

Онтология на основните стилове в изобразителното изкуство и техните отличителни картини

Даниел Халачев, ИИОЗ, 4М13400603

14 декември 2024 г.

Атомарни концепти

- **Artwork** - произведение на изкуството
- **Age** - епоха в човешкото развитие
- **Style** - стил в изобразителното изкуство
- **Artist** - художник, нарисувал картината
- **Region** - регион на света, където е работил художникът
- **Medium** - средство за изобразяване
- **Depiction** - какво изобразява картината
- **Museum** - музей, в който се помещава картината днес

Атомарни подконцепти

Paint \sqsubseteq Medium

Landscape \sqsubseteq Depiction

Неатомарни концепти

Painting \doteq [AND Artwork, [EXISTS 1 :depicts], [EXISTS 1 :hasMedium]]

OilPainting \doteq [AND Painting, [FILLS :hasMedium, OilPaint]]

AcrylicPainting \doteq [AND Painting, [FILLS :hasMedium, AcrylicPaint]]

HistoricalEventPainting \doteq [AND Painting, [FILLS :depicts, HistoricalEvent]]

PortraitPainting \doteq [AND Painting, [FILLS :depicts, Portrait]]

LandscapePainting \doteq [AND Painting, [ALL :depicts, Landscape]]

PortraitOilPainting \doteq [AND OilPainting, PortraitPainting]

Роли

belongsTo : Style → Age
represents : Artwork → Style
createdBy : Artwork → Artist
housedIn : Artwork → Museum
locatedIn : Museum → Region
negativeReactionTo : Style → Style
positiveReactionTo : Style → Style
depicts : Painting → Depiction
usesMedium : Painting → Medium
livedIn : Artist → Region
precededBy : Age → Age
succeededBy : Age → Age.

belongsTo(*Paleolithic, PrehistoricAge*)

belongsTo(*Neolithic, PrehistoricAge*)

belongsTo(*AncientEgyptian, Antiquity*)

belongsTo(*AncientGreek, Antiquity*)
positiveReactionTo(*AncientGreek, AncientEgyptian*)

belongsTo(*Roman, Antiquity*)
positiveReactionTo(*Roman, AncientGreek*)

belongsTo(*Byzantine, MiddleAges*)

belongsTo(*Romanesque, MiddleAges*)

belongsTo(*Gothic, GothicAge*)
positiveReactionTo(*Gothic, Romanesque*)

belongsTo(*ItalianRenaissance, Renaissance*)
negativeReactionTo(*ItalianRenaissance, Gothic*)

belongsTo(*Nordic Renaissance*, *Renaissance*)

belongsTo(*Baroque*, *New Age*)

negativeReactionTo(*Baroque*, *Renaissance*)

belongsTo(*Rococo*, *New Age*)

negativeReactionTo(*Rococo*, *Baroque*)

belongsTo(*Classicism*, *New Age*)

negativeReactionTo(*Classicism*, *Rococo*)

belongsTo(*Romanticism*, *New Age*)

belongsTo(*Realism*, *Modern Age*)

negativeReactionTo(*Realism*, *Romanticism*)

belongsTo(*Impressionism*, *Modern Age*)

negativeReactionTo(*Impressionism*, *Realism*)

belongsTo(*PostImpressionism*, *Modern Age*)

positiveReactionTo(*PostImpressionism*, *Impressionism*)

belongsTo(*Expressionism*, *Modern Age*)

negativeReactionTo(*Expressionism*, *Realism*)

belongsTo(*Cubism*, *Modern Age*)

negativeReactionTo(*Cubism*, *Impressionism*)

belongsTo(*Futurism*, *Modern Age*)

belongsTo(*Dadaism*, *Modern Age*)

belongsTo(*Surrealism*, *Modern Age*)

positiveReactionTo(*Surrealism*, *Dadaism*)

belongsTo(PopArt, ContemporaryAge)

belongsTo(ConceptualArt, ContemporaryAge)

positiveReactionTo(ConceptualArt, PopArt)

precededBy(Antiquity, PrehistoricAge)

succeededBy(Antiquity, MiddleAges)

precededBy(MiddleAges, Antiquity)

succeededBy(MiddleAges, GothicAge)

precededBy(GothicAge, MiddleAges)

succeededBy(GothicAge, Renaissance)

precededBy(Renaissance, GothicAge)

succeededBy(Renaissance, NewAge)

precededBy(NewAge, Renaissance)

succeededBy(NewAge, ModernAge)

precededBy(ModernAge, NewAge)

succeededBy(ModernAge, ContemporaryAge)

precededBy(ContemporaryAge, ModernAge)

