



# Smelling the Past Without Hallucination

**Raphaël Troncy - Data Science Department**

Credits: P. Lisena · T. Ehrhart · D. Schwabe · M. van Erp · W. Tullett  
· I. Leemans · L. Marx · S. Ehrich · S. Tonelli · S. Menini · **ChatGPT**

# Why Olfaction?

classic

# Domain-specific terminology & knowledge

hydrolytic

fresh

sweet

rich

volatiles

aldehyde

bursts

pungent

tones

blueberries

sweet

gasoline-like

flavour

corpulent

woody

citrus

medicinal

Perfume makers

Wine sommeliers

Chemists

Lisena et al. (2021) **Data Mining and Knowledge Graphs as a Backbone for Advanced Olfactory Experiences**. In *STT21: Smell, Taste, and Temperature Interfaces workshop*

# Stakeholders

- Perfume-making
- **Olfactory Heritage**
- Scholar  
(neuroscience)
- GLAMS
- Human Computer Interfaces
- Urban design
- **Tourism**
- **Environment preservation**

PRESS RELEASE

Perfume-related know-how  
in Pays de Grasse  
recognised as an intangible  
cultural heritage of  
humanity by UNESCO

HERITAGE

INTANGIBLE CULTURAL HERITAGE

Published on 28.11.2018



French MPs were spurred to "protect the sensory heritage" of the countryside after outsiders complained about the way of life  
ALAMY

## Law protects rural smells in France

Charles Bremner, Paris

Friday January 22 2021, 12:01am GMT, The Times



thejapanimes



NATIONAL

## Ministry compiles list of nation's 100 best-smelling spots

SHARE Oct 31, 2001

Sulfurous hot springs, lavender blossoms, grilled eel





**Ms. Tarantula (official)** @fortuneontwit  
I lost my smell

1



**MamaPyjama** @MamaPyjama2 · 15 mag

Aw crap. I've **lost** my senses of **smell** and taste. I'm going to try really hard to not get depressed about this but for people who know me I'm, like, \*extremely\* food motivated.



**bella ross** @bellamayara  
Welp... day 4 of being s  
**smell**

6



**Dhrubajyoti Deka** @Djdhruba2 · 24 set 2020

I didn't understand how **important smell** is

Until I **lost** it today.

17



44

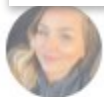


**alex** @amrakow · 22 mag

t my taste and **smell** :(



8



**Sarah Coulter** @sarahcoulter  
I have absolutely **lost** all  
never recover

2



**Howard Pinsky** @Pinsky · 15 mag

I was hoping we were just dealing with the flu but my wife and I got hit with  
both my taste



**Anosmia And Me** @AnosmiaM · 27 feb 2021

When you have **lost** your sense of **smell** 'memory' smells are so important.

They connect you to your past. [#lossofsmell](#) [#anosmia](#)

[#anosmiaawarenessday](#)



**Ken Reid** ✓  
For the "CO  
COVID in the last six months who **lost** their sense of **smell** and taste and  
NEVER got it back. That's literally 40% of your physical senses gone. That's  
a life long disability

3

14

57



1



2



I have **lost** my senses to taste and **smell** hope this is temporary

*What are the **most frequent** smell sources in **London** in the 18th century?*

*When did the smell of **pollution** start to be mentioned?*

# Centuries of collective smell memories



## Heritage

*What smells were perceived during the **Waterloo Battle**?*

*What **emotions** were associated with floral smells in the 19th century?*

*How have the **adjectives** used for describing a smell change over time?*

PARRY'S  
CYCLOPÆDIA  
OF  
PERFUMERY

A HANDBOOK

On the Raw Materials used by the Perfumer, their  
Origin, Properties, Characters and Analysis; and  
on other subjects of Theoretical and Scientific  
Interest to the User of Perfume Materials, and to  
those who have to Examine and Value such Materials

ERNEST  
Analytical

OSPHRÉSIOLOGIE,  
OU

TRAITÉ DES ODEURS, DU SENS ET DES ORGANES  
DE L'OLFACTION;

AVEC L'HISTOIRE DÉTAILLÉE DES MALADIES DE NEZ ET DES SENSÉS PARALÉS,  
ET DES OPÉRATIONS QUI LEUR SONT CONNEXES;

PAR HIPPOL. CLOQUET.

J. B.



A PARIS,  
CHEZ MÉQUIGNON-MARVIS, LIBRAIRE  
POUR LA PARTIE DE MÉDECINE,  
RUE DE L'ÉCOLE DE MÉDECINE, N° 5.  
1821.

Text

# Centuries of collective smell memories



# Heritage



Images





# Design Methodology - Odeuropa Ontology

# Competency questions (CQ)

74 questions, organised in 7 categories  
defined by olfactory experts (history and heritage domain)

## 1. Smells

*What smells were significant in the past?*

## 2. Noses

*How did people use their noses in the past and what types of smell expertise or experience can we find?*

## 3. Identities

*What meaning did smells have and how did they communicate identities or stereotypes?*

## 4. Emotions

*What feelings were associated with smells in parts of Europe at different times?*

