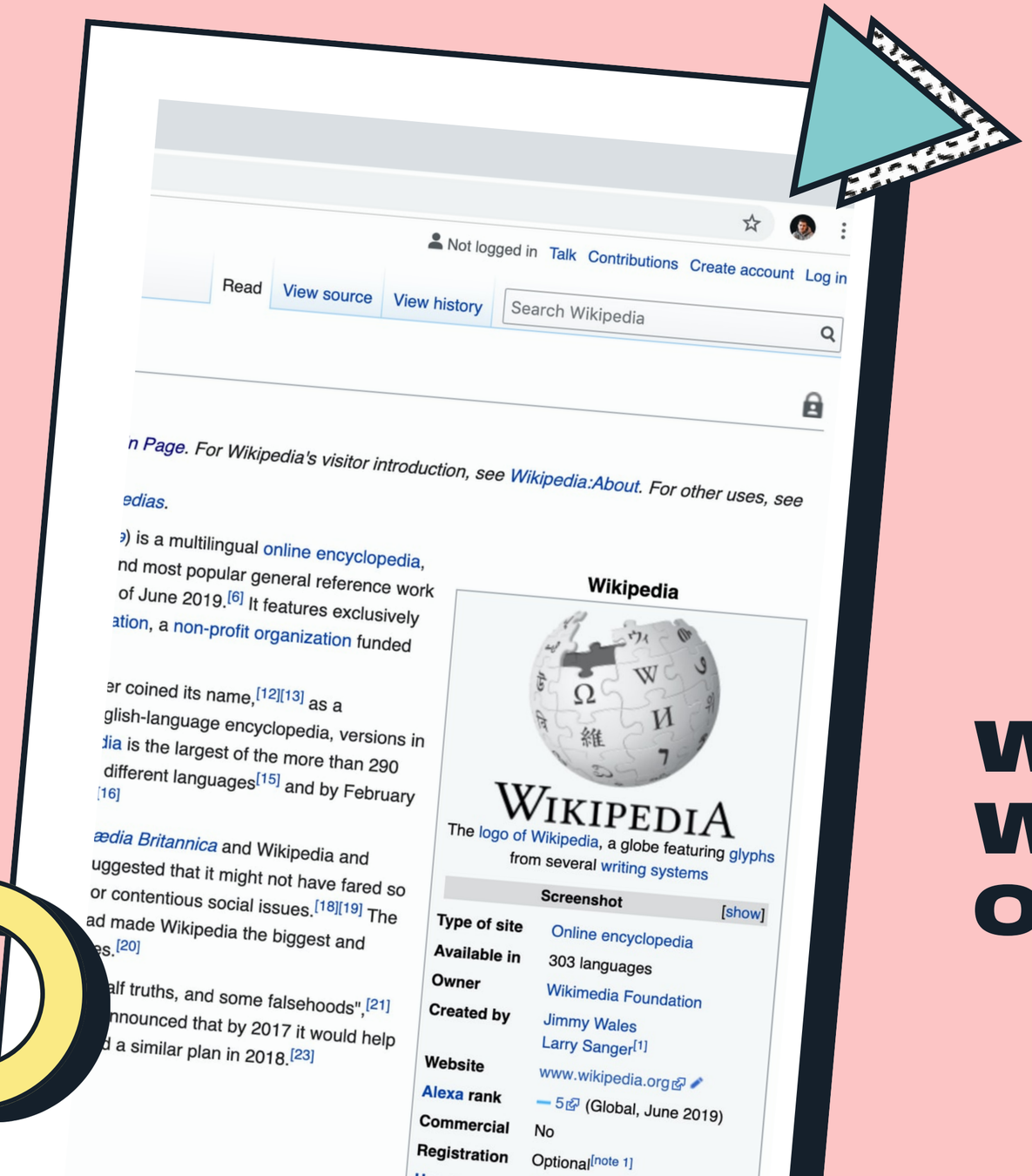

WHY DIDN'T WE CHOOSE ONTOLOGIES?