От тях *precededBy* и *succeededBy* са противоположни и транзитивни, а *createdBy* и *housedIn* са функционални.

Константи

• Artwork

Michelangelo → Artist

David → Artwork

livedIn(Michelangelo, WesternEurope)

createdBy(David, Michelangelo)

represents(David, ItalianRenaissance)

housedIn(David, GalleriaDellAccademia)

• Age

PrehistoricAge → Age

Antiquity → Age

MiddleAges → Age
GothicAge → Age
Renaissance → Age
NewAge → Age
ModernAge → Age
ContemporaryAge → Age

• Style

Paleolithic → Style
Neolithic → Style
AncientEgyptian → Style
AncientGreek → Style
Roman → Style
Byzantine → Style
Romanesque → Style
Gothic → Style
ItalianRenaissance → Style
NordicRenaissance → Style
Baroque → Style
Rococo → Style
Classicism → Style
Romanticism → Style
Realism → Style
Impressionism → Style
PostImpressionism → Style
Expressionism → Style
Cubism → Style
Futurism → Style
Dadaism → Style
Surrealism → Style
PopArt → Style
ConceptualArt → Style

• Medium

Chalk → Medium
Graphite → Medium

- **Paint** \sqsubseteq Medium

OilPaint → Paint
AcrylicPaint → Paint

- **Depiction**

HistoricalEvent → Depiction
Portrait → Depiction
GroupScene → Depiction
AbstractDepiction → Depiction

