MINSUK CHANG
WITH HYEUNGSIK JUNG
WITH VIVIAN HARE, JUHO KIM & MANEESH AGRAWALA

RecipeScape: mining and analyzing diverse processes in cooking

DO YOU LIKE CHOCOLATE CHIP COOKIES?
Sally's Baking Addiction

"There's no such thing as an ideal chocolate chip cookie. At least, not one that we can all agree upon. Like pizzas and hamburgers, the ideal chocolate chip cookie varies from person to person, from mood to mood."

J. Kenji López-Alt
on Serious Eats

Recipe sharing online

YouTube KR

chocolate chip cookie

Filters

About 495,000 results

PERFECT Easy Chocolate Chip Cookies Recipe
BakeLikeAPro
2 years ago • 1,641,027 views
PERFECT Easy Chocolate Chip Cookies Recipe Easy ! Chocolate Chip Cookies Recipe ! ☆▷Please SUBSCRIBE: ...

Classic Chocolate Chip Cookies | Oh Yum with Anna Olson
Oh Yum with Anna Olson
6 months ago • 419,420 views
Making the classic chocolate chip cookie with Anna Olson. Subscribe for more video recipes: http://goo.gl/MJV4af Anna Olson ...

How to Make the Best Chocolate Chip Cookies!
kawaiisweetworld
2 years ago • 2,772,391 views
Hey everyone! This is the best chocolate chip cookie recipe for chewy on the inside, crispy on the outside cookies! These cookies ...

The BEST Oatmeal Chocolate Chip Cookies!
Living On A Dime
93 watching
Subscribe to Living On A Dime on YouTube! http://bit.ly/1QDDmbN Visit Our Website: http://www.LivingOnADime.com/ Free e-Mail ...
LIVE NOW NEW

Baking Chocolate Chip Cookies with Shopkins Kooky Cookie from Official Magazine Recipe
CookieSwirlC
7 months ago • 2,884,299 views
Let's bake up so Shopkins Chocolate chip cookies using the recipe in the Shopkins Official Magazine #3. Make no egg cookies ...

Queen Elsa from Disney Frozen Makes Homemade Chocolate Chip Cookies - Cookieswirlc Video
CookieSwirlC

chocolate chip cookie recipes

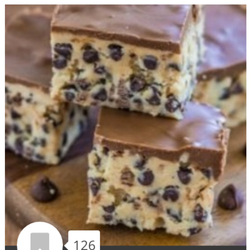
6,526 results

Options

All | My Recipes

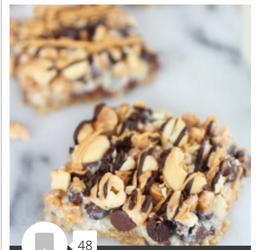
Desserts (5,646) Breakfast (48) Other (27) Appetizers (22) Bread (9) Main Dish (6) Drinks (3) Marinades and Sauces (1) Side Dish (1)

31
Chocolate Chip Cookies
2

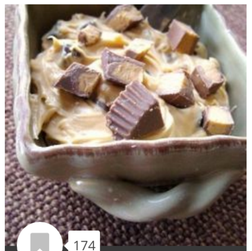


126
Chocolate Chip Cookie Dough Bars
1

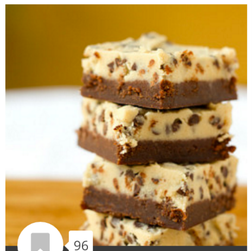
752
Chocolate Chip Cookie Dough Bites
1



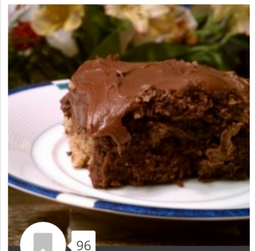
48
Oatmeal Chocolate Chip Cookie 7 Layer Bars



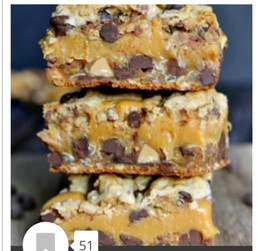
174
Peanut Butter Chocolate Chip Cookie Dough Dip



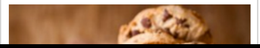
96
Chocolate Chip Cookie Dough Blondies
1



96
Chocolate Chip Cookie Dough Brownies ("brookies")
3



51
Peanut Butter Caramel Toffee Chocolate Chip Cookie Bars

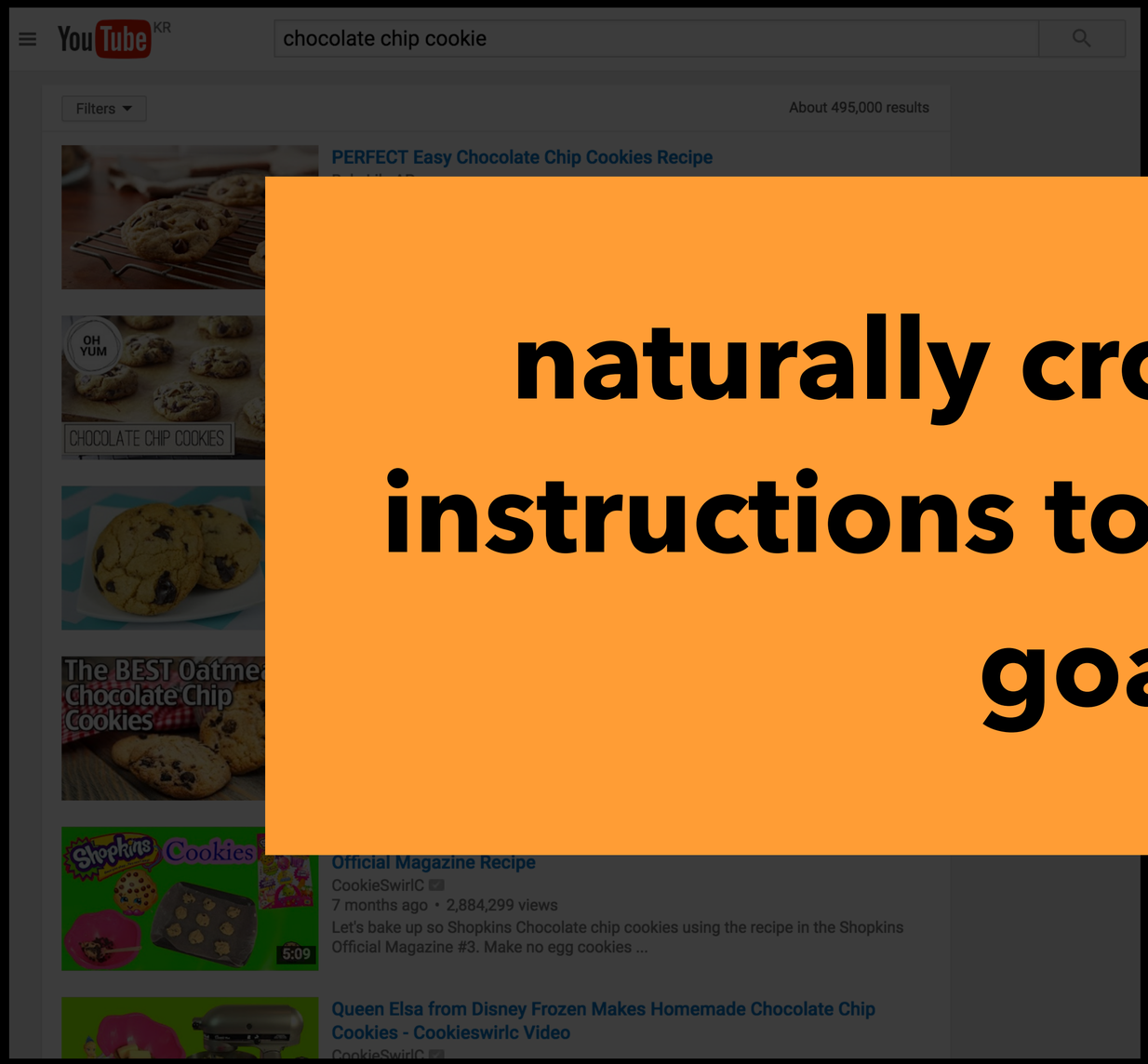


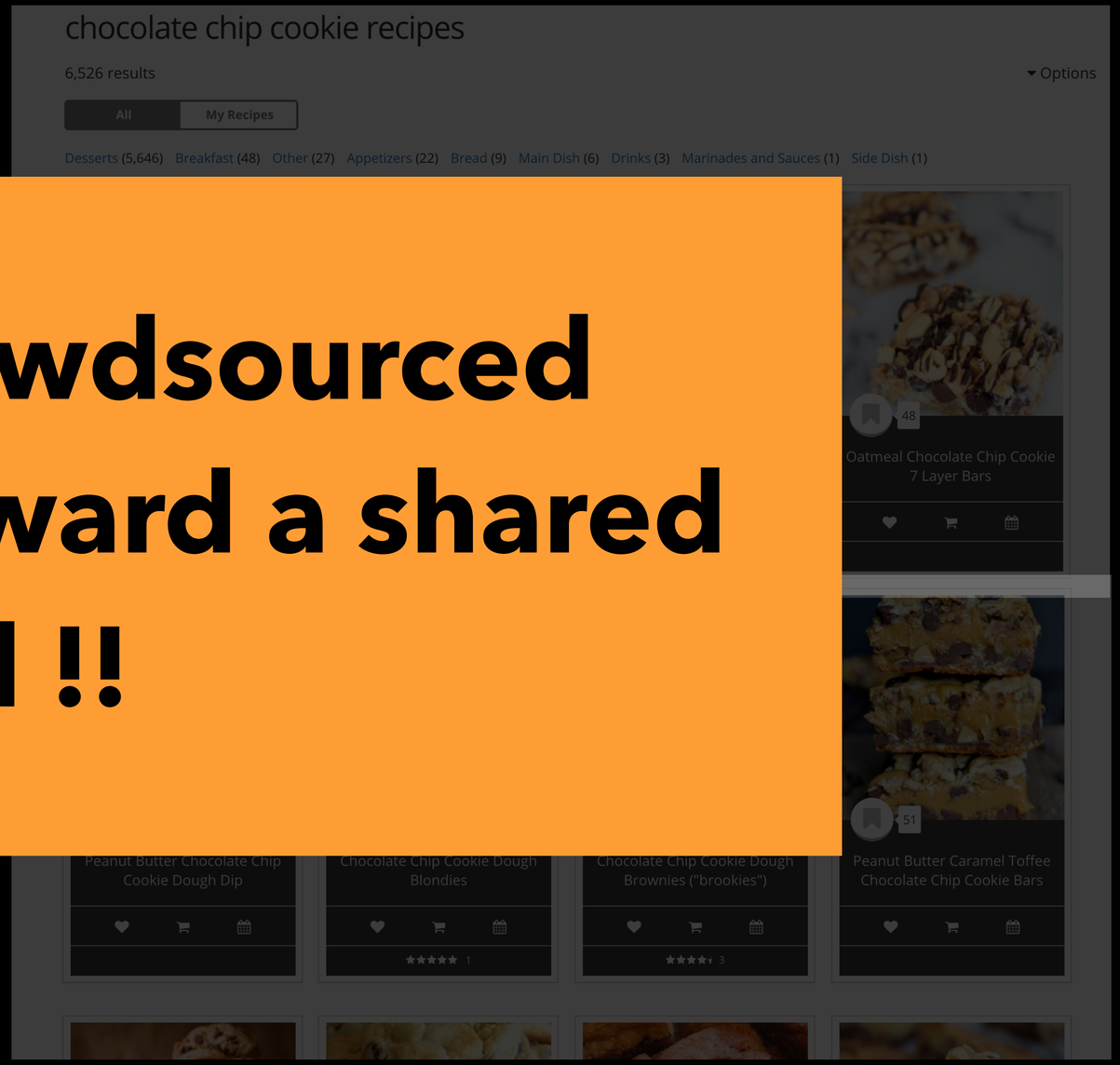
Recipe sharing online

By nature, recipes are:

- instructional
- procedural
- (usually) descriptive

Recipe sharing online



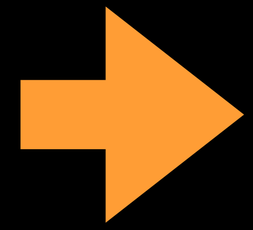


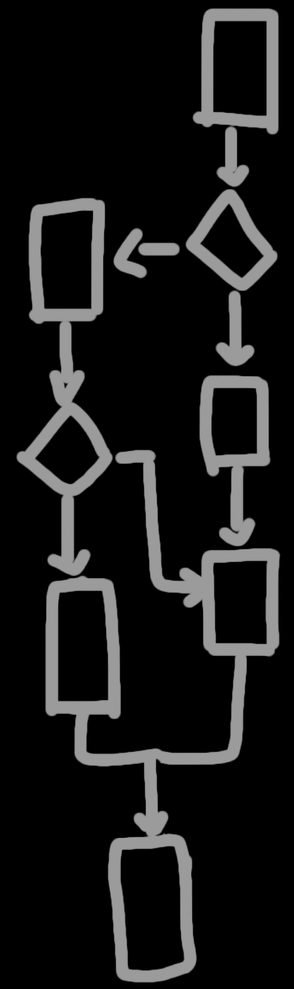
naturally crowdsourced instructions toward a shared goal !!

