

# *Example for Combining Data-Driven and Knowledge-Based Systems*

*Knut Hinkelmann*



# Which Wine would you choose?



£20.50

QTA DA PACHECA  
COLHEITA WHITE

Young and very aromatic  
this Pacheca have an  
Moscato.

REGION DOURO



£30.50

DUAS QUINTAS  
WHITE

Sweet bouquet of yellow  
roses, peaches and  
apricots.

REGION DOURO



Experience?  
Knowledge?  
Or in the end just the  
price?  
Can AI help?



£27.50

CALLABRIGA  
RED

Deep red in colour with  
lively aromas of fresh with  
some notes floral, spicy  
and balsamic notes.

REGION DOURO

£28.00  
VALE RAPOSA  
RESERVA RED

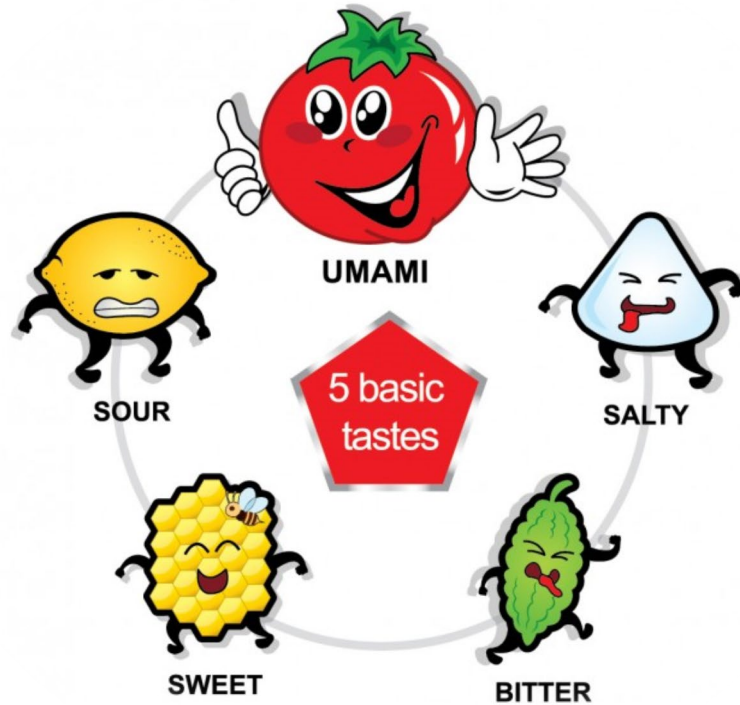
Smooth, soft tannins and  
a fruity finish. If you  
know the Douro this wine  
will make you start have  
an opinion.

