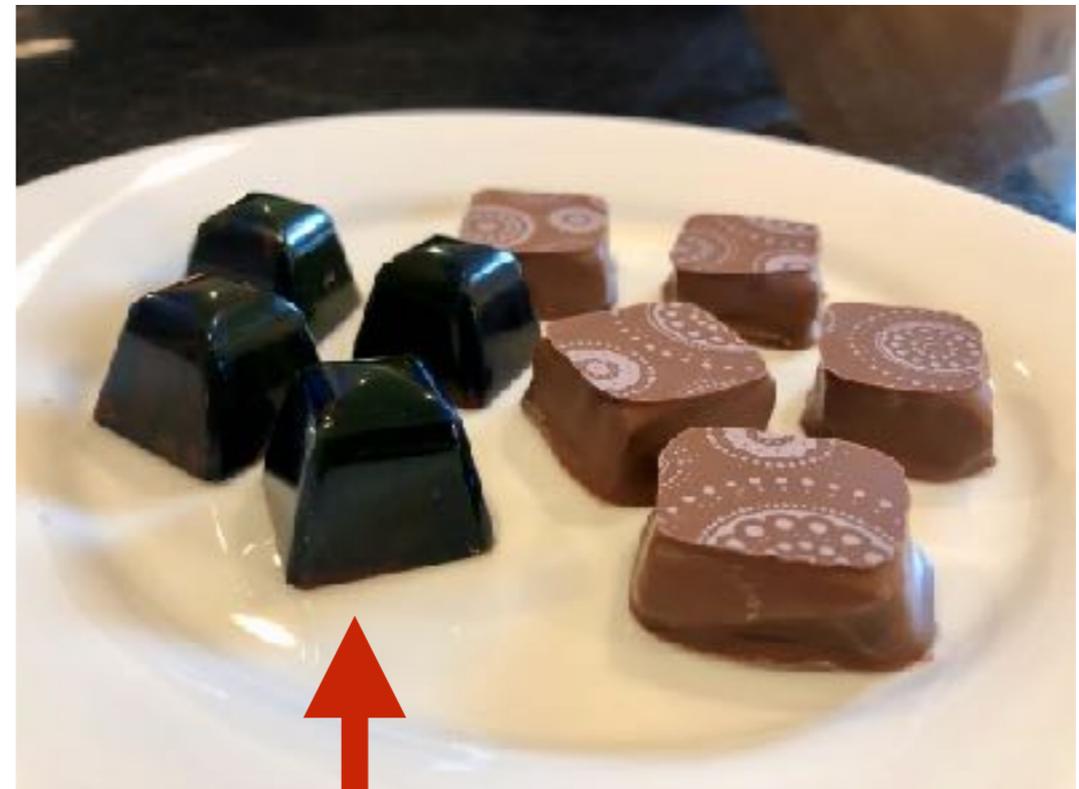
- First, heat chocolate so all crystals melted
 - 108°F for bittersweet usually works
 - Be sure not to burn the chocolate (don't go above 115°F)
- Then, to solidify it:
 - Method 1 (“Tabling”): Pour 2/3 of the chocolate onto a room temperature marble slab; fold chocolate over itself using a scraper or palette knife until it becomes thick, around 84°F; put back in the bowl and mix, aiming for 91°F or less
 - Idea: Form lots of crystals (folding), then melt away the bad ones (by adding back to the 1/3 chocolate)
 - Method 2 (“Microwave”): When melting chocolate, use a microwave, and heat so only 2/3 is melted; then remove and stir until all melted
 - Idea: The 1/3 unmelted chocolate is *seed* for the crystal form
 - Method 3: Buy a chocolate tempering machine!