“Proportion of ingredients is important, but the final result is also a matter of how you put them together.”

Alain Ducasse

a matter of how you
put them together





PROCESS!

RECIPE = PROCESS

Obs 1. Cooking is a very important activity in our lives

Obs 2. We have hundreds of ~~recipes~~ naturally crowdsourced processes for a single dish

RECIPE = PROCESS

Obs 1. Cooking is a ver

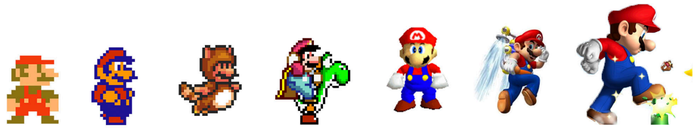
Obs 2. We have hur ced processes for a single dish

Can we understand the collective knowledge and practices around cooking? How?

Cultural analytics

“Longitudinal”

how individual entities evolve, influence with time



1985 Super Mario Bros.

1988 Super Mario Bros. 2

1991 Super Mario Bros. 3

1992 Super Mario World

1996 Super Mario 64

2002 Super Mario Sunshine

2006 New Super M. Bros.

2007 Super Mario Galaxy

2009 New Super M. Bros. Wii

2010 Super Mario Galaxy 2

2011 Super Mario 3D Land

2012 New Super M. Bros. 2

2012 New Super M. Bros. Wii U

“Cross-sectional”

what’s the current state of the world

Cultural analytics

"Cross-sectional"

what's the current state of the world

What can we learn from analyzing the embedded processes in hundreds of recipes for a single dish?

- What makes a cookie a cookie?
- Average recipe? Creative variants or outliers?
- Simplest vs most complex recipe?
- What are some common skills?
- Can we discover ordering constraints?
- Can we cluster fundamentally different ways of making a cookie?

