# Language Models are Open Knowledge Graphs

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#### **ABSTRACT**

This paper shows how to construct knowledge graphs (KGs) from pre-trained language models (e.g., BERT, GPT-2/3), without human supervision. Popular KGs (e.g., Wikidata, NELL) are built in either a supervised or semi-supervised manner, requiring humans to create knowledge. Recent deep language models automatically acquire knowledge from large-scale corpora via pre-training. The stored knowledge has enabled the language models to improve downstream NLP tasks, e.g., answering questions, and writing code and articles. In this paper, we propose an unsupervised method to cast the knowledge contained within language models into KGs. We show that KGs are constructed with a single forward pass of the pre-trained language models (without fine-tuning) over the corpora. We demonstrate the quality of the constructed KGs by comparing to two KGs (Wikidata, TAC KBP) created by humans. Our KGs also provide open factual knowledge that is new in the existing KGs. Our code and KGs will be made publicly available.

# 1 Introduction

Knowledge graphs (KGs) are an important resource for both humans and machines. Factual knowledge in KGs is injected into AI applications to imitate important skills possessed by humans, e.g., reasoning and understanding. KG construction is mainly supervised, requiring humans to handwrite every fact, such as Freebase (Bollacker et al., 2008) and Wikidata. KGs can also be constructed in a semi-supervised way, in which a semi-automatic extractor is used to obtain the facts from web corpora (e.g., NELL (Carlson et al., 2010) and Knowledge Vault (Dong et al., 2014)). Humans however still need to interact with the extractor to improve the quality of the discovered facts. Therefore, human supervision, which is often expensive, is required in constructing KGs.

Recent progress in language models (LMs), such as BERT (Devlin et al., 2018) and GPT-2/3 (Radford et al., 2019; Brown et al., 2020), has led to superior results even outperforming humans in a wide range of tasks, e.g., sentence classification (Wang et al., 2018), question answering (Brown et al., 2020). Pre-trained LMs are also capable to write poetry, music, and code, while such tasks often require we human to spend a significant amount of time in learning the relevant knowledge to work well. In fact, these pre-trained LMs automatically acquire factual knowledge from large-scale corpora (e.g., BookCorpus (Zhu et al., 2015), Common Crawl (Brown et al., 2020)) via pre-training. The learned knowledge in pre-trained LMs is the key to the current success. We therefore consider the following question: instead of using the manually created knowledge, *can we use the knowledge stored in pre-trained LMs to construct KGs?* 

In this paper, we design an unsupervised approach called MAMA that successfully recovers the factual knowledge stored in LMs to build KGs from scratch. MAMA constructs a KG with a single forward pass of a pre-trained LM (without fine-tuning) over a textual corpus. As illustrated in Figure 1, MAMA has two stages: Match and Map. Match stage generates a set of candidate facts by matching the facts in the textual corpus with the knowledge in the pre-trained LM. General or world knowledge from large-scale corpora is embedded in the LM, thus candidate facts in the target corpus are often covered by the knowledge in the LM. The candidate facts are matched through an efficient beam search in the attention weight matrices of the pre-trained LM without fine-tuning. Map stage

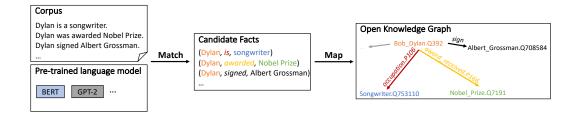


Figure 1: Overview of the proposed approach MAMA. MAMA constructs an open knowledge graph (KG) with a single forward pass of the pre-trained language model (LM) (without fine-tuning) over the corpus. Given the input: a textual corpus containing passages and sentences, e.g., English Wikipedia, and a pre-trained LM, e.g., BERT, GPT-2/3, MAMA (1) generates a set of candidate facts via *matching* the knowledge in the pre-trained LM with facts in the textual corpus, e.g., a candidate fact (*Dylan*, *is*, *songwriter*) from the sentence "Dylan is a songwriter.", and (2) produces an open KG by *mapping* the matched candidate facts to both an existing KG schema, e.g., (*Bob\_Dylan.Q392*, *occupation.P106*, *Songwriter.Q753110*) in Wikidata schema, and an open schema, e.g., (*Bob\_Dylan.Q392*, *sign*, *Albert\_Grossman.Q708584*).

produces an open KG via mapping the matched candidate facts from Match stage to both fixed KG schema and open schema. If the schema of candidate facts exists in the KG schema, we map the candidate facts directly to the fixed KG schema. Otherwise, we reserve the unmapped candidate facts in the open schema. This results in a new type of KG, *open KG*, with a mixture of mapped facts in fixed KG schema and unmapped facts in the open schema.

Our contributions are as follows:

- 1. We show *how to construct KGs from pre-trained LMs*. The KGs are constructed with a single forward pass of the pre-trained LMs without fine-tuning over the textual corpora. This helps researchers explicitly understand what the language models learn, bridging the deep LM and KG communities through enhanced model transparency.
- 2. We propose an unsupervised two-stage approach, MAMA, to first *match* the candidate facts in the corpora with the knowledge stored in LMs, then *map* the matched candidate facts to both fixed and open schema to produce a KG.
- 3. We generate a new type of KG, namely open KG, consists of *mapped facts* in the fixed KG schema of existing KGs (Wikidata and TAC KBP) annotated by humans; and *unmapped facts* in the open schema that are new in the reference KG schema. The reach of this result is broad and has downstream utility for knowledge graph construction, deep neural network interpretation, and information extraction.

## 2 MAMA

We introduce an unsupervised end-to-end approach Match and Map (MAMA) as illustrated in Figure 1 to construct open knowledge graphs (KGs) from language models (LMs). MAMA constructs the KGs with a single forward pass of the pre-trained LMs (without fine-tuning) over the corpora. The two stages of MAMA are:

**Match** generates a set of candidate facts from a textual corpus. LMs contain global or world knowledge learned from large-scale corpora, which often does not perfectly match the knowledge in the target corpus. The goal of this stage is to match the knowledge stored in pre-trained LMs with facts in the corpus. Each fact is represented as a triplet (head, relation, tail)  $^1$ , in short, (h, r, t), and passed to Map stage. Match procedure is detailed in Sec. 2.1.

Map produces an open KG using the matched candidate facts from Match stage. The constructed open KG has two portions: (a) mapped candidate facts that are in a fixed KG schema, e.g., (Dylan, is, songwriter) is mapped to (Bob\_Dylan.Q392, occupation.P106, Songwriter.Q753110) according to Wikidata schema; and (b) unmapped candidate facts that are in an open schema, e.g., a candidate fact (Dylan, signed, Albert Grossman) is partially mapped to (Bob\_Dylan.Q392, sign, Albert\_Grossman.Q708584) in the open schema. This stage is described in Sec. 2.2.

We use the term "head" and "tail" to denote head and tail's "entities" or "entity mentions" for simplicity.

Ste	р0	Step 1	Step 2	Step 3
	7	$\bigcap$		
(	Dy	lan is	a song	gwriter )

Step	Action	Intermediate candidates	Matching degrees
0	START	(Dylan,	0
1	YIELD	(Dylan, is	0.3
2	YIELD	(Dylan, is songwriter	0.7
3	STOP	(Dylan, is, songwriter)	0.7

(a)	Matching	exampl	e
(u)	Mucining	CAump	

	<sub>Query:</sub> Dylan	is	a	songwri	ter
<i>Key:</i> Dylan	x	х	x	х	
is	0.3	х	x	х	
a	0.1	0.2	x	х	
songwriter	0.1	0.4	0.2	х	

(b) Attention matrix for matching degree calculation.

Figure 2: Illustration of Match stage. The upper part of (a) represents the general matching steps of generating the best matched candidate fact (*Dylan*, *is*, *songwriter*) from the sentence "Dylan is a songwriter." The lower portion shows the corresponding step-by-step process. Given a head-tail pair (*Dylan*, *songwriter*), at each step, the search chooses one of the actions, i.e., START, YIELD, STOP to produce an intermediate candidate fact. The search *starts* by adding the head "Dylan" as an initial candidate (step 0). The matching degree of the candidate is initialized as 0. Next, a new candidate is *yielded* if the candidate has not reached the tail "songwriter", by appending the next largest attended token (with the largest score from the attention matrix (b) of the sentence) to the end of the current candidate, and the corresponding matching degrees are increased by the associated attention scores (step 1 and step 2). Otherwise, the search *stops*, and the candidate fact with the best matching degree is returned for the head-tail pair (step 3). The attention matrix (b) is from the forward pass of the LM without fine-tuning over the sentence. "x" marks the tokens to prevent searching backward.

## 2.1 MATCH

We frame the matching procedure as a search problem. To obtain the best matched candidate facts of an input sentence, the candidates with the top matching degrees are returned from a search process. The matching degree is derived from the search in the attention weight matrices of the pre-trained LM, since the attention weight matrices are the container of the knowledge in the pre-trained LM. The attention weight matrices are simply from the forward pass of the LM without fine-tuning over the sentence.

#### 2.1.1 BEAM SEARCH

We design a simple-yet-effective beam search to find the best matched candidate facts. For every head-tail pair (h,t) in a sentence, the search maintains the k-best matched candidate facts of the pair. Let's first consider the search from left to right with beam size equals to 1. An example search process is shown in Figure 2. Given a head-tail pair (Dylan, songwriter), at each step, the search performs one of the following actions:

**START** the search from the head. The head h is added as an initial candidate into the beam. For simplicity, we use START(h) to denote the action, which returns a candidate (h). In Figure 2(a), at step 0, the head "Dylan" is added as (Dylan), into the beam. The matching degree is initialized to 0.

YIELD a new intermediate candidate in the beam if the current candidate has not reached the tail. The next largest attended token (with the largest score from the attention matrix) is appended to the end of the current candidate to yield the new candidate. The corresponding matching degrees are increased by the associated attention scores. At step 1 (orange arrow in Figure 2(a)), "is" is appended to the current candidate to yield (Dylan, is, , since "is" has the largest attention score with "Dylan" in the attention matrix. The attention score is 0.3 as highlighted in orange in Figure 2(b). The multi-head attention is reduced to a single head so that every two tokens of the sentence are associated with one attention weight. We experiment with different reduction setups in Sec. A.3. "x" marks the tokens (prior to the current token) that are not considered in the search to prevent searching backward. Step 2 similarly takes YIELD action to produce (Dylan, is songwriter, . We use YIELD(c, s,  $A_s$ ) to denote the action, where c is a current candidate, s represents the sentence, and a is the

## **Algorithm 1** Beam search for matching candidate facts.

```
Input: Head-tail pair (h, t), sentence s, attention matrix A_s, action manager \mathcal{O} = \{ START, YIELD, STOP \},
      beam size k
Output: Candidate facts \mathbb{T}_{(h,t)}
 1: \mathbb{T}_{(h,t)} \leftarrow \{ \text{START}(h) \}
                                                                                       > Start by adding the head as a candidate in the beam
 2: while \exists c \in \mathbb{T}_{(h,t)}[\mathcal{O}(c) = \texttt{YIELD}] do
 3:
            \mathbb{T}_{(h,t)} \leftarrow \emptyset
                                                                                                                                     ⊳ Initialize a new beam
           for each c \in \mathbb{T}_{(h,t)} do
4:
5:
                 if \mathcal{O}(c) = \text{YIELD} then
                       \widetilde{\mathbb{T}}_{(h,t)} \leftarrow \widetilde{\mathbb{T}}_{(h,t)} \cup \{ \text{YIELD}(c,s,\mathbf{A}_s) \}
 6:
                                                                                                   ▷ Yield a new candidate if not reached the tail
7:
                      \widetilde{\mathbb{T}}_{(h,t)} \leftarrow \widetilde{\mathbb{T}}_{(h,t)} \cup \{ \operatorname{STOP}(c,t) \}
 8:
                                                                                            ⊳ Stop then produce a valid fact if reached the tail
                 end if
9:
10:
            end for
            \mathbb{T}_{(h,t)} \leftarrow \text{TOP}(k, \widetilde{\mathbb{T}}_{(h,t)})
                                                                                                         \triangleright Maintain k-best candidates in the beam
12: end while
13: return \mathbb{T}_{(h,t)}
```

attention matrix from the forward pass of the pre-trained LM over s, which yields a new candidate.

**STOP** the search step if the candidate has reached the tail, then add the candidate as a valid candidate fact into the beam. As beam size equals to 1, (Dylan, is, songwriter) is the only returned candidate fact for the given pair. We denote this step using STOP(c,t), which returns a valid fact.

