DOX and Pizza

AF01–DoE and Pizza

- The trick to creating your perfect piece of pizza is to find the right combination of ingredients and styles that satisfy your expectations. What to do? Make your own. The session will cover tips in replicating “real” New York-style pizza via a not-so-heavily statistical pizza analysis design of experiments (DOE). Mr. Pizza promises that if attendees are “left empty” by the data, there will still be a real slice, or two, to for the taking.

Session Leader

- Elías Monreal is Quality Manager at Industrial Tool Die and Engineering, Senior member of American Society for Quality (ASQ), chair of Tucson Old Pueblo Section (TOPS) 0707, currently holds five ASQ certifications: CMI, CQT, CCT, CQA, CSSGB, and preparing for June’s CQE. Elías is also a fourth year Arizona Quality Alliance (AQA) Examiner for Arizona’s State Quality Award based on the Baldrige Criteria.
  - Makes a wicked pie.
Outline

- Caveats and Disclaimer
- Background
  - Problem Statement
- Cause and Effect Diagram
  - Dough
  - Sauce
  - Cheese
- Serving
- Shortcut Method(s)
- Summary
- Bibliography

ASQ 2008 WCQI
Caveats and Disclaimer #1

- Are they are Pizza Executives from Pizza Hut, Roundtable, Shakey’s, or Domino’s here today?
Good because we are *not* going to discuss trade secrets or how to mass produce 100 pizzas per day for DPMO or MTBF. Just handcrafted small batches that would *not* impact on market share.
Caveats and Disclaimer #2

- This is not a heavily statistical analysis of pizza on Design of Experiments (DOX). Rather an entertaining, creative, novel approach in causal analysis to identify variables and optimize outcomes.

- If you feel cheated, I’ll buy you a slice of pizza and we’ll call it even.

- The term DOX will be utilized vs. DOE. No disrespect to Genichi Taguchi but I believe acronym is incorrect. Ten years ago, I really believed DOE and FMEA were governmental agencies within ASQ? As comedian, Jerry Seinfeld might say, What’s The Deal with…ANOVA(Analysis of Variance), why isn’t it AOV?
Caveats and Disclaimer #3

- The results of these DOX activities will *not* be analyzed or graphs projected using computer software programs like JMP/SAS, DOE KISS, MINITAB, or Excel.

My subjective qualitative results on making a great slice of pizza is the final outcome. Before starting any DOX project, let’s modify master carpenter, Norm Abram’s safety monology:

- Before we use any quality tools, let's take a moment to talk about shop safety.
- Be sure to read, understand, and follow all the quality rules that come with your statistical package.
- Knowing how to use your statistical tools properly will greatly reduce the risk of personal injury.
- And remember this: there is no more important safety rule than to wear these - pocket protector. Trust me, they are making a fashion comeback.
Caveats and Disclaimer #4

- We will be discussing a thin NY style pizza and no in depth discussions of Chicago deep dish, Sicilian style, Mexican tortilla, French bagé(Mexican bolillo/torta), Greek, pan styles, cheese in crust, cheese in side, or stuffing a pizza into a pizza. We’ll be discussing my replication of an oversized, hand-tossed, thin, light, and minimalistic approach to pizza. Presentation Disclaimer, as modified from Michael Feldman's “Whad'Ya Know?;
  - All research on 'DOX and Pizza' has been painstakingly researched, eaten, and enjoyed, although the statistics may have not.
  - Ambiguous, misleading or poorly calculated statistics are par for the course.
  - Listeners who are sticklers for the truth should get their own presentation.
  - Elias’ pizza opinions are well-reasoned and insightful. Needless to say, they are not those of ASQ or TOPS. Anyone who says otherwise is itching for a fight.
Nothing beats eating a slice of hot, gooey, cheesy, fresh pizza…except maybe a homemade slice, that would be nice. The only deterrent is the various combinations/permutation in the varieties of ingredients and techniques.

During supplier audits to east coast, I cannot resist a slice of heaven; however, the best slice in Tucson doesn’t come close to worst NY slice. Enclosed are my experiments, experiences and tips in trying to replicate “real” New York style pizza from the pizza capital of the world: Tucson, Arizona.