## 5. Practices

*What kinds of practices produced smells?*

## 6. Sites and contexts

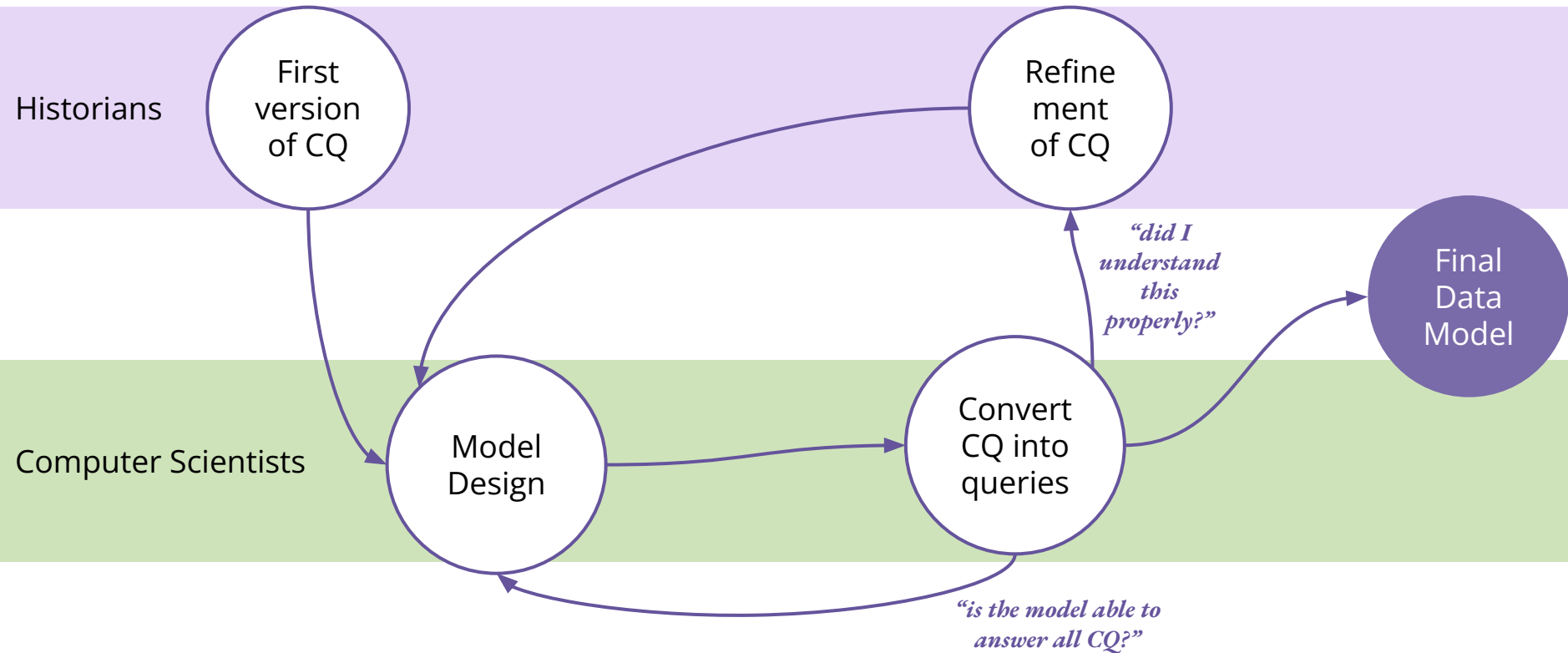
*Which communities, institutions, or spaces were associated with particular smells?*