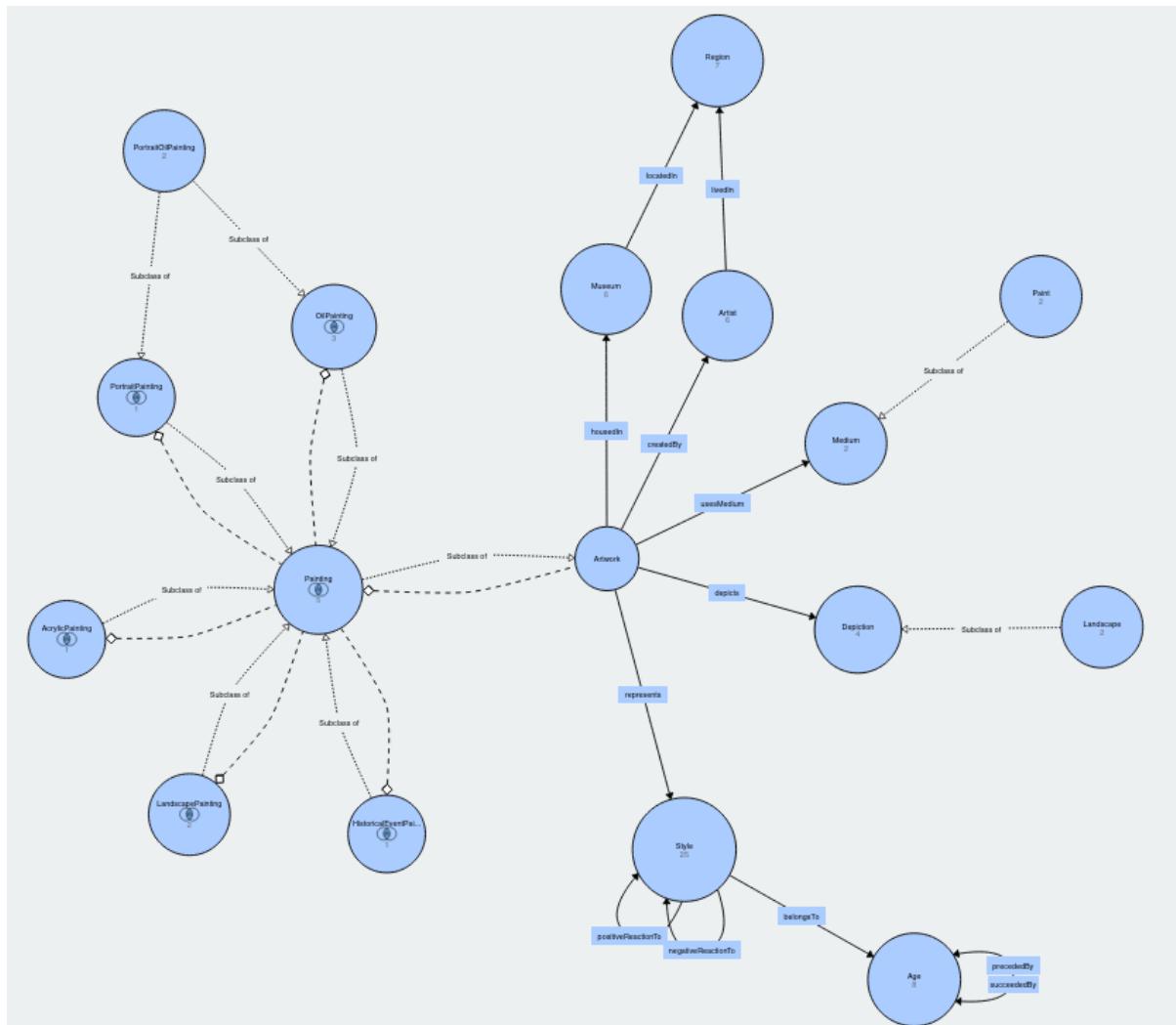
- **Landscape** \sqsubseteq Depiction

NaturalLandscape → Landscape
UrbanLandscape → Landscape

- **Region**

Asia → Region
Africa → Region
Australia → Region
NorthAmerica → Region
SouthAmerica → Region
EasternEurope → Region
WesternEurope → Region

Визуализация



Представители на изброяните стилове и епохи

Художници

- VincentVanGogh → Artist

livedIn(VincentVanGogh, WesternEurope)

- JohannesVermeer → Artist

livedIn(JohannesVermeer, WesternEurope)

- LeonardoDaVinci → Artist

livedIn(LeonardoDaVinci, WesternEurope)

- FranciscoGoya → Artist

livedIn(FranciscoGoya, WesternEurope)

- AndyWarhol → Artist

livedIn(AndyWarhol, NorthAmerica)

- ClaudeMonet → Artist

livedIn(ClaudeMonet, WesternEurope)

Музеи

- LouvreMuseum → Museum

locatedIn(LouvreMuseum, WesternEurope)

- MoMA → Museum

locatedIn(MoMA, NorthAmerica)

- PradoMuseum → Museum

locatedIn(PradoMuseum, WesternEurope)

- KatheKollwitzMuseum → Museum

locatedIn(KatheKollwitzMuseum, WesternEurope)

- BibliotecaRealeTurin → Museum

locatedIn(BibliotecaRealeTurin, WesternEurope)

- Mauritshuis → Museum

locatedIn(Mauritshuis, WesternEurope)