REGION DOURO

# *Which Whiskey do you like?*



# Recommendation Criteria: Taste



# Describing Taste - Profiles

## Flavour Profiles

Young & Spritely

Sweet, Fruity & Mellow

Spicy & Dry

Deep, Rich & Dried  
Fruits

Old & Dignified

Light & Delicate

Juicy, Oak & Vanilla

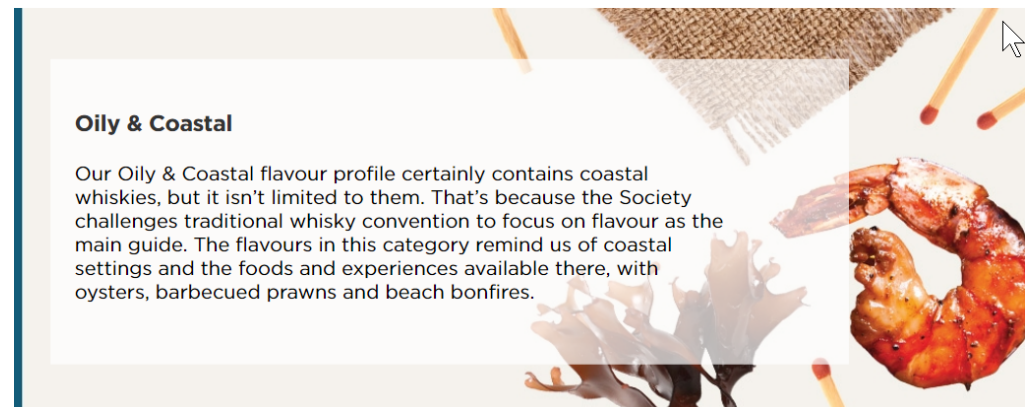
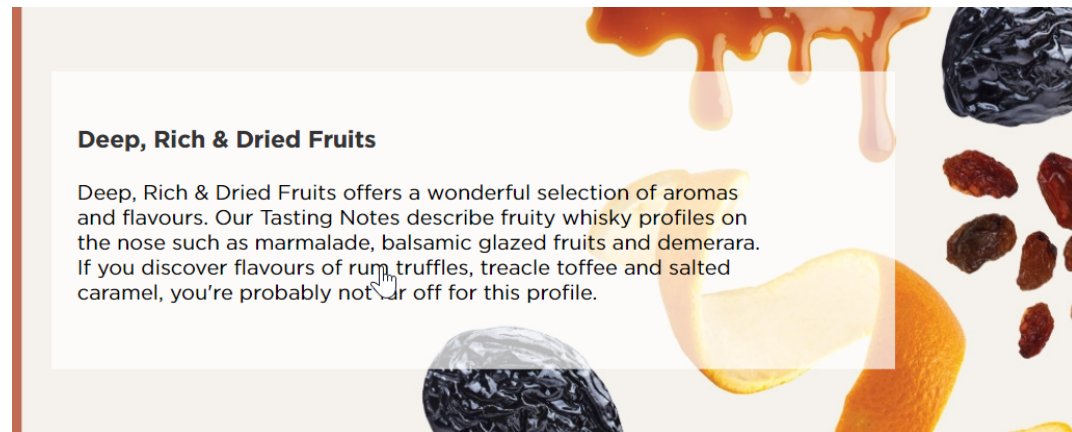
Oily & Coastal

Lightly Peated

Heavily Peated

Peated

Spicy & Sweet



(Source: Website of the Scotch Malt Whisky Society [www.smws.com](http://www.smws.com))



## *Describing Taste – Individual Whiskies*

The palate is bathed in a **sunshine glow of tropical fruits (banana, custard apple, monstera)** – intensely sweet, mouth-watering and lip-smacking, but with Victory V's and **salt and pepper crisps** reminding us it has slept long in oak.

The air was filled with **cinder toffee, raisins, dates, Brazil nuts, balsamic vinegar** and a rich Malmsey Madeira wine. On the palate we nibbled **sweet, salty and spicy roasted party nuts** whilst we chatted, sharing a laugh and a drink with friends.

We were foraging for **berries in bushes**, drank a **cranberry orange prosecco cocktail** and distilled **sandalwood oil**. On the palate neat it was just like a Caribbean black cake, a boozy **rum-soaked fruit cake** with a good dose of molasses, brown sugar and browning (burnt sugar) sauce. With **water polished mahogany**, sweet myrrh incense and salty liquorice were followed by zesty Indian lime pickle and extra dark honey vanilla cornbread.

(copied from whisky descriptions of the Scotch Malt Whisky Society [www.smws.com](http://www.smws.com))