## 7. Texts and images

*How smells are represented in texts and images?*



# Collaboration between Disciplines



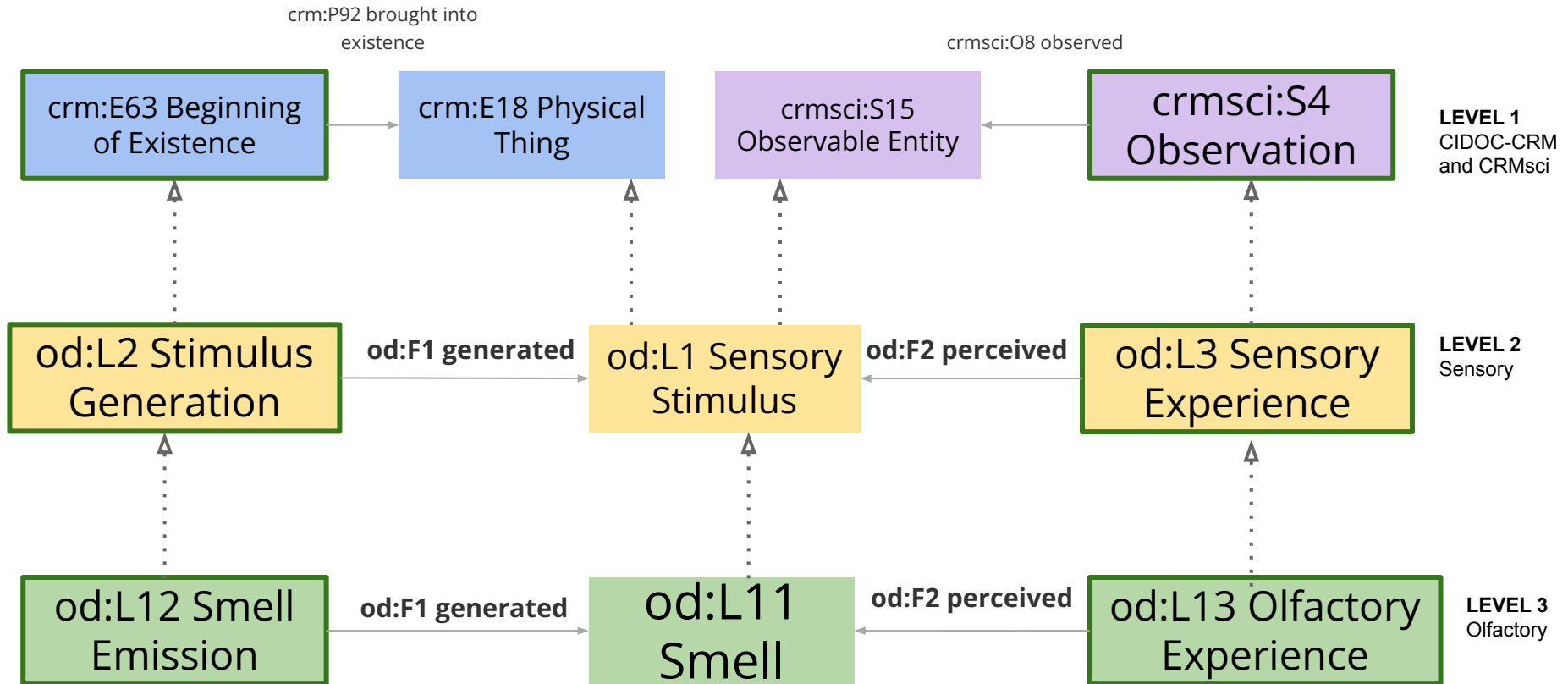
# Core



Event



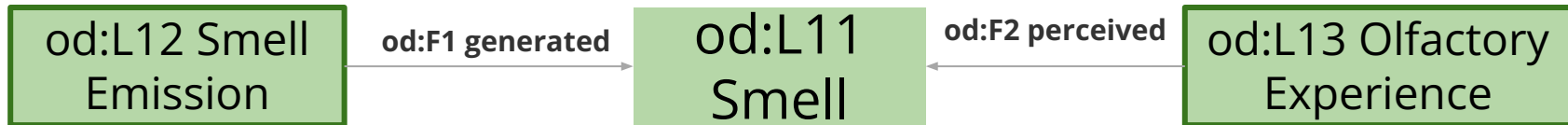
subclass of  
property





# What is a Smell?

- In this model, we consider a **smell as a unique and non-repeatable entity**
  - Two roses have two distinct (but similar) smells
  - A smell is normally connected to time and space
  - The “smell of roses” exists only as a generalisation of the smells of all roses
- A given smell can be experienced by multiple people
  - Each person can describe the same smell differently





# What the model enables to represent

Smell  
Emission

Olfactory  
Experience

Odorizing

- Provenance of the information (which document, which tool)
- Space & Time
- Co-occurring event

- **Source**
- **Carrier**
- Smell Transformation
- Smells Interaction
- Connection with multiple experiences

- Perceiver
- **Gesture**
- **Attributes** used for describing it
- **Emotion**
- Evoked entities
- Multi-sensory experiences

- User
- Technique
- Purpose

# Controlled vocabularies in SKOS

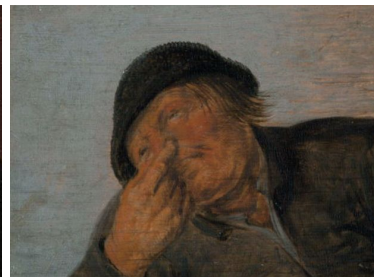
## Multilingual Vocabularies (6 langs)

realised during the project



### Olfactory Objects

420 Concepts



### Olfactory Gestures

35 Concepts

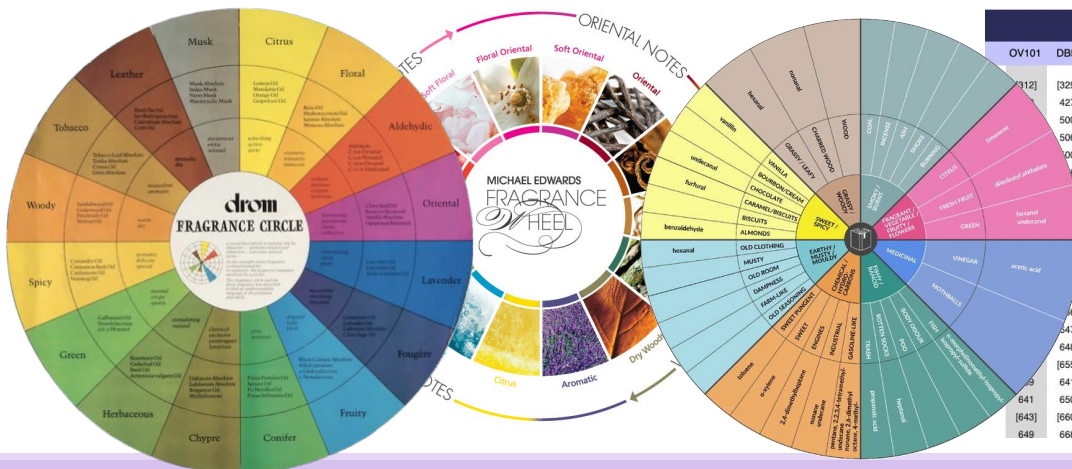


### Fragrant spaces

110 Concepts

- hierarchy
- bridges between vocabularies
- interlinks with Wikidata and Iconclass

## Olfactory taxonomies published in SKOS





Can we see smells?  
Can we read smells?