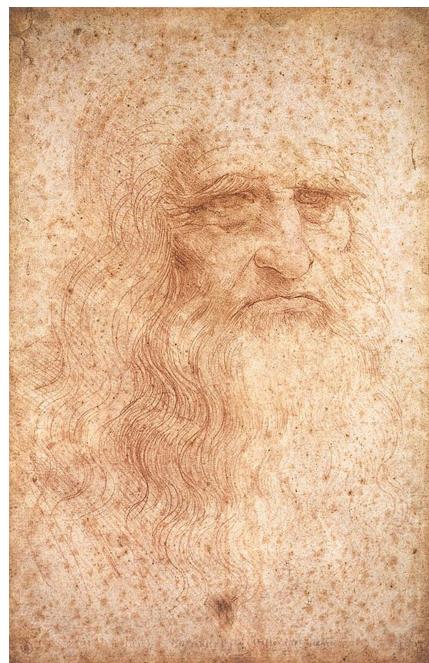
Картини

- MonaLisa → PortraitPainting, PortraitOilPainting



*createdBy(MonaLisa, LeonardoDaVinci)
depicts(MonaLisa, Portrait)
usesMedium(MonaLisa, OilPaint)
represents(MonaLisa, ItalianRenaissance)
housedIn(MonaLisa, LouvreMuseum)*

- PortraitOfAManInRedChalk → PortraitPainting



*createdBy(PortraitOfAManInRedChalk, LeonardoDaVinci)
depicts(PortraitOfAManInRedChalk, Portrait)
usesMedium(PortraitOfAManInRedChalk, Chalk)
represents(PortraitOfAManInRedChalk, ItalianRenaissance)
locatedIn(PortraitOfAManInRedChalk, BibliotecaRealeTurin)*

- GirlWithAPearlEarring → PortraitOilPainting, PortraitPainting



*createdBy(GirlWithAPearlEarring, JohannesVermeer)
depicts(GirlWithAPearlEarring, Portrait)
usesMedium(GirlWithAPearlEarring, OilPaint)
represents(GirlWithAPearlEarring, Baroque)
housedIn(GirlWithAPearlEarring, Mauritshuis)*

- CampbellsSoupCans → AcrylicPainting



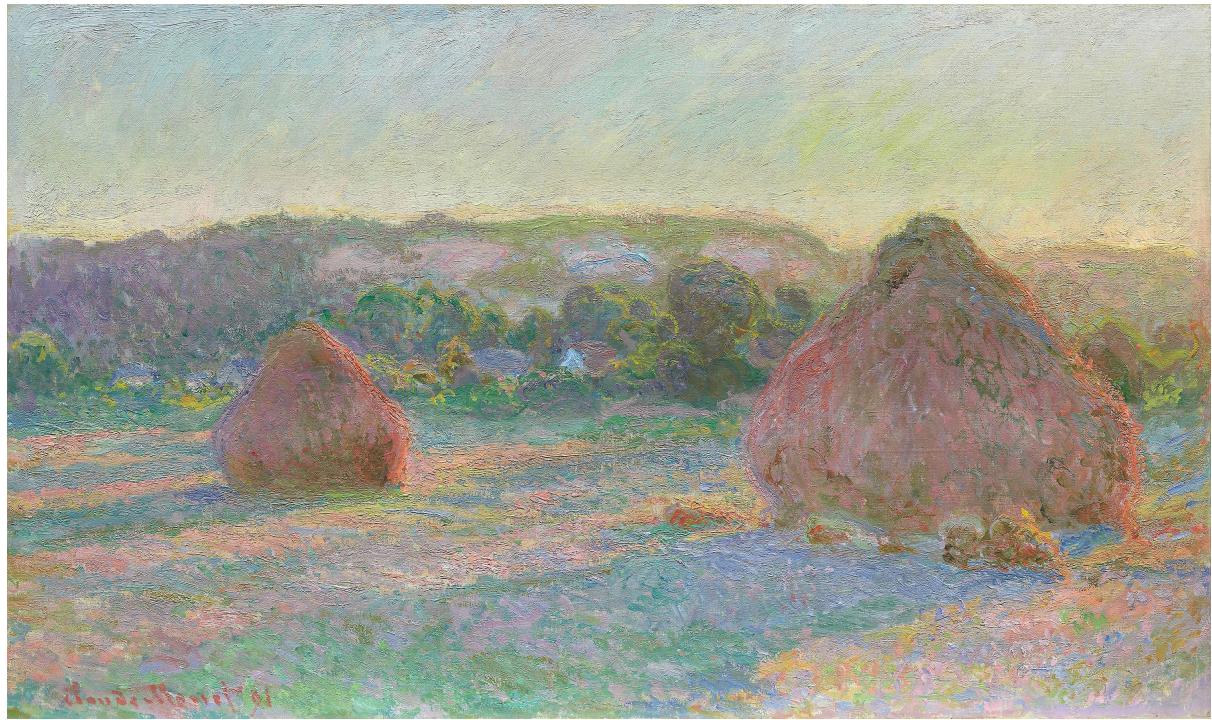
*createdBy(CampbellsSoupCans, AndyWarhol)
depicts(CampbellsSoupCans, AbstractDepiction)
usesMedium(CampbellsSoupCans, AcrylicPaint)
represents(CampbellsSoupCans, PopArt)
housedIn(CampbellsSoupCans, MoMA)
livedIn(AndyWarhol, NorthAmerica)*