Pizza definition according to Encyclopedia Americana(2007); a flat, open-faced pie of Italian origin, consisting in its basic form of bread dough covered with tomato sauce, cheese, layer of garnishes and baked in a hot oven. The crust is generally thin and crisp, although there are also thicker varieties.

Greeks, not Italians made first pizzas until unique 15th century, New World ingredient – tomatoes.
Problem Statement

- How to make GREAT tasting pizza?
- First, the Holy Trinity (Dough, Sauce, Cheese) must be correct. What makes you think adding additional toppings is going to make the pie any better? Once the foundation is done correctly, use whatever pizza style, sauce or topping you prefer.

In The Thermodynamics of Pizza, Harold Morowitz wrote, “To a first approximation of an uncooked pizza consists of an array of three cylindrical disks: A, B, and C. Disk A is made of yeast-flour dough and is of thickness $\alpha$. Disk B is made of largely of tomato paste and is of thickness $\beta$. Disk C is made of mozzarella cheese and is of thickness $\gamma$. In general $\alpha > \beta > \gamma$. The uncooked trilamellar pizza is rapidly placed in an effective infinite isothermal reservoir at 533K (500°F).”

- This reminds me, why engineers should not write cookbooks:
Problem Statement

Chocolate Chip Cookies

**Ingredients:**

- 532.35 cm$^3$ gluten
- 4.9 cm$^3$ NaHCO$_3$
- 4.9 cm$^3$ refined halite
- 236.6 cm$^3$ partially hydrogenated tallow triglyceride
- 177.45 cm$^3$ crystalline C$_{10}$H$_{22}$O$_{11}$
- 177.45 cm$^3$ unrefined C$_{10}$H$_{22}$O$_{11}$
- 4.9 cm$^3$ methyl ether of proto catechuic aldehyde
- Two calcium carbonate-en-capsulated avian albumen-coated protein
- 473.2 cm$^3$ theobroma cacao
- 236.6 cm$^3$ de-encapsulated legume meats (sieve size 10)

**Directions:**

To a 2-L jacketed round reactor vessel (reactor 1) with an overall heat transfer coefficient of about 100 BTU/°F-ft$^2$-hr, add ingredients one, two and three with constant agitation.

In a second 2-L reactor vessel with a radial flow impeller operating at 100 rpm, add ingredients four, five, six and seven until the mixture is homogenous. To reactor 2, add ingredient eight, followed by three equal volumes of the homogenous mixture in reactor 1. Additionally, add ingredient nine and ten slowly, with constant agitation.

Care must be taken at this point in the reaction to control any temperature rise that may be the result of an exothermic reaction.

Using a screw extrude attached to a £4 nodulizer, place the mixture piecemeal on 316SS sheet (300 x 600 mm).

Heat in a 460K oven for a period that agrees with Frank & Johnston’s first order rate expression (see JACOS, 21, 58), or until golden brown. Once the reaction is complete, place the sheet on a 25°C heat-transfer table, allowing the product to come to equilibrium.
Dough

- Could perform DOX on dough; salt, sugar, oil, flour, yeast, and water.
- Let’s review pizza’s classification in Flat Bread Technology by Jalal Qarooni:

Classification of Flat Breads

- Single-Layered
  - Leavened (sourdough or yeast)
  - Unleavened (chemically leavened)

- Double-Layered (leaveded, sourdough or yeast)
  - Pita (Arabic)

- Dough
  - English muffin
  - Ciabatta/Focaccia
  - Naan/Toodor/Tandoori
  - Pizza Crust

- Batter
  - Pancake
  - Blintzes
  - Crepe
Dough

Salt/Sugar

- Counterintuitive to place salt or sugar but balances yin & yang of taste buds.
- Salt/Sugar aid in colour development and flavor.
- If you add too much salt you kill the yeast but add too little and yeast grows rampant and will exhaust themselves too quickly.