The details of the proposed beam search are in Algorithm 1. The inputs of the search algorithm are a head-tail pair (h,t), a sentence s, an attention matrix  $\mathbf{A}_s$  of s. Both h and t are identified by the noun chunk in s.  $\mathbf{A}_s$  is the attention matrix associated with s from the forward pass of LM without fine-tuning. The search gets started by adding the head h as the initial candidate in the beam (line 1). While there are still new candidates waiting to be yielded (line 2), the search continues, and the top k candidates sorted by the matching degrees are maintained (line 3-11) in the beam. In practice, we implement an action manager  $\mathcal{O}$  to decide which action to take at each step. Given a candidate c in the beam,  $\mathcal{O}(c) = \text{START}$  always happens at the beginning of the search. If c has not reached the tail t yet,  $\mathcal{O}(c) = \text{YIELD}$ . Otherwise,  $\mathcal{O}(c) = \text{STOP}$ . We also notice some facts are in reverse order in the sentence, e.g., " $\cdots$  said Jason Forcier, a vice president at battery maker A123 Systems Inc." for facts of relation "org:top\_members\_employees", thus enable bidirectionality by running the algorithm in both directions (left to right and right to left). The beam search is implemented by the breadth-first search, which is efficient as the time complexity is  $O(k \cdot d)$ , where d is the maximum depth of the search tree.

## 2.1.2 FILTER

Although the basic functionality provided by beam search is sufficient for finding useful candidate facts, we have found a few constraints useful. Given a candidate fact (h, r, t) from beam search result  $\mathbb{T}_{(h,t)}$ , it remains as a fact if satisfying all the following constraints.

Constraint #1 The matching degree of (h,r,t) is above a threshold. We compare the matching degrees corpus-wide to only reserve the facts that are matched better with the knowledge in LMs. For example, MAMA extracts a fact (Rolling Stone, wrote, pop song) from "Rolling Stone wrote: "No other pop song has so thoroughly challenged artistic conventions", which is not an accurate fact based on the sentence. We observe the associated matching degree is below a proper threshold, while the matching degrees of high-quality facts from the same documents, e.g., (Dylan, is, songwriter), or confident facts from the other documents are beyond the threshold.

Constraint #2 The distinct frequency of r is above a threshold. To avoid facts to be over-specified, e.g., (Dylan, signed to Sam Peckinpah's film, Pat Garrett and Billy the Kid), we require r should take many distinct head-tail pairs in the corpus.

Constraint #3 Relation r is a contiguous sequence in the sentence. We can avoid r that has no meaningful interpretation (Fader et al., 2011), e.g., (Rolling Stone, wrote challenged, conventions) from the above sentence.

# 2.2 MAP

The objective of Map stage is to generate an open KG. The open KG contains (a) *mapped facts* in a KG schema (Sec. 2.2.1), e.g., Wikidata schema, if the schema of the candidate facts is within the existing KG schema; and (b) *unmapped facts* from (a) in an open schema (Sec. 2.2.2).

#### 2.2.1 MAPPED FACTS IN KG SCHEMA

The goal is to map a candidate fact (h,r,t) to a fact  $(h_k,r_k,t_k)$  in the KG schema. The reason for mapping to an existing KG schema is to make use of the high-quality schema designed by experts (to avoid duplicated efforts of building from scratch) and enable evaluating the candidate facts with oracle KG facts contributed by human volunteers. We first map both entities h,t to  $h_k,t_k$ , then map the relation r to  $r_k$  in the reference KG schema.

Entity linking to KG schema We leverage an unsupervised entity linker based on a mention-to-entity dictionary (Spitkovsky & Chang, 2012) to link the entities for scalability consideration. Besides, contextual information is crucial to link the entities correctly, we use the word embedding of the context to disambiguate the entities, which means we only link the entities with high contextual similarities based on the word embedding. We adopt the entity linker to map h, t to  $h_k, t_k$ .

Relation mapping with KG schema We largely follow the relation mapping method proposed by Angeli et al. (2015) to construct an offline relation map between KG relation and relation phrases of the candidate facts. The basic idea is that the more often linked head-tail pairs (i.e., entities are with type information from the entity linking step) co-occur between the candidate facts and KG facts, the more likely the corresponding relations are mapped to each other. In addition, we normalize each relation phrase of the candidate facts by lemmatization, and removing inflection, auxiliary verbs, adjectives, adverbs. After the relation mapping is constructed, one author manually checks whether the top 15 relation phrases are true mappings for each KG relation. We only reserve the true ones in the final relation mapping. This process takes approximately one day. Later, r is mapped to r with an efficient look-up operation in the relation mapping.

# 2.2.2 UNMAPPED FACTS IN OPEN SCHEMA

An unmapped candidate fact (h, r, t) means at least one of h, r, and t is not mapped to the KG schema based on the method in Sec. 2.2.1. There are two types of unmapped candidate facts:

**Partially unmapped facts** represent at least one of h, r, and t are mapped to the KG schema. It can be h or t mapped to  $h_k$  or  $t_k$  based on the entity linker in Sec. 2.2.1. It can also be r that mapped to  $r_k$  using the relation mapping in Sec. 2.2.1. This actually results in unmapped facts that are in a mixture of the KG schema and the open schema. As the overall schema of the unmapped facts is not in the KG schema, we use open schema to denote such unmapped facts in the rest of the paper for simplicity. An example is (*Dylan*, signed, Albert Grossman) in Figure 1, where both head and tail are linked to Wikidata schema based on the entity linker in Sec. 2.2.1, but the relation cannot be mapped since there is no relation mapping from "signed" to a KG relation in Wikidata schema.

Completely unmapped facts indicate all h, r, and t are not mapped to the KG schema. This means neither the entity linker nor the relation mapping is able to map h, r, and t to  $h_k$ ,  $r_k$ ,  $t_k$  respectively. The resulting unmapped candidate facts stay in the open schema, e.g., a candidate fact (*Jacob*, *was*, *A Registered Mennonite*) stays the same in the open schema from a sentence "Jacob was a registered Mennonite in Amsterdam."

The resulting open KG is a new type of KG that mixes the fixed KG schema with the flexible open schema, suggesting new directions for the next generation of KGs. The open KG not only contains existing knowledge in the reference KGs, but also extends the fixed KG schema with an additional open schema to improve the coverage of the KGs, that benefits the downstream KG based applications, e.g., QA and commonsense reasoning (Wang et al., 2019; Brown et al., 2020).

#### 3 EXPERIMENTS

How well can language models generate knowledge graphs? We experimentally explore how well can MAMA answer the question in the section. To measure the ability of LMs in generating KGs, we directly measure the quality of resulting open KGs. The open KG (see an example in Figure 3) contains two types of facts: mapped facts in the fixed KG schema; and unmapped facts in the

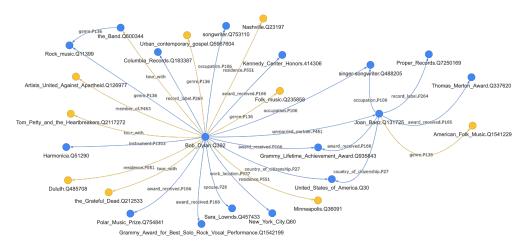


Figure 3: A snapshot subgraph of the open KG generated by MAMA using BERT<sub>LARGE</sub> from Wikipedia pages neighboring "Bob\_Dylan". The blue node and arrow represent the mapped facts in the Wikidata schema, while the yellow node and arrow denote the unmapped facts in the open schema. We also visualize the correct facts that are new in Wikidata in yellow.

KG	# of oracle facts	# of documents
TAC KBP	27,655 <sup>3</sup>	3,877,207
Wikidata	27,368,562	6,047,494

Table 1: Dataset statistics of two knowledge graphs: TAC KBP and Wikidata. TAC KBP refers to TAC KBP Slot Filling 2013 challenge. # of oracle facts for TAC KBP is the number of oracle facts in the 2013 task. # of documents for TAC KBP is the number of the documents in the 2013 task. # of oracle facts for Wikidata is the total number of oracle facts in Wikidata. # of documents for Wikidata is the size of English Wikipedia.

open schema. We first quantitatively evaluate MAMA by comparing the mapped facts to oracle KGs annotated by humans in Sec. 3.1, then conduct an in-depth analysis of the unmapped facts in Sec. 3.2.

## 3.1 RESULTS ON MAPPED FACTS

We first study the quality of the mapped facts. As the candidate facts have been mapped to the schema of oracle KGs, we are able to quantitively compare the candidate facts with the oracle facts in the reference KGs.

#### 3.1.1 Datasets

We compare the mapped facts from MAMA with the facts in two KGs:

**TAC KBP** TAC Knowledge Base Population (KBP) Slot Filling is a task to search a document collection to fill in the tail/object entity for predefined relations (slots) for a given head/subject entity in a reference KG. We experiment with the reference KG in the 2013 challenge. We use the document collection and oracle facts of the 2013 task. The statistic of the dataset is shown in Table 1.

**Wikidata** We use popular Wikidata as another KG. We use all the oracle facts in Wikidata. We use the English Wikipedia as the text corpus, since a large amount of facts in Wikidata is from English Wikipedia. The statistic is in Table 1.

To evaluate the mapped facts, we first use Match stage of MAMA to run over the corresponding documents to generate the candidate facts. Then Map stage is leveraged to map the candidate facts to the schema of TAC KBP and Wikidata respectively. The parameter settings, such as beam size in Algorithm 1, are shared across TAC KBP and Wikidata based on the parameter study in Sec. A.3.

# 3.1.2 TAC KBP

To verify the ability to produce correct facts, we compare candidate facts from MAMA to the outputs of two open information systems, which also produce triplets in the form of (h, r, t).

Method	Precision%	Recall%	F1%
OpenIE 5.1 <sup>2</sup>	56.98	14.54	23.16
Stanford OpenIE (Angeli et al., 2015)	61.55	17.35	27.07
MaMa-BERT <sub>BASE</sub> (ours)	61.57	18.79	$\bar{28.79}$
$MAMA-BERT_{LARGE}$ (ours)	61.69	18.99	29.05
MAMA-GPT-2 (ours)	61.62	18.17	28.07
MAMA-GPT-2 <sub>MEDIUM</sub> (ours)	62.10	18.65	28.69
$MAMA$ -GPT- $2_{LARGE}$ (ours)	62.38	19.00	29.12
MAMA-GPT-2 <sub>XL</sub> (ours)	62.69	19.47	29.72

Table 2: Compare the quality of mapped facts on TAC KBP.

**Stanford OpenIE** leverages POS tag and dependency parser, and generates self-contained clauses from long sentences to extract the triplets, which is the best open information extraction system (Angeli et al., 2015) on TAC KBP (Surdeanu, 2013). After collecting the triplets from the system, we use the same Map procedure with MAMA (Sec. 2.2.1) to map the triplets to the corresponding KG schema.

**OpenIE 5.1** <sup>2</sup> is the successor to Ollie (Schmitz et al., 2012), and it improves extractions from noun relations, numerical sentences, and conjunctive sentences depending on the linguistic patterns. Similarly, the same Map procedure (Sec. 2.2.1) is leveraged to map the triplets from the system to the KG schema.

We use two families of pre-trained LMs with MaMa. We use  $BERT_{BASE}$  and  $BERT_{LARGE}$  from Devlin et al. (2018) with MaMa, namely MaMa-BERT\_{BASE} and MaMa-BERT\_{LARGE}. Besides, GPT-2s from Radford et al. (2019) are used, i.e., MaMa-GPT-2, MaMa-GPT-2 $_{MEDIUM}$ , MaMa-GPT-2 $_{LARGE}$ , and MaMa-GPT-2 $_{XL}$ .

Table 2 shows the results on TAC KBP. We use the official scorer of TAC KBP Slot Filling 2013 to evaluate precision, recall, and F1 on TAC KBP <sup>3</sup>.