- ThirdOfMay1808 → HistoricalEventPainting



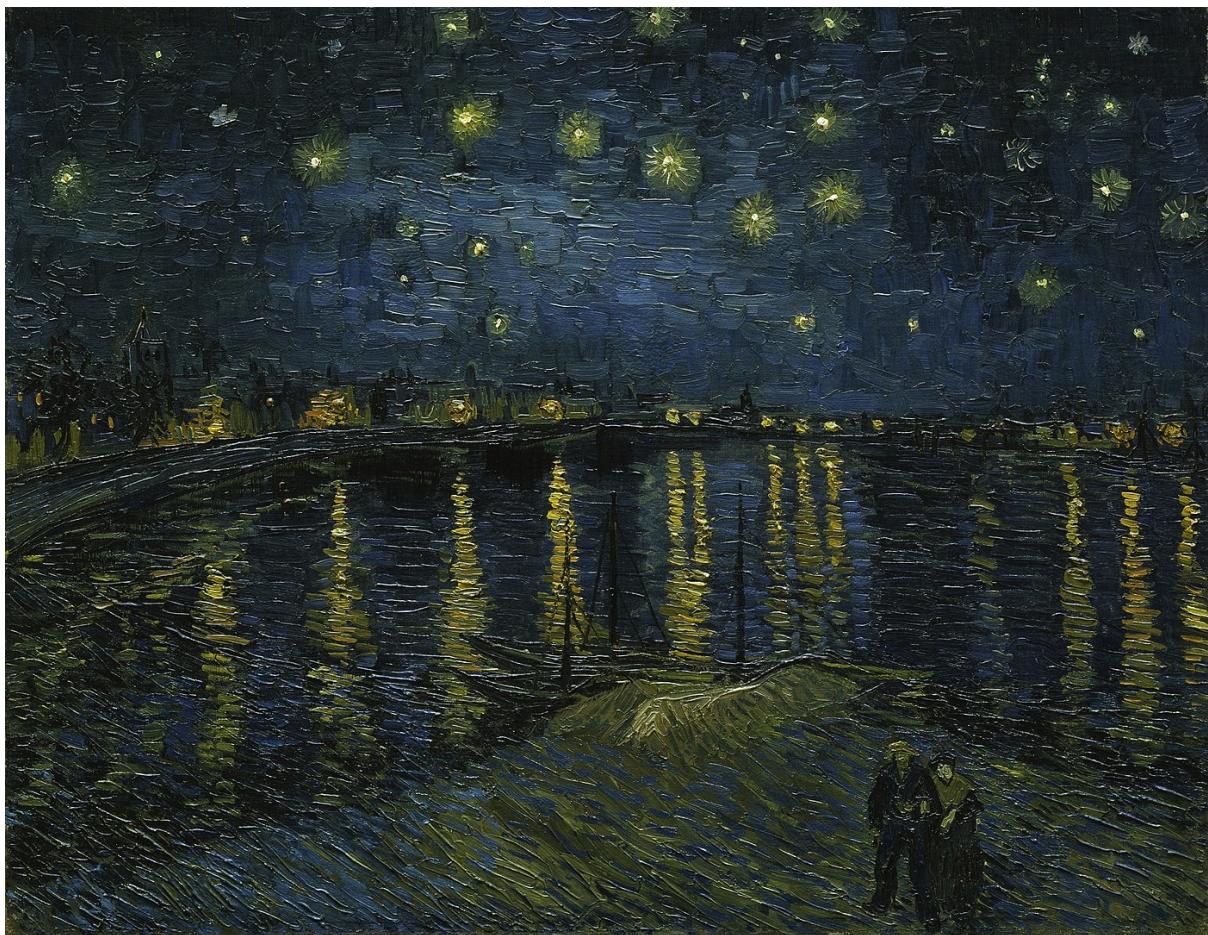
*createdBy(ThirdOfMay1808, FranciscoGoya)
depicts(ThirdOfMay1808, HistoricalEvent)
usesMedium(ThirdOfMay1808, OilPaint)
represents(ThirdOfMay1808, Romanticism)
housedIn(ThirdOfMay1808, PradoMuseum)*