Salt/Sugar Tips, Hints:

- Experiment with Sea Salt. It melts well, imparts great flavor and less iodized aftertaste than table salt.
- Experiment with honey rather than granulated sugar for honey-wheat dough. The caramelization from honey results in a rich golden brown crust.
Dough

**Shorting or Vegetable Oil**

- Used to improve dough handling properties and impart flavor:
  - oils; olive, soybean, or cottonseed
  - fats; butter, lard, margarine, or shortening

**Shorting or Vegetable Oil Tips, Hints:**

- Personal preference: distinctive fruity Olive oil
- Oil inside of bowl and place dough inside while resting/rising.
Dough

**Flour** (bread, all purpose, wheat, pastry, semolina)

- One can perform DOX on flour types; bread (12-14% protein), all purpose (10-12% protein), pastry (6-8% protein), Rye (6-8% protein), Semolina (milled Durum wheat), cornmeal, barley, sourdough, whole wheat, rice, or soya.
  - Master bread flour before experimenting with other flour types.
- Stay way from bleached white flour, as bleaching process imparts flavor.
- Be mindful of moisture/protein content, as this will change from lot to lot.
- Unfortunately, it takes 4hrs to overnight for dough to rests and rise!!
  It is well work the time/effort in creating flavor and texture.
Flour Tips, Hints:

- High protein content translates to higher gluten which results in larger bubbles and air pockets in dough. Preblended bread flours will give great results and in a pinch All-Purpose will work. Purchase organic grocer’s flour with the highest protein content to produce strong, elastic and airy dough. High protein content reduces absorption of sauce into dough thus crisp crust; however, low protein content has less shrinkage but good chewiness.

- Personal preference: 50% bread and 50% Semolina, but you experiment.

- Personal preference: food processor rather than hand or electric mixer.

- Use 9-3 o’clock position and hand stretch inside/out rather than rolling dough

- 2008 Guinness Book of World Records: Tony Gemigani spun 17.6oz(500g) of dough for two minutes to form a pizza base measuring 2.77 ft(0.84 m); Joe Carlucci, set the record for highest pizza-base toss using 20oz(567g) of dough, achieving a height of 21.42 ft (6.52m)
### Dough

**Leavening Agent** *(Sourdough, bacteria, yeast, mold, chemical agent)*

- Sourdough yeast or dough starters are a time consuming adventure.
- Place some type of leavening agent, such as baking soda, baking powder, or yeast. As leavening agents are activated and begin to eat the sugars from dough, they produce alcohol and carbon dioxide. The alcohol imparts favoring and carbon dioxide to create the texture and produces air bubbles inside the dough.
- They should be allowed to rest and rise in warm, moist environment. If not possible, could place in frig but let rest overnight. For maximum texture, be patient, let dough rest and rise. This produces light airy dough.

### Yeast Tips, Hints:

- Ensure water temperature at 100-110°F (warm bath water) when adding to yeast. Any colder/hotter and yeast will be compromised or will not activate.
**Dough**

**Water** (distilled, reverse osmosis, diaphragm, aquifer filtered, mineral, UV, spring)

- Used Tucson’s blended tap water consisting of allocated Central Arizona Project (CAP) blended Colorado River and groundwater got me to thinking about using distilled or bottled water. Using distilled water made for a pretty bland pie. Great success using Evian bottled water, until I learned Aquafina (Pepsi®) and Dasani (Coke®) are both bottled filtered tap water.
  - Ok you conspiracy theorist, spell Evian backwards and you get… Naïve.

**Water Tips, Hints:**

- Instead of water use your favorite beer. It works for bread, it works great for pizza. The only drawback it takes 8 hrs to rest/rise but well worth the wait.
- Future Analyses: What does Italian tap water taste like and chem-signature???
INGREDIENTS

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Ingredient</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 cup</td>
<td>Warm water(100°F)</td>
</tr>
<tr>
<td>1</td>
<td>Package dry yeast</td>
</tr>
<tr>
<td>1.5 cup</td>
<td>Water (beer)</td>
</tr>
<tr>
<td>2 tbsp</td>
<td>Olive oil</td>
</tr>
<tr>
<td>2 tbsp</td>
<td>Semolina flour</td>
</tr>
<tr>
<td>±4 cups</td>
<td>High Gluten/Bread</td>
</tr>
<tr>
<td>1 tbsp</td>
<td>Salt</td>
</tr>
<tr>
<td>1 tbsp</td>
<td>Sugar</td>
</tr>
</tbody>
</table>

DIRECTIONS

Mix cup of warm water and yeast; let stand until yeast dissolves and frothy, about 5 minutes. Add remaining water and olive oil.