RecipeScape: Recipe Analytics Interface

2 Main visualizations

- RecipeMap

- RecipeDeck

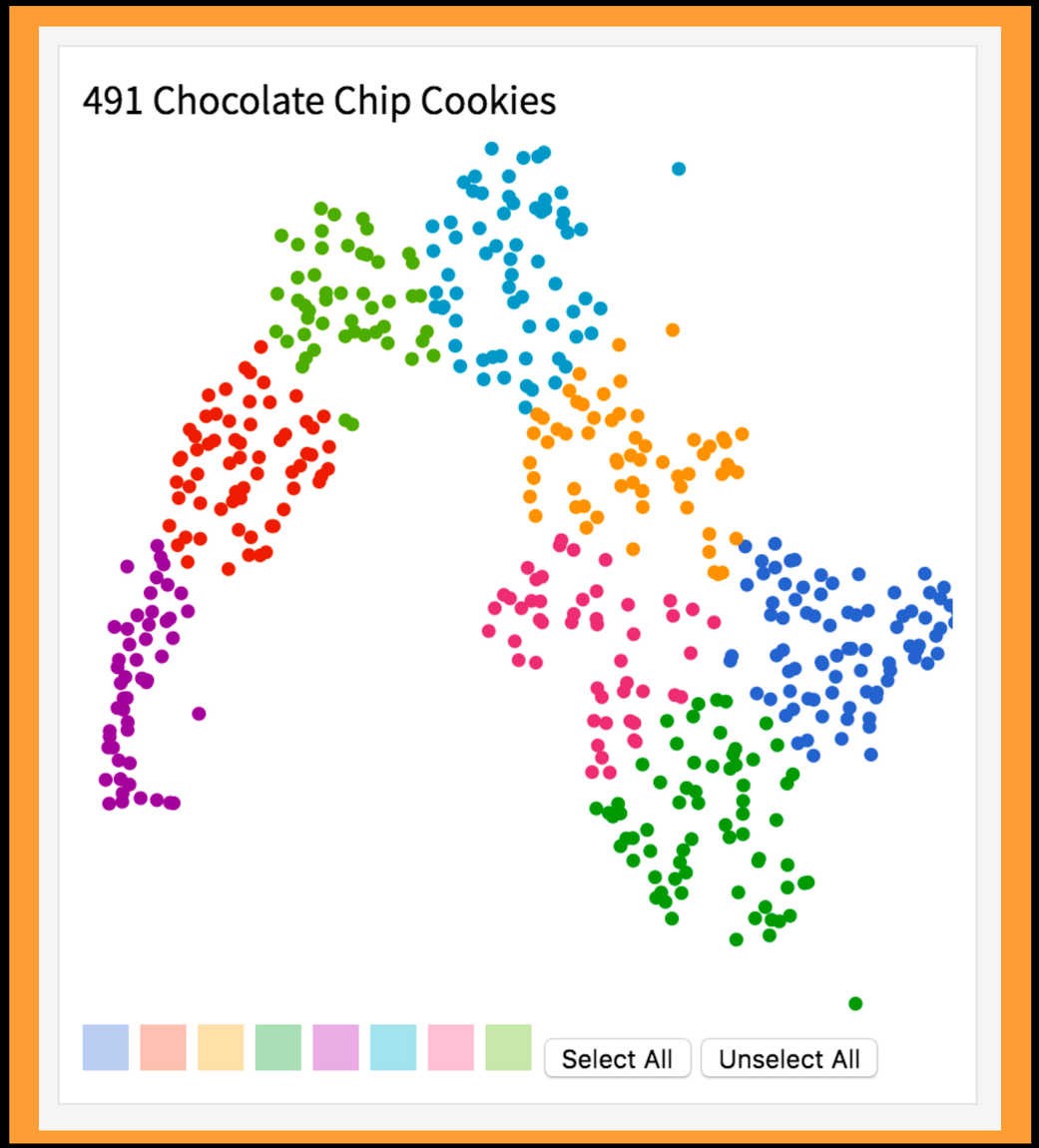
RecipeScape: Recipe Analytics Interface

2 Main visualizations

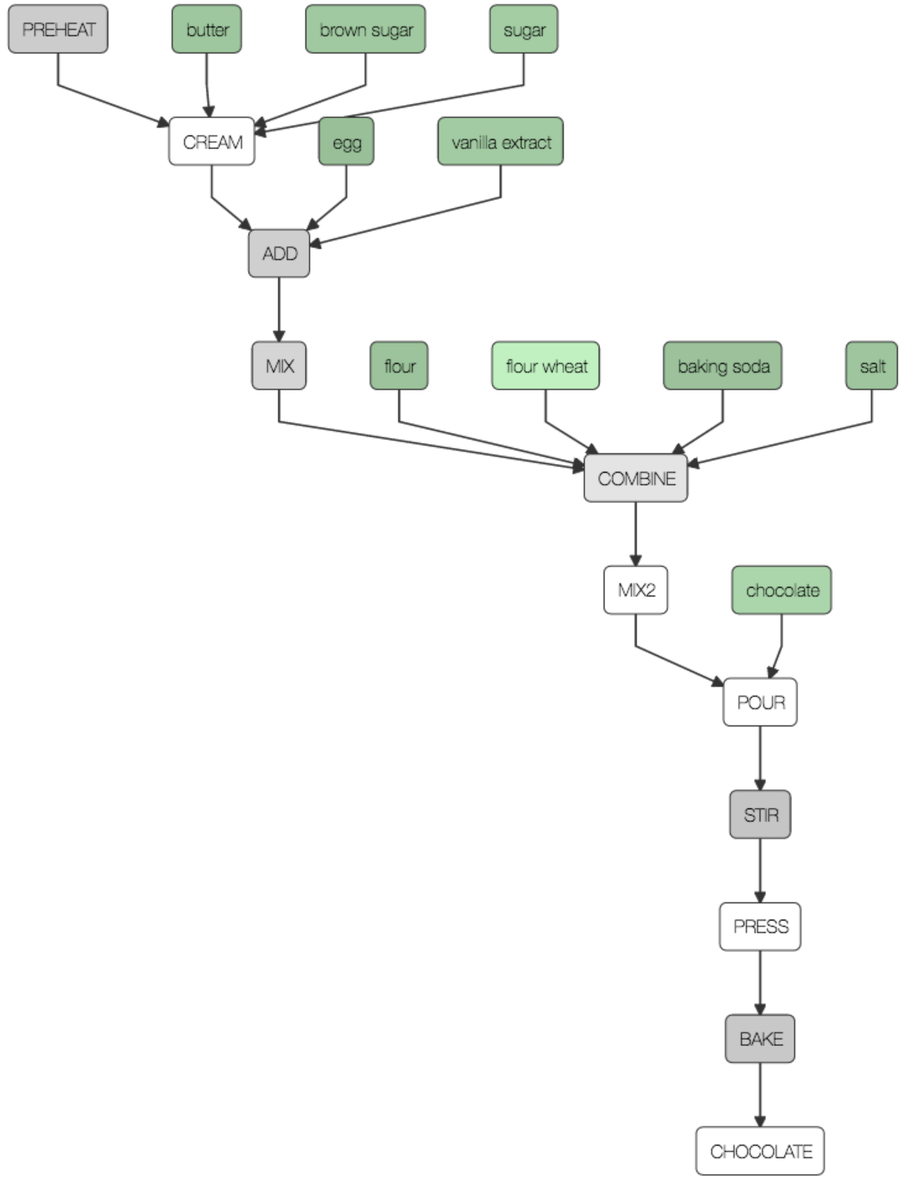
- RecipeMap

- RecipeDeck

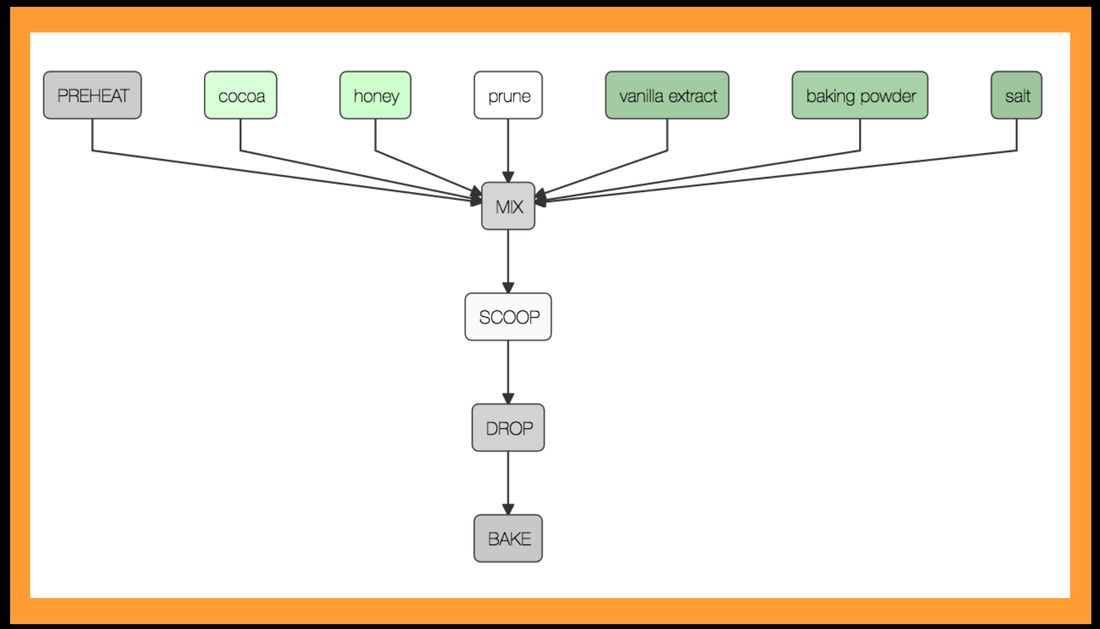
RecipeMap

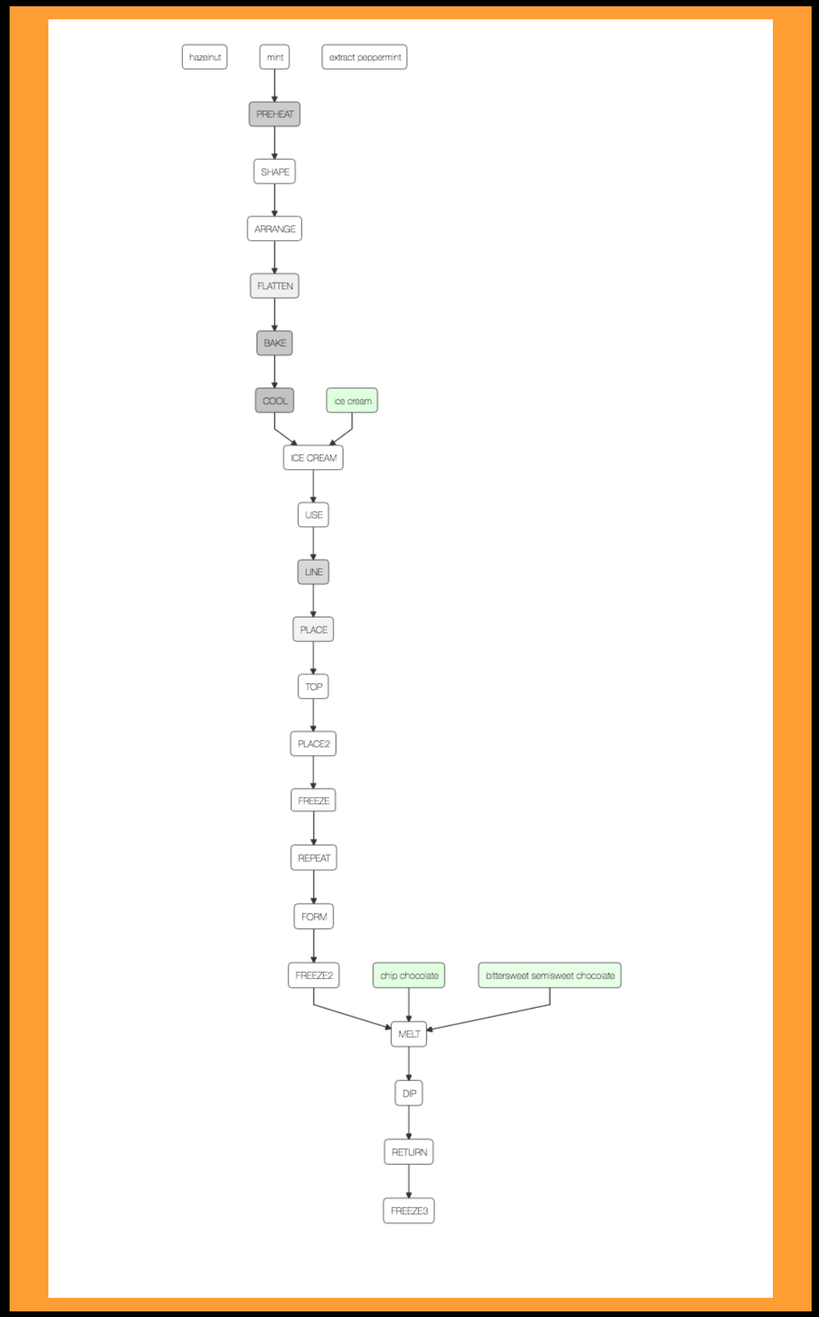


The Median Chocolate Chip Cookie Recipe



Far Away from the Median Recipe





RecipeScape: Recipe Analytics Interface

2 Main visualizations

- RecipeMap

- RecipeDeck

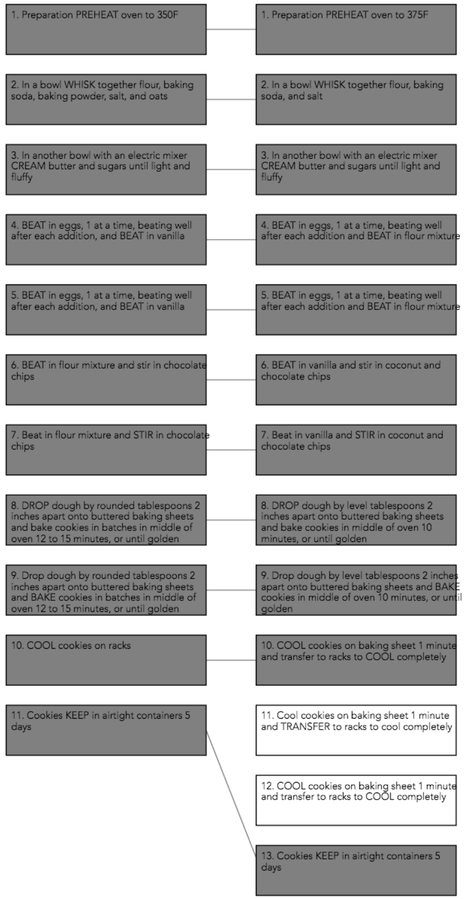
pairwise comparison view – union graph

High similarity

Chocolate Chip Oatmeal Cookies

vs.

Coconut Chocolate Chip Cookies

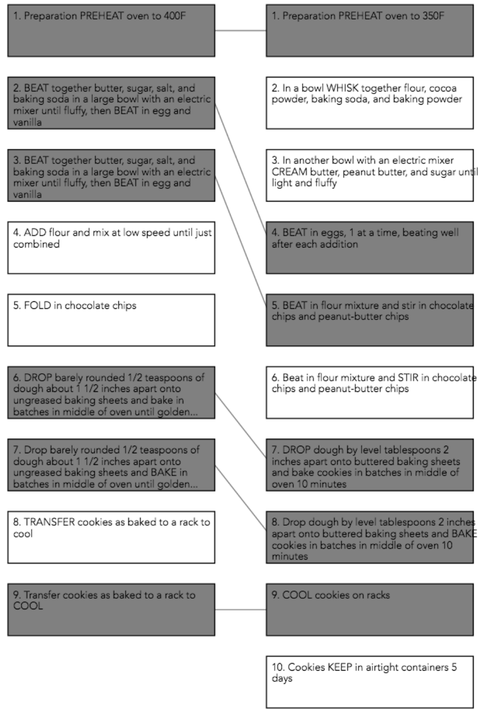


Medium similarity

Tiny Chocolate Chip Cookies

vs.