- Haystacks → LandscapePainting



createdBy(Haystacks, ClaudeMonet)
housedIn(Haystacks, ArtInstituteOfChicago)
depicts(Haystacks, NaturalLandscape)
represents(Haystacks, Impressionism)
usesMedium(Haystacks, OilPaint)

- StarryNightOverTheRhone → LandscapePainting



*createdBy(StarryNightOverTheRhone, VincentVanGogh)
depicts(StarryNightOverTheRhone, NaturalLandscape)
usesMedium(StarryNightOverTheRhone, OilPaint)
represents(StarryNightOverTheRhone, PostImpressionism)
housedIn(StarryNightOverTheRhone, MoMA)*

Заявки

Примерните заявки по-долу могат да бъдат изразени чрез разширение на езика \mathcal{DL} , което поддържа променливи и отрицания[1].

- Да се намери всяка картина, която е изложени в музей, разположен в регион, различен от този, където е живял художникът ѝ

MovedPainting \doteq Painting \sqcap

$$\exists \text{ createdBy.}(\text{Artist} \sqcap \exists \text{ :livedIn.}?\text{artistRegion}) \sqcap \\ \exists \neg(\text{ housedIn.}(\text{Museum} \sqcap \exists \text{ :locatedIn.}?\text{artistRegion}))$$

- Да се намерят тези художници, които са изработили портрети с различни графични средства

PortraitMaster \doteq

$$\text{Artist} \sqcap \\ \exists \text{ :createdBy.}(\text{Artwork} \sqcap \exists \text{ :depicts.} \text{Portrait} \sqcap \exists \text{ :usesMedium.}?\text{medium1}) \sqcap \\ \exists \text{ :createdBy.}(\text{Artwork} \sqcap \exists \text{ :depicts.} \text{Portrait} \sqcap \exists \neg(\text{ :usesMedium.}?\text{medium2}))$$

Синтаксисът на Protege не позволява променливи, но заявките могат да бъдат изразени чрез SPARQL по следния начин:

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX : <http://example.org/art_ontology.owl#>
```

```
SELECT DISTINCT ?painting
WHERE {
    ?painting rdf:type/rdfs:subClassOf* :Painting .
    ?painting :createdBy ?artist .
    ?painting :housedIn ?museum .
    ?artist :livedIn ?artistRegion .
    ?museum :locatedIn ?museumRegion .
    FILTER (?artistRegion != ?museumRegion)
}
```

```
SELECT DISTINCT ?artist
WHERE {
    ?painting1 :depicts :Portrait .
    ?painting1 :createdBy ?artist .
    ?painting1 :usesMedium ?medium .