Chocolate Truffles

- Ingredients
 - 4.5oz bittersweet chocolate
 - 4oz heavy cream
 - 1/2 ounce corn syrup
 - 1/2 ounce softened (not melted) butter
 - Pinch of salt
- Melt chocolate and cream in microwave gently
- Let cool to 85-95°F and add remaining ingredients
 - Now you have a *ganache*
- Let cool until you can roll it by hand into balls
- Dip in tempered chocolate or coat with cocoa powder or powdered sugar

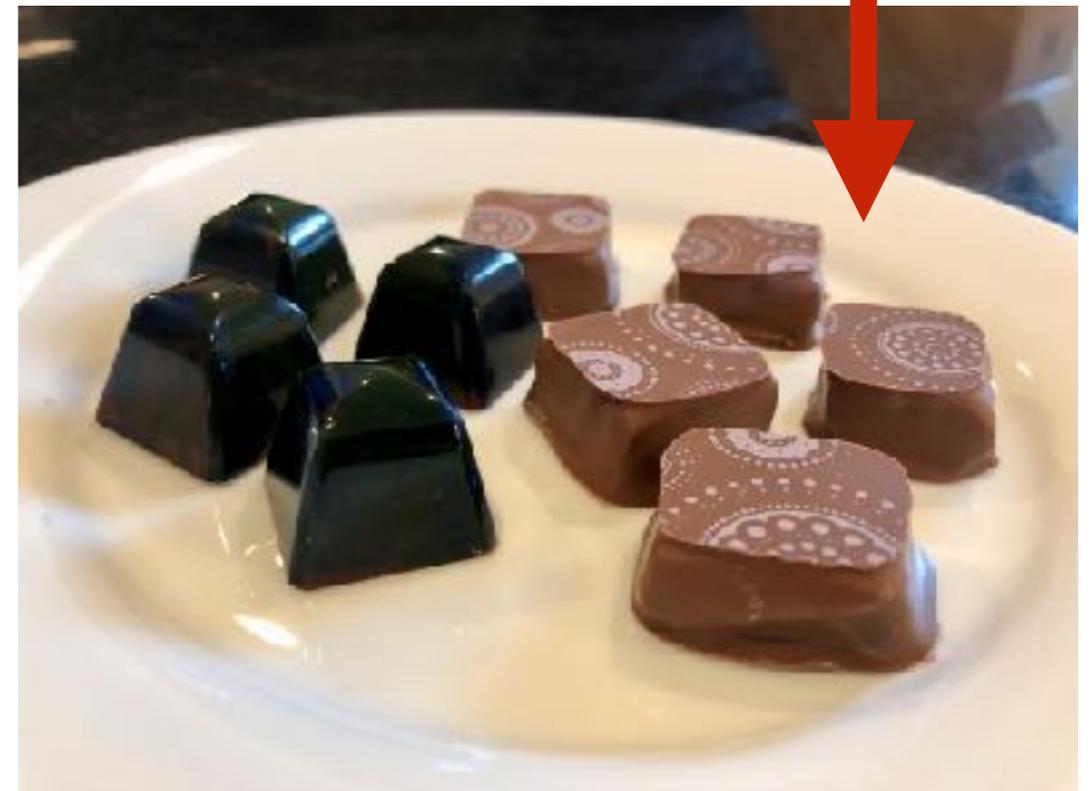
Molded Chocolates

- Directions
 - Pour tempered chocolate into molds, then pour out, leaving a shell to set
 - Optional: decorate molds with colored cocoa butter first
 - Fill shell with ganache, leaving 1/8-inch at top
 - Fill remaining shell with tempered chocolate to form bottom



Hand-Dipped Chocolates

- Directions
 - Pour ganache into square pan lined with plastic wrap
 - Cool in refrigerator (2 hours) or freezer (30 mins)
 - Remove, coat one side with melted chocolate to form “foot”
 - Cut into squares
 - Dip squares in tempered chocolate
 - Optional: Decorate with transfer sheets



For More Information

- Andrew Shotts, *Making Artisan Chocolates*. Quarry Books, 2007.
- Peter Greweling, *Chocolates and Confections*. Wiley, 2010.