Double-Peanut Double-Chocolate Chip Cookies



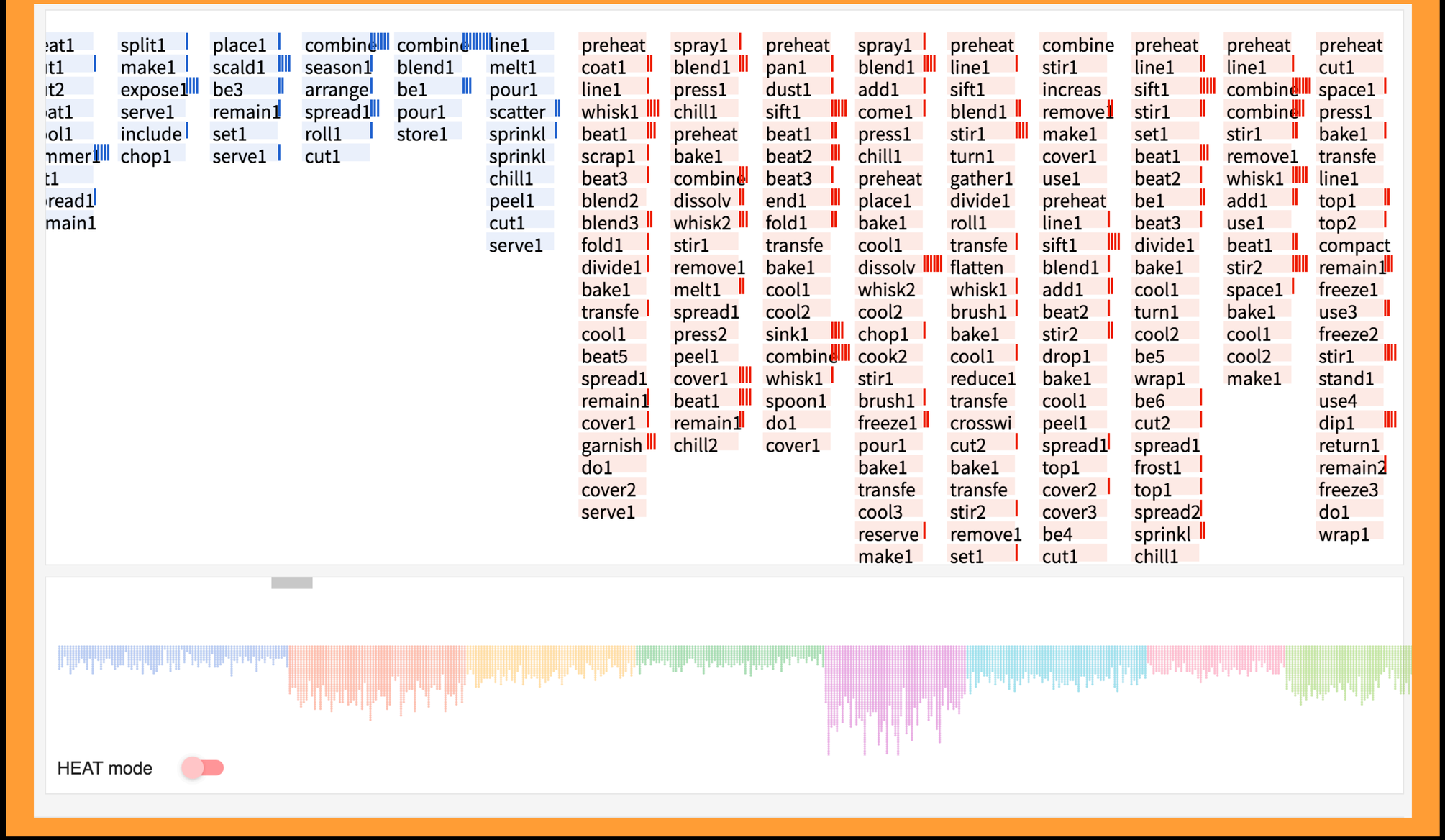
RecipeScape: Recipe Analytics Interface

2 Main visualizations

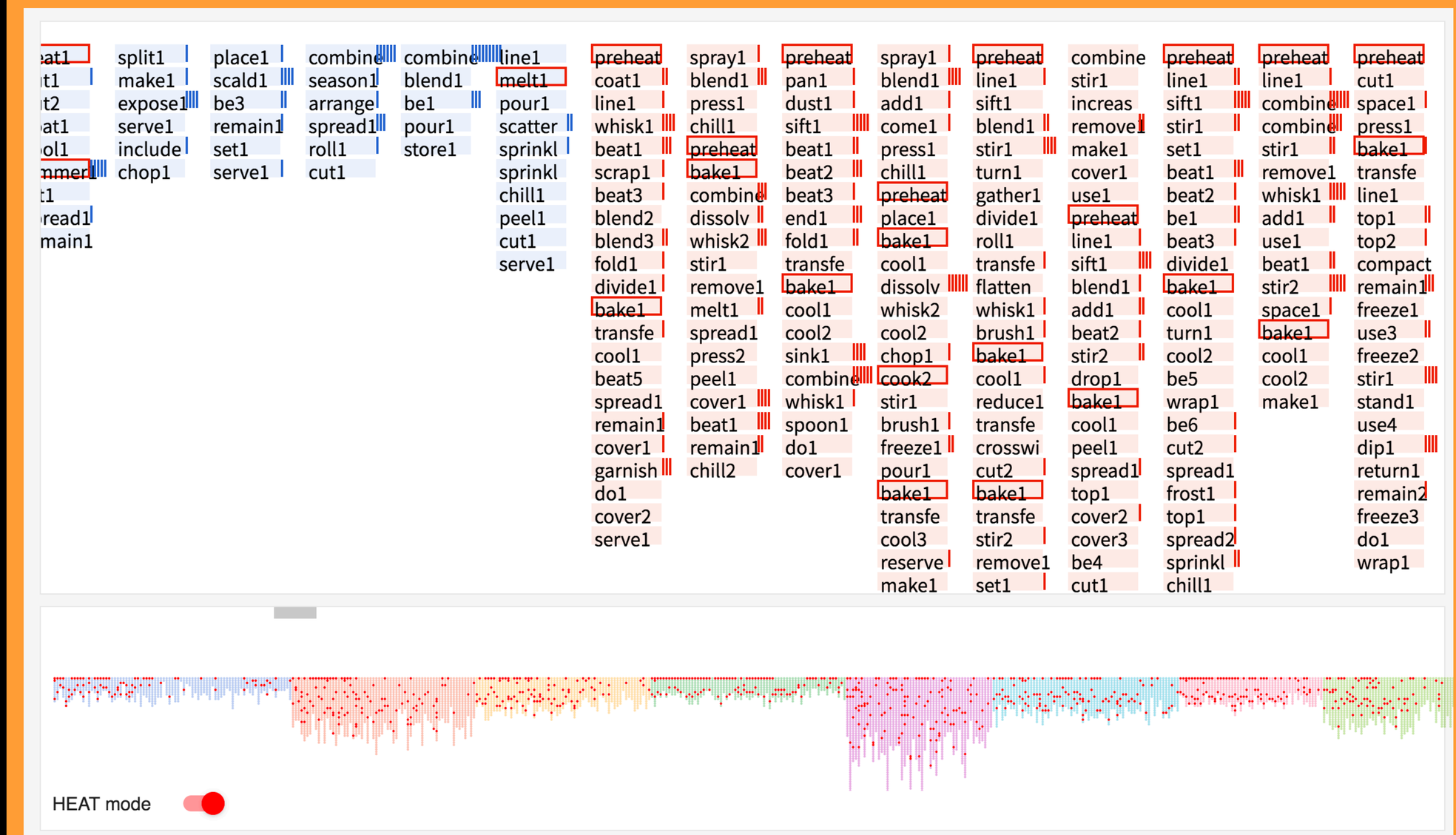
- RecipeMap

- RecipeDeck

RecipeDeck: looking at all the recipes at once

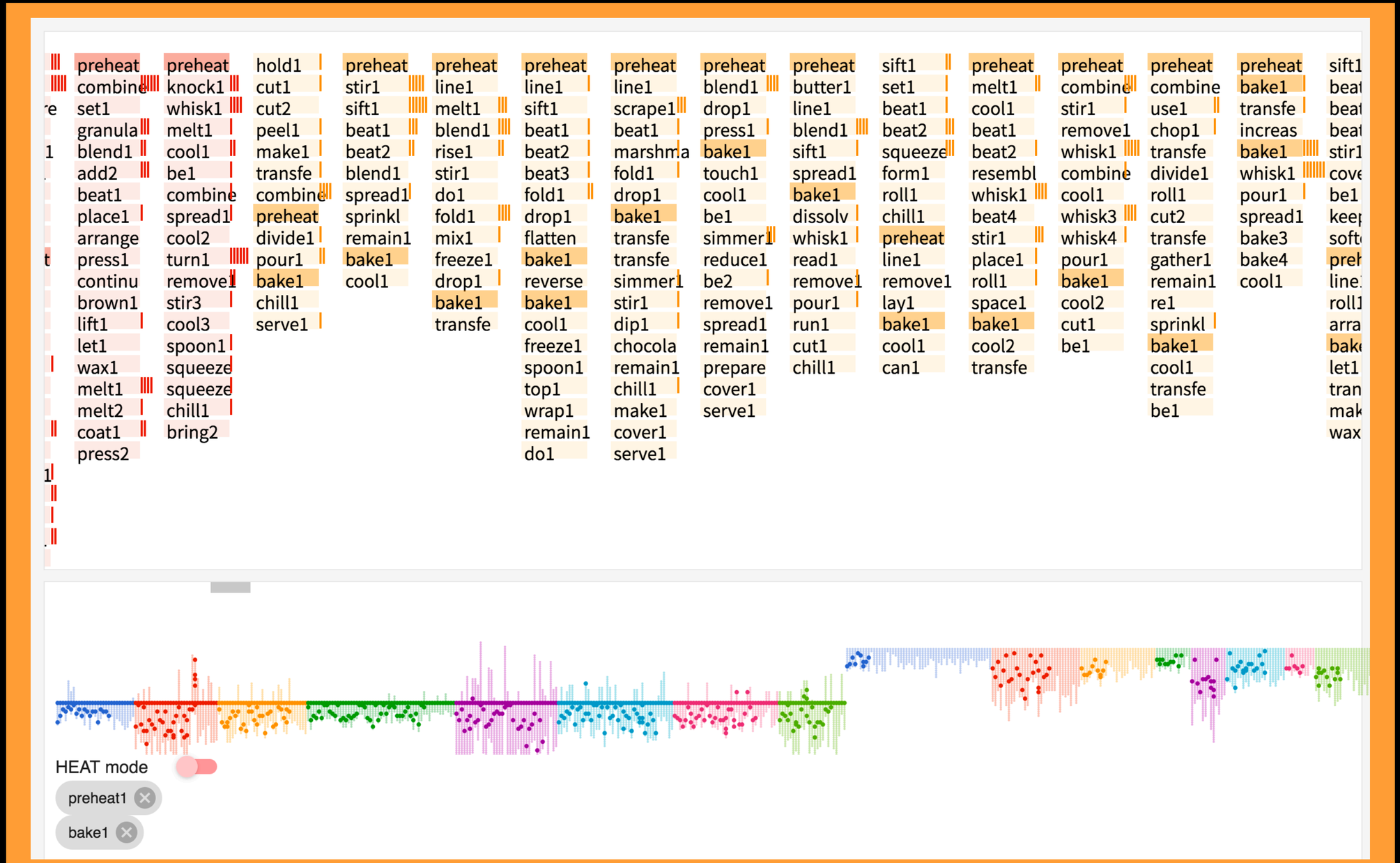


RecipeDeck: heat mode

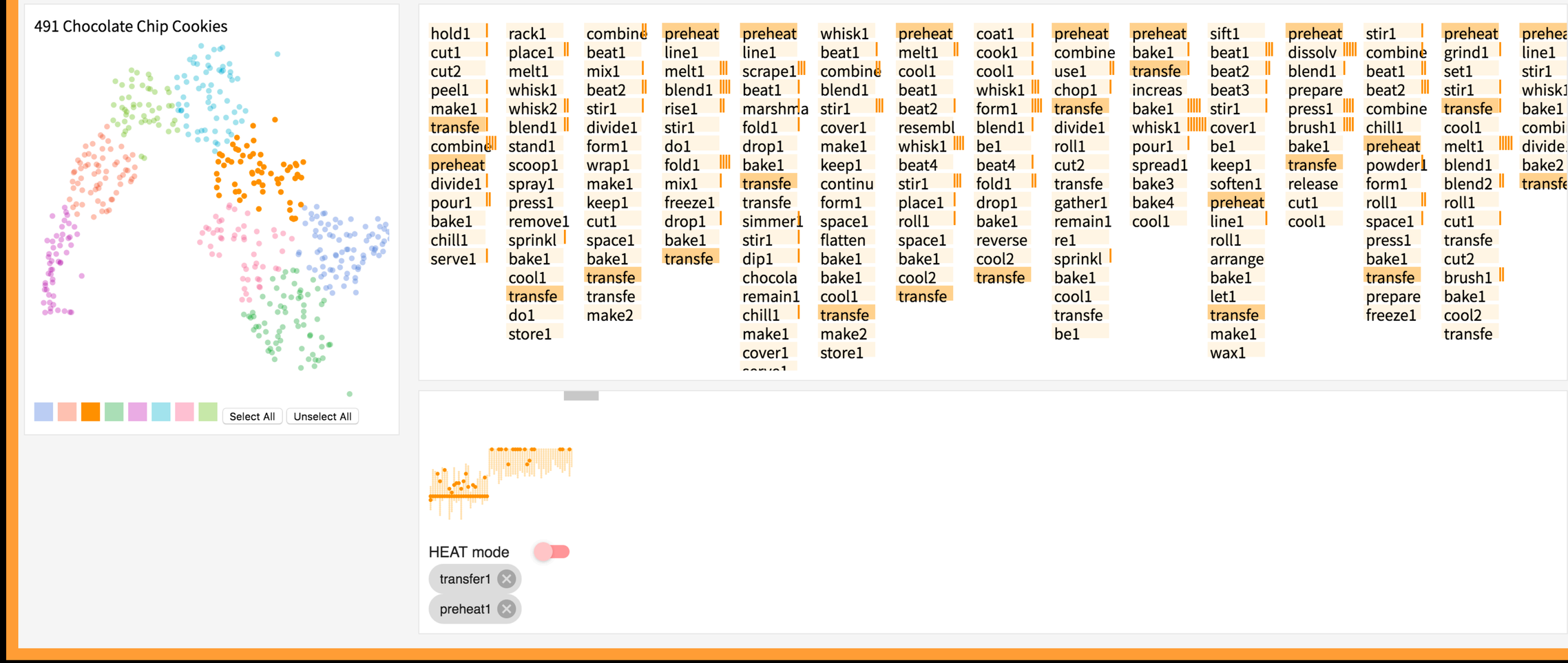


RecipeDeck: select individual action

RecipeDeck: select more than one action



RecipeScape : within clusters



Computational Pipeline behind RecipeScape

Recipe Text

INGREDIENTS

8 ounces unsalted butter (2 sticks; 225g)

1 standard ice cube (about 2 tablespoons; 30mL frozen water)

10 ounces all-purpose flour (about 2 cups; 280g)

3/4 teaspoon (3g) baking soda

2 teaspoons Diamond Crystal kosher salt or 1 teaspoon table salt (4g)

5 ounces granulated sugar (about 3/4 cup; 140g)

2 large eggs (100g)

2 teaspoons (10mL) vanilla extract

5 ounces dark brown sugar (about 1/2 tightly packed cup plus 2 tablespoons; 140g)

8 ounces (225g) semisweet chocolate, roughly chopped with a knife into 1/2- to 1/4-inch chunks

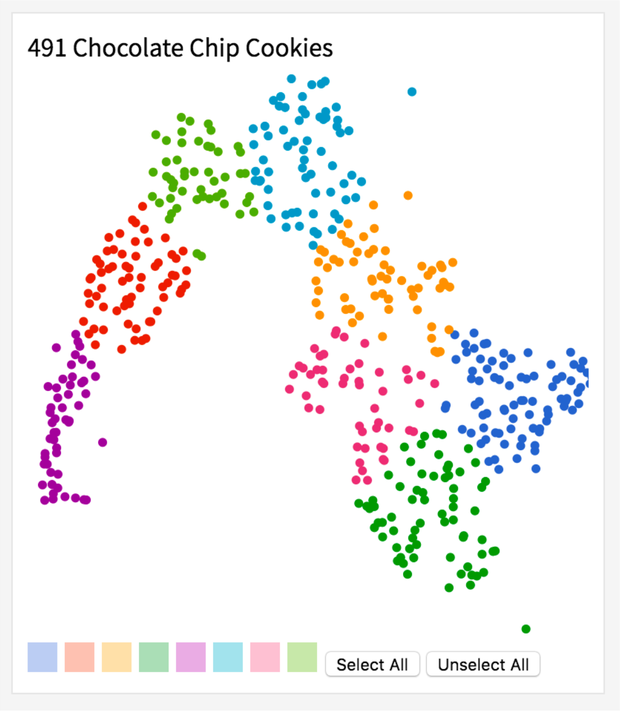
DIRECTIONS

1. Melt butter in a medium saucepan over medium-high heat. Cook, gently swirling pan constantly, until particles begin to turn golden brown and butter smells nutty, about 5 minutes. Remove from heat and continue swirling the pan until the butter is a rich brown, about 15 seconds longer. Transfer to a medium bowl, whisk in ice cube, transfer to refrigerator, and allow to cool completely, about 20 minutes, whisking occasionally. (Alternatively, whisk over an ice bath to hasten the process.)