# Data Driven Filtering

## Customers also bought

Neu



Talisker Skye Single Malt Scotch  
Whisky 70cl mit Etui und 2  
Rocking Gläsern

CHF 58.00



The Ultimate Mortlach 2008  
Single Malt Scotch Whisky 70cl

CHF 68.00

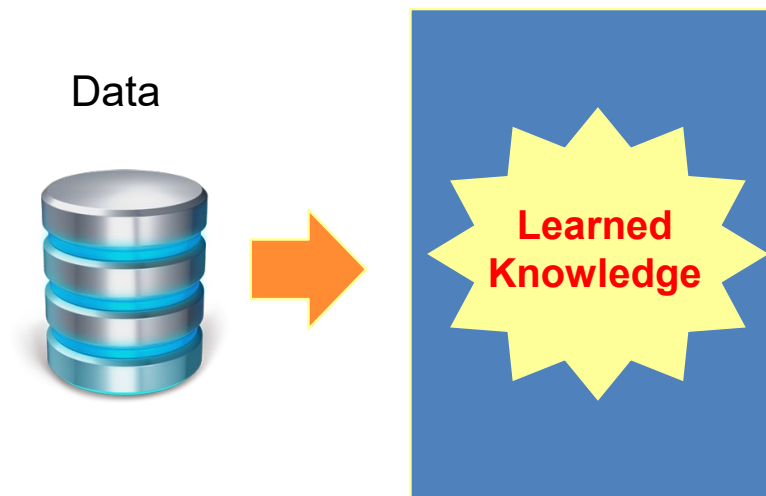


Talisker Port Ruighe Single Malt  
Scotch Whisky 70cl mit Etui

CHF 65.00

# Data Driven Recommendation

Collaborative Filtering  
- compare tastes





## *Challenges for Data Driven Solutions*

- Consistency of Past and Future
- New and Rare Products
- Explanations

# Consistency between Data and Intent

## Customers also bought

Neu



Talisker Skye Single Malt Scotch Whisky 70cl mit Etui und 2 Rocking Gläsern

CHF 58.00



The Ultimate Mortlach 2008 Single Malt Scotch Whisky 70cl

CHF 68.00



Talisker Port Ruighe Single Malt Scotch Whisky 70cl mit Etui

CHF 65.00



Kopfgetriebeöl 10T30 Nuss-Karamell Likör 50cl

CHF 24.90

Not a whisky

# Challenge: New and Rare Products

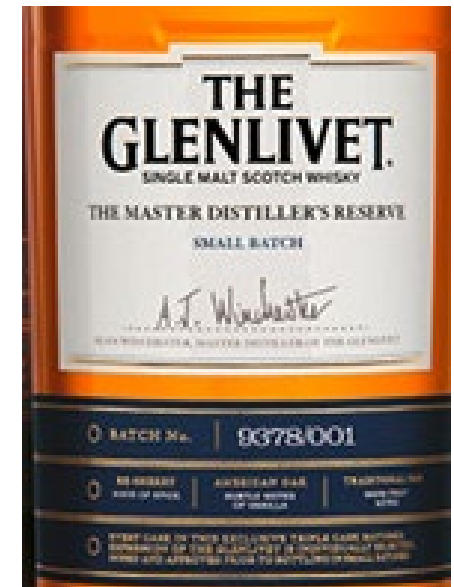
## Limited Editions



## Single Cask



## Small Batch

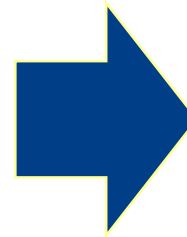


## New Distilleries/Brands



# Objective: Chat with an Expert

## Whisky Expert



## A Virtual Bartender

Hi, I'm your barkeeper. I'd like to recommend you some whiskies. Are you familiar with whiskies?

nope unfortunately not!

Okay, pal - that's not a problem. I love to introduce guests to the world of whisky. I'd recommend an starter whisky, that is normally a sweeter one. Is it okay or do you want to proceed with attribute selection?

starter-whisky

Okay pal, you'd probably start with a sweeter whisky like Glenmorangie. However you'll find some more sweet ones below.