MAMA constructs improved KGs. From the results, we find that all our methods achieve competitive precision, which is greater than 60%, given the unsupervised nature of MAMA. All the proposed methods outperform the two open IE systems. This shows that MAMA is able to produce high-quality knowledge directly from pre-trained LMs by a single forward pass without human supervision. The results show the effectiveness of MAMA in generating candidate facts from Match stage, and producing high-quality KGs through Map stage. We also find that MAMA-GPT-2<sub>XL</sub> performs the best. MAMA-GPT-2<sub>XL</sub> outperforms the previous state-of-the-art Stanford OpenIE by over 2.6% in F1. This shows the proposed end-to-end MAMA is able to recover the knowledge stored in pre-trained LMs without relying on any extra linguistic features, such as POS tag and dependency parser used in open IE systems. The main reason leading to the moderate results of OpenIE 5.1 is that the system generates objects of the triplets with extraneous words, which hurt the performance in slot filling tasks. Even though the proposed methods all outperform the two open IE systems in the recall, however improving recall is clearly the future direction to further improve the performance of MAMA. We find that the main cause of the moderate recall is the incorrect entities caused by spaCy noun chunk as summarized in Sec. A.2.

**Larger/deeper LMs produce KGs of higher quality.** BERT<sub>LARGE</sub> outperforms BERT<sub>BASE</sub> since the doubling parameter size. GPT-2s share similar trends, where we observe performance increases when the model size increases. This complies with our intuition on more knowledge is stored in deeper and larger models. Such increases in performance seem subtle on TAC KBP, we find this might due to the relatively small number of oracle facts by noticing a more significant improvement on Wikidata in Sec. 3.1.3. We plan to further improve the results with larger pre-trained LMs, e.g., GPT-3 (Brown et al., 2020), Megatron-LM (Shoeybi et al., 2019).

BERT LMs outperform GPT-2 LMs under similar model sizes. More specifically, BERT\_BASE performs better than MAMA-GPT-2 in F1, and MAMA-BERT\_LARGE outperforms MAMA-GPT-2\_MEDIUM in F1. BERT\_BASE and MAMA-GPT-2 are similar in size, while MAMA-BERT\_LARGE and MAMA-GPT-2\_MEDIUM are similar in model size as well. This is mainly because that the recall of BERT LMs is higher than that of corresponding GPT-2 LMs. The result indicates that the Cloze-style loss function (i.e., masked language model) of BERT is more effective and flexible in

<sup>2</sup> https://github.com/dair-iitd/OpenIE-standalone

<sup>&</sup>lt;sup>3</sup>There are 2,383 correct oracle facts based on the "manual runs" assessment in TAC KBP.

Method	Precision%	Recall%	F1%
Stanford OpenIE (Angeli et al., 2015)	23.32	13.09	16.77
MAMA-BERT <sub>LARGE</sub> (ours)	29.52	16.56	21.22
MAMA-GPT-2 <sub>XL</sub> (ours)	31.32	17.42	22.39

Table 3: Compare the quality of mapped facts on Wikidata.

recovering more knowledge than the autoregressive LM objective. We also notice that the precision of GPT-2 LMs is higher than that of according BERT LMs. The reason is that the autoregressive LM objective captures more accurate knowledge than Cloze-style loss does by not introducing extra noise (e.g., masked tokens) during pre-training.

#### 3.1.3 WIKIDATA

We select our best BERT based method MAMA-BERT<sub>LARGE</sub>, and GPT-2 based method MAMA-GPT- $2_{\rm XL}$  on TAC KBP to compare with Stanford OpenIE (the best open IE system on TAC KBP) for scalability experiments on Wikidata. We follow the same definition as the slot filling task to calculate precision, recall, and F1 on Wikidata. Table 3 summarizes the results.

MAMA is scalable to larger corpora. Similar to the trends on TAC KBP, MAMA-GPT-2<sub>XL</sub> performs the best in precision, recall, and F1. The results show the effectiveness of MAMA in generating candidate facts and high-quality KGs. We also find that MAMA-GPT-2<sub>XL</sub> outperforms MAMA-BERT<sub>LARGE</sub> by over 1% in F1. This shows that the larger model (GPT-2<sub>XL</sub> has 5x more parameters compared to BERT<sub>LARGE</sub>) contains more knowledge, and MAMA is able to restore the knowledge. When larger or deeper models (e.g., GPT-3) are used with MAMA, we can expect more gains of the KG quality. Thanks to the efficient nature of MAMA, which relies only on the forward pass of the LMs without fine-tuning, the results suggest that MAMA is scalable to large KGs.

Larger corpora embed more complete KGs. In particular, MAMA-GPT- $2_{\rm XL}$  outperforms Stanford OpenIE by 5.6% in F1. MAMA-BERT<sub>LARGE</sub> outperforms Stanford OpenIE by approximately 4.4% in F1. Both F1 gains are larger compared to that on TAC KBP. This is because that the LMs contain world knowledge from pre-training corpora, e.g. Wikipedia and Common Crawl. The larger the textual corpora are, the more knowledge our method is able to recover and match to the knowledge stored in LMs. The finding is particularly important, since we are now able to construct larger KGs of high quality from scratch when larger datasets are used, such as WebText2 and Common Crawl (Raffel et al., 2019; Brown et al., 2020). Similar to the observations on TAC KBP, the precision is higher compared to recall. Wikidata is not fully built from Wikipedia, MAMA could improve the recall by running on those larger corpora to collect more facts.

## 3.2 ANALYSIS OF UNMAPPED FACTS

As illustrated in Figure 3, the open KG constructed by MAMA is a new type of KG combining the fixed KG schema with the flexible open schema. We turn to study the quality of the candidate facts that are not mapped to the above reference KG schema, but are in the open schema generated by MAMA. We manually judge such unmapped facts generated by our best method MAMA-GPT-2<sub>XL</sub> from 100 sampled documents in Wikidata and TAC KBP respectively.

**The quality of unmapped facts is verified.** We find 35.3% of the unmapped facts are true on Wikidata. We find 83.2% of those true facts are partially unmapped facts as defined in Sec. 2.2.2, e.g., (Bob\_Dylan.Q392, tour\_with, the\_Grateful\_Dead.Q212533), whose relation is not within the schema of Wikidata, while both head and tail are in the schema. The remaining true facts are completely unmapped facts (Sec. 2.2.2), e.g., a candidate fact (Jacob, was, A Registered Mennonite) stays the same in the open schema.

Accurate entity detection is desired. We also notice 45.5% of the untrue unmapped facts on Wikidata are due to the *incorrect entities* detected by the spaCy. *Incorrect or missing entity linking* (to either head or tail) in Sec. 2.2.1 causes additional 9.1% errors in the unmapped facts. 4.5% of the untrue unmapped facts are caused by the *missing relation mapping* in Sec. 2.2.1. The rest errors made by MAMA-GPT-2<sub>XL</sub> are *incorrect relation phrases*, such as uninformative relation phrases, e.g., (*Dylan, made, his breakthrough*), which is similar to the errors made by open IE systems (Fader et al., 2011). Both entity linking and relation mapping of Map stage rely heavily on the accuracy of entity detection from the spaCy noun chunk. We conclude that the main root cause of the untrue unmapped facts is due to the errors made by the spaCy noun chunk.

We observe similar trends on TAC KBP. We plan to leverage crowdsourcing platforms, e.g., Mechanical Turk, to conduct quantitative evaluations over the unmapped facts to better understand the strengths and shortage of MAMA. We plan to identify more accurate entities by relying on attention weights in LMs (Clark et al., 2019; Hewitt & Manning, 2019) instead of using extra resources. We will also investigate stronger entity linkers (Kolitsas et al., 2018) and learn a more robust relation mapping through weak or distant supervision (Mintz et al., 2009; Ratner et al., 2017). We will investigate more sophisticated approaches, such as graph neural networks (Kipf & Welling, 2016), to generate more accurate relation phrases from the attention weight matrices by considering structural information.

## 4 RELATED WORK

**Knowledge graph construction** can be generally categorized into two groups, 1) supervised approaches. Wikidata, Freebase (Bollacker et al., 2008), YAGO (Suchanek et al., 2007), YAGO2 (Hoffart et al., 2013), DBpedia (Auer et al., 2007) are built based on human supervision from Wikipedia infoboxes and other structured data sources; 2) semi-supervised approaches. Open information extraction systems, e.g., OLLIE (Schmitz et al., 2012), Reverb (Fader et al., 2011), Stanford OpenIE (Angeli et al., 2015), and OpenIE 5.1 <sup>2</sup> aim to leverage carefully-designed patterns based on linguistic features (e.g., dependencies and POS tags), to extract triplets from web corpora for open schema KG. Besides, NELL (Carlson et al., 2010), DeepDive (Niu et al., 2012), Knowledge Vault (Dong et al., 2014) extract information based on a fixed schema or ontology, where humans help improve the accuracy of the extractions. Probase (Wu et al., 2012) produces taxonomies instead of rich typed relations in general KGs. MAMA instead uses learned knowledge stored in pre-trained LMs without human supervision to construct an open KG, which is a mixture of fixed schema and open schema.

Language models, e.g., BERT (Devlin et al., 2018), GPT (Radford et al., 2018), GPT-2/3 (Radford et al., 2019; Brown et al., 2020), ELMo (Peters et al., 2018), Transformer-XL (Dai et al., 2019), ALBERT (Lan et al., 2019), RoBERTa (Liu et al., 2019), XLNet (Yang et al., 2019) and Megatron-LM (Shoeybi et al., 2019) contain factual knowledge obtained via pre-training on large-scale corpora such as Wikipedia and BookCorpus (Zhu et al., 2015). Studies have leveraged the pre-trained LMs as virtual KGs, and show reasonable performance in QA tasks (Dhingra et al., 2020; Guu et al., 2020), and language modeling (Khandelwal et al., 2019). LMs are further enhanced by KGs (Zhang et al., 2019; Peters et al., 2019) to improve knowledge-driven tasks. While the existing work utilizes knowledge in an implicit way, the main difference is that our approach explicitly extracts knowledgeable facts from the LMs. Compare to LAMA (Petroni et al., 2019; 2020), instead of conducting fact recall in cloze statements, MAMA directly generates the whole fact in the form of a triplet (h, r, t) from a sentence. Besides, the benchmark datasets used with MAMA are larger compared to the LAMA benchmark, e.g., Wikidata is 3 orders of magnitude larger compared to the largest dataset in the LAMA benchmark.

**Neural network interpretation** here specifically refers to pre-trained deep language model analysis. There has been a lot of work to understand what the neural networks learn (Linzen et al., 2016; Adi et al., 2016; Tenney et al., 2019). With regards to analyzing Transformer (Vaswani et al., 2017) based language models (e.g., BERT and GPT-3), substantial recent work focuses on both visualizing and analyzing the attention (Vig, 2019; Jain & Wallace, 2019; Clark et al., 2019; Michel et al., 2019; Vig et al., 2020; Ramsauer et al., 2020; Hendrycks et al., 2020). Instead of analyzing or visualizing, we use LMs to generate structured KGs to directly recover what LMs learn from the corpora.

## 5 CONCLUSION

We show that the knowledge graphs can be constructed by a single forward pass of the language models over textual corpora. We propose a two-stage unsupervised approach MAMA to first match the facts in the corpus with the internal knowledge of the language model, and then map the matched facts to produce a knowledge graph. We demonstrate the quality of the resultant open knowledge graphs by comparing to two knowledge graphs (Wikidata and TAC KBP). The open knowledge graph also features new facts in the open schema, which could have broad implications for knowledge graphs and their downstream applications. The results also suggest that larger language models store richer knowledge than existing knowledge graphs, and generating on even larger high-quality text corpora could continue improving knowledge graphs. Additionally, the knowledge graphs generated by our approach can help researchers to look into what the language models learn, so our interpretable knowledge graphs establish a bridge between the deep learning and knowledge graph communities.

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# A ADDITIONAL DETAILS AND ANALYSIS OF MAMA

## A.1 IMPLEMENTATION DETAILS

To evaluate the mapped facts, we first use Match stage of MAMA to run over the corresponding documents to generate the candidate facts. For Map stage on TAC KBP, we link to the oracle annotation of the entities or spans in the TAC KBP corpus. On Wikidata, the entity linking method described in Sec. 2.2.1 is first leveraged to link entities in the candidate facts to Wikipedia anchors. Then a Wikipedia anchor to the Wikidata item dictionary is used to further link the entities to Wikidata. If the head or tail is a pronoun, we further use neuralcoref <sup>4</sup> for coreference resolution. We use GloVe (Pennington et al., 2014) embedding for disambiguation. The relation mapping is constructed offline for TAC KBP and Wikidata respectively using the method in Sec. 2.2.1. For oracle facts in Wikidata, we only preserve those facts describing relations that could be linked to a corresponding Wikipedia anchor. We rule out facts of attributes about entities and facts of auxiliary relations (such as *topic's main category.P901*) and finally results in 27,368,562 oracle facts.