2. Meanwhile, whisk together flour, baking soda, and salt in a large bowl. Place granulated sugar, eggs, and vanilla extract in the bowl of a stand mixer fitted with the whisk attachment. Whisk on medium-high speed until mixture is pale brownish-yellow and falls off the whisk in thick ribbons when lifted, about 5 minutes.

3. Fit paddle attachment onto mixer. When brown butter mixture has cooled (it should be just starting to turn opaque again and firm around the edges), add brown sugar and cooled brown butter to egg mixture in stand mixer. Mix on medium speed to combine, about 15 seconds. Add flour mixture and mix on low speed until just barely combined, with some dry flour still remaining, about 15 seconds. Add chocolate and mix on low speed until dough comes together, about 15 seconds longer. Transfer to an airtight container and refrigerate dough at least overnight and up to 3 days.

RecipeScape



How to extract structural similarity measure from recipe text?

Recipe Text

INGREDIENTS

8 ounces unsalted butter (2 sticks; 225g)

1 standard ice cube (about 2 tablespoons; 30mL frozen water)

10 ounces all-purpose flour (about 2 cups; 280g)

3/4 teaspoon (3g) baking soda

2 teaspoons Diamond Crystal kosher salt or 1 teaspoon table salt (4g)

5 ounces granulated sugar (about 3/4 cup; 140g)

2 large eggs (100g)

2 teaspoons (10mL) vanilla extract

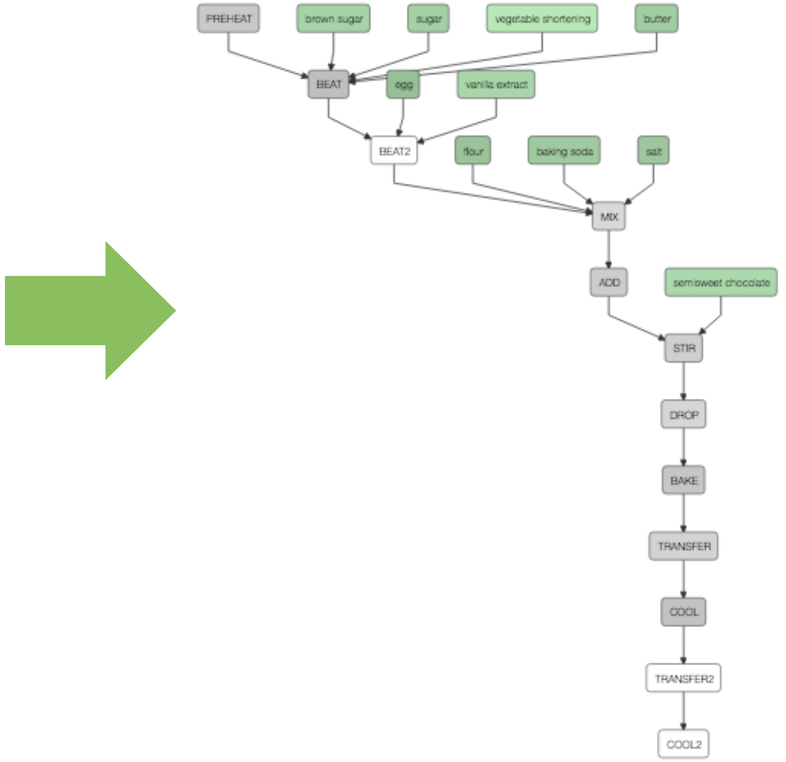
5 ounces dark brown sugar (about 1/2 tightly packed cup plus 2 tablespoons; 140g)

8 ounces (225g) semisweet chocolate, roughly chopped with a knife into 1/2- to 1/4-inch chunks

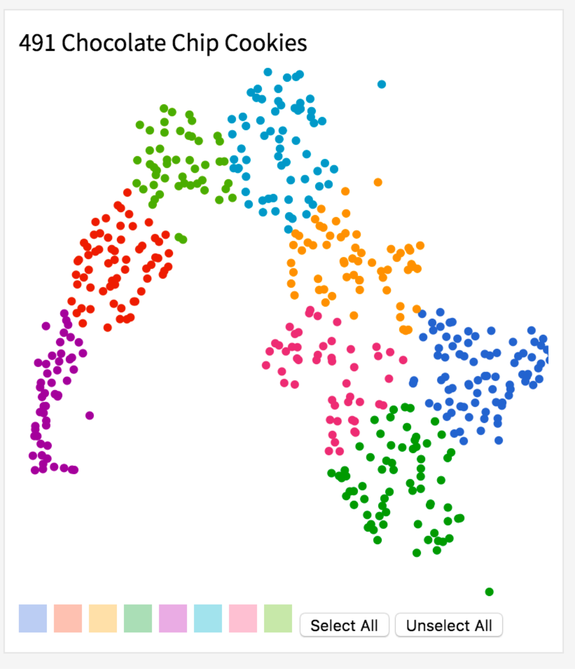
DIRECTIONS

1. Melt butter in a medium saucepan over medium-high heat. Cook, gently swirling pan constantly, until particles begin to turn golden brown and butter smells nutty, about 5 minutes. Remove from heat and continue swirling the pan until the butter is a rich brown, about 15 seconds longer. Transfer to a medium bowl, whisk in ice cube, transfer to refrigerator, and allow to cool completely, about 20 minutes, whisking occasionally. (Alternatively, whisk over an ice bath to hasten the process.)
2. Meanwhile, whisk together flour, baking soda, and salt in a large bowl. Place granulated sugar, eggs, and vanilla extract in the bowl of a stand mixer fitted with the whisk attachment. Whisk on medium-high speed until mixture is pale brownish-yellow and falls off the whisk in thick ribbons when lifted, about 5 minutes.
3. Fit paddle attachment onto mixer. When brown butter mixture has cooled (it should be just starting to turn opaque again and firm around the edges), add brown sugar and cooled brown butter to egg mixture in stand mixer. Mix on medium speed to combine, about 15 seconds. Add flour mixture and mix on low speed until just barely combined, with some dry flour still remaining, about 15 seconds. Add chocolate and mix on low speed until dough comes together, about 15 seconds longer. Transfer to an airtight container and refrigerate dough at least overnight and up to 3 days.

Graphical Representation



RecipeScape



Step 1: Scrape online recipes

Log In | Sign Up

epicurious

Search

RECIPES & MENUS EXPERT ADVICE INGREDIENTS HOLIDAYS & EVENTS COMMUNITY VIDEO GIFT GUIDE

CHOCOLATE-CHOCOLATE CHIP COOKIE AND STRAWBERRY GELATO SANDWICHES

BY GABE SORIA & AMANDA ZUG-MOORE | BON APPÉTIT MAY 2009

4/4 REVIEWS (10)

100% MAKE IT AGAIN

INGREDIENTS

- 2 1/4 cups all purpose flour
- 1/2 cup natural unsweetened cocoa powder
- 1 teaspoon baking soda
- 1/2 teaspoon salt
- 1 cup (2 sticks) unsalted butter, room temperature
- 1 cup (packed) dark brown sugar
- 1/2 cup sugar
- 2 large eggs
- 1 teaspoon vanilla extract
- 1/2 teaspoon almond extract
- 2 cups semisweet chocolate chips
- Fresh Strawberry Gelato , slightly softened