**Glenglassaugh**  
This whisky comes from the northern Scottish provinces, where it was distilled a...

[select Glenglassaugh](#)

**Talisker**  
This noble drop w

Let me know which one you'd like to choose by clicking on the appropriate card

[select Glenglassaugh](#)

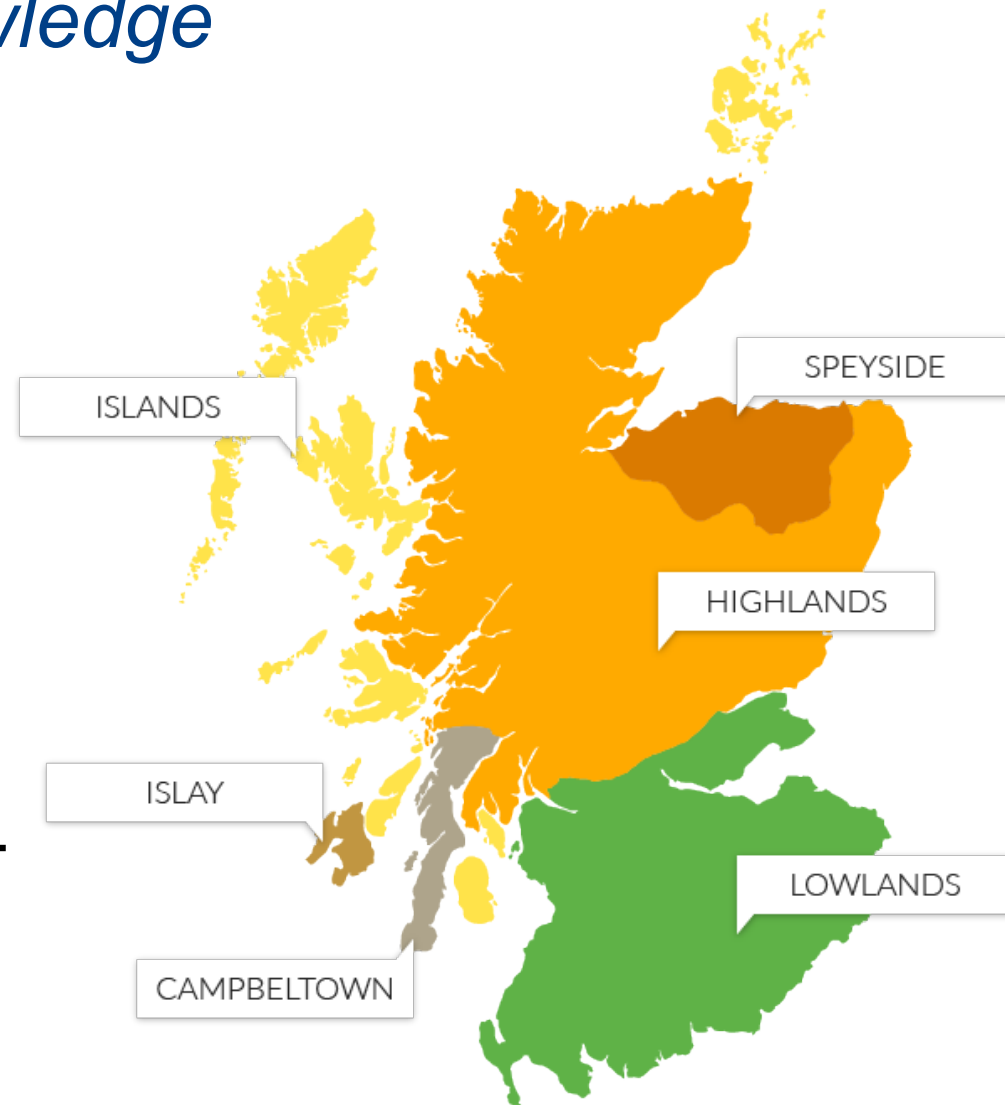
Excellent choice, Let me know how you liked it.

it was not that good

Thank you for your feedback. I will remember your preferences!

# Semantic AI: Expert Knowledge

- Ontology:
  - ◆ Lagavullin and Ardbeg are from Islay
  - ◆ Whiskies from Islay are typically smoky
- Rules:
  - ◆ Whiskies can be finished in other casks: Sherry, Port, ...
  - ◆ Oak casks give a vanilla flavour
  - ◆ ...



# Combining Data-driven and Knowledge-based Recommendation

Collaborative Filtering  
- compare tastes



Knowledge Base  
- explanations

