

Ontology-Planning according to Natalya F. Noy and Deborah L.

Step 1. Determine the domain and scope of the ontology

The proposed ontology will cover the domain of German cuisine and be extended to the domain of German Restaurants with regards to their geographical Location. The ontology will be used to develop a chatbot Q&A System, which will be able to answer a user's queries regarding which famous dishes to eat and beverages to drink in Germany, their specific ingredients and also which restaurants excel in preparing a particular dish. The end user will be a tourist who is unfamiliar with German cuisine and is looking to inform themselves of German cuisine.

Competency Questions:

1. What are some traditional German dishes I should try?
 2. What is the difference between Bratwurst and Currywurst?
 3. Which German regions are known for specific dishes or specialties?
 4. What is a typical German breakfast like?
 5. Is there a vegetarian version of Schnitzel in German cuisine?
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Location-Based Questions

6. Where can I eat authentic Bavarian food in München?
7. Can you recommend a good German restaurant in Berlin that serves Sauerbraten?
8. Are there any restaurants in Hamburg that serve Labskaus?
9. What's the best place to try Black Forest Cake in the Black Forest region?
10. Which restaurants in Munich serve Schweinshaxe and have outdoor seating?

Step 2. Consider reusing existing ontologies

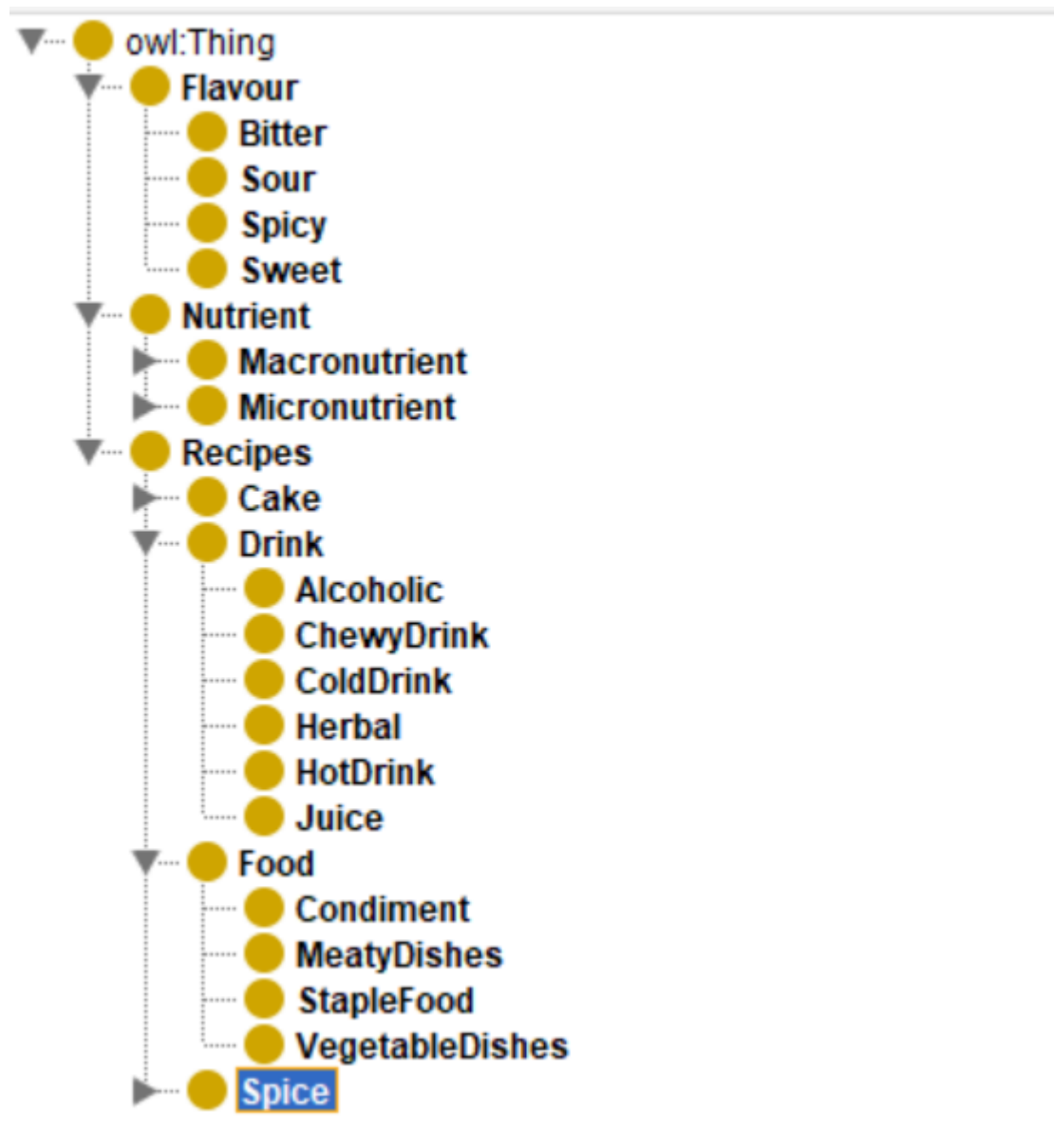
Greek Ontology

Noteworthy Entities:

- <Place of Origin> → origin can be a place of interest culturally or it might imply some higher quality "Wine from Baden-Wü"
- <Main Ingredient> Central predicate
- <Way of Preparation> → doesn't seem to be so important to me
- <Cuts> → fillet, chicken breast etc.
- <State of MI> fresh, fried, minced

- <Ingredients>
- <Functions> → a dish functions as a desert, appetizer, main course, soup, misc.

Indonesian Ontology (Prof. Kemas)



Step 3. Enumerate important terms in the ontology

To model knowledge about German cuisine, we identify the key terms we want to make statements about or explain to users. These terms will form the basis of our ontology and later the structure of our knowledge graph.

The most important terms for our domain are:

Core Concepts