For Wikidata, at Match stage, we randomly split the English Wikipedia data into 20 partitions, and map the data partitions to 20 distributed servers to run. Each server is configured with four Tesla K80 12Gs. We set the max sequence length to 256, and batch size as 32 for MaMa-BERT<sub>LARGE</sub> and 4 for MaMa-GPT-2<sub>XL</sub>. We use implementations of pre-trained LMs in Transformers package <sup>5</sup>. We use spaCy sentencizer <sup>6</sup> to segment the documents into sentences. MaMa-BERT<sub>LARGE</sub> takes approximately 48 hours, and MaMa-GPT-2<sub>XL</sub> costs around 96 hours. The resulting candidate facts of Match stage from the 20 servers are then reduced a data server, where a MongoDB database is maintained to store the oracle Wikidata and entity linking results to enable the efficient Map stage. To produce the open KGs, Map stage takes around 18 hours. The setup is similar to TAC KBP. Match stage is done within 48 hours for all the settings. The batch sizes of MaMa-BERT<sub>BASE</sub>, MaMa-GPT-2<sub>MEDIUM</sub>, MaMa-GPT-2<sub>LARGE</sub> are 64, 32, 16, 8 respectively.

The parameter settings are shared across TAC KBP and Wikidata. All the choices are based on the parameter study in Sec. A.3. The beam size of Algorithm 1 is set to 6. The matching degree threshold of Constraint #1 (Sec. 2.1.2) is set to 0.005, and the number of distinct head-tail pairs of Constraint #2 (Sec. 2.1.2) is set to 10. To generate the attention weight matrix  $\mathbf{A}_s$  of a sentence, we reduce the weights of every attention head in the last layer of pre-trained LMs using the mean operator.

# A.2 ERROR ANALYSIS

There is still significant room to improve MAMA. To further understand the shortage of MAMA, we conduct an error analysis of the errors in precision (i.e., incorrect facts returned by MAMA) of Table 2 and Table 3. We choose our best method MAMA-GPT-2<sub>XL</sub> for the study. We sample 100 documents from the Wikidata dataset, and manually check the reasons for the errors. We find 33.1% of the errors are caused by *incorrect entities*, while the relation phrases are correct. The errors are due to the incorrect noun chunk detected by the spaCy <sup>7</sup>. 18.3% of the errors are due to the *missing relation mapping* created in Sec. 2.2.1. Note that we find approximately 23.8% of the errors are actually *correct facts that are new in the reference KGs*. e.g., (Bob\_Dylan.Q392, residence.P551, Nashville.Q23197) (in Figure 3) is not an existing fact in Wikidata, but it is a correct mapped fact based on our annotation. The rest errors made by MAMA-GPT-2<sub>XL</sub> are *incorrect relation phrases*, such as uninformative relation phrases. We find similar errors are made by MAMA-GPT-2<sub>XL</sub> on TAC KBP. Similar to Sec. 3.2, enhancing the entity detection, entity linker, relation mapping, and relation generation are helpful. We also plan to leverage lifelong learning (Carlson et al., 2010) to add true facts to the reference KGs to improve the evaluation.

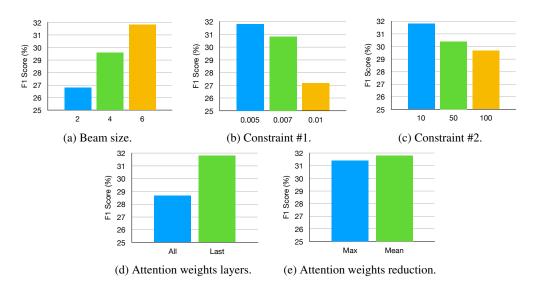


Figure 4: Parameter study with MAMA-BERT<sub>BASE</sub> on TAC KBP hold-out subset.

#### A.3 PARAMETER STUDY

We study the effects of the parameters using MaMa-BERT<sub>BASE</sub> on TAC KBP. We randomly sample 20% of the oracle query entities as a hold-out dataset to tune the parameters, and use the best parameter setting achieved for both TAC KBP and Wikidata experiments. When studying the effect of a certain parameter, we keep the remaining parameters as default described in Sec. A.1. We use F1 to measure the effects.

**Effects of beam size** Figure 4(a) illustrates the effects of various beam sizes in Algorithm 1. We find that in general, the larger the beam size is, the better F1 the setting achieves. This is because that MAMA is able to reserve more potentially correct facts when more candidates are allowed in the Match stage. However, F1 improvement gradually becomes subtle, while the computation costs increase more significantly. For sake of the efficiency, we do not explore larger beam sizes. We set the beam size as 6.

**Effects of search constraints** Figure 4(b) compares the effect of different thresholds of the matching degree of Constraint #1 in Sec. 2.1.2. We set the threshold as 0.005 since it achieves the best result. Note that the summed attention score is normalized by the length of the fact to penalize the cumbersome facts. Figure 4(c) shows the impact of the number of distinct head-tail pairs in identifying common relations of Constraint #2 in Sec. 2.1.2. The best result is achieved when it equals 10. This shows that while MAMA mostly identifies frequent relations, it is also able to capture some rare relations for the open schema.

Effects of attention weights Figure 4(d) shows the comparison between attention weights of the last layer and the mean of all layers. The attention weights of the last layer perform better. This is due to the attention weights in lower layers are low-level linguistic knowledge according to (Clark et al., 2019; Ramsauer et al., 2020), which are less relevant to the factual knowledge for the KG construction. Figure 4(e) compares the impact of different attention reduction, i.e., mean, max, over the attention heads of the last layer. We find the "mean" perform better. The reason is that the token often intensively attends to several specific tokens in the sequence (Michel et al., 2019), and the "mean" operator is more sensitive to such information.

<sup>4</sup> https://github.com/huggingface/neuralcoref

 $<sup>^{5}</sup>$  https://github.com/huggingface/transformers

<sup>6</sup> https://spacy.io/api/sentencizer

<sup>7</sup>https://spacy.io/usage/linguistic-features/#noun-chunks

# B SAMPLES FROM MAMA ON TAC KBP

#### B.1 MAPPED FACTS

We randomly sample 100 documents from TAC KBP corpus, then randomly sample sentences from those documents. The uncurated candidate facts and the corresponding mapped facts of the sampled sentences based on our best methods MAMA-BERT<sub>LARGE</sub> and MAMA-GPT- $2_{XL}$  are shown in Figure 5 and Figure 6 respectively. We also randomly sample several sentences in which MAMA-BERT<sub>LARGE</sub> differs from MAMA-GPT- $2_{XL}$  in the resulting facts for comparison, which is illustrated in Figure 7. In each table, "ID" represents the document ID of a sampled sentence in TAC KBP corpus. "Sentence" indicates the sampled sentence. "Candidate facts to mapped facts" column contains the candidate facts (on the left side of " $\rightarrow$ ") and their corresponding mapped facts (on the right side of " $\rightarrow$ ").

#### B.2 UNMAPPED FACTS

We randomly sample 100 documents from TAC KBP corpus. From those documents, we show unmapped facts from the sampled sentences from those documents. We manually check the correctness of the unmapped facts according to Sec. 3.2, and show the correct ones. The original candidate facts with the corresponding unmapped facts of the sampled sentences generated by MAMABERT<sub>LARGE</sub> and MAMA-GPT- $2_{XL}$  are shown in Figure 8 and Figure 9. A further comparison of the unmapped candidate facts is illustrated in Figure 10. In each table, "ID" represents the document ID of a sampled sentence in TAC KBP corpus. "Sentence" indicates the sampled sentence. "Candidate facts to unmapped facts" column contains the candidate facts (on the left side of " $\rightarrow$ ") and their corresponding unmapped facts (on the right side of " $\rightarrow$ ").

## C SAMPLES FROM MAMA ON WIKIDATA

#### C.1 MAPPED FACTS

Similar to TAC KBP, we randomly sample 100 documents from the Wikidata corpus (i.e., English Wikipedia), then randomly sample sentences from those documents. The uncurated candidate facts and the corresponding mapped facts of the sampled sentences based on our best methods MAMA-BERT<sub>LARGE</sub> and MAMA-GPT-2<sub>XL</sub> are shown in Figure 11 and Figure 12 respectively. We also randomly sample several sentences in which MAMA-BERT<sub>LARGE</sub> differs from MAMA-GPT-2<sub>XL</sub> in the resulting facts for comparison, which is illustrated in Figure 13. In each table, "**ID**" represents the Wikipedia page's title of a sampled sentence. "**Sentence**" indicates the sampled sentence. "**Candidate facts to mapped facts**" column contains the candidate facts (on the left side of " $\rightarrow$ ") and their corresponding mapped facts (on the right side of " $\rightarrow$ ").

## C.2 UNMAPPED FACTS

Similar to TAC KBP, we randomly sample 100 documents from the Wikidata corpus. From those documents, we show unmapped facts from several sampled sentences from those documents. We manually check the correctness of the unmapped facts according to Sec. 3.2, and show the correct ones. The original candidate facts with the corresponding unmapped facts of the sampled sentences generated by MAMA-BERT<sub>LARGE</sub> and MAMA-GPT- $2_{XL}$  are shown in Figure 14 and Figure 15. A further comparison of the unmapped candidate facts is illustrated in Figure 16. In each table, "ID" represents the Wikipedia page's title of a sampled sentence. "Sentence" indicates the sampled sentence. "Candidate facts to unmapped facts" column contains the candidate facts (on the left side of " $\rightarrow$ ") and their corresponding unmapped facts (on the right side of " $\rightarrow$ ").

## D ADDITIONAL OPEN KG SUBGRAPHS FROM MAMA ON WIKIDATA

We sample several documents from the Wikidata corpus. We visualize the mapped facts and unmapped facts from those documents as examples of subgraphs in the resulting open KGs. We show the snapshots of the subgraphs generated by MAMA-BERT<sub>LARGE</sub> from Figure 17 to Figure 24. We