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Open Knowledge Graph Creation

in the art domain

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20.07.21

Knowledge Graphs 2021

Hasso Plattner Institute Potsdam

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The three steps to knowledge

1

OpenIE

2

Embeddings

3

Clustering

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1

Open Information Extraction

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OpenIE

OpenIE extracts triples

- OpenIE6 - using Iterative Grid Labelling and Coordination Analysis
- expects 1 sentence per line - co-reference-resolution beforehand
- unfiltered: ~3 Million triples (with threshold of > 0.8 confidence: ~460.000 triples)
- Bad/Funny Examples:
  - <'It' - 'is' - 'always Picasso'>
  - <'We' - 'learn' - 'more about them and them'>
  - <'One' - 'can skip' - 'truth'>

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OpenIE

Cleanup afterwards

- Entities smaller than 4 characters
- Relations smaller than 4 characters other than 'was', 'be', 'is'...
- Entity/Relation only numbers/special characters
- Remove pronouns like 'I', 'Them', 'They', 'He' etc.
- ~460.000 triples to 370.000 triples

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2

EMBEDDINGS

Our Embeddings

- using TransE, ConvE and HolE
- library called Ampligraph
- trained with 100 dimensions
- no pre-trained embeddings as input

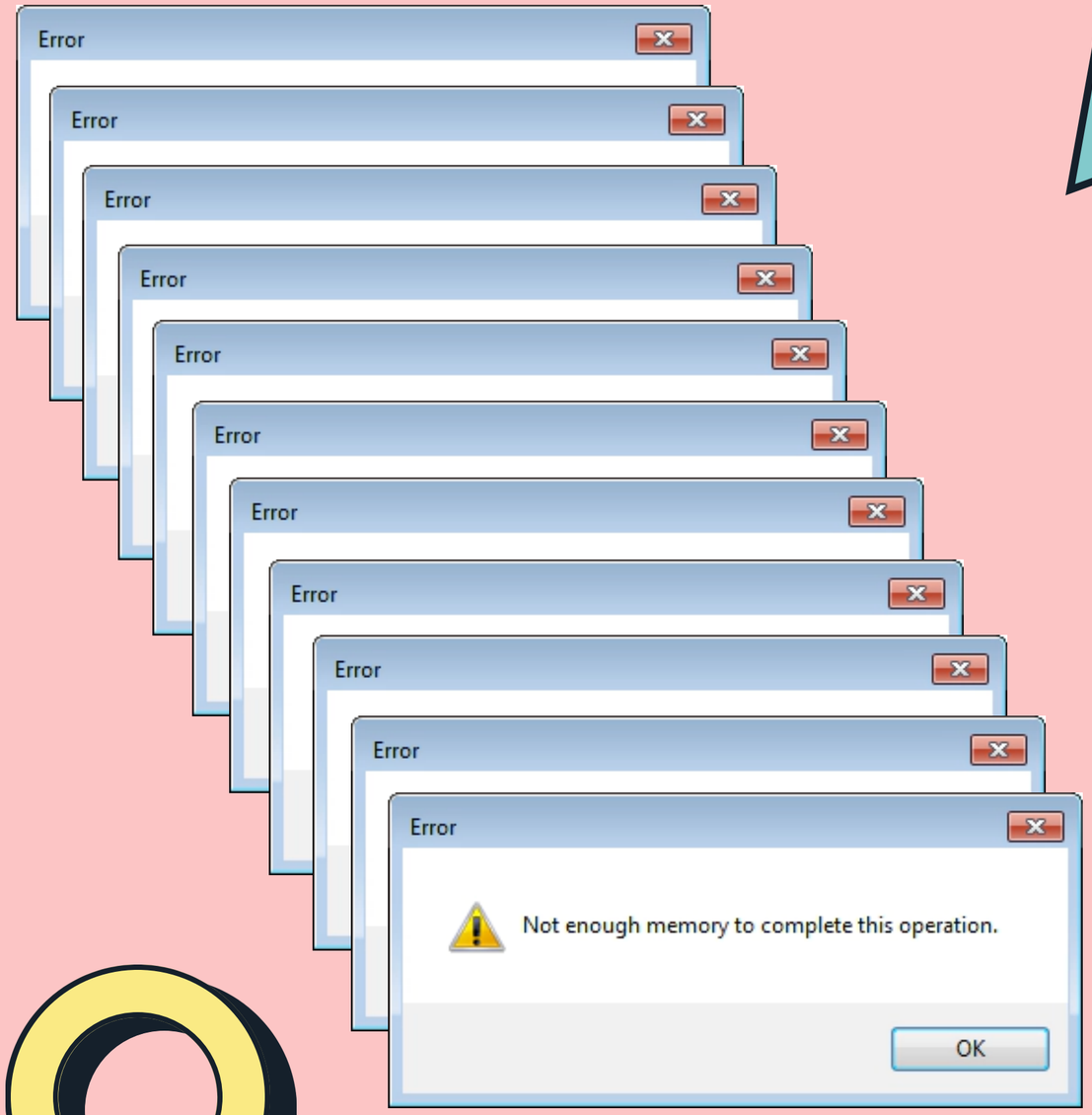
CESI

Our Embeddings

- using TransE, ConvE and HolE
- library called Ampligraph
- trained with 100 dimensions
- no pre-trained embeddings as input

CESI