- **Dish** : Represents a specific prepared food item in German cuisine.
- **Beverage** : A drink, either alcoholic or non-alcoholic, often consumed with or as part of a meal.
- **Region** : A geographic origin of the dish or beverage within Germany.

Ingredients and Composition

- `Main Ingredient` : The central component that defines the dish's identity.
- `Ingredients` : Secondary elements used in preparation.
- `StateOfMI` : The physical or culinary state of the main ingredient (e.g., fresh, chopped, marinated).
- `Cuts` : Specific meat portions (e.g., fillet, minced meat), relevant for meat-based dishes.

Culinary Properties

- `Flavor` : A subjective descriptor of taste (e.g., savory, sour, spicy).
- `WayOfPreparation` : How the dish is cooked or prepared (e.g., fried, stewed, grilled).
- `EstimatedPrepTime` : An estimated time range for preparing or serving the dish

Classification and Variation

- `MealType` : Categorizes dishes based on the meal (e.g., breakfast, lunch, dinner).
- `DietType` : Indicates dietary constraints or suitability (e.g., vegetarian, halal).
- `Variation` : Captures alternative versions of dishes, such as vegan or regional variants.

Nutritional Aspects

- `Nutrient` (*optional*): Contains information about the nutritional content, such as calories, fats, proteins, vitamins.

Step 4. Define the classes and the class hierarchy

Class	Description
Dish	A prepared food item from German cuisine.
Beverage	A drinkable liquid (alcholic / non-alcoholic)
Region	A geographical region in Germany.
Main Ingredient	A main ingredient, composing the essence of the dish
StateOfMI	Fresh of MI, e.g. fresh / crushed / chopped/ in dough / engulfed in sauce
Ingredients	A secondary item used to make a dish or beverage. (Spices, Condiments, Vegetables)
DietType	Specifies dietary properties (e.g., vegetarian, vegan, halal, kosher).
MealEatenAtPartOfDay	The part of the day (e.g., breakfast, lunch) a dish is eaten.
Variation	A variation of a dish (e.g., vegetarian Schnitzel).
Flavor	(Subjective) -> Description of Flavor
Nutrient (optional)	Nutritional Information (Fat, Protein, Vitamins etc.)
WayOfPreparation	Fried, boiled, cooked, stewed, grilled etc.
Cuts	(relating to meat) chicken breast, beef fillet, minced meat..
EstimatedPrepTime	Approx. time to expect to be served the food. e.g. Bratwurst: 5-10 min, Maultaschen: 15-25 min