Meanwhile, pulse flour and salt/sugar in processor to combine. Add liquid ingredients (holding back a tablespoon or so) to flour and pulse together. If dough does not readily form into ball, add remaining liquid, and continue to pulse until ball forms.

Turn dough onto lightly floured work surface; knead by hand with a few strokes to form smooth, round ball. Put dough into, oiled bowl, cover with damp cloth and leave at room temperature. Let rise, about 60 minutes and punch down dough. Now ready to stretch to size.

Turn dough out onto lightly floured work surface. Pizza peel that has been lightly coated with semolina, brush dough very lightly with olive oil before topping and cooking.

Based: American Test Kitchen
Sauce

- Could easily perform DOX on sauce: thick sauce, thin sauce, whole/diced canned or fresh tomatoes (Is it a vegetable or fruit?), number of garlic cloves, spices, cook for 1 hour, 4hrs or place in crock pot overnight, etc.

- Thin or Thick sauce, is similar to the infamous Taste Great or Less Filling debate. Some folks prefer a strained and thinned sauce rather than thick and rustic sauce.

- Personal Preference: buy Italian preblended spices. For example, Emeril® is very good but avoid Mrs.Dash® or any blend that contains pepper flakes. The peppers give the sauce an almost chili-bean overtone. These blends take the “guess” work of buying/storing/measuring spices by adding a small handful of this and a small handful of that…you know the mad scientist approach.

- After you’ve master the tomato-based sauce, experiment with other sauces:
  - sauces; pesto, alfredo, BBQ, or herb/garlic olive oil.
Sauce

Recipe:

**INGREDIENTS**

- 1 Large Onion
- 1 Bell Pepper
- 1 Celery
- 1 Carrot
- 3 Pressed Garlic cloves
- 2 tbsp Olive Oil
- 2 28-oz can tomato
- Blended Spices
- Salt/Paper to taste

**DIRECTIONS**

1. Finely Chop vegetables
2. Place olive oil in pan, over medium-high heat.
3. When hot, place garlic until aroma is released.
4. Sauté aromatics, simmer until onion is translucent.
5. Place can of diced tomato with juice. Season with blended spices (oregano, basil, parsley, thyme, rosemary, marjoram, sage) and salt/pepper to taste. Lower heat and simmer for 30 minutes.

**Optional:**

Let sauce cool down and puree, but I prefer to cook sauce until melted. This produces an intensely flavorful and rustic sauce.
Sauce

Sauce Tips, Hints:
- Buy a garlic press for dicing garlic
- Personal preference: Hunt’s Diced Tomatoes® that contain aromatics.
- Why is it my sauce recipe smallest batch is a whole pot!!! Somehow, I can’t make “small” portions. Very much like I can’t make less than one sheet of lasagna. It either comes out too dry, wet or not enough cheese?
- Freeze and use culinary concoction like Cuban Sofrito or French Mirepoix.

Spaghetti sauce  Ground beef/turkey + mushrooms + red wine
Sloppy Joes     Ground beef/turkey + tomato paste
Chili          Meat(ground turkey, chicken, beef, tofu) + kidney/red/great northern/pinto beans + beer
Jambalaya      Meat(sausage, chicken thighs, shrimp) + clam juice + rice
Gumbo         Meat(chicken, smoked turkey sausage or andouille) + roux + okra

basis for various dishes; Stocks, Soups, Stews, Rice(Dirty/Mexican) & Sauces
This is no time for you lactose intolerant folks. We need cheese and lots of it!!

Please be kind to your pizza and don’t add too much toppings/cheese, as this will increase the moisture in dough and decrease the “crunchy” texture.