    ?painting2 :depicts :Portrait .
    ?painting2 :createdBy ?artist .
    ?painting2 :usesMedium ?otherMedium .
    FILTER (?medium != ?otherMedium)
}
```

Сравнение с други онтологии

Кратко търсene в интернет откри много ограничено множество онтологии на естествен език, които са посветени на изкуството, сред които най-популярна е тази на Oxford[2]. Опит за достъп на 14.12.2024 чрез университетския ми профил върна грешка.

Търсено обаче не откри онтологии, които са машинно четими. Затова ще посоча някои предимства, недостатъци и възможности за подобрения, които не са базирани на съпоставка с други онтологии:

- онтологията е консистентна
- зададени са подходящ брой ограничения над ролите, които да помогнат в логическите изводи, но да не намалят изразителната сила на онтологията - например ролята *represents* не е функционална, което отразява възможността едно произведение на изкуството да е екземпляр на повече от един стил
- онтологията е проектирана да подлежи на лесно разширение:
 - за различни видове техники - може да бъдат добавени концепти като *Technique*
 - за всякакви видове изкуство чрез общия концепт *Artwork*, който може да бъде разширен не само с *Painting*, но и други видове творби - например скулптури, чрез *Sculpture* чрез допълнителни ограничения с други концепти, например *Medium*, към който може да бъдат добавени константи или подконцепти като *HardMaterial*, *Marble* и др.
- могат да бъдат дефинирани роли, задаващи точни години за началото и края на епохите, които, с подходящи правила за извод, могат да заменят релациите *precededBy* и *succeededBy*. По този начин епохите могат да се застъпват. Тази онтология умишлено не беше проектирана така с цел да бъдат спазени изискванията за брой и вид на ролите.
- съществуват десетки други стилове и хиляди произведения на изкуството, които не фигурират в онтологията и могат да бъдат добавени след консултация с експерт в областта.

Литература

- [1] *Reasoning in description logics with variables: preliminary results regarding the EL logic*. – *inria.hal.science*. [Accessed 13-12-2024]. URL: <https://inria.hal.science/hal-01163342v1>.
- [2] Stephen Davies. *Ontology of Art*. Под ред. на Jerrold Levinson. Oxford University Press, септ. 2009.
- [3] *Campbell's Soup Cans - Wikipedia* – *en.wikipedia.org*. [Accessed 13-12-2024]. URL: https://en.wikipedia.org/wiki/Campbell%27s_Soup_Cans.

- [4] *Girl with a Pearl Earring* - Wikipedia — en.wikipedia.org. [Accessed 13-12-2024]. URL: https://en.wikipedia.org/wiki/Girl_with_a_Pearl_Earring.
- [5] *Mona Lisa* - Wikipedia — en.wikipedia.org. [Accessed 13-12-2024]. URL: https://en.wikipedia.org/wiki/Mona_Lisa.
- [6] *Portrait of a Man in Red Chalk* - Wikipedia — en.wikipedia.org. [Accessed 13-12-2024]. URL: https://en.wikipedia.org/wiki/Portrait_of_a_Man_in_Red_Chalk.
- [7] *The Third of May 1808* - Wikipedia — en.wikipedia.org. [Accessed 13-12-2024]. URL: https://en.wikipedia.org/wiki/The_Third_of_May_1808.
- [8] *Haystacks (Monet series)* - Wikipedia — en.wikipedia.org. [Accessed 13-12-2024]. URL: [https://en.wikipedia.org/wiki/Haystacks_\(Monet_series\)](https://en.wikipedia.org/wiki/Haystacks_(Monet_series)).
- [9] *Starry Night Over the Rhône* - Wikipedia — en.wikipedia.org. [Accessed 13-12-2024]. URL: https://en.wikipedia.org/wiki/Starry_Night_Over_the_Rh%C3%B4ne.
- [10] *Periods in Western art history* - Wikipedia — en.wikipedia.org. [Accessed 13-12-2024]. URL: https://en.wikipedia.org/wiki/Periods_in_Western_art_history.
- [11] *Visual arts* - Wikipedia — en.wikipedia.org. [Accessed 13-12-2024]. URL: https://en.wikipedia.org/wiki/Visual_arts.
- [12] Kyle DeGuzman. *Art History Timeline – A Guide to Western Art Movements* — studiobinder.com. [Accessed 13-12-2024]. URL: <https://www.studiobinder.com/blog/art-history-timeline/#art-history-timeline-prehistoric-art>.