- using HolE as embedding
- repo from original paper
- trained with 100 dimensions
- using pre-trained GloVE embeddings
- additionally uses some side information



MEMORY ERRORS!!!

Too many dimensions and clustering!

3

Clustering

How to do it at scale?

CESI uses Hierarchical Agglomerative Clustering (HAC)

- HAC is in O(n^2)
- Not feasible for large amount of embeddings (in our case ~500k)
- 'Approximate' variant from CESI paper not (feasibly) usable for custom data

DBSCAN to the rescue!

- Classic 'Density'-based clustering algorithm
- DBSCAN is fast and does not need a predefined number of clusters
- We interpret 'noise' labels as entities / relations without a cluster

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Canonicalization Results

Input

- ~500k noun phrases
- ~62k relation phrases
- ~370k unique triples

Output

- ~350k noun phrases (difference: ~150k, -30%)
- 13k relation phrases (difference: ~49k, -79%)
- ~345k unique triples (difference: ~25k, -7%)

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EVALUATION

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We have no ground truth!

How can we even evaluate our results?

- Create ground truth by manual labelling :(
- Look at the quality of some predefined set of clusters
- Perform a predefined set of queries

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Evaluation without Ground Truth

Cluster Inspection

- In general, the cluster quality is just okay

- Some examples for the <Picasso> cluster:
  - <Pablo Picasso>
  - <Most significant artist century>, <Best artist>, ...
  - <upheaval first world war>, <Communist Party>

