For a Flavor Boost, Chefs Turn to Big Data; Mining databases has produced bizarre yet delicious combinations of ingredients

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FULL TEXT

Corrections &Amplifications

A chef making a pizza with three toppings who had 25 different ingredients available would be able to make more than 2,000 different kinds of pizza. An earlier version of this article incorrectly stated that he could make nearly 7,000 combinations. (March 28, 2017)

Every creative cook faces the challenge of choosing ingredients that combine deliciously. This is mostly a matter of culinary experience, intuition and imagination, plus a lot of trial and error. But Big Data can help, too.

Consider what I call the pizza problem: If you have 25 toppings, you can make 25 different one-topping pizzas, so it isn't hard to think through which one you like best. But for a three-topping pie, you've got more than 2,000 combinations to choose from. There is no practical way that you can evaluate that many options.

Enter the food scientist and trained chef Michael Nestrud. A few years ago, while working on his Ph.D. at Cornell University, he showed that you can recognize a good three-topping pizza by asking consumers which pairs of toppings are good together--a much simpler comparison--and then picking threesomes in which each topping pairs well with the other two.

Dr. Nestrud uses an arcane branch of mathematics called graph theory, the same sort of analysis used to pick out "cliques" of Facebook friends, in which every member of the group is friends with every other member. More recently, he has applied the technique to produce more harmonious combinations of snacks, main courses, side dishes and desserts in U.S. Army field rations, based on soldiers' pairwise preferences. He also has used it to determine which snack foods should sit next to one another on convenience-store shelves, based on which items consumers tend to think of together.

In his current job with Ocean Spray, America's largest cranberry company, Dr. Nestrud searches through Twitter's daily archives to find every tweet that mentions certain flavor-related words. By seeing what else people talk about when they talk about cranberries, both during and after the holiday season, he hopes to learn more about the other flavors that consumers associate with cranberries, which may lead to novel flavor combinations for his company's products.

Data miners have an even richer treasure trove available in the form of online recipe archives. Every recipe testifies that someone, at some point, thought a particular combination of ingredients was tasty. Scientists are now using these archives to test a controversial idea about flavor pairing.

Almost two decades ago, the British chef Heston Blumenthal discovered that white chocolate and caviar tasted good together. The pairing was so odd, yet so delicious, that he mentioned it to a flavor chemist--who eventually discovered that both ingredients were rich in a compound called trimethylamine, which has a fishy flavor. Mr. Blumenthal wondered, naturally, whether shared flavor molecules might point to other ingredients that combine well. Since then, with the guidance of flavor chemists, he has found other surprisingly satisfying pairings based on shared molecules: pineapple and blue cheese, carrots and violets, snails and beets.

But is the principle true in general, or was the talented chef just using his intuition to pick pairings that happened

to turn out well? That's where Sebastian Ahnert comes in. By day a theoretical physicist at the University of Cambridge, by night an enthusiastic amateur cook, Dr. Ahnert understands both data networks and cooking. In 2011, he and his colleagues downloaded more than 56,000 recipes from online archives and cross-referenced their ingredients to another database listing each ingredient's flavor molecules.

Sure enough, they found that the ingredients in real recipes tend to share more flavor molecules than do a random set of ingredients--but this held only for European and Latin American cuisines. Asian recipes, by contrast, actually shared fewer molecules than would be found in a random set of ingredients, suggesting that Asian cuisines work on fundamentally different flavor principles.

Dr. Ahnert is now refining his analysis by focusing on ingredient pairs recommended by famous chefs. He has found that such chef-endorsed pairs do indeed share more flavor molecules than do random pairs of ingredients, and the pattern gets stronger when he counts only the most important flavor molecules.

Could such computer-assisted cookery someday finds its way into ordinary home kitchens? It already has, to an extent. It turns out that IBM's Watson supercomputer, famous for beating humans at "Jeopardy!", is also a culinary genius. Anyone with an internet connection can now give Chef Watson a few ingredients, and the computer will draw on online recipe databases, tables of flavor molecules and databases of how well people like particular flavors to produce new recipes that it predicts will work.

Some of Watson's suggestions are weird--such as a Bloody Mary made with puréed cauliflower and ouzo instead of tomato juice and vodka, or meatballs with a sauce of turnip, avocado, clam juice and Indian spices. But bizarre as these recipes may sound, I can report that they are surprisingly delicious.

Dr. Holmes is a writer for New Scientist magazine and the author of "Flavor: The Science of Our Most Neglected Sense," which will be published in April by W.W. Norton.

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Credit: By Bob Holmes

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