Sub-Classes:

Dish

- MainDish
- SideDish
- StapleDish → **Classical** German dishes Tourists should try
- Dessert
- Snack
- Soup

Beverage

- AlcoholicBeverage
 - Beer , Wine , Schnapps
→ Beer: Helles, Hefeweizen, Kölsch .. → Wine: Red/White/Rosé, ..
 - Cocktails
- NonAlcoholicBeverage
 - Tea , Coffee , Juice, Lemonade, Smoothie, Shake, Water

Region

- → Name
- • State (e.g., Bayern, Baden-Württemberg)
- City (e.g., Berlin, München)
- → IsKnownFor

Main Ingredient

- Meat
 - Pork
 - Beef
 - Chicken
 - Lamb
- Fish
- Vegetable
- Pasta
- Dough
- Tofu
- Mushrooms
- Dairy
- Grain
- Legume
- Egg
- Fruit

StateOfMI

- Raw
- Chopped
- Minced
- Mashed
- CookedInDish (e.g., boiled in soup, fried in pan)
- Battered
- InDough
- InSauce

Ingredients

- Spice (e.g., Pfeffer, Muskatnuss)
- Condiment (e.g., Senf, Essig)
- OilAndFat (e.g., Butter, Schmalz)
- Herb (e.g., Petersilie, Schnittlauch)
- Vegetable
- Bread

DietType

- Vegetarian
- Vegan
- GlutenFree
- Halal
- Kosher
- Pescatarian

MealType

- Breakfast
- Lunch
- Dinner
- Snack
- Fast-Food

Flavor

- Savory
- Sweet
- Sour
- Bitter
- Spicy
- Umami

- Mild

WayOfPreparation

- Frying
 - PanFried
 - DeepFried
 - Boiling
 - Steaming
 - Baking
 - Grilling
 - Roasting
 - Smoking
-

Cuts

- Whole
- Filet
- Chop
- Minced
- Sliced
- SausageForm

EstimatedPrepTime

- QuickPrep (e.g., 0–10 min)
- MediumPrep (e.g., 10–30 min)
- LongPrep (>30 min)

Step 5. Define the properties of classes—slots

Dish

- hasName (string)
- hasDescription (string)
- isFromRegion → Region
- hasMainIngredient → Main Ingredient
- hasIngredients → Ingredients (list)
- hasStateOfMainIngredient → StateOfMI
- hasDietType → DietType
- eatenAtTime → MealEatenAtPartOfDay
- hasVariation → Variation (list)
- hasFlavorProfile → Flavor (list)

- `hasNutrient` → `Nutrient` (optional, list)
- `hasPreparationMethod` → `WayOfPreparation`
- `hasEstimatedPreparationTime` (duration or minutes)

Meat Dish

- `hasCut` → `Cuts`

Beverage

- `servedHotOrCold`
- `isCarbonated`
- `hasIngredient` → `Ingredient``
- `consumedWithMealType` → `MealEatenAtPartOfDay`
- `AlcoholicBeverage`
→ `Alcohol Content`
- `NonAlcoholicBeverage`

Region

- `hasName` (string)
- `isKnownFor` → `Dishes / Beverages` (list of dishes and beverages)

Main Ingredient

- `hasName` (string)
- `isAnimalBased` (bool)
- ``isPlantBased` (bool)

StateOfMI

- `hasStateName` (e.g., "chopped", "mashed", etc.)

DietType

- `hasName`
- `isCompatibleWithDish` → `Dish`

MealEatenAtPartOfDay

- `hasName` (e.g., Frühstück, Mittagessen, Abendessen)
- `hasTypicalDishes` → `Dish`

Variation

- `hasName` (e.g., "vegetarian", "low-fat", "with mushrooms")
- `modifiesDish` → `Dish`

Flavor

- `hasName` (e.g., "spicy", "sweet", "umami")
- `hasIntensity` (mild, medium, strong)

WayOfPreparation

- `hasMethodName` (e.g., "boiling", "roasting")
- `usesTool` (e.g., "oven", "pan")