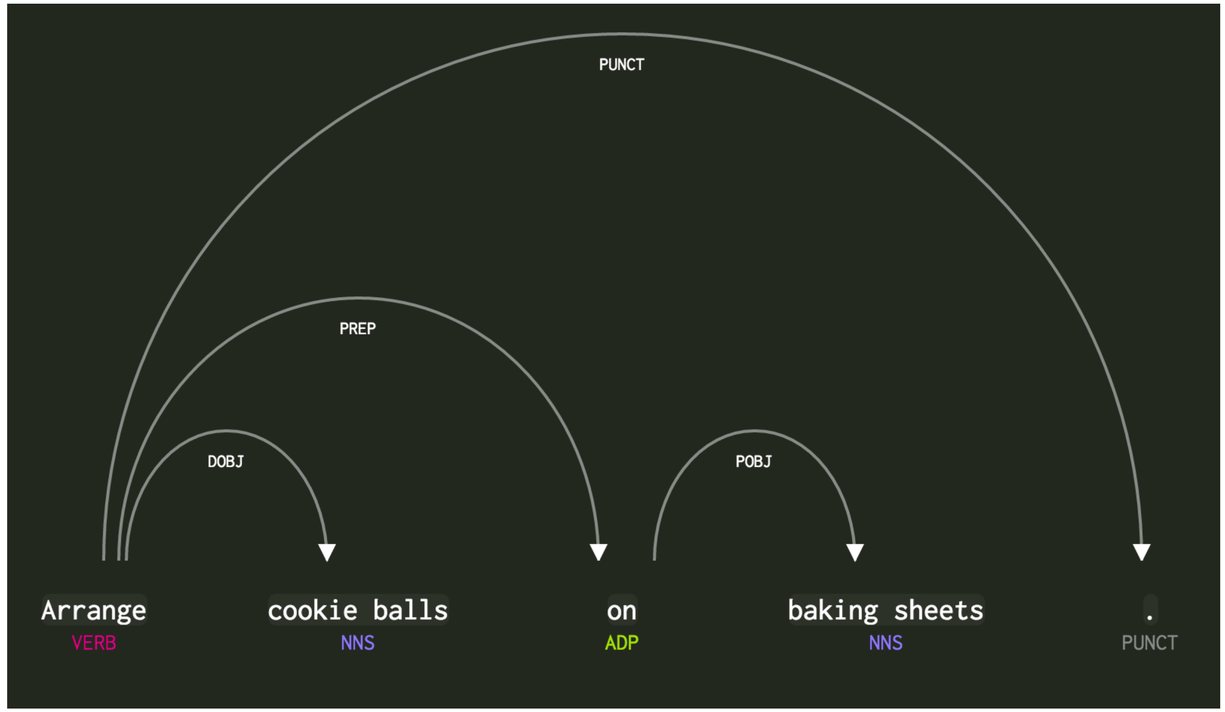
PREPARATION

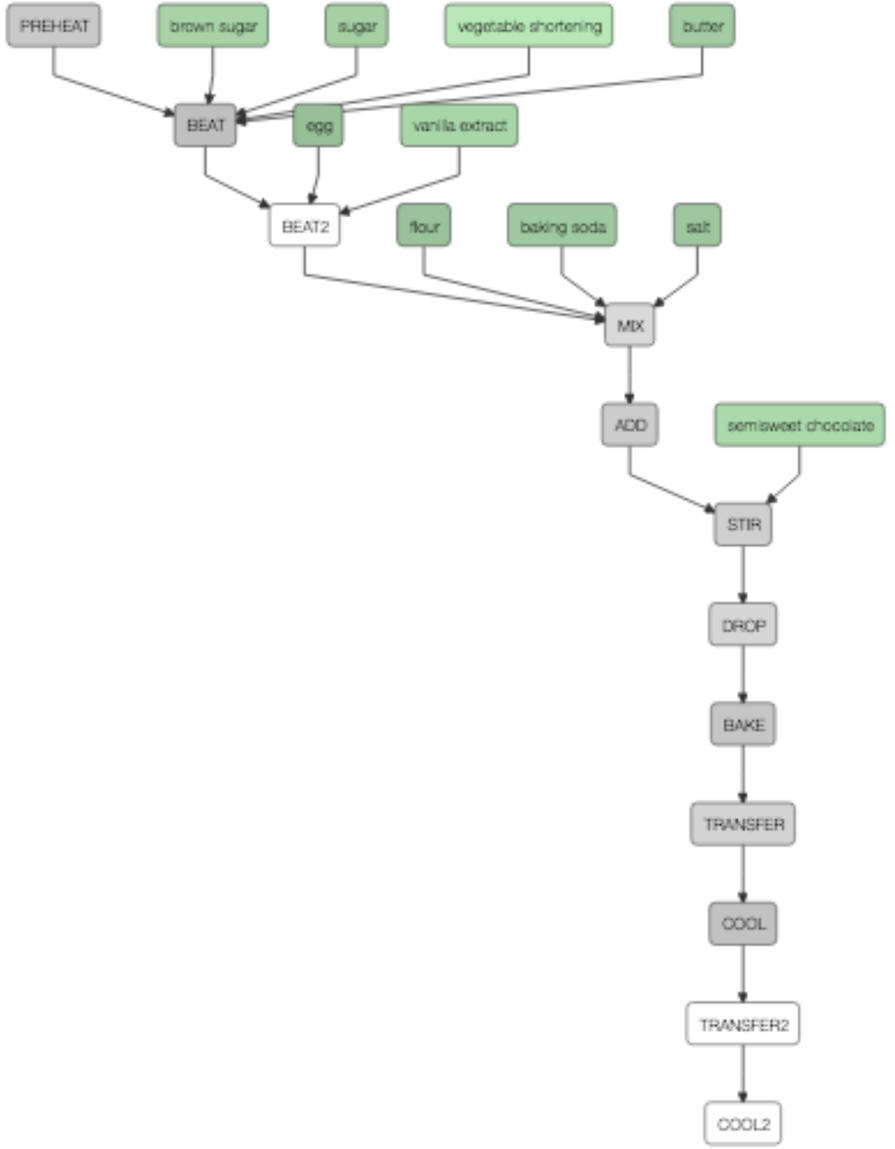
Preheat oven to 375°F. Line 2 large rimmed baking sheets with parchment. Sift first 4 ingredients into bowl. Using electric mixer, beat butter in large bowl until fluffy. Beat in both sugars, then eggs, 1 at a time. Beat in extracts, then flour mixture. Fold in chocolate chips. Drop batter by heaping tablespoonfuls onto prepared sheets, spacing mounds 2 to 3 inches apart. Using moist fingertips, flatten mounds to 3/4-inch thickness.

Bake cookies 5 minutes. Reverse sheets. Bake until cookies are puffed and dry-looking but soft to touch, about 5 minutes. Cool completely. Freeze on sheets 15 minutes.

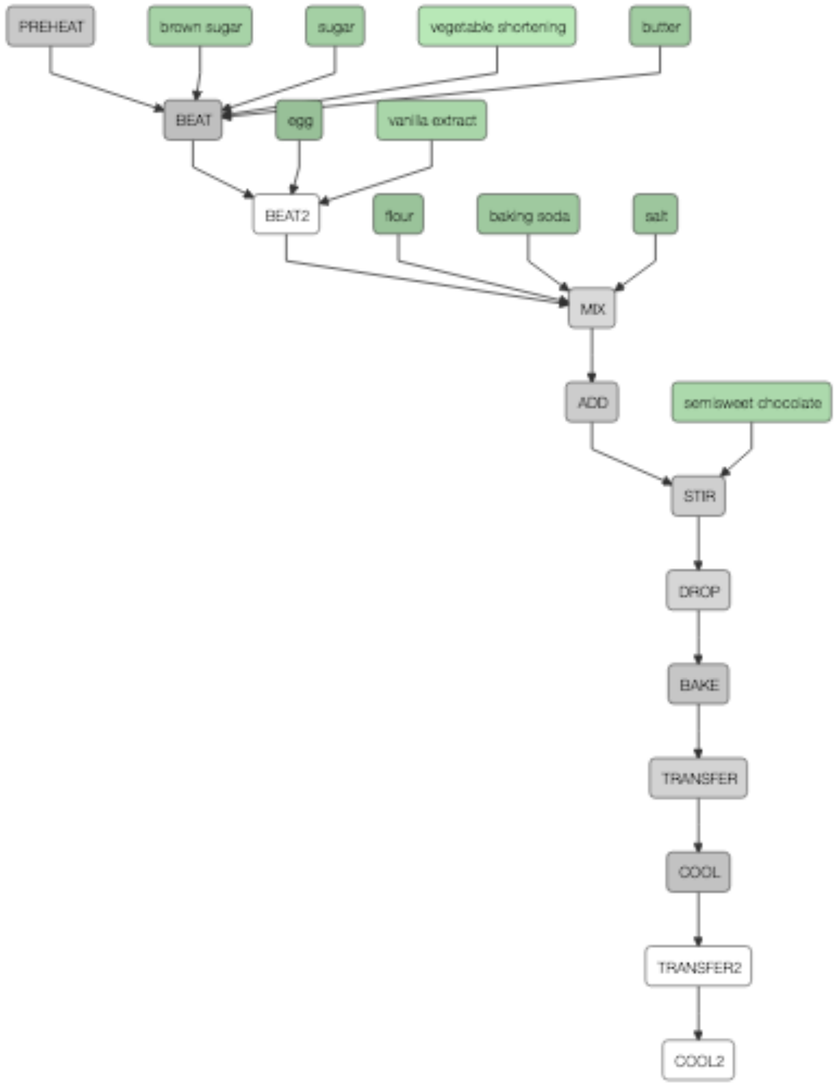
Spoon 1/3 cup gelato onto flat side of 1 cookie. Top with second cookie, flat side down; press together. Wrap and freeze. Repeat with remaining gelato and cookies. DO AHEAD: *Keep frozen up to 2 days.*

Step 2: Parse recipes and produce a tree

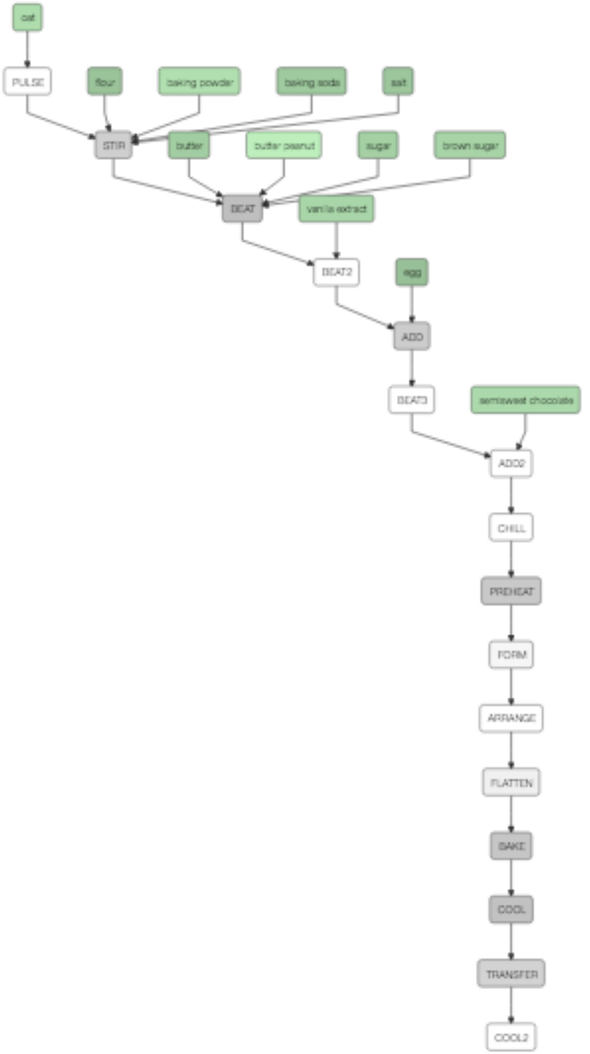




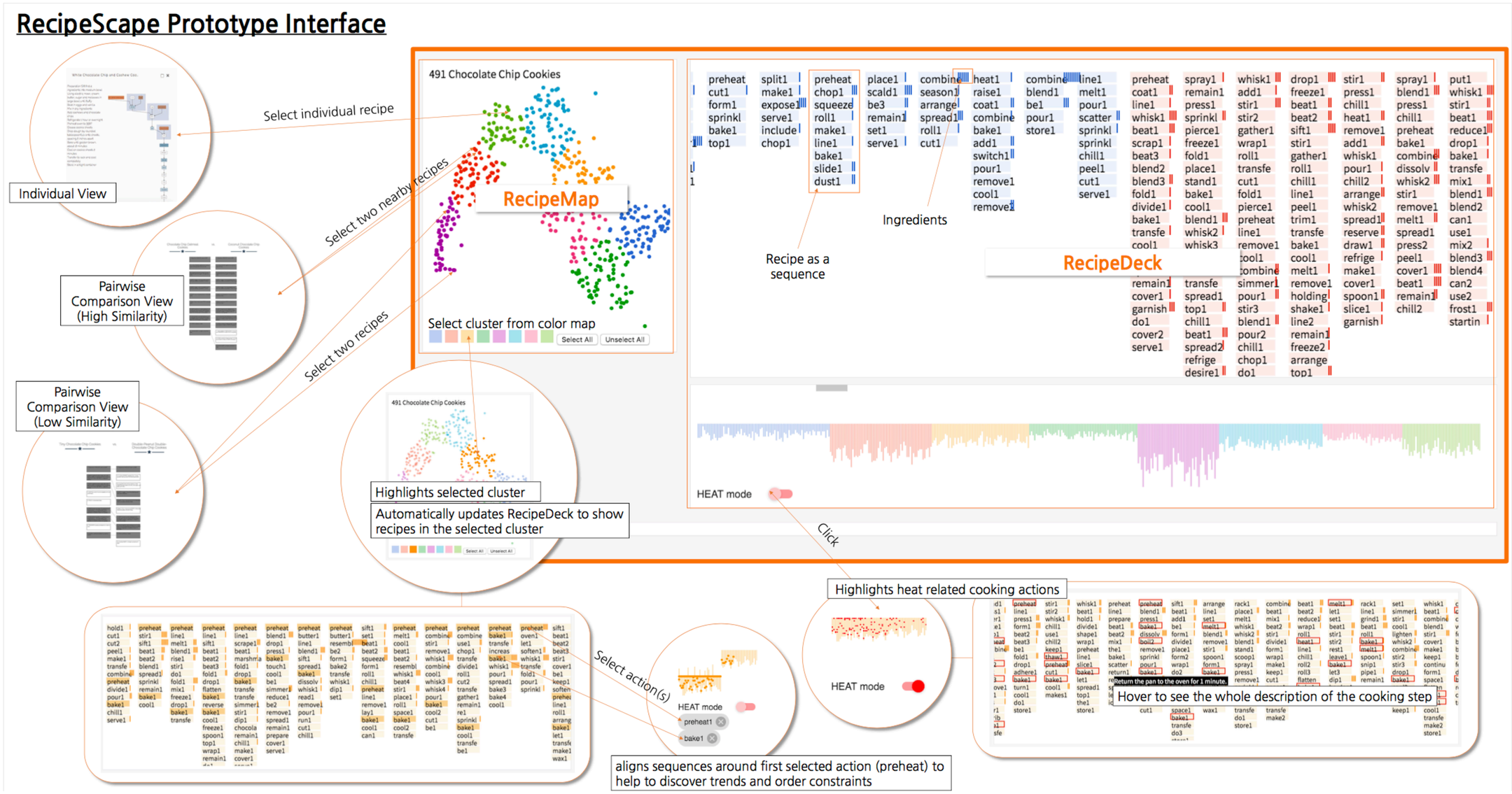
Step 3: Compute similarity between recipe topologies