SF13_ENG_001 SF13_ENG_004 SF13_ENG_007 SF13_ENG_009	Bashardost left Pakistan for France in 1981.  Douglas Flint will succeed Stephen Green as Group Chairman and Stuart Gulliver will be appointed Group Chief Executive following Michael Geoghegan's decision to retire early next year, "HSBC said in a statement.	(Bashardost, left, Pakistan) → (Ramazan Bashardost, per:countries.of_residence, Pakistan) (Douglas Flint, as, Group Chairman) → (Douglas Flint, per:title, Chairman)
SF13_ENG_007	following Michael Geoghegan 's decision to retire early next year , "HSBC said in a statement .	
SF13_ENG_009	Mohammed Tantawi, head of Al - Azhar University, told a schoolgirl to remove her niqab when he spotted her during a tour of an	$(Mohammed\ Tantawi,\ head\ of,\ Al-Azhar\ University) \rightarrow (Mohammed\ Sayed\ Tantawi,\ per.employee\_or\_member\_of,\ Al-Azhar\ University)$
	Al - Azhar affiliated school , the independent Al - Masry al - Youm newspaper reported this week .  He took office in 2006 by defeating longtime incumbent Anwar Chowdhry from Pakistan , who was later barred for alleged financial corruntion .	$(Long time\ Incumbent\ Anwar\ Chowdhry,\ from,\ Pakistan) \rightarrow (Anwar\ Chowdhry,\ per: origin,\ Pakistan)$
SF13_ENG_010	In addition to his wife, Wendy, Dio is survived by son Daniel, grandchildren Julie and Joey, and father Pat.	$(\text{Dio, is survived by son, Daniel}) \rightarrow (\text{Ronnie James Dio, per:children, Daniel})$
SF13_ENG_011 SF13_ENG_011	Marshall is charged with grand larceny and fraud and faces up to 25 years in prison if convicted.  Marshall, a Tony Award - winning Broadway producer and former U. S. diplomat, sat stonelike as the jury forewoman read each	(Marshall, is charged, Fraud) → (Anthony Marshall, per-charges, fraud) (Marshall, ,, A Tony Award-Winning Broadway Producer) → (Anthony Marshall, per-title, producer)
SF13.ENG.011	verdict aloud, the word "guilty" "clearly resonating in the otherwise silent courtroom.  The blueblood scion of one of America's most illustrious families appeared to listen impassively as verdicts finding him guilty on 14 counts of grand larceny, conspiracy and fraud were read to a packed courtroom.	$(Him, guilty, Grand\ Larceny) \rightarrow (Anthony\ Marshall, per: charges, grand\ larceny)$
SF13_ENG_011 SF13_ENG_012	But Marshall 's son, Philip, told a different story.  Al - Qaeda 's American spokesman Adam Gadahn, also known as Azzam the American, called on Muslims in the West on Sunday	(Marshall'S Son, ,, Philip) → (Anthony Marshall, per.children, Philip)  (Adam Gadahn, also known, Azzam) → (Adam Gadahn, per.alternate_names, Azzam)
SF13_ENG_012	to carry out more attacks like the deadly shooting at the US base in Fort Hood , Texas .  Gadahn , also known as Azzam the American , was born in 1978 .	$(Gadahn, , also known as, Azzam) \rightarrow (Adam Gadahn, per: alternate\_names, Azzam) \\$
SF13_ENG_012 SF13_ENG_012	Gadahn grew up in California and converted to Islam before he moved to Pakistan in 1998 and attended an al - Qaida training camp six years later, according to media reports.	(Gadahn, in, California) → (Adam Gadahn, per:statesorprovinces_of_residence, California)
SF13_ENG_012 SF13_ENG_014	Galahn moved to Pakistan in 1998, according to the FBI, and is said to have attended an al-Qaida training camp six years later, serving as a translater and consultant for the group.  After the Munich attack, he lived in Lebanon, Jordan and several Eastern European countries, where he had close ties to Commu- nist bloc intelligence agencies.	$(Gadahn, moved to, Pakistan) \rightarrow (Adam Gadahn, percountries_of_residence, Pakistan)$ $(He, lived in, Lebanon) \rightarrow (Mohammed Oudeh, percountries_of_residence, Lebanon)$
SF13_ENG_015 SF13_ENG_017	Clifton attended Howard University but left before graduating to pursue poetry .  "Alexander Haig devoted his career to serving our country , both as a soldier and as a diplomat , "Albright said . "	$(Clifton, attended, Howard University) \rightarrow (Lucille Clifton, per:schools_attended, Howard University)$ $(Alexander Haig, devoted his, soldier) \rightarrow (Alexander Haig, per:title, soldier)$
SF13_ENG_017 SF13_ENG_019	In 1979, he resigned and retired from the Army.  McGregor is survived by his wife, Lori, and four children, daughters Jordan, Taylor and Landri, and a son, Logan.	(He, and retired from, The Army) → (Alexander Haig, per:employee_or_member_of, Army) (Mcgregor, his wife, Lori) → (Keli McGregor, per:spouse, Lori)
SF13.ENG_020	"Mike was a first - rate journalist, a valued member of our staff for 25 years and we will miss him, "Times Editor Russ Stanton said."	(Mike, was, A First-Rate Journalist) → (Mike Penner, per:title, first-rate journalist)
SF13_ENG_020 SF13_ENG_024	Penner is survived by his brother, John, a copy editor at the Times, and his former wife, Times sportswriter Lisa Dillman.  She was charged with theft in Beaumont, Texas, for allegedly failing to pay for \$10,000 worth of dental work in 2006.	(Penner, his brother ,, John) $\rightarrow$ (Mike Penner, per-siblings, John) (She, was charged, Theft) $\rightarrow$ (Crystal Taylor, per-charges, theft)
SF13_ENG_025 SF13_ENG_026	Michigan native Nancy Kissel was convicted of murder and sentenced in Hong Kong 's High Court in September 2005.  Neal returned to New York and concentrated on stage work.	(Michigan Native Nancy Kissel, was convicted, Murder) → (Nancy Kissel, per.charges, murder) (Neal, returned to, New York) → (Patricia Neal, per:statesorprovinces of residence, New York)
SF13_ENG_026	In 1953, she married Roald Dahl, the British writer famed for "Charlie and the Chocolate Factory," "James and the Giant Peach" and other tales for children.	(She, married, Roald Dahl) → (Patricia Neal, per:spouse, Roald Dahl)
SF13_ENG_026 SF13_ENG_027 SF13_ENG_027	Oscar - winning actress Patricia Neal has died of lung cancer at her home on Martha 's Vineyard, Massachusetts, on Sunday.  Al - Hakim 's son, Ammar al - Hakim, has been groomed for months to take his father 's place.	(Patricia, died of, Lung Cancer) → (Patricia Neal, per:cause_of_death, lung cancer) (Al-Hakim'S Son, ,, Ammar Al-Hakim) → (Abdul Aziz Al-Hakim, per:children, Ammar al-Hakim)
SF13_ENG_027 SF13_ENG_027	Al - Hakim is the head of Supreme Iraqi Islamic Council (SIIC), the largest Shitte party in Iraq.  His former Shitte partners have gathered again to form their own group, the Iraqi National Alliance (INA), which includes the	(Al-Hakim, is, Supreme Iraqi Islamic Council) → (Abdul Aziz Al-Hakim, per.employee_or_member_of, Supreme Iraqi Islamic Council) (Al-Hakim, who died in, Iran) → (Abdul Aziz Al-Hakim, per.country.of_death, Iran)
SF13.ENG.028	influential Supreme Iraqi Islamic Council (SIIC) of Ammar al - Hakim , who succeeded his father Abdul Aziz al - Hakim , who diced in a hospital in Iran last month after a long battle with cancer.  "I" d rather have Sully doing this than some stranger, or some hotshot trying to be the next Billy Mays, "said the guy who	(The Next Billy Mays, his son, Billy Mays Iii) $\rightarrow$ (Billy Mays, per.children, Billy Mays III)
SF13_ENG_028 SF13_ENG_029	actually is the next Billy Mays, his son Billy Mays III.  Fignor continued cycling during and after a stint in the Army, and drew attention in the early 1980s when he managed to keep up.	(The Next Billy Mays, his son, Billy Mays in) → (Billy Mays, per-children, Billy Mays III)  (Fignon, during and after a stint in, The Army) → (Laurent Fignon, per-employee_or_member_of, the Army)
SF13_ENG_029	with Hinault during a race in which amateurs and professionals rode together.  Laurent Patrick Fignon was born in Paris on Aug. 12, 1960.  Anderson became the Tigers' manager in June 1979 and built on a foundation that included Alan Trammell at shortstop, Lou	(Laurent Patrick Fignon, was born in, Paris) → (Laurent Fignon, per:city_of_birth, Paris)
SF13_ENG_030	Whitaker at second base, Kirk Gibson in the outfield and Jack Morris on the pitching staff.	(Anderson, became, The Tigers' Manager) → (Sparky Anderson, per:title, manager)
SF13_ENG_030	In addition to his wife, Carol, Anderson is survived by his sons, Lee and Albert; his daughter, Shirlee Englebrecht; and many grandchildren.	(Anderson, is survived by his sons, Lee) → (Sparky Anderson, per:children, Albert)
SF13_ENG_031 SF13_ENG_032	Blake Edwards, a writer and director who was hailed as a Hollywood master of screwball farces and rude comedies like "Victor/ Victoria" and the "Pink Panther" movies, died Wednesday night in Santa Monica, Calif. He was 88.	(Blake Edwards, ,, writer) → (Blake Edwards, per.title, writer)
SF13,ENG,032 SF13,ENG,035	Hwang, who lives in Seoul under tight police security, has written books and delivered speeches condemning Kim's regime as authoritarian and dictatorial.  Kaczynska, who was 67, married Kaczynski in 1978 after meeting him in the northern Polish city of Gdansk, where they were	(Hwang, who lives, Scoul) → (Hwang Jang-Yop, percities.of_residence, Scoul) (Kaczynska, married, Kaczynski) → (Maria Kaczynska, perspouse, Kaczynski)
SF13_ENG_036	Notes that account in the case of a marieu Raczynski in 1978 after incetting min in the notifier Poissi city of cleansk, where they were both academics.  Upon his release he went into exile in India, where he masterminded the 1973 hijacking of a Royal Nepal Airlines plane known to	(Kaczynska, matricu, Kaczynski) — (Garia Kaczynska, per.sponse, Kaczynski)  (His Release, exile, India) — (Girija Prasad Koirala, per.countries, of residence, India)
SF13_ENG_036	becarrying hundreds of thousands of dollars in cash to fund his banned Nepalic Congress party.  Koirala began his political career as a union organiser and was imprisoned for seven years in 1960 after a failed uprising against	(Koirala, began his, A Union Organiser) → (Girija Prasad Koirala, pertitle, union organiser)
SF13_ENG_036	the monarchy .  Koirala was born in 1925 in Bihar of India where his father Krishna Prasad Koirala and his family were living in exile .	(Koirala, was born in 1925 in, Bihar) → (Girija Prasad Koirala, per.city,of,birth, Bihar)
SF13_ENG_036	Koirala was born in 1925 in Bihar of India at the time when his father Krishna Prasad Koirala along with his family was exiled by Rana rulers.	(Koirala, was born in 1925 in, Bihar) → (Girija Prasad Koirala, per:city_of_birth, Bihar)
SF13_ENG_037	Chabrol.'s survivors also include his third wife. Aurore Pajot, who acted as his script supervisor on nearly all of his movies from 1968 on and whom he married in 1981; and Pajot.'s daughter. Cecile Maistre, who was an assistant director on his films and wrote the script with him for "The Cirl Cut in Two" (2007).	(Chabrol'S Survivors, third wife, Aurore Pajot) → (Claude Chabrol, per:spouse, Aurore Pajot)
SF13_ENG_038	The joint statement said Cunningham was " an inspiring performer and dancer into his 80s, and a visionary choreographer and	$(Cunningham, was ``, An Inspiring Performer) \rightarrow (Merce Cunningham, per: title, performer)\\$
SF13_ENG_038 SF13_ENG_039	dedicated teacher throughout his life , he led quietly and by example ," the statement said ."  Merce Cunningham , the nonagenarian choreographer , is planning for a world without him .  A court on Monday cleared the widower of British reality television star Jade Goody , who died of cancer last year , of rape .	(Merce Cunningham, ,, The Nonagenarian Choreographer) → (Merce Cunningham, pertitle, choreographer) (British Reality Television Star Jade, who died, Cancer) → (Jade Goody, per:cause of death, cancer)
SF13_ENG_041	Don Hewitt, the CBS newsman who invented the highly popular TV newsmagazine "60 Minutes" and produced it for 36 years, died Wednesday.	(Don Hewitt, ,, The Cbs Newsman) → (Don Hewitt, per:title, newsman)
SF13_ENG_041	"He was the consummate television newsman," Don Hewitt, a longtime CBS News executive and creator of the long - running" 60 Minutes" news program, told Reuters."	(Don Hewitt, ,, executive) → (Don Hewitt, per.title, executive)
SF13.ENG.041 SF13.ENG.041	Hewitt was already a highly respected TV newsman .  Donald Shepard Hewitt was born in New York on Dec . 14 , 1922 , and grew up in the suburb of New Rochelle .	(Hewitt, was, A Highly Respected Tv Newsman) → (Don Hewitt, per-title, TV newsman)  (Donald Shenard Hewitt, born, New York) → (Don Hewitt, per-title orrowings of birth, New York)
SF13_ENG_043 SF13_ENG_044	Eleanor Louise Greenwich was born in Brooklyn on Oct . 23, 1940.	(Donald Shepard Hewitt, born, New York) → (Don Hewitt, per:stateorprovince of birth, New York) (Eleanor Louise Greenwich, was born, Oct.) → (Ellie Greenwich, per:date of birth, 1940-10-23)
SF13_ENG_048	A little more than a year after Dunne died from bladder cancer, the colorful remnants of his estate have been consigned by his family to Stair Galleries in Hudson, N. Y., which will auction them Nov. 20.  Charles Gwalthney, an architect known for his influential modernist home designs and famous clients like director Steven Spielberg	(Dunne, died, Bladder Cancer) → (Dominick Dunne, per:cause_of_death, bladder cancer)  (Charles Gwathmey, _architect) → (Charles Gwathmey, per:title, architect)
SF13_ENG_049	has died.  Besides his wife, Mandelbrot is survived by two sons, Laurent, of Paris, and Didier, of Newton, Mass., and three grandchildren	(Mandelbrot, is survived by two sons ,, Laurent) → (Benoit Mandelbrot, per.children, Laurent)
SF13_ENG_049	For yourse he worked for IBM in New York	$(He, for, Ibm) \rightarrow (Benoit Mandelbrot, per:employee.or, member.of, IBM)$
SF13_ENG_049	After several years spent largely at the Centre National de la Recherche Scientifique in Paris; Mandelbrot was hired by IBM in 1958 to work at the Thomas J. Watson Research Center in Yorktown Heights, N. Y. Although he worked frequently with academic researchers and served as a visiting professor at Harvard and the Massachusetts Institute of Technology, it was not until 1987 that	(Mandelbrot, was hired by, Ibm)   (Benoit Mandelbrot, Per-employee.or.nnember.of, IBM)
SF13_ENG_056	he began to teach at Yale, where he earned tenure in 1999.  "It's an issue for everybody in the state because peanuts are a big part of our economy, "said Don Koehler, executive director	(The Georgia Peanut Commission, director, Don Koehler) → (Georgia Peanut Commission, org:top_members_employees, Don
SF13.ENG.060	of the Georgia Peanut Commission."  "We" Il be meeting with AAAS provides the provided the provi	$ \begin{array}{l} \text{Koehler)} \\ \text{(The Aaas President, ,, Agre)} \rightarrow \text{(American Association for the Advancement of Science, org:top.members.employees, Peter C.} \\ \end{array} $
SF13_ENG_060	collaboration, "Agre, the AAAS president, was quoted as saying.  However, Alan Leshner, chief executive officer of the American Association for the Advancement of Science, noted that Nobels are generally wiren for work that's a decade old or more, and that the U. S. mustn't become complacent.	Agre)  (The American Association, chief executive, Alan Leshner) → (American Association for the Advancement of Science, our top members employees. Alan Leshner)
SF13_ENG_062	"First of all , they never have enough funding , "said Andy Kunz , president of the U. S. High Speed Rail Association , a nonprofit	(The U.S. High Speed Rail Association, ,, Andy Kunz) → (U.S. High Speed Rail Association, org:top,members,employees, Andy Kunz)
SF13_ENG_064	China 's shock at NATO's military campaign in the former Yugoslavia helped prod Beijing into playing a bigger role in U. N. peacekeeping, said Bates Gill, director of the Stockholm International Peace Research Institute and co - author of a recent report on China 's peacekeeping activities.	$(The Stockholm International Peace Research Institute, director of, Bates Gill) \rightarrow (Stockholm International Peace Research Institute, org.top\_members\_employees, Bates Gill)$
SF13.ENG.064	"Non - state actors, for example, a small group of pirates off the coast of Somalia, Al Qaida and Taliban who operate across borders and have more and more sophisticated means of violence, are becoming bigger and bigger challenges to the international system, "said Bates Gill, director of the Stockholm international Peace Research Institute.	$(The Stockholm International Peace Research Institute, director, Bates Gill) \rightarrow (Stockholm International Peace Research Institute, org.top.members.cmployees, Bates Gill)$
SF13_ENG_068	"It is not surprising that one primarily cosmetic business is trying to throw another under the bus by transferring a tax from rich doctors and their wealthy customers to struggling small businesses, "John Overstreet, director of the Indoor Tanning Association, said in a statement Saturday.	$(The Indoor Tanning \ Association, director \ of, John \ Overstreet) \rightarrow (Indoor \ Tanning \ Association, org. top\_members\_employees, John \ Overstreet)$
SF13_ENG_076	, salo in a statement Saturuay.  The chairman of the Swiss Bankers Association , Patrick Odier , told weekly NZZ am Sonntag that Italy and France have shown interest in deals like ones Switzerland signed this week with Germany and Britain .	$(The \ Swiss \ Bankers \ Association, \ , \ Patrick \ Odier) \rightarrow (Swiss \ Bankers \ Association, \ org:top\_members\_employees, Patrick \ Odier)$
SF13_ENG_076	The majority of voters in Switzerland, which manages more than 25 percent of the world's foreign - held private wealth, support banking secrecy, according to a survey published last month by the Swiss Bankers Association in Basel.	$(The \ Swiss \ Bankers \ Association, in, Basel) \rightarrow (Swiss \ Bankers \ Association, org. city\_of\_headquarters, Basel)$
SF13_ENG_078	" Americans have a right to know the truth Islam is a religion of intolerance and violence, " said Richard Thompson, legal director of the Thomas More Law Center in Ann Arbor."	(The Thomas More Law Center, in, Ann Arbor) → (Thomas More Law Center, org:city_of_headquarters, Ann Arbor)
SF13_ENG_082 SF13_ENG_082	New solutions may be enacted for these orphans, though, said Mary Robinson, CEO of the National Council for Adoption.  "When you close a country, you end up causing more problems than you prevented," said Chuck Johnson, CEO of the National Council for Adoption."	(The National Council, "Mary Robinson) → (National Council for Adoption, org.top,members,employees, Mary Robinson) (Adoption, Council for, Chuck Johnson) → (National Council for Adoption, org.top,members,employees, Chuck Johnson)
SF13_ENG_084	"This is definitely a Goldilocks problem," said Jason Grumet, president of the Bipartisan Policy Center and an energy adviser to the Obama campaign last year.	$(\mbox{The Bipartisan Policy Center, } \mbox{$_{\rm m}$ Jason Grumet}) \rightarrow (\mbox{Bipartisan Policy Center, } \mbox{$_{\rm m}$ or $_{\rm m}$ or $
SF13_ENG_085	"Banks are in strong need for the capital markets ( to raise funds ), "Li Fuan, a director at the China Banking Regulatory Commission, was quoted as saying at a forum over the weekend.	(The China Banking Regulatory Commission, director at, Li Fuan) → (China Banking Regulatory Commission, org:top.members_employees, Li Fuan)
SF13.ENG.089 SF13.ENG.089	RIA Novosti and Interfax cite Anatoly Isaikin, head of Rosoboronexport, as saying Thursday" nothing is blocking the continuation of military - technical cooperation "with Iran. Rosoboronexport is the only company in Russia that is allowed to export arms, dual - use products and military - related services.	(Rosoboronexport, head of, Anatoly Isaikin) → (Rosoboronexport, org:top.members.employees, Anatoly Isaikin)  (Rosoboronexport, is the only company in, Russia) → (Rosoboronexport, org:country.of.headquarters, Russia)
SF13_ENG_089 SF13_ENG_091	With his wife, Cornelie, Middelhoff invested money in 2000 and 2001 with Esch in funds that were formed to buy five properties from KarstadtQuelle, as Arcandor was then known, and leased back to the department store chain before Middelhoff joined the	(Rosoboronexport, is the only company in, Russia) → (Rosoboronexport, org.country.of_headquarters, Russia) (Arcandor, "Karstadiquelle) → (Arcandor, org.alternate_names, KarstadiQuelle)
	company, according to Middelhoff 's spokesman.	