I even flew in cheese from Wisconsin with the premise that cheese has higher fat/cream content and “fresher” than my local Tucson inventory…not true.

I’ve learned…use whatever cheese blend you enjoy; Cheddar, Colby, Danablu, Feta, Fontina, Gouda, Gorgonzola, Gruyere, Monterey Jack, Munster, Mozzarella, Provolone, Ricotta, Parmesano-Reggiano, Swiss, etc.

I’ve had mild success with pre-shredded Italian blended cheese mix.

**Cheese Tips, Hints:**

- Place cheese in freezer and cut in large cube chunks rather than grating.
- My personal bias; Oaxaca or Chihuahua(Mennonita) to get that creamy, soft, mild cheese taste that melts uniformly.
Garnishes

- Additional toppings: **meats**; anchovies, chicken, clams, bacon, ground beef, ham, meatballs, pancetta, pepperoni, prosciutto, sausage, salami, shrimp, soy, tuna, **vegetables**; artichoke hearts, broccoli (what?), bell peppers, eggplant, garlic, jalapeños, mushrooms, onion, piñon nuts, spinach, squash, tomatoes, zucchini, **spices**; basil, chives, cilantro, marjoram, oregano, parsley, rosemary, sage, thyme, **sauces**; pesto, alfredo, BBQ, or herb/garlic olive oil.

**Garnish Tips, Hints:**
- Prior to placing toppings, use fork/roller to punch holes and top with olive oil
- Whatever you place on pizza, it must cook in 10 minutes.
  - Don’t overload fresh veggies, adds moisture and results in soggy toppings.
  - Make mini-pizzas with various toppings for your next party
- Be creative with blank canvas.
Garnishes

Favorite Toppings:

- **Don Elias**: XX® dough, Beef Chorizo, Mixed Peppers (red/yellow bell, Anaheim, Jalapeños), Oregano, Oaxaca
- **Curds and Whey**: Mozzarella, Brie, Camembert, Roquefort, Gorgonzola, Havarti
- **Difbulator**: dough (parsley, basil, oregano), Ground Beef, Panchetta, Proscuitto, Pepperoni, Ham, Sausage, Cheese
- **Hawaii Five-O**: Ham, Pineapple, Cheese
  
On a pizza, ham and pineapple is an abomination and blasphemy…but friends seam to like it.
- **It’s All Greek to Me**: Thyme infused dough, Lamb, Mixed depitted Olives (Purple/Green/Black), Feta
- **Herbivore**: Sun-dried Tomatoes, Mixed; Mushrooms, Peppers, depitted Olives, Boca ground beef, Onions, Brie
- **Justin Wilson’s “I GARONTEEE!”**: Boudin, Andouille, Okra, Tabasco, Zatarain's spices, Cheese
- **Pizza’eh**: Moosehead® dough, Back Bacon (Canadian Bacon), Mixed Mushrooms, Sharp Aged Cheddar
- **Trumped**: Lobster, Caviar, Truffles, Brick, Camembert, Blue
- **Glutton Free Gluten**: White Rice, Tapioca Flour, crumbled Gardenburger® Veggie Medley, cheese
- **Le Desserte**: spice dough (vanilla, cinnamon, nutmeg), Mascarpone, Mixed berries in liquor (Cognac or Rum),

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Baking

- Verify oven temperature variance with thermometer.
- Heat too high causes pizza to burn but cook to low and pizza will not be crunchy.
- Sprinkle your pizza stone/paddle with a liberal amount of Semolina or Cornmeal.
- Experiment with placing pie on outdoor grill with mesquite wood chips for added flavor.
- 425°F for flour/wheat and 450°F for sourdough
  - Max 10 minutes!!!
Baking Tips, Hints:

- Line bottom layer of oven with stone/tile. This will give you a constant temperature and crispest crust/texture. Rich Dad would say, trust me on this one don’t skimp on this item, invest in baking stone from Pampered Chief®. Poor Dad would say buy the thickest unglazed clay or terra cotta quarry tiles(six 6x6). Buy case(30 tiles) and replace as needed. Also don’t waste time to clean tiles with soap, just scrape off bits and wipe clean with water. Why shouldn’t you use soap to clean tiles? This is the same theory behind not cleaning grill in removing the “bits” molecules. As it affects taste and besides the stained tiles builds character. The BBQ grill masters and I have something in common.