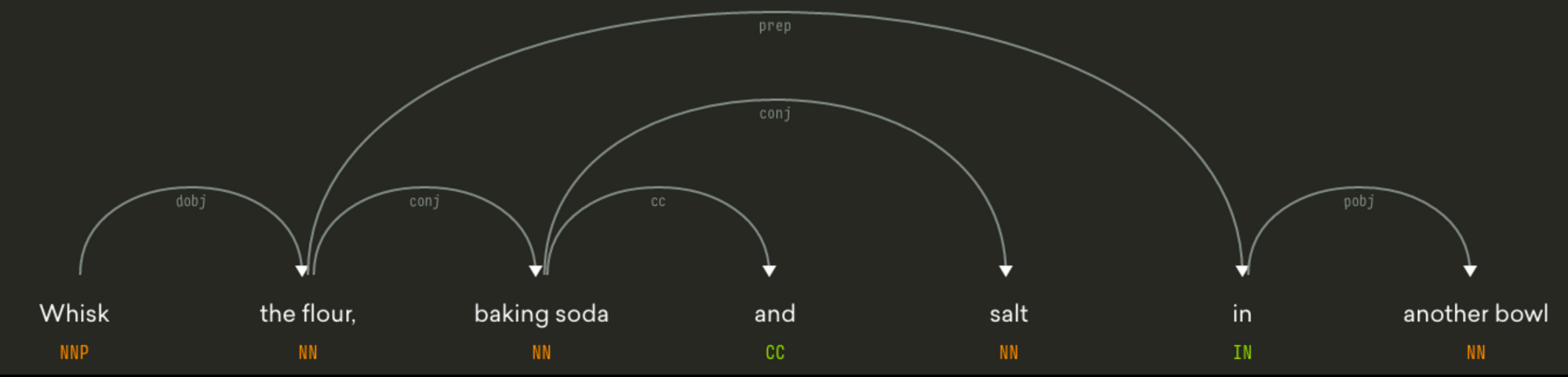


VS

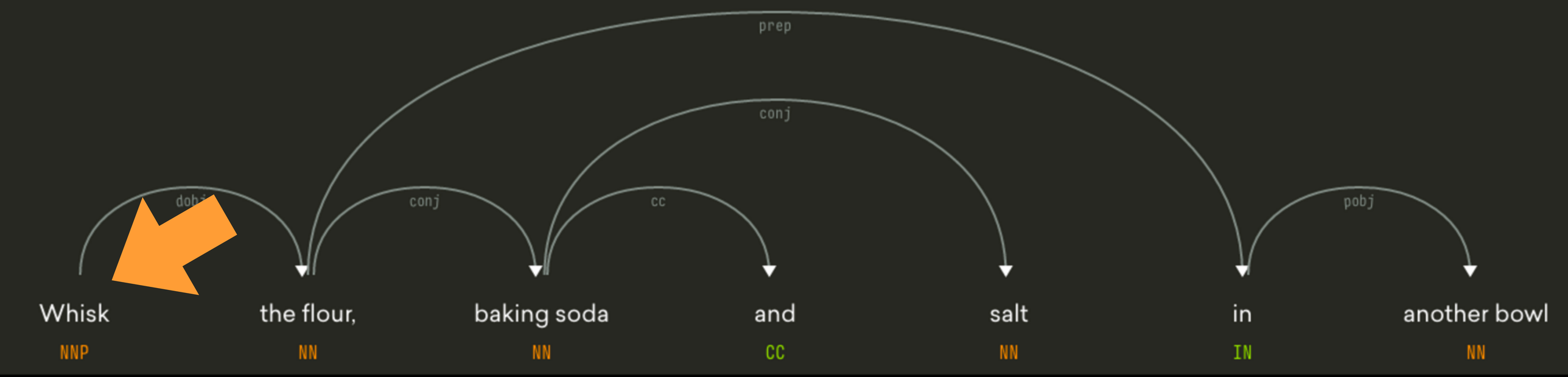


Step 4: Visualize & support analytics

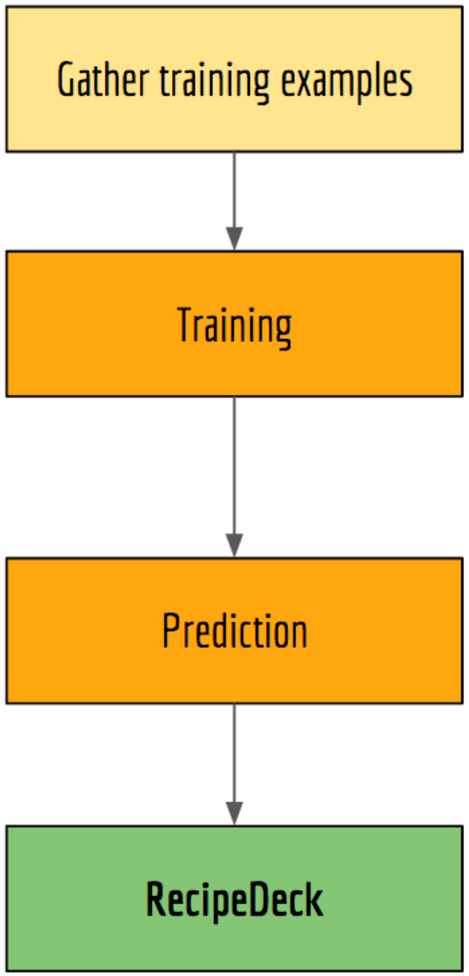




Problem 1: Decomposing and detecting cooking actions from the sentences



Problem 1: Decomposing and detecting cooking actions from the sentences



1) Upgraded version of NYT Cooking's Ingredient Tagger

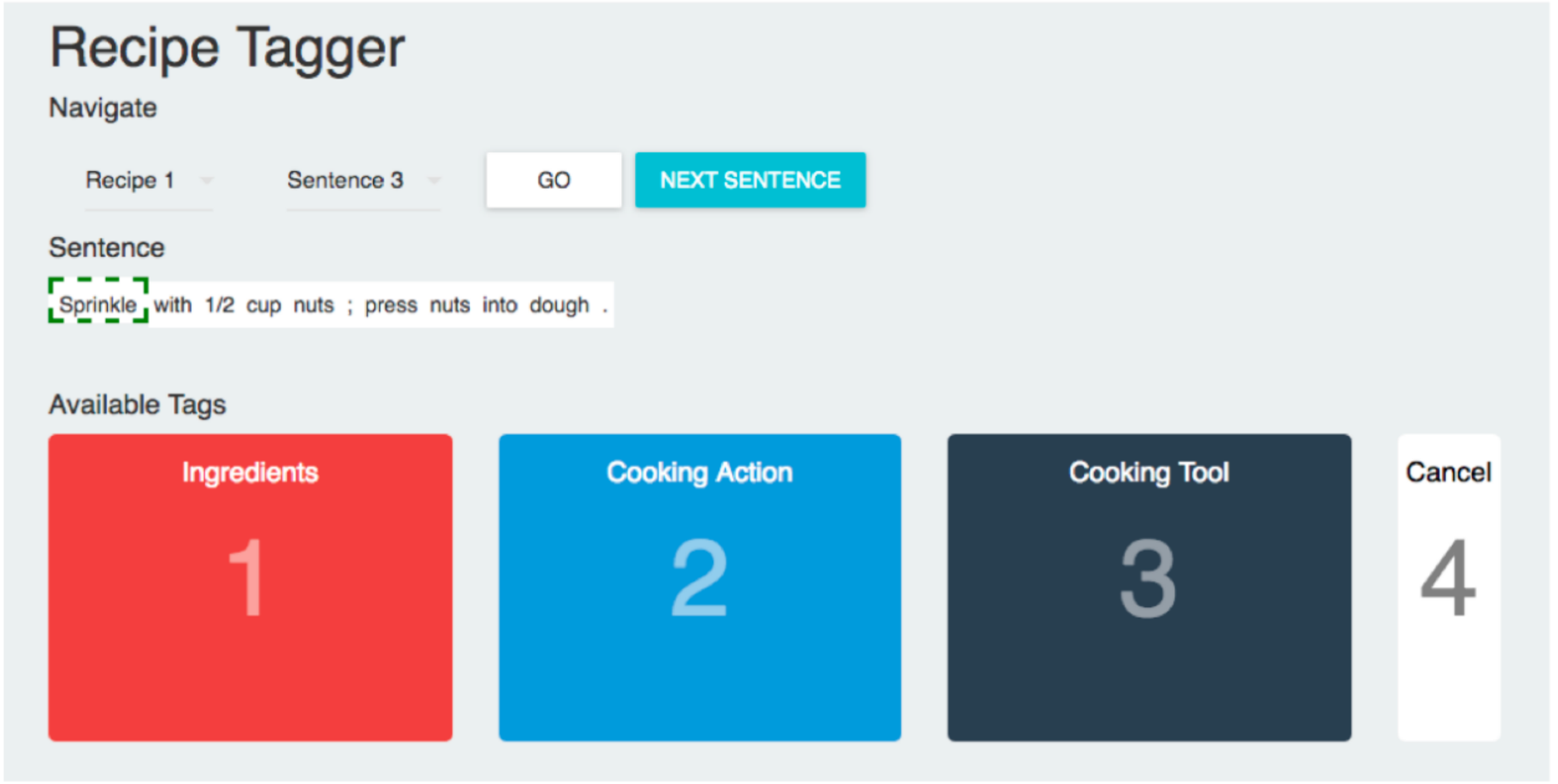
How do we collect labeled training examples? → crowdsourcing

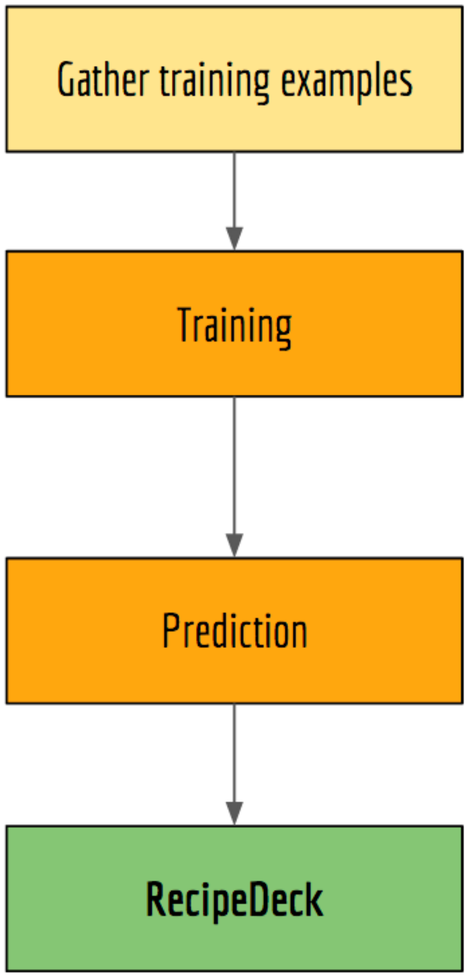
2) Training: Feed labeled examples to the CRF

ex) Whisk-Verb, Beat-Verb, Salt-Ingredient, etc…

3) Run CRF for unlabeled sentences to get cooking verbs

4) The cooking verbs are stacked in the order they appear


Recipe Tagger
Navigate
Recipe 1
Sentence 3
GO
NEXT SENTENCE
Sentence
Sprinkle with 1/2 cup nuts ; press nuts into dough .
Available Tags
Ingredients
1
Cooking Action
2
Cooking Tool
3
Cancel
4



1) Upgraded version of NYT Cooking's Ingredient Tagger

How do we collect labeled training examples? → crowdsourcing

2) Training: Feed labeled examples to the CRF

ex) Whisk-Verb, Beat-Verb, Salt-Ingredient, etc…

3) Run CRF for unlabeled sentences to get cooking verbs

4) The cooking verbs are stacked in the order they appear

Problem 2:

Finding the appropriate representation for recipes!