**Title:** Portrait of Helena Schermer  
**Date:** c.1620  
**Creator:** Andreas Schuch (c.1634–1680)  
**Medium:** Oil on canvas

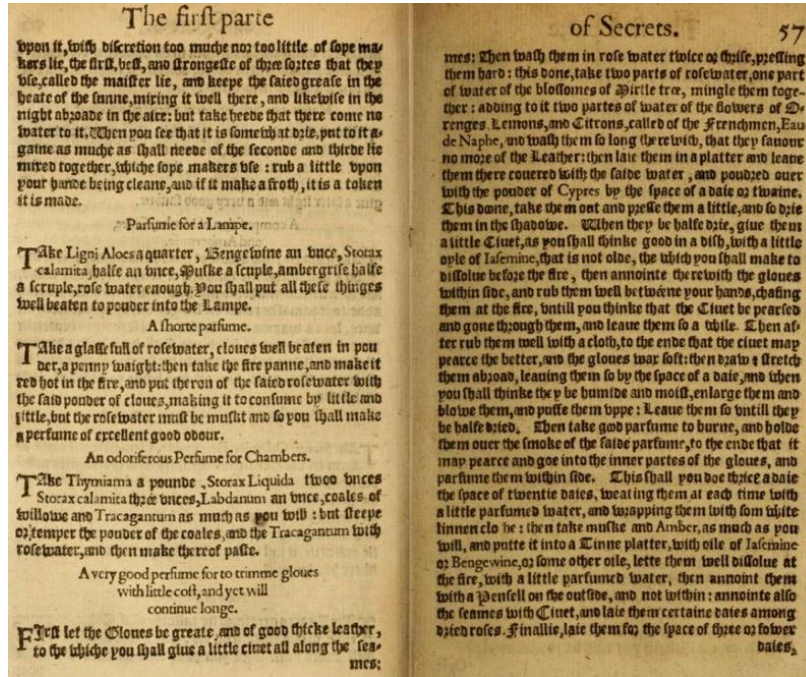
“Follow you nose”  
Exhibition at  
Ulm Museum

First let the gloues bee greate, and of good thicke leather, to the which you shall gyue a little **Ciuet** all alonge the seames: Than washe them in **rose water**, twice or thryse, pressing them harde: this doen, take twoo partes of **rose water**, one parte of the **water of the blossoms of Mirtell** tree, mingle them together: addinge to it two partes of the **water of the flowres of Orenge, Lemons, & Citrons**, called of the Frēchmen, can de nafe, and washe them so long therwith, that they **sauour no moore of the leather** [...]

Than wil they bee **excellent**, as if it were to present an **emperour** withall.

*-- Girolamo Ruscelli. The Secrets of the Reuerende Maister Alexis of Piemount. 1558*

# Verie good perfume for to trimme gloues with litle cost, and yet will continue longe



## Ingredients:

rose water; myrtle blossom water; orange, lemon, and citron water; perfumed water; cypress powder; jasmine oil; ben oil; perfume (*probably incense*); dried roses; civet; musk; and ambergris.

Girolamo Ruscelli, *The Secrets of the Reuerende Maister Alexis of Piemount*, trans. Wyllyam Warde (London, 1558)





# Let's ask ChatGPT



What is the perfume recipe from the book of secrets by Girolamo Ruscelli, under the pen name Alessio Piemontese?



Girolamo Ruscelli, writing under the pen name Alessio Piemontese, published a book titled "Secreti nobilissimi de l'arte profumatoria" ("Most Noble Secrets of the Art of Perfumery") in 1555. This book contains various perfume recipes, one of which is known as "Acqua Admirabile" or "Admirable Water."

The recipe for "Acqua Admirabile" from the book is as follows:

#### Ingredients:

- 1 pound of lavender flowers
- 1 pound of dried rosemary
- 1 pound of dried marjoram
- 1 pound of dried sage
- 1 pound of fresh lemon balm
- 1 pound of fresh lemon peel
- 1 pound of fresh orange peel
- 4 ounces of cinnamon
- 4 ounces of cloves
- 4 ounces of nutmeg
- 4 ounces of cardamom
- 4 ounces of benzoin
- 4 ounces of storax
- 4 ounces of aloeswood
- 4 ounces of rose water
- 4 ounces of musk

#### Instructions:

1. Grind all the herbs and spices into a fine powder.
2. Mix the powder with the rose water, musk, and other liquid ingredients.
3. Place the mixture in a large jar and let it steep for 40 days in a cool, dark place.
4. After 40 days, strain the mixture through a cloth and transfer the liquid to a clean bottle.
5. Seal the bottle and let it age for another 40 days before using.

This recipe is one of the many perfume recipes found in "Secreti nobilissimi de l'arte profumatoria," and it is a testament to the skill and knowledge of perfumers during the Renaissance era.



What is the typical European recipe to scent gloves?



During the Renaissance era in Europe, it was fashionable to wear perfumed gloves as a way to mask the smell of leather and to provide a pleasant fragrance to the wearer. The following is a typical recipe for scenting gloves from that time period:

#### Ingredients:

- 1/2 pound of Orris root
- 1/2 pound of benzoin
- 1/2 pound of storax
- 1/4 pound of cloves
- 1/4 pound of cinnamon
- 1/4 pound of sandalwood powder
- 1/4 pound of lavender flowers
- 1/4 pound of rose petals
- 1/4 pound of musk

#### Instructions:

1. Grind all the ingredients into a fine powder.
2. Put the powder into a muslin bag or pouch.
3. Place the gloves in a box or container and add the pouch of powder.
4. Close the box or container and let the gloves absorb the fragrance for several days, shaking the box or container occasionally to distribute the powder.
5. After a few days, remove the gloves from the box or container and shake off any excess powder.

This recipe can be adjusted based on personal preference, and different herbs, spices, and scents can be used to create a unique fragrance. However, the basic principle of using a combination of natural ingredients to create a pleasant scent remains the same.



Do you know what scent Helena Schermar might have worn?



Helena Schermar was a historical figure who lived in the early 17th century and was the wife of the Dutch painter Frans Hals. While I do not have any specific information on the scents that she wore, it was common for women of that era to wear perfumes made from natural ingredients such as floral extracts, spices, and herbs.