- Preheat the oven with stone/tile to 425°F for thirty minutes.

- Rich Dad would buy Wooden Peel to get loaves of bread or pizza in/out of oven. Poor Dad would use parchment paper on inverted rimless baking sheet.
Serving Tips, Hints:

- Drizzle a little olive oil on hot pizza for added flavor and moistness.
- Invest in large metal pizza serving dish and use pizza cutter for slices.

In The Thermodynamics of Pizza, Harold Morowitz said it best, “The melted mozzarella layer...is the obvious source of trauma to the roof of the mouth and from the point of view of medical physics is clearly the key agent in the etiology of pizza burn.” Caution: Pizza is Hot!!!

- Beer pairing: Molson Ice® (light beer), Dos Equis XX® (Lager-green bottle), Bass® (dark beer)
- Wine pairing: Ruffino Chianti Riserva® (red), Chardonnay or Chablis
- Other paring: Arugula salad or watching playoffs for Lord Stanley’s Cup
Shortcut Method

- It’s 1am, your back from long night; preparing your organization for an ISO Registration Audit, Viking hording, or returning from club crawling/dancing and you need a quick pizza fix:

Frozen Pizza

- Not bad substitute but quick survey, raise of hands on who adds; extra cheese or additional toppings to frozen pizza???

- Nov-2007 saddened me, as General Mills voluntarily recalled 3.3 million pounds of frozen meat pizza products, including Totino’s and Jeno’s frozen pizzas because they may be linked to an outbreak of E.Coli.
  - I almost cried throwing away pies. What’s next, recall on Beer???
    If this ever occurs bachelors around the WORLD are going to starve!!!
Shortcut Method

**Semi-Fresh Pizza**

**Dough**  Frozen Tandoori Naam. [10-oz can refrigerated pizza crust] Place in center of lightly greased preheated 425°F degree oven on cookie sheet for 7-10 minutes. This will thaw the dough and prepare for toppings.

**Sauce**  Place one diced cloves of garlic in olive oil. Don’t burn garlic, as this will ruin sauce. Place handful of preblended spices and one 8oz can of diced tomatoes for thick sauce or pureed tomatoes for thin sauce. Cook for 10-15 minutes until sauce has thickened.

**Cheese**  Top with generous portion of cheese cut into square blocks.

**Meat**  pepperoni slices, turkey/ham cold cuts cut into squares, or whatever is in the fridge.

- Top dough with sauce, cheese, meat toppings and bake at 425°F for 7-10 minutes or until crust golden brown. This is a vastly superior substitute to frozen pizza.

**Impressing Date or Family members**

- Purchase loafs of rested and freshly made dough from pizzeria($3.99). Make simple sauce from above and top with choice of favorite cheese and toppings. Bake as you would any handmade dough and take credit. *Shhhh***
Summary

- Homemade pizza is blank canvas waiting for your cornucopia of toppings. Have a minimalist approach to your pizza toppings; don’t overcomplicate, resist temptation to pile on topping, use simple but fresh ingredients.
  - Follow your taste and imagination.
- Get to know your oven’s “real” temperature.
  - Cook at 425°F for maximum of 10 minutes.
- Line preheated oven with unglazed clay tiles for added texture and crispness.
- Use beer rather than water for added flavor and texture and rise dough twice.
- The answer to my “unknown” ingredient was always with me, cheese from my childhood: Oaxaca or Chihuahua (Mennonita). What I was trying to recreate wasn’t “real” NY pizza but childhood memories of cooking with grandfather.
- Finally, let’s enjoy some pizza!!!
Bibliography

- America’s Test Kitchen (http://www.americastestkitchen.com/)
- Beer Batter Recipe (http://dianasgourmetpizzeria.ca/page/15bai/Menu.html)
- web.mst.edu/~sme/WORKSHOP/DOE%20for%20SME%202003%20Rev%2023.ppt –