Figure 5: Mapped facts: MAMA-BERT  $_{\rm LARGE}$  on TAC KBP.

similarly illustrate the snapshots of the subgraphs constructed by MaMa-GPT- $2_{\rm XL}$  from Figure 25 to Figure 32. In each figure, the blue node and arrow represent the mapped facts in the Wikidata schema, while the yellow node and arrow denote the unmapped facts in the open schema. We additionally visualize the correct facts that are new in Wikidata according to Sec. A.2 in yellow.

SF13_ENG_001	Sentence  But in a sign of just how disenchanted some Afghans have become with their government, Bashardost, a doctoral scholar who lived	Candidate facts to mapped facts  (Bashardost, "A Doctoral Scholar) → (Ramazan Bashardost, per:title, scholar)
SF13_ENG_001	in France for two decades, is widely believed to be at least fourth in popularity among 42 candidates in the August elections.  Bashardost left Pakistan for France in 1981.	$(Bashardost, left, Pakistan) \rightarrow (Ramazan  Bashardost, per:countries, of\_residence, Pakistan) \\$
SF13,ENG,007 SF13,ENG,009	Mohammed Tantawi, head of Al-Azhar University, told a schoolgirl to remove her niqab when he spotted her during a tour of an Al-Azhar affiliated school, the independent Al-Maxy al-Youn newspaper reported this week.  He took office in 2006 by defeating longitim incumbent Anwar Chowdhry from Pakistam, who was later barred for alleged financial	(Mohammed Tantawi, head, Al-Azhar University) → (Mohammed Sayed Tantawi, per.employee.or.member.of, Al-Azhar University) (Longtime Incumbent Anwar Chowdhry, from, Pakistan) → (Anwar Chowdhry, per.origin, Pakistan)
SF13_ENG_010	The took office in 2000 by deteating nongoine arctimeter Answar Choward from Pakssan, who was rater out ed to an eged manicial corruption.  In addition to his wife, Wendy, Dio is survived by son Daniel, grandchildren Julie and Joey, and father Pat.	(Dio, is survived by son, Daniel) → (Ronnie James Dio, per.children, Daniel)
SF13 ENG.011 SF13 ENG.011	Marshall is charged with grand larceny and fraud and faces up to 25 years in prison if convicted.	(Marshall, with Fraud) → (Anthony Marshall, per:https://doi.org/10.00000000000000000000000000000000000
SF13.ENG.011	Marshall, a Tony Award-winning Broadway producer and former U.S. diplomat, sat stonelike as the jury forewoman read each vertical aloud, the word 'guilty' clearly resonaiting in the otherwise silent courtroom.  The blueblood scion of one of America's most liturations families appeared to listen impassively as verdicts finding him guilty on	(Him, guilty on, Grand Larceny) → (Anthony Marshall, per-charges, grand larceny)
SF13,ENG,011	14 counts of grand larceny, conspiracy and fraud were read to a packed courtroom.  But Marshall's son, Philip, told a different story.	(Marshall'S Son Philip) → (Anthony Marshall, per.children, Philip)
SF13_ENG_012	Al-Qaeda's American spokesman Adam Gadahn, also known as Azzam the American, called on Muslims in the West on Sunday to carry out more attacks like the deadly shooting at the US base in Fort Hood. Texas.	(Adam Gadahn, , also known, Azzam) → (Adam Gadahn, per:alternate.names, Azzam)
SF13_ENG_012 SF13_ENG_012	Gadahn, also known as Azzam the American, was born in 1978.  Gadahn grew up in California and converted to Islam before he moved to Pakistan in 1998 and attended an al-Oaida training camp	(Gadahn, also known as, Azzam) → (Adam Gadahn, per:alternate_names, Azzam)  (Gadahn, in, California) → (Adam Gadahn, per:statesorprovinces_of_residence, California)
SF13_ENG_012	six years later, according to media reports.  Gadahn moved to Pakistan in 1998, according to the FBI, and is said to have attended an al-Qaida training camp six years later,	(Gadahn, moved to, Pakistan) → (Adam Gadahn, per:countries_of_residence, Pakistan)
SF13_ENG_014	serving as a translator and consultant for the group.  After the Munich attack, he lived in Lebanon, Jordan and several Eastern European countries, where he had close ties to Communist	(He, lived in, Lebanon) → (Mohammed Oudeh, per:countries_of_residence, Lebanon)
SF13,ENG,015 SF13,ENG,017	bloe intelligence agencies.  Clifton attended Howard University but left before graduating to pursue poetry.  "Alexander Haig devoted his career to serving our country, both as a soldier and as a diplomat," Albright said."	(Clifton, attended, Howard University) → (Lucille Clifton, per:schools, attended, Howard University)
SF13,ENG,017 SF13,ENG,019	Acceptance range devoted instructed to serving our country, from as a source; and as a cuptomat, Attorgen sand.  In 1979, he resigned and retired from the Army.  McGregor is survived by his wife, Lori, and four children, daughters Jordan, Taylor and Landri, and a son, Logan.	(Alexander Haig, as, soldier) — (Alexander Haig, pertifite, soldier) (He, resigned and, The Army) — (Alexander Haig, percimployee, or, member, of, Army) (Megregor, by his wife, Lori) — ) (Kell McGregor, perspoase, Lori)
SF13_ENG_020	"Mike was a first-rate journalist, a valued member of our staff for 25 years and we will miss him," Times Editor Russ Stanton said.	(Mike, was, A First-Rate Journalist) → (Mike Penner, per:title, first-rate journalist)
SF13.ENG.020 SF13.ENG.024	Penner is survived by his brother, John, a copy editor at the Times, and his former wife, Times sportswriter Lisa Dillman.  She was charged with theft in Beaumont, Texas, for allegedly failing to pay for \$10,000 worth of dental work in 2006.	(Penner, by his brother, John) → (Mike Penner, per:siblings, John) (She, was charged with, Theft) → (Crystal Taylor, per:charges, theft)
SF13_ENG_025 SF13_ENG_026	Michigan native Nancy Kissel was convicted of murder and sentenced in Hong Kong's High Court in September 2005.  Neal returned to New York and concentrated on stage work.	(Michigan Native Nancy Kissel, convicted of, Murder) → (Nancy Kissel, per:charges, murder) (Neal, returned, New York) → (Patricia Neal, per:statesorprovinces_of_residence, New York)
SF13_ENG_026	In 1953, she married Roald Dahl, the British writer famed for "Charlie and the Chocolate Factory," "James and the Giant Peach" and other tales for children.	(She, married, Roald Dahl) → (Patricia Neal, per:spouse, Roald Dahl)
SF13_ENG_026 SF13_ENG_027	Oscar-winning actress Patricia Neal has died of lung cancer at her home on Martha's Vineyard, Massachusetts, on Sunday.  Al-Hakim's son, Ammar al-Hakim, has been groomed for months to take his father's place.	(Neal, has died of, Lung Cancer) → (Patricia Neal, per.cause_of_death, lung cancer)  (Al-Hakim'S Son, ,, Ammar Al-Hakim) → (Abdul Aziz Al-Hakim, per.children, Ammar al-Hakim)
SF13_ENG_027	Al-Hakim is the head of Supreme Iraqi Islamic Council (SIIC), the largest Shiite party in Iraq.	(Al-Hakim, of, Supreme Iraqi Islamic Council) → (Abdul Aziz Al-Hakim, per:employee_or_member_of, Supreme Iraqi Islamic Council)
SF13_ENG_027	His former Shiite partners have gathered again to form their own group, the Iraqi National Alliance (INA), which includes the influential Supreme Iraqi Islamic Council (SIIC) of Ammar al- Hakim, who succeeded his father Abdul Aziz al-Hakim, who died in home in the latest and the superior of the state of the superior	(Al-Hakim, died in a, Iran) → (Abdul Aziz Al-Hakim, per:country_of_death, Iran)
SF13,ENG,028	in a hospital in Iran last month after a long battle with cancer.  "I'd rather have Sully doing this than some stranger, or some hotshot trying to be the next Billy Mays," said the guy who actually is the next Billy Mays, his son Billy Mays III.	(The Next Billy Mays, , his son, Billy Mays Iii) $\rightarrow$ (Billy Mays, per:children, Billy Mays III)
SF13.ENG.029	Fignon continued cycling during and after a stint in the Army, and drew attention in the early 1980s when he managed to keep up with Hinault during a race in which amateurs and professionals rode together.	$(Fignon, during \ and \ after \ a \ stint \ in, \ The \ Army) \rightarrow (Laurent \ Fignon, per.employee\_or.member\_of, \ the \ Army)$
SF13_ENG_029 SF13_ENG_030	with rimant during a rate in winter lamateurs and professionars four togetree.  Laurent Patrick Fignon was bom in Paris on Aug. 12, 1960.  Anderson became the Tigers' manager in June 1979 and built on a foundation that included Alan Trammell at shortstop, Lou-	(Laurent Patrick Fignon, was born in, Paris) → (Laurent Fignon, percity_of_birth, Paris) (Anderson, became, The Tigers' Manager) → (Sparky Anderson, pertitle, manager)
SF13_ENG_030	Whitaker at second base, Kirk Gibson in the outfield and Jack Morris on the pitching staff.  In addition to his wife, Carol, Anderson is survived by his sons, Lee and Albert; his daughter, Shirlee Englebrecht; and many	(Anderson, is survived by his sons, Lee) → (Sparky Anderson, per.children, Lee)
SF13_ENG_031	grandchildren.  Blake Edwards, a writer and director who was hailed as a Hollywood master of screwball farces and rude comedies like "Vic-	(Blake Edwards, ,, writer) $\rightarrow$ (Blake Edwards, per:title, writer)
SF13_ENG_032	tor/Victoria" and the "Pink Panther" movies, died Wednesday night in Santa Monica, Calif. He was 88.  Hwang, who lives in Seoul under tight police security, has written books and delivered speeches condemning Kim's regime as	$(Hwang, , who \ lives, Seoul) \rightarrow (Hwang \ Jang-Yop, per:cities\_of\_residence, Seoul)$
SF13_ENG_035	authoritarian and dictatorial.  Kaczynska, who was 67, married Kaczynski in 1978 after meeting him in the northern Polish city of Gdansk, where they were both	$(Kaczynska, married, Kaczynski) \rightarrow (Maria Kaczynska, per:spouse, Kaczynski)$
SF13_ENG_036	academics.  Upon his release he went into exile in India, where he masterminded the 1973 hijacking of a Royal Nepal Airlines plane known to	$(His \ Release, he \ went \ into, India) \rightarrow (Girija \ Prasad \ Koirala, per: countries, of, residence, India)$
SF13.ENG.036	be carrying hundreds of thousands of dollars in cash to fund his banned Nepali Congress party.  Koirala began his political career as a union organiser and was imprisoned for seven years in 1960 after a failed uprising against the monarchy.	$(Koirala, career\ as,\ A\ Union\ Organiser) \rightarrow (Girija\ Prasad\ Koirala, per: title,\ union\ organiser)$
SF13_ENG_036 SF13_ENG_036	Koirala was born in 1925 in Bihar of India where his father Krishna Prasad Koirala and his family were living in exile.  Koirala was born in 1925 in Bihar of India at the time when his father Krishna Prasad Koirala along with his family was exiled by	(Koirala, was born in 1925 in, Bihar) → (Girija Prasad Koirala, per.city.of.birth, Bihar) (Koirala, born in 1925, Bihar) → (Girija Prasad Koirala, per.city.of.birth, Bihar)
SF13_ENG_037	Rana rulers.  Chabrol's survivors also include his third wife, Aurore Pajot, who acted as his script supervisor on nearly all of his movies from	(Chabrol'S Survivors, wife, Aurore Pajot) → (Claude Chabrol, per:spouse, Aurore Pajot)
	1968 on and whom he married in 1981; and Pajot's daughter, Cecile Maistre, who was an assistant director on his films and wrote the script with him for "The Girl Cut in Two" (2007).	, , , , , , , , , , , , , , , , , , , ,