Cuts

- `hasCutType` (e.g., "whole", "sliced", "minced")

EstimatedPrepTime

- `hasTimeInMinutes` (integer)

Step 6. Define the facets of the slots

Dish

Property	Range / Type	Cardinality	Notes
<code>hasName</code>	<code>string</code>	1	Name of the dish
<code>hasDescription</code>	<code>string</code>	0..1	Optional description
<code>isFromRegion</code>	<code>Region</code>	0..1	Origin of the dish
<code>hasMainIngredient</code>	<code>MainIngredient</code>	1	Only one main
<code>hasIngredients</code>	<code>Ingredient</code>	1..*	List of all ingredients
<code>hasStateOfMainIngredient</code>	<code>StateOfMI</code>	0..1	Optional (e.g., chopped)
<code>hasDietType</code>	<code>DietType</code>	0..*	Can match multiple diets
<code>eatenAtTime</code>	<code>MealEatenAtPartOfDay</code>	0..*	e.g., both lunch and dinner
<code>hasVariation</code>	<code>Variation</code>	0..*	e.g., vegetarian, regional
<code>hasFlavorProfile</code>	<code>Flavor</code>	0..*	e.g., sweet and sour
<code>hasNutrient</code>	<code>Nutrient</code>	0..*	e.g., protein
<code>hasPreparationMethod</code>	<code>WayOfPreparation</code>	1..*	Boiled and then fried, etc.
<code>hasEstimatedPreparationTime</code>	<code>duration</code> OR <code>integer</code> (minutes)	0..1	Time in minutes
<code>hasCut</code>	<code>Cuts</code>	0..1	Mostly for meat-based dishes
<code>isStapleDish</code>	<code>boolean</code>	0..1	Indicates if culturally iconic

Beverage

Property	Range / Type	Cardinality	Notes
hasName	string	1	e.g., Spezi, Apfelschorle
isServedHot	boolean	0..1	Tea, Glühwein vs. Pils
isCarbonated	boolean	0..1	Sodas, beer
hasIngredient	Ingredient	0..*	Lemon, sugar, etc.
consumedWithMealType	MealEatenAtPartOfDay	0..*	e.g., beer with dinner
hasAlcoholContent	decimal	0..1	Only for alcoholic drinks
isAlcoholic	boolean	1	True/False classification

Region

Property	Range / Type	Cardinality	Notes
hasName	string	1	e.g., Bavaria, Swabia
isKnownFor	Dish OR Beverage	0..*	Typical specialties

Main Ingredient

Property	Range / Type	Cardinality	Notes
hasName	string	1	e.g., pork, cabbage
isAnimalBased	boolean	0..1	May be both False
isPlantBased	boolean	0..1	For mushrooms, both could be false factually, but should be True

Ingredient

Property	Range / Type	Cardinality	Notes
hasName	string	1	e.g., pork, cabbage
isAnimalBased	boolean	0..1	May be both False
isPlantBased	boolean	0..1	

State of MI

Property	Range / Type	Cardinality	Notes
hasStateName	string	1	e.g., minced, boiled

DietType

Property	Range / Type	Cardinality	Notes
hasName	string	1	e.g., vegetarian, halal
isCompatibleWith	Dish	0..*	inverse of hasDietType

MealEatenAtPartOfDay

Property	Range / Type	Cardinality	Notes
hasName	string	1	Frühstück, Mittagessen, Abendbrot
hasTypicalDishes	Dish	0..*	Also beverages (e.g., Kaffee)

Variation

Property	Range / Type	Cardinality	Notes
hasName	string	1	e.g., "vegan schnitzel"
modifiesDish	Dish	0..*	Links to base dish

Flavor

Property	Range / Type	Cardinality	Notes
hasName	string	1	e.g., sour, savory
hasIntensity	string (enum: mild, medium, strong)	0..1	

Method of Preparation

Property	Range / Type	Cardinality	Notes
hasMethodName	string	1	boiling, grilling
usesTool	string	0..*	oven, deep fryer

Cuts

Property	Range / Type	Cardinality	Notes
hasCutType	string	1	refers to meat mostly - chicken breast / beef fillet

Step 7. Create instances

→ Add Description Logic