- CESI seems to be a bit better than the rest

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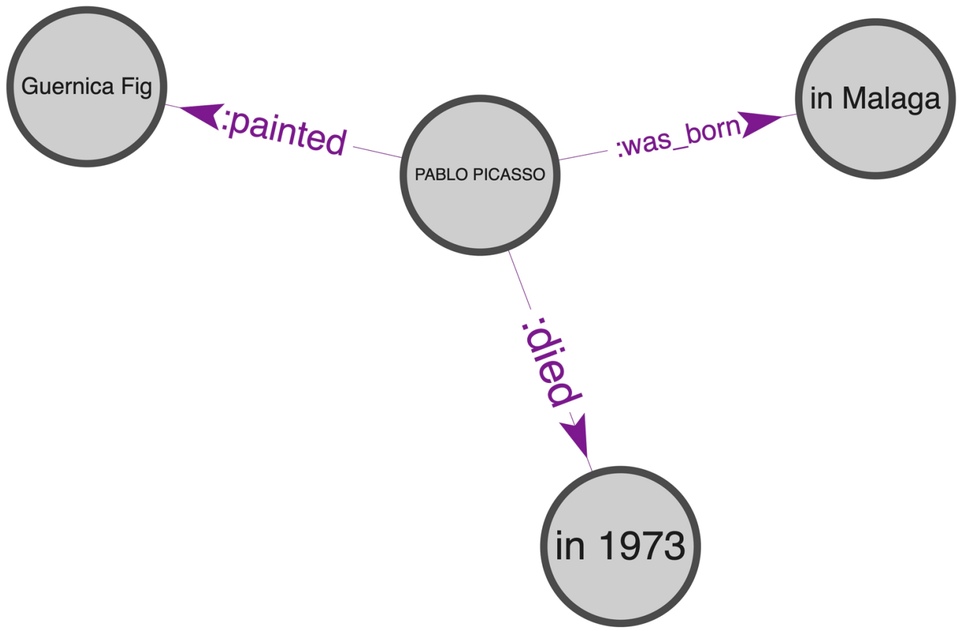
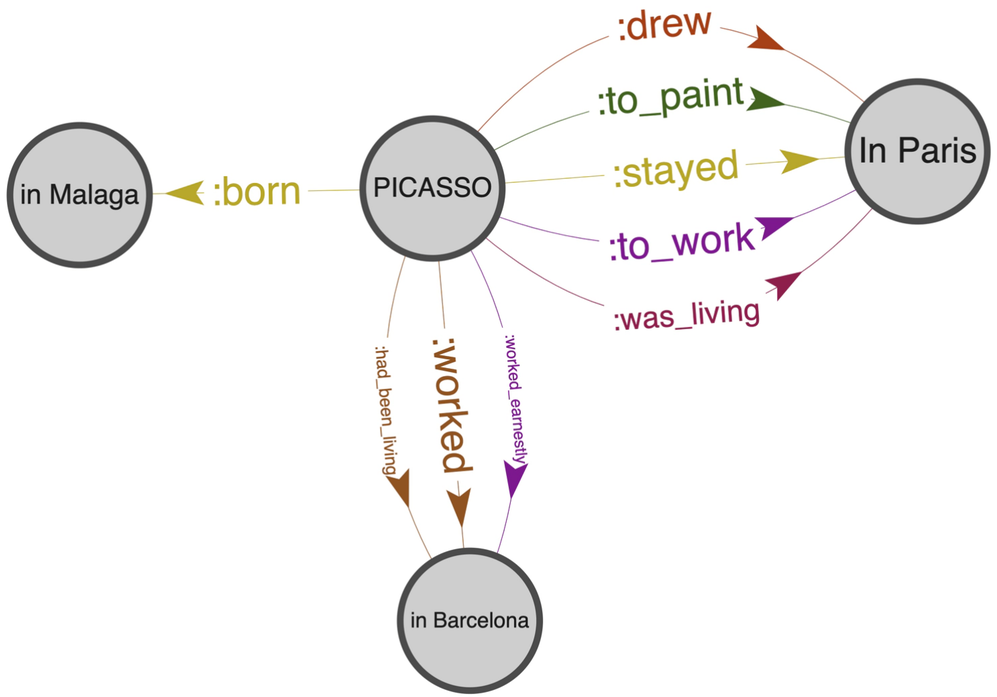
LOOKING AT OUR GRAPH





LET'S LOOK AT SOME EXAMPLES

Our example queries

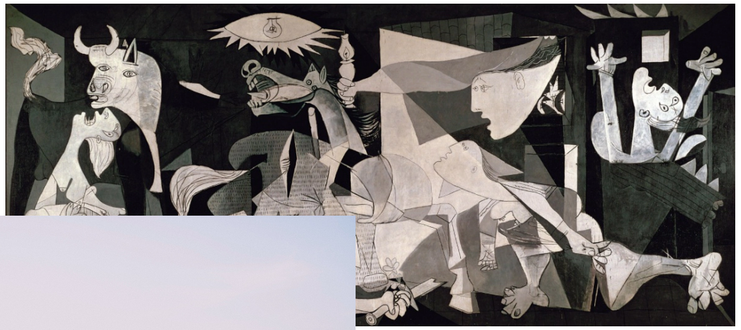
1. Picasso, painted, Guernica

2. Picasso, was_born_in, Malaga

3. Eva Goul, died_of, tuberculosis

4. Olga Picasso, has_son, Paulo Picasso

5. Museu Picasso, in, Barcelona



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How many matches did we get?

	TransE	ConvE	HoIE	CESI
Query 1	✓	✓	✓	✓
Query 2	✓	✓	✓	✓
Query 3	✗	✗	✓	✓
Query 4	✗	✗	✗	✗
Query 5	✗	✗	✓	✓
Total	**2/5**	**2/5**	**4/5**	**4/5**

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LEARNINGS

THOROUGH PREPROCESSING IS IMPORTANT

PRE-TRAINED EMBEDDINGS ARE USEFUL

EVALUATION WITHOUT A GROUND TRUTH IS PRETTY HARD

YOU DON'T ALWAYS NEED DOMAIN EXPERTS TO FIND WHAT YOU NEED

Others have seen **what is** and asked **why**. I have seen **what could be** and asked **why not.**

Pablo Picasso