SF13_ENG_038	The joint statement said Cunningham was "an inspiring performer and dancer into his 80s, and a visionary choreographer and dedicated teacher throughout his life, he led quietly and by example," the statement said. "	(Cunningham, was, An Inspiring Performer) → (Merce Cunningham, per:title, performer)
SF13.ENG.038 SF13.ENG.039	Merce Cunningham, the nonagenarian choreographer, is planning for a world without him.  A court on Monday cleared the widower of British reality television star Jade Goody, who died of cancer last year, of rape.	(Merce Cunningham, ,, The Nonagenarian Choreographer) → (Merce Cunningham, per:title, choreographer) (Goody, ,, Cancer) → (Jade Goody, per:cause.of.death, cancer)
SF13,ENG,041 SF13,ENG,041	Don Hewitt, the CBS newsman who invented the highly popular TV newsmagazine "60 Minutes" and produced it for 36 years, died Wednesday.	(Don Hewitt, "The Cbs Newsman) → (Don Hewitt, pertitle, newsman)  (Don Hewitt, "executive) → (Don Hewitt, pertitle, executive)
SF13,ENG,041	"He was the consummate television newsman," Don Hewitt, a longtime CBS News executive and creator of the long-tunning "60 Minutes" news program, told Reuters. " Hewitt was already a highly respected TV newsman.	(Hewitt, was, A Highly Respected Tv Newsman) → (Don Hewitt, per.title, TV newsman)
SF13_ENG_041 SF13_ENG_043	Donald Shepard Hewitt was born in New York on Dec. 14, 1922, and grew up in the suburb of New Rochelle.  Eleanor Louise Greenwich was born in Brooklyn on Oct. 23, 1940.	(Donald Shepard Hewitt, born, New York) → (Don Hewitt, per:stateorprovince_of_birth, New York)  (Eleanor Louise Greenwich, born in, Oct.) → (Ellie Greenwich, per:date_of_birth, 1940-10-23)
SF13_ENG_044	A little more than a year after Dunne died from bladder cancer, the colorful remnants of his estate have been consigned by his family to Stair Galleries in Hudson, N.Y., which will auction them Nov. 20.	(Dunne, died, Bladder Cancer) → (Dominick Dunne, per:cause_of_death, bladder cancer)
SF13_ENG_048	Charles Gwathmey, an architect known for his influential modernist home designs and famous clients like director Steven Spielberg, has died.	$(Charles\ Gwathmey, ., \ architect) \rightarrow (Charles\ Gwathmey, \ per: title, \ architect)$
SF13_ENG_049 SF13_ENG_049	Besides his wife, Mandelbrot is survived by two sons, Laurent, of Paris, and Didier, of Newton, Mass., and three grandchildren.  For years, he worked for IBM in New York.	(Mandelbrot, two sons, Laurent) → (Benoit Mandelbrot, per.children, Laurent)  (He, worked, lbm) → (Benoit Mandelbrot, per.employee_or_member_of, IBM)
SF13_ENG_049	After several years spent largely at the Centre National de la Recherche Scientifique in Paris, Mandelbrot was hired by IBM in 1958 to work at the Thomas J. Watson Research Center in Yorktown Heights, N.Y. Although he worked frequently with academic	(Mandelbrot, hired by, Ibm) → (Benoit Mandelbrot, per:employee_or_member_of, IBM)
CELL ENGLOSS	researchers and served as a visiting professor at Harvard and the Massachusetts Institute of Technology, it was not until 1987 that he began to teach at Yale, where he earned tenure in 1999.	
SF13_ENG_056 SF13_ENG_060	"If so a issue for everybody in the state because peanuts are a big part of our economy," said Don Koehler, executive director of the Georgia Peanut Commission."  "We'll be meeting with scientists, university and science policy officials to explore practical opportunities for exchange and collab-	(The Georgia Peanut Commission, director of, Don Koehler) — (Georgia Peanut Commission, org.top_members_employees, Don Koehler)  (The Asset Pearlett - Asset) — (American Association for the Advancement of Science, control members employees, Date C
SF13,ENG,060 SF13,ENG,060	We'll be meeting with scientists, university and science policy officials to explore practical opportunities for exchange and collaboration," Agre, the AAAS president, was quoted as saying.  However, Alan Leshner, chief executive officer of the American Association for the Advancement of Science, noted that Nobels	(The Asas President, "Agre) → (American Association for the Advancement of Science, org.top_members.employees, Peter C. Agre)  (The American Association, "Alan Leshner) → (American Association for the Advancement of Science,
SF13_ENG_060	are generally given for work that's a decade old or more, and that the U.S. mustn't become complacent.  Norman Augustine, the former chairman and chief executive of the Lockheed Martin Corporation: Patricia Goldman, former	org:top_members_employees, Alan Leshner)  (The American Association of Mary Good) → (American Association for the Advancement of Science.
	vice chairman of the National Transportation Safety Board; Mary Good, a former president of the American Association for the Advancement of Science; Roger Martin, dean of the Rotman School of Management; Brian O'Neill, a former president of the	org-top_members_employees, Mary Good)
SF13.ENG.062	Insurance Institute for Highway Safety: and Sheila Widnall, a professor at the Massachusetts Institute of Technology.	(The U.S. High Speed Rail Association, of, Andy Kunz) → (U.S. High Speed Rail Association, org:top_members_employees,
SF13,ENG,064	"First of all, they never have enough funding," said Andy Kunz, president of the U.S. High Speed Rail Association, a nonprofit that advocates a national high-speed rail network."  China's shock at NATO's military campaign in the former Yugoslavia helped prod Beijing into playing a bigger role in U.N.	Andy Kunz)  (The Stockholm International Peace Research Institute, ,, Bates Gill) → (Stockholm International Peace Research Institute,
SF13.ENG.064	peacekeeping, said Bates Gill, director of the Stockholm International Peace Research Institute and co-author of a recent report on China's peacekeeping activities.  "Non-state actors, for example, a small group of pirates off the coast of Somalia, Al Qaida and Taliban who operate across borders	org:top.members_employees, Bates Gill)  (The Stockholm International Peace Research Institute, , director of, Bates Gill) → (Stockholm International Peace Research Institute)
aria_ENG_064	"Non-state actors, for example, a small group of pirates off the coast of Somalia, Al Qaida and Taliban who operate across borders and have more and more sophisticated means of violence, are becoming bigger and bigger challenges to the international system," said Bates Gill, director of the Stockholm International Peace Research Institute.	(The Stockholm International Peace Research Institute, , director of, Bates Gill) → (Stockholm International Peace Research Institute, org:top_members_employees, Bates Gill)
SF13.ENG.068	saud Bales Gill, director of the Stockholm International Peace Research Institute.  "It is not surprising that one primarily cosmetic business is trying to throw another under the bus by transferring a tax from rich doctors and their wealthy customers to struggling small businesses," John Overstreet, director of the Indoor Tanning Association,	(The Indoor Tanning Association, director of, John Overstreet) → (Indoor Tanning Association, org:top_members_employees, John Overstreet)
SF13.ENG.076	doctors and their weathing Castorines to Studgering small obstitutes, on the Total Techniques and the Indian Techniques and a statement Saturday.  The chairman of the Swiss Bankers Association, Patrick Odier, told weekly NZZ am Sonntag that Italy and France have shown	(The Swiss Bankers Association, ,, Patrick Odier) → (Swiss Bankers Association, org:top_members_employees, Patrick Odier)
SF13,ENG,076	interest in deals like ones Switzerland signed this week with Germany and Britain.  The majority of voters in Switzerland, which manages more than 25 percent of the world's foreign-held private wealth, support	
SF13_ENG_078	banking secrecy, according to a survey published last month by the Swiss Bankers Association in Basel.  "Americans have a right to know the truth – Islam is a religion of intolerance and violence," said Richard Thompson, legal director	(The Thomas More Law Center, in, Ann Arbor) → (Thomas More Law Center, organity, of headquarters, Ann Arbor)
SF13_ENG_082	of the Thomas More Law Center in Ann Arbor."  New solutions may be enacted for these orphans, though, said Mary Robinson, CEO of the National Council for Adoption.	(The National Council, of, Mary Robinson) → (National Council for Adoption, org:top_members_employees, Mary Robinson)
SF13_ENG_082	"When you close a country, you end up causing more problems than you prevented," said Chuck Johnson, CEO of the National Council for Adoption."	$(The \ National \ Council, CEO \ of, \ Chuck \ Johnson) \rightarrow (National \ Council \ for \ Adoption, \ org: top\_members\_employees, \ Chuck \ Johnson)$
SF13,ENG,084	"This is definitely a Goldilocks problem," said Jason Grumet, president of the Bipartisan Policy Center and an energy adviser to the Obama campaign last year.	(The Bipartisan Policy Center, ,, Jason Grumet) → (Bipartisan Policy Center, org.top,members,employees, Jason Grumet)
SF13.ENG.085	"Banks are in strong need for the capital markets (to raise funds)," Li Fuan, a director at the China Banking Regulatory Commission, was quoted as saying at a forum over the weekend.	(The China Banking Regulatory Commission, a director, Li Fuan) → (China Banking Regulatory Commission, org:top_members_employees, Li Fuan)  (The China Banking Regulatory Commission, org:top_members_employees, Li Fuan)
SF13,ENG,089 SF13,ENG,089	RIA Novesti and Interfax cite Anatoly Isaikin, head of Rosoboronexport, as saying Thursday "nothing is blocking the continuation of military-technical cooperation" with The Rosoboronexport is the only company in Russia that is allowed to export arms, dual-use products and military-related services.	(Rosoboronexport, , head of, Anatoly Isaikin) → (Rosoboronexport, org.top_nembers_employees, Anatoly Isaikin)  (Rosoboronexport, is the only company in, Russia) → (Rosoboronexport, org.country_of_headquarters, Russia)
SF13_ENG_089 SF13_ENG_091	ROSOOFOREAGE THE OF ONLY COMPANY IN RUSSIA HAR IS AHOWCE TO EXPORT ARMS, QUARTER PROJECTS AND MILITARY-FEBRICAS SERVICES.  With his wife, Cornelie, Middelhoff invested money in 2000 and 2001 with Esch in funds that were formed to buy five properties from KarstadiQuelle, as Arcandor was then known, and leased back to the department store chain before Middelhoff joined the	(Kosoooronexport, is the only company in, Russia) → (Kosoooronexport, org.country_or_neanquarters, Russia)  (Arcandor, "Karstadiquelle) → (Arcandor, org.alternate_names, KarstadiQuelle)
SF13_ENG_091	from Kaisaanqueire, as Arcandon was tien known, and reased tack to the department softe chain detote strauethori joined the company, according to Middelhoff's spokesman.  Arcandor's mail-order subsidiary Quelle is in worse shape however, Klaus-Hubert Goorg told a press conference in the western city	$(Arcandor, "Essen) \rightarrow (Arcandor, org.city,of_headquarters, Essen)$
a-13_ENG_091	Arcandor's mail-order subsidiary Quelle is in worse shape however, Klaus-Hubert Goerg told a press conference in the western city of Essen, where Arcandor is based.	$(Alcandos, _n \ Essen) \rightarrow (Alcandos, org. city_os_neaequariers, Essen)$