Some of the popular scents during the 17th century in Europe included lavender, rose, jasmine, orange blossom, bergamot, musk, and ambergris. Many of these scents were used in perfumes, powders, and other fragranced products. Women also used scented gloves and handkerchiefs to carry and apply their preferred fragrance.

It is likely that Helena Schermar wore one or more of these fragrances, or perhaps she had a preferred scent that was made specifically for her. However, without further historical documentation or personal accounts, it is difficult to know for certain what scent Helena Schermar may have worn.



You're wrong. Helena Schermar married the councillor Anton Schermar in 1620. Why do say she was the wife of Frans Hals?



I apologize for the error in my previous response. You are correct that Helena Schermars was the wife of Anton Schermar and not Frans Hals. I must have inadvertently mixed up the names while responding to your question.

Unfortunately, I do not have any specific information on the scents that Helena Schermar may have worn, as there are no historical accounts that I am aware of that describe her personal fragrance preferences. However, as I mentioned earlier, it was common during the 17th century for women to wear perfumes made from natural ingredients such as floral extracts, spices, and herbs, and it is possible that Helena Schermar also wore one or more of these fragrances.



# Fallacies and myths ...



How did people use smells to protect themselves against plague?



During the time of the plague, people believed that bad smells or "miasma" in the air were responsible for spreading the disease. To protect themselves, they used a variety of methods to mask or purify the air around them.



One common method was the use of "pomanders," which were small, perfumed balls or sachets filled with fragrant herbs and spices. People would carry these with them or hang them in their homes to ward off bad smells and, by extension, the plague.

Another method was the burning of aromatic herbs and woods, such as rosemary, juniper, and frankincense, which were believed to have purifying properties. This was often done in small burners called "thuribles," which could be carried around or placed in a home or church.

In addition, people would sometimes wear masks filled with fragrant herbs, such as a mix of rose petals and cloves, to protect themselves from the bad smells and potentially disease-carrying particles in the air.

While these methods were not effective in preventing the spread of the plague, they provided people with a sense of comfort and control in the face of a devastating disease.

Tulips mostly do not have a smell (they are specifically cultivated for their visual qualities and endurance to diseases, not to produce nice smells).

ChatGPT project scents from visual icons of Dutch identity.



What does the Netherlands smell like?



As an AI language model, I don't have the ability to experience smells firsthand. However, I can provide some information on common smells associated with the Netherlands based on what I have been trained on.



The Netherlands is a relatively small and densely populated country with a diverse landscape that includes cities, countryside, and coastlines. Some of the scents that one might encounter in the Netherlands could include the smell of salty sea air along the coast, the fragrance of tulips and other flowers in the famous Dutch flower fields, the scent of fresh cheese and baked goods in local markets, the aroma of freshly brewed coffee in cafes, and the smell of diesel fuel from the many bicycles and boats that are popular forms of transportation in the country. Additionally, there may be some less pleasant smells associated with urban areas, such as exhaust fumes from cars and buses.





civet



rose water



dried rose



musk



amber



myrtle blossom water



orange flower water



Jasmine oil

od:L12 Smell Emission

od:L11 Smell

od:L14 Smell Transformation

od:L11 Smell

od:L13 Olfactory Experience

crm:E13 Attribute Assignment



Emperor  
crm:E21 Person

od:F2 has source

od:F3 has carrier

od:F2 has source

crm:E29 Design or Procedure  
crm:P33 used specific technique

od:F1 generated

crm:P140 assigned attribute to

od:F2 perceived

crm:P17 was motivated by

crm:P2 has type

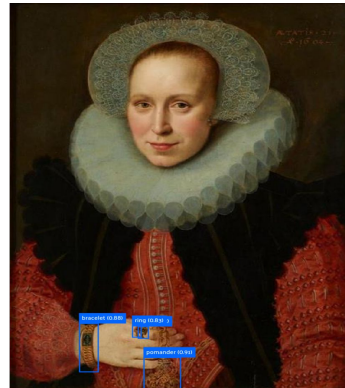
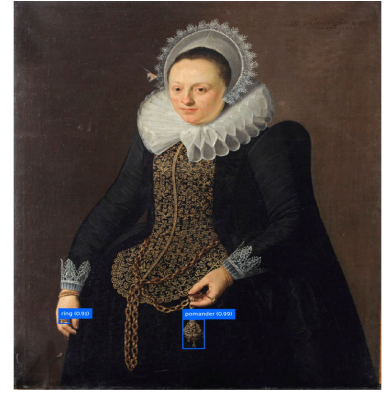
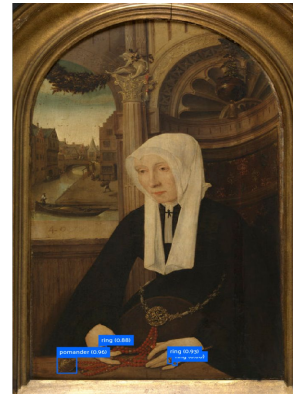
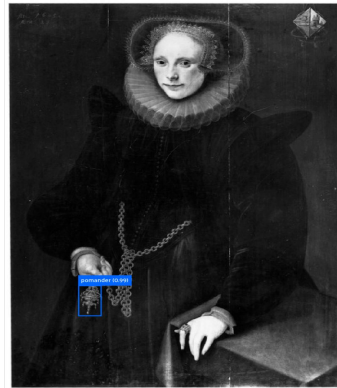
crm:P141 assigned