PREPARATION

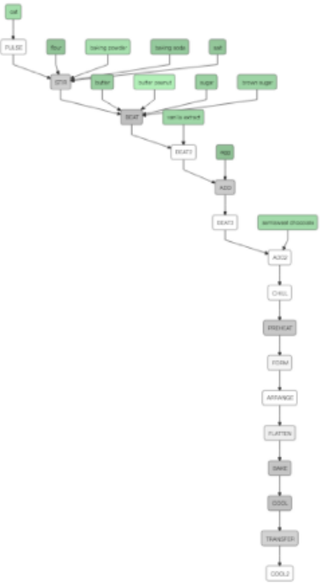
Preheat oven to 160°C (325°F). Place the butter, both the sugars, egg, vanilla, flour, baking soda and cocoa in a food processor and process until a dough forms.

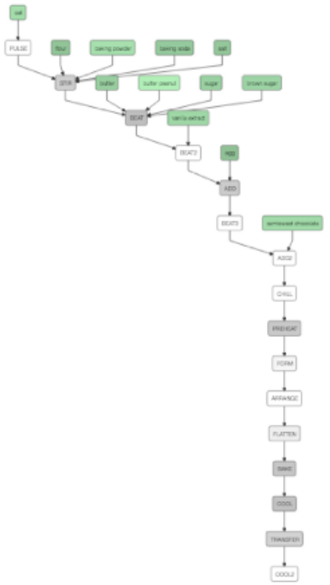
Press the dough out to a 10-inch round on a baking tray lined with non-stick baking paper, scatter with the chocolate and lightly press the pieces into the dough. Bake for 15–20 minutes or until firm to the touch. Allow to cool slightly on the tray. Serve warm with ice cream and caramel sauce.

NLP

Cooking Action	Ingredient
Preheat	
Place	{Butter, sugar, egg, r...}
Process	
...	

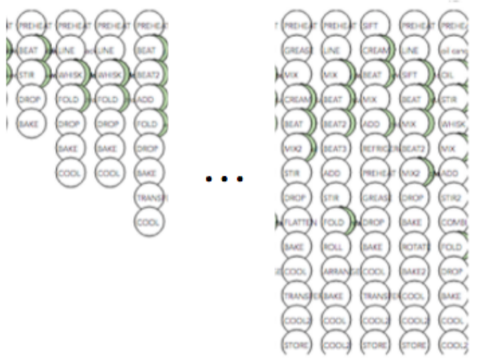
Tree Construction

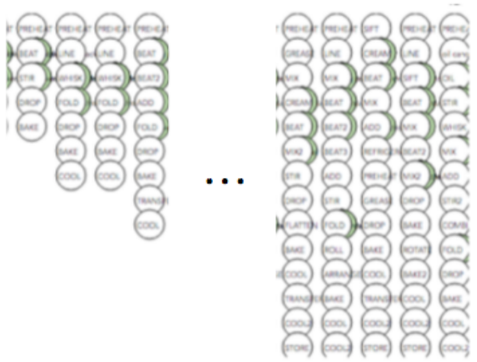




Topological Sort

Repeat all steps upto here for all Recipes

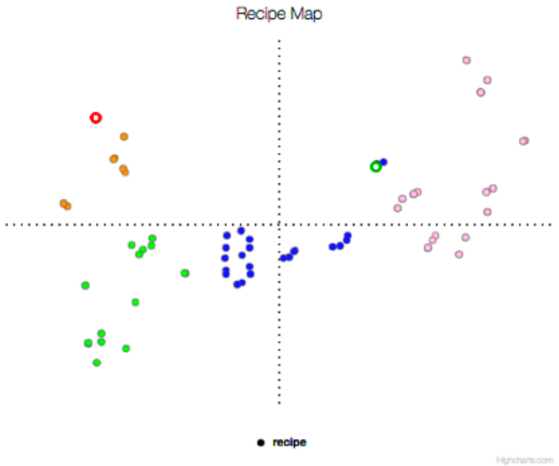




Edit Distance

	Recipe 1	...	Recipe N
Recipe 1			
...			
Recipe N			

T-SNE



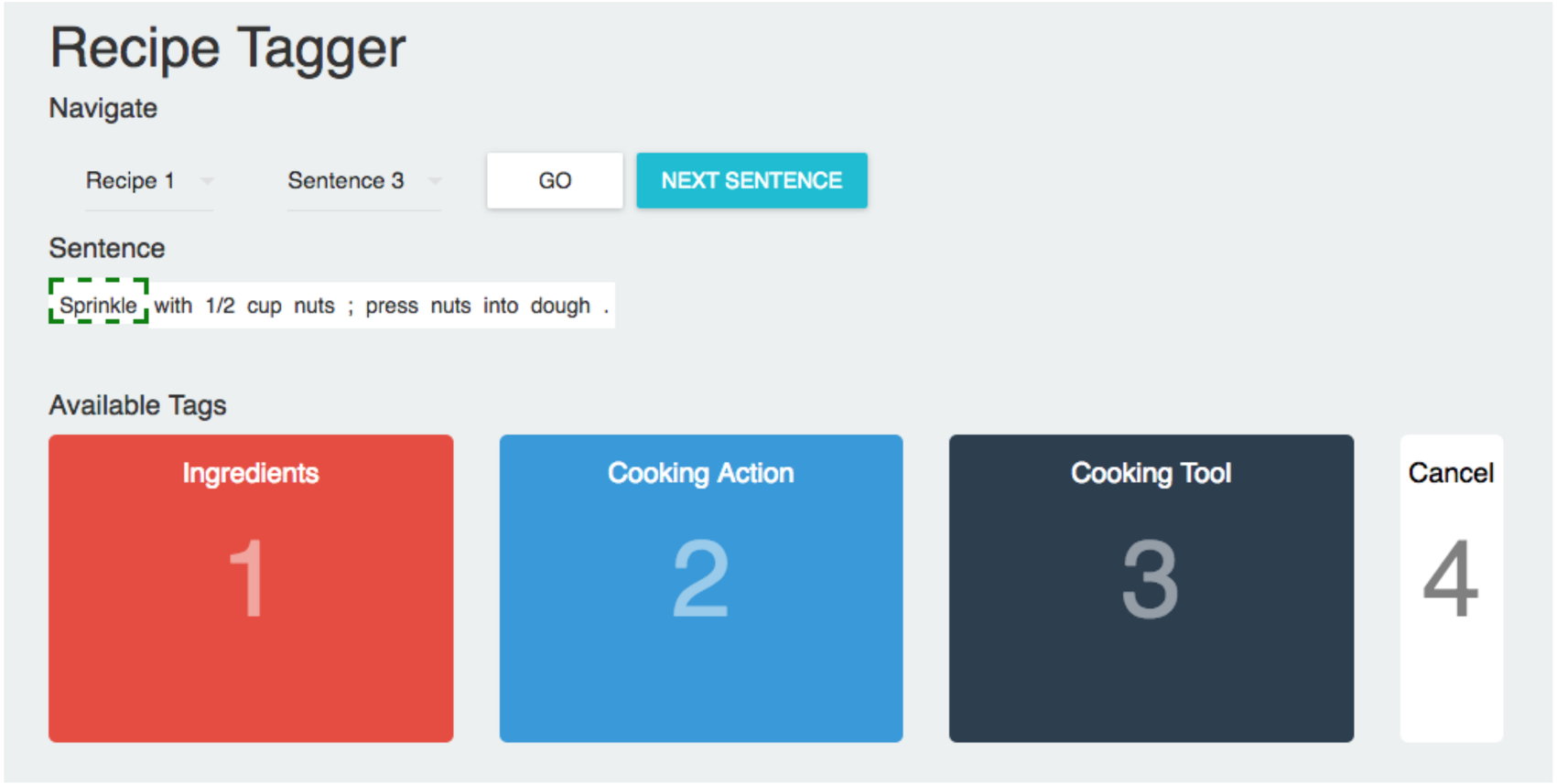
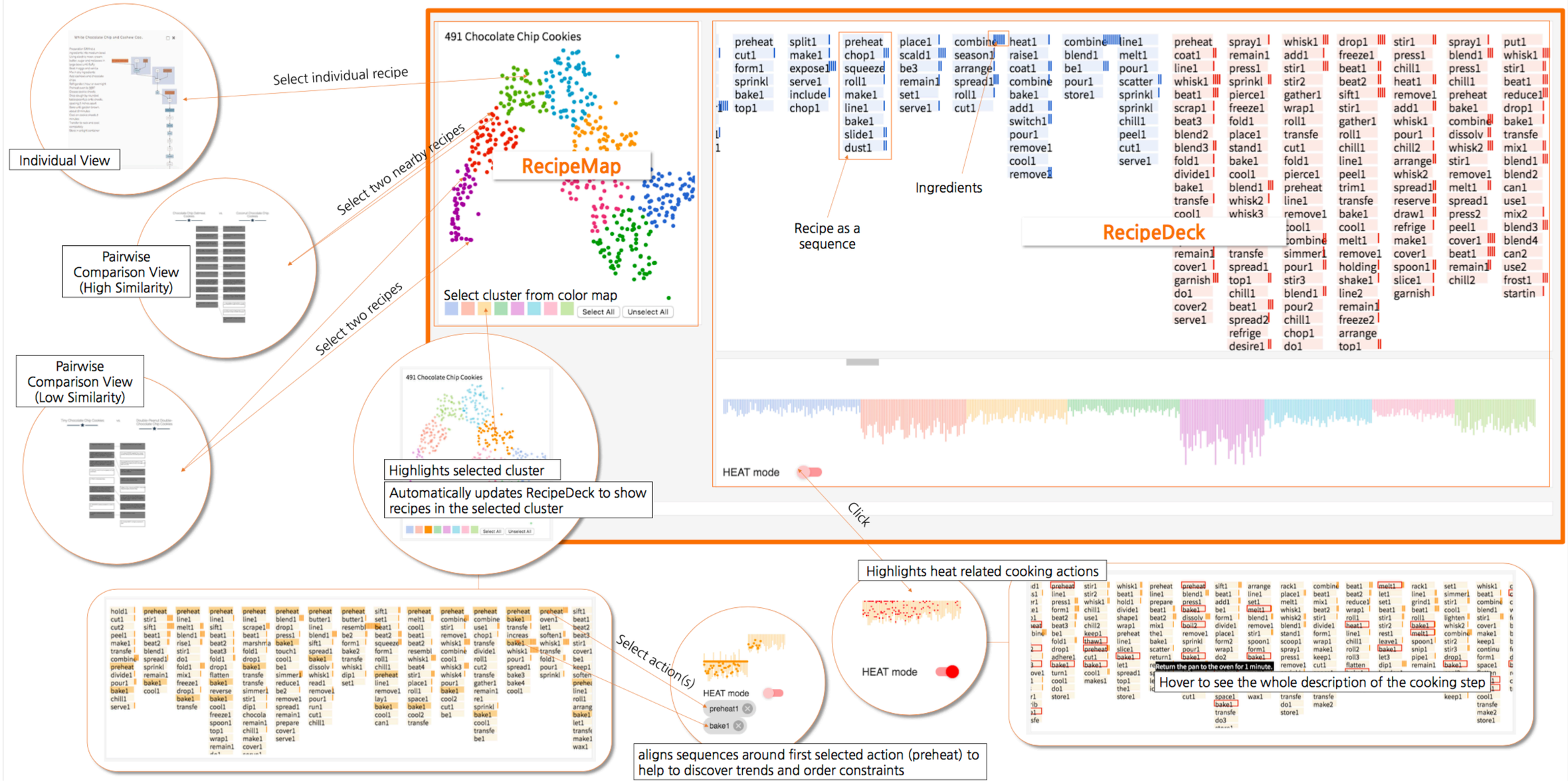
VISION AND NEXT STEPS

- RecipeScape: Recipe analytics tool
- Analyzing cooking recipes in aggregate and at scale helps us better understand collective knowledge and practice around cooking.
- Generalizable technique. Interesting & fun applications like makeup instructions, travel guides, path planning etc
- Cooking is essentially applying different kinds of heat transfer to various ingredients. How can we utilize this insight?
- Can we augment all recipes to support learning/cooking applications?
- Video-based recipes?

KAIST INTERACTION LAB | kixlab.org

Minsuk Chang | minsuk@cs.kaist.ac.kr

RECIPE TAGGER INTERFACE



RecipeScape Prototype Interface