Figure 6: Mapped facts: MaMa-GPT-2 $_{\rm XL}$  on TAC KBP.

ID	Sentence	BERT <sub>LARGE</sub> Candidate facts	to mapped facts GPT-2 <sub>XL</sub>
SF13_ENG_005	The men, who live in the Chicago area, were identified as David Coleman Headley, 49, a US citizen, and Tahawwur Hussain Rana, 48, Rana, a native of Pakistan and citizen of Canada.	(Rana, , a native of, Canada) → (Tahawwur Hussain Rana, per:origin, Canada)	
SF13_ENG_006	Khan died at his music centre near San Francisco in the United States after a pro- longed kidney ailment, the news agency said.	(Khan, died at his, The United States) $\rightarrow$ (Ali Akbar Khan, per:country_of_death, United States)	
SF13_ENG_006 SF13_ENG_006	By his early 20s he was music director of All-India Radio in Lucknow, broadcasting as a solo artist and composing for the radio's orchestra.  Defying his father , Khan moved to Bombay and began writing scores for films , including Chetan Anand's "Anandhiyan" (1952) , Salyajit Ray 's "Devi" (1960) and Tapan Siraha's "Hungry Stones" (1960).	· (Khan, moved, Bombay) → (Ali Akbar Khan, percities of residence, Bombay)	(He, of, All-India Radio) → (Ali Akbar Khan, per:employee_or_member_of, All-India Radio)
SF13_ENG_007	Januar Lapaur summa 8 Trungry sciences (1900).  In 1966 he graduated from the faculty of theology at Al-Azhar, the 10th century university that has trained the majority of Sunni Muslim clerics from Africa and Acia	•	(He, graduated from, Al-Azhar) → (Mohammed Sayed Tantawi per:schools.attended, Al-Azhar)
SF13_ENG_009	He became AIBA president in 2006 by defeating longtime incumbent Anwar		(Longtime Incumbent Anwar Chowdhry, by, Aiba President) → (Anwar Chowdhry
SF13_ENG_011 SF13_ENG_012	Chowdhry of Pakistan, who was later barred for alleged financial corruption.  Marshall could get a lengthy prison term if convicted of grand larceny.  Gadahn, also known as Azzama i - Amriki, was dressed in white robes and wearing  a white turban as he called for attacks on what he described as "high - value targets	(Gadahn, known as, Azzam Al-Amriki) $\rightarrow$ (Adam Gadahn, per:alternate_names, Azzam al-Amriki)	per:employee.or.nember.of, AIBA) (Marshall, of, Grand Larceny)   (Anthony Marshall, per:charges, larceny)
SF13_ENG_012	." Garlahn grow up on a form in California and converted to Jelam before moving to	$(Gadahn, to, Pakistan) \rightarrow (Adam \ Gadahn, per:countries\_of\_residence, Pakistan)$	•
SF13_ENG_012	Pakistan in 1998 and reportedly attending an al - Qaida training camp .  He was born in Oregon on Sept. 1, 1978 to a Jewish family.	•	(He, born in, Sept.) → (Adam Gadahn, per:date_of_birth, 1978-09-01)
SF13_ENG_015 SF13_ENG_015	Besides her sister, Philip, survivors include a son, Graham; three daughters, Sidney, Gilliam and Alexia; and three grandchildren. In addition to her daughter, of Columbia, other survivors include two daughters, Sidney Clifton of Los Angeles and Gilliam Clifton - Monell of Fort Washington, Md.; a son, Graham Clifton of Wichita; a sister; and three grandchildren.	$\label{eq:continuous} (\text{Her Sister, son ,, Graham}) \rightarrow (\text{Lucille Clifton, per:children, Graham})$ $(\text{Her Daughter, ,, Sidney Clifton}) \rightarrow (\text{Lucille Clifton, per:children, Sidney Clifton})$	•
SF13_ENG_017 SF13_ENG_019	Haig, 85, died early Saturday in a Baltimore, Maryland, hospital.  McGregor was born in Iowa, but grew up in Colorado where his father, Brian, was	(Haig, died early, A Baltimore, Maryland, Hospital) → (Alexander Haig, per:stateorprovince_of_death, Maryland) (Mcgregor, but grew up, Brian) → (Keli McGregor, per:parents, Brian)	•
SF13_ENG_025	a coaching legend at Arvada West .  Kissel was born in Adrian, Michigan, but her family had also lived in Minneapolis.		(Kissel, in, Minneapolis) → (Nancy Kissel, per:cities_of_residence, Minneapolis) (Kissel, of, Michigan) → (Nancy Kissel, per:statesorprovinces_of_residence
SF13_ENG_025 SF13_ENG_026	Kissel, 46, of Adrian, Michigan, was convicted of drugging then bashing her hus- band Robert to death in a luxury Hong Kong apartment and sentenced to life in prison in September 2005.	.  (Neal, died at her home in, Edgartown) → (Patricia Neal, percity,of,death, Edgar-	(Rissel, of, Michigan) → (Nancy Rissel, per:statesorprovinces_of_residence. Michigan)
SF13_ENG_026 SF13_ENG_026	Neal had lung cancer and died at her home in Edgartown , Massachusetts on Martha 's Vineyard , said longtime friend Bud Albers of Knoxville .  She grew up in Knoxville, Tenn., where Neal was turned onto acting at 10 after	((rear, died at ner nome in, Edgartown) → (Faircia Near, perceity of death, Edgartown)	<ul> <li>(She, in, Tenn.) → (Patricia Neal, per:statesorprovinces of residence, Tennessee)</li> </ul>
SF13_ENG_027	seeing an impassioned speech about "demon rum" at the local temperance union speaking contest.  Al-Hakim who died Wednesday of June cancer in Tehran, was a symbol for many		(Al-Hakim, who died, Tehran) → (Abdul Aziz Al-Hakim, per.city_of_death
SF13_ENG_028	of the re-emergence of Iraq's Shitte political majority after decades of oppression under Saddam Hussein's Sunni-led regime.  TAMPA Heart disease exacerbated by cocaine use killed celebrated TV pitch-	(Celebrated Tv Pitchman Billy Mays, killed, Tampa) → (Billy Mays,	Tehran)
SF13_ENG_030	man Billy Mays , according to the Hillsborough County medical examiner 's final autopsy report released Friday . Family spokesman Dan Ewald said Anderson died from complications from demen-	per:cause_of_death, TAMPA Heart disease)  (Anderson, died from, Dementia) → (Sparky Anderson, per:cause_of_death, de-	
SF13_ENG_031	tia.  He served in the Coast Guard during World War II and had a rare leading role in the	mentia)  (He, in, The Coast Guard) → (Blake Edwards, per:employee_or_member_of, Coast	
SF13_ENG_031	low - budget thriller "Strangler of the Swamp" (1946).  His agent Lou Pitt confirmed he had died, while the "Entertainment Tonight" news show and website reported that he died in Santa Monica on Wednesday night from	Guard) (He, died, Complications) $\rightarrow$ (Blake Edwards, per:cause_of_death, complications)	
SF13_ENG_033	Its agent Lot it is community in the Lot of the Linescalinated torquist levers show and website percent data the died is Samat Monica on Webscading night from complications of pneumonia, with Andrews at his side.  It is a career that spanned seven decade, Surfurbag authored several groundbreaking studies in various helds—such as quantum theory, strophysics, radio-autroomy and diffusion of constinct adulation in the Earth's atmosphere – That were of "Nobel Prize calibre," said Germady Meyars, the director of the Lebedev Physics Institute in Moscow, where Ginzbrug worked.		(Ginzburg, in, The Lebedev Physics Institute) → (Vitaly Ginzburg, per:employee_or_member_of, Lebedev Physics Institute)
SF13_ENG_035 SF13_ENG_037	in anoxon, white Columnia workers.  Kaczynska, who died aged 59, married Kaczynski in 1978.  Prime Minister Francois Fillon called Chabrol a "great director, producer and screenwister (bob) was one of the grand figures of the 'Nouvelle vague,' which revolutionized the style