crm:P14 carried out by

hedonic

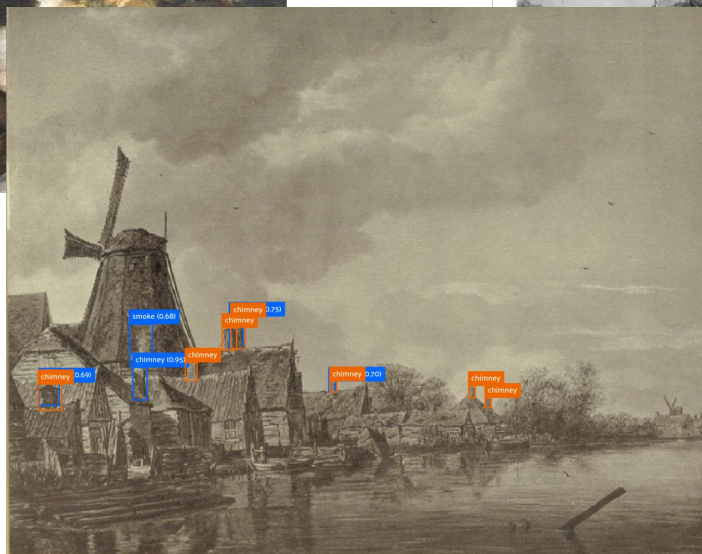
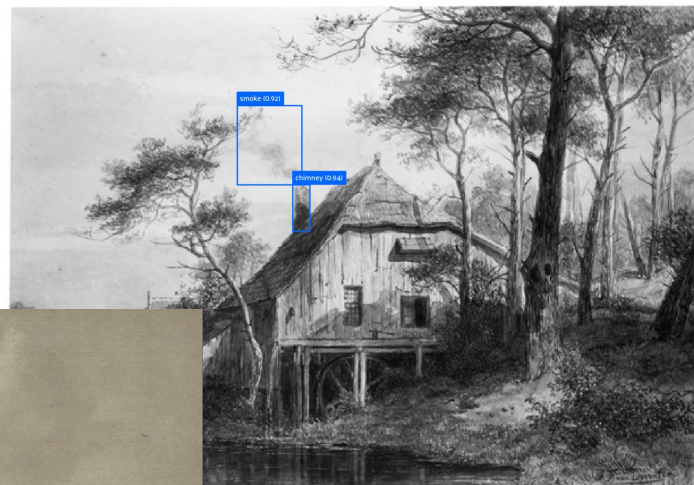
excellent

# How AI can help?





# Example Predictions: Smoke and Chimneys



ODOR  
Dataset v3



The screenshot displays the INCEpTION annotation platform interface. At the top, there is a toolbar with icons for navigation and editing. The main area shows several paragraphs of text with various words and phrases highlighted in colored boxes (yellow, blue, red) and connected by red lines to labels representing semantic roles. The labels include: Smell\_Source, Location, Smell\_Word, Effect, Perceiver, Quality, Evoked\_Odorant, Odour\_Carrier, and Perceiver. The text includes excerpts from 'The Tricks of the Town' (1746), 'George Anne, Bellamy, An apology for the life of George Anne Bellamy' (1785), and 'The gentleman, out of humour at my delicacy...'.

- 7 languages
- Frame-based annotations
- Smell source
  - Carrier
  - Quality
  - Perceiver
  - Odorants
  - Place
  - Time
  - Circumstances
  - Effects

**INCEpTION annotation platform, <https://inception-project.github.io/>**

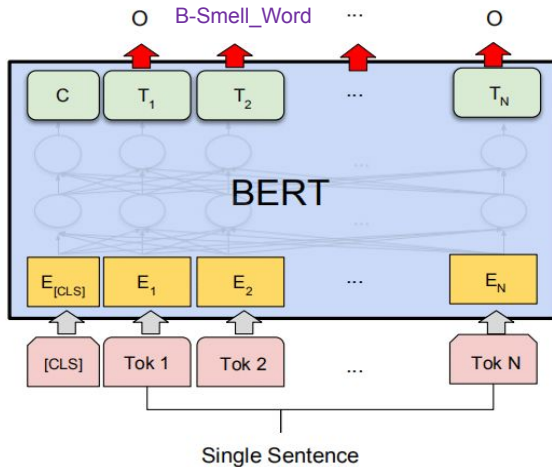




# Odeuropa text processing system

- **Token classification:** a label to each token in a sentence

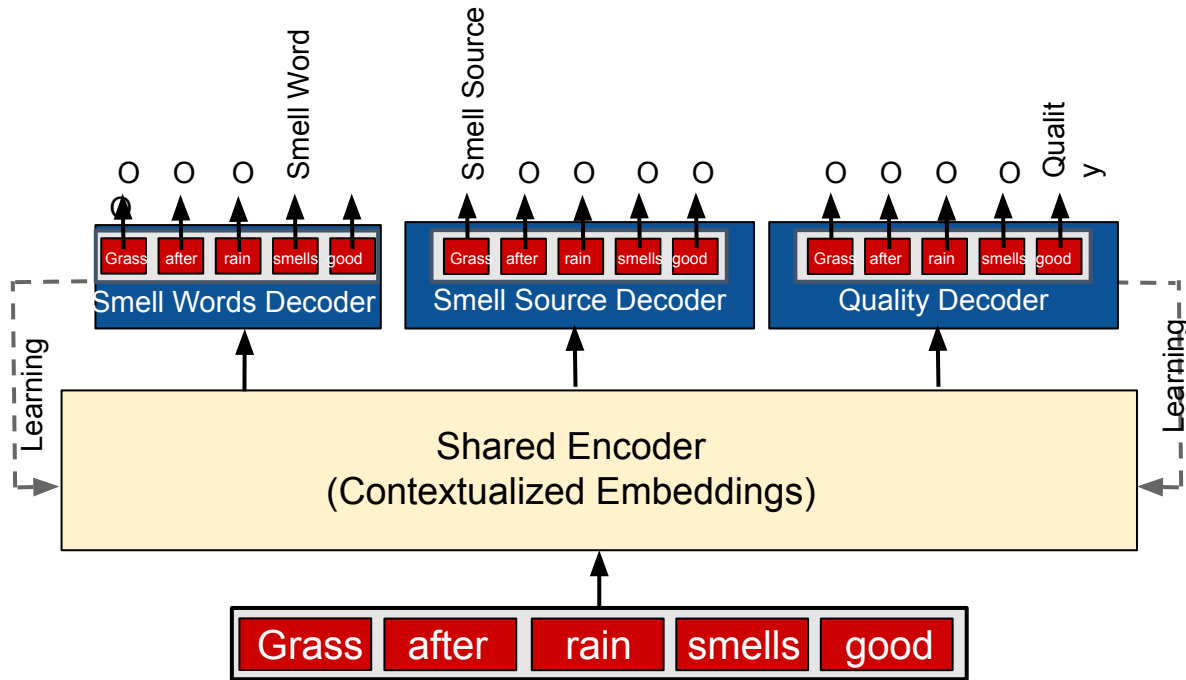
The scent of flowers is often cloying  
O B-Smell\_Word B-Smell\_Source I-Smell\_Source O O Quality



- Fine-tuning BERT and Multilingual BERT LMs as **baseline** Systems
- Using IOB chunking schema
- Classes: Smell Word, Smell Source, Quality,  
+  
Odour Carrier, Evoked Odorant, Location, Perceiver, Time, Circumstances, Effect



# Odeuropa text processing system



- Multi-task learning: multiple learning tasks are solved at the same time, exploiting commonalities and differences across tasks.
- Information can be shared across the tasks
- Tasks can be in a hierarchy (tasks can be auxiliary to the principal ones)



# Odeuropa text processing system



English. Average of 10 folds

Model	Training Metric	Smell Word	Smell Source	Quality	Odour Carrier	Evoked Odorant	Location Perceiver	Time	Circumstances	Effect	
<b>Multitask</b>											
monolingual	span-f1	<b>0,871</b>	0,571	0,758	0,482	<b>0,572</b>	0,542	<b>0,510</b>	0,434	0,461	<b>0,405</b>
monolingual	token-f1	0,864	0,571	<b>0,759</b>	<b>0,483</b>	0,535	0,535	0,484	0,417	<b>0,480</b>	0,365
multilingual	span-f1	0,860	<b>0,583</b>	0,747	0,452	0,542	<b>0,560</b>	0,488	<b>0,471</b>	0,455	0,271
multilingual	token-f1	0,860	0,533	0,741	0,441	0,473	0,500	0,461	0,440	0,457	0,296
<b>BERT-Standard</b>											
monolingual	token-f1	0,821	0,461	0,652	0,361	0,295	0,349	0,365	0,370	0,215	0,115
multilingual	token-f1	0,839	0,475	0,671	0,359	0,338	0,378	0,377	0,369	0,212	0,125



# Frames semantic shift



Two periods - data extracted with the model is divided into:

- **1500-1799**
- **1800-1930**

Approach inspired by the work by El-Ebshihy et al. 2018.

Two aligned embedding spaces (FastText)

Hypothesis: if the embeddings of a smell source change, the way the documents talk about the smell source should be different

**Threshold for change:** average similarity of the smell sources between the period (minus standard deviation)





# Historical language processing



	bert-base-uncased			macBERTh		
	Precision	Recall	F1	Precision	Recall	F1
Quality	41.66	60.60	49.38	63.77	67.50	<b>65.58</b>
Smell source	37.31	42.21	39.61	45.34	50.64	<b>47.85</b>
Smell word	83.47	91.86	<u>87.47</u>	78.97	<b>92.34</b>	85.13
Overall	54.14	64.89	58.82	62.69	70.16	<b>66.18</b>

macBERTh captures more information for all frame elements, i.e. the recall is always higher & the precision is lower only for Smell word



# Finding text and images evoking the same smell

“Having secured rooms in this establishment , we started for a walk through the town . The first thing that strikes a stranger upon his arrival at Accra is a strong , all - pervading smell of **pig.**”

## MUSTI Challenge

<https://multimediaeval.github.io/editions/2022/tasks/musti/>

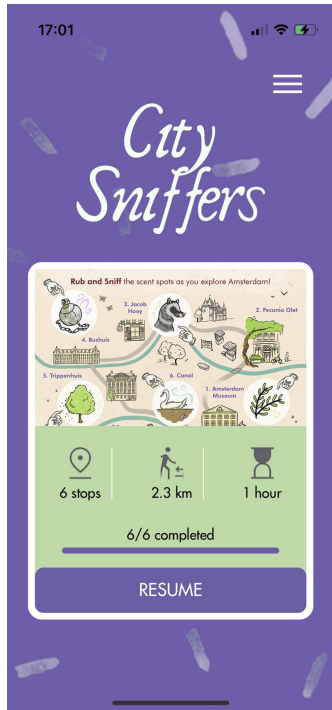


Julien Creytens, *Varkens en kippen scharrelen bij boerderij*, source: [1]

# Approach: Vision Transformers / NLI

	English	German	French	Italian	Overall
dummy-baseline	.4285	.4289	.3333	.4273	.4075
mUNITER	.4269	.4289	.3551	.4398	.4177
mUNITER-SNLI	.4474	.4644	.3605	.5020	.4473
mUNITER-MUSTI	.6965	.4579	.5022	.6535	.6011
mUNITER-SNLI-MUSTI	.7482	<b>.5014</b>	<b>.5053</b>	.6850	<b>.6176</b>
Shao et al.	<b>.7867</b>	.4568	.3743	<b>.7501</b>	.6033
Vilbert-SNLI-MUSTI	<b>.8024</b>	-	-	-	-

# City Sniffers to explore a city



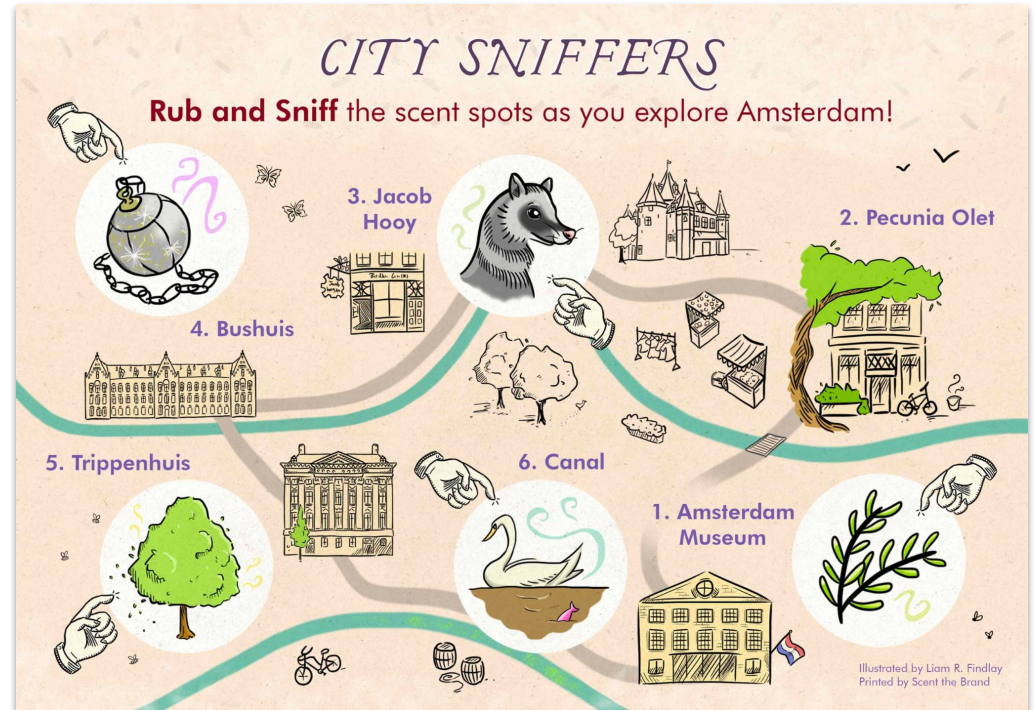
17:00

[Back](#) Stop 4: Plague an...

expanding their trade with Asia. In the course of the seventeenth century, the VOC brought many new commodities back to European cities. In particular, the Dutch company brought an influx of **spices** into European cities: **nutmeg, mace, and cloves**. However it was through using violence and forced labour that they expanded their trade.

For instance, the Dutch tortured, massacred, and enslaved the indigenous community at Banda islands, situated East of Java, in order to gain a monopoly on the trade of **mace and nutmeg**.

These were not just culinary curiosities: they were also used in medicines that could be bought in apothecaries as seen at the previous stop. In the





Odeuropa Smell Explorer

Encyclopaedia of Smell History & Heritage

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Overview | Explanatory Essays | Project Members | Contributors | Contact

Smell History

Author:  
Date published:  
doi:  
Cite:

Smell Heritage

These essays aim to explain key concepts, methods, or approaches represented by or that have fed into the Encyclopaedia. Each starts, as always, with an introductory paragraph in a bigger font.

Sensory Mining

The essays, which will be around 2,000-3,000 words in length, will then come below. They will include images or other figures in-line with the text. <sup>[1]</sup>

Smell-scape

<sup>[1]</sup> Throughout the ESHH footnotes will be in superscript with square brackets and hyperlink to the footnote at the end of the entry, essay, or other page, which can also take you back to the point in the text of the citation.

<sup>[2]</sup>

Smell etc.

FAU, EURECOM, ITM

The project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101019441.



Encyclopaedia of Smell History & Heritage



# Smell digitisation and preservation



Case studies:

**Historic leather** (environment of a historic/classic car)



**Rover, P5B HM Queen Elizabeth II, 1973**



The volatile organic compounds responsible for the smell of the car were collected and analysed using GC-MS/GC-O.



The smell of the car interior was analysed in situ by trained assessors.



# Smell digitisation and preservation



Case studies:

**Historic leather** (environment of a historic/classic car).

## Participants

- [1] classic car enthusiasts
- [2] members of the public with no necessary link to classic cars
- [3] staff from the British Motor Museum
- [4] trained assessors



What do **YOU** smell?

What terms come to your mind first?



# Public impact: Smell = surprise & essential



- Odeuropa project launch **global press storm**
- **+300** press articles published in 3 months
- **Major outlets** / all countries
- 2020-2023: **300+ direct appearances** in newspapers, magazines, radio, podcasts, TV, online
- **millions** of readers & viewers worldwide



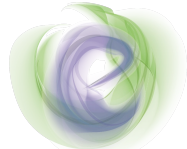
<https://www.youtube.com/watch?v=DaS8VDU2EYc>

<https://www.france.tv/france-2/telematin/2434899-emission-du-jeudi-13-mai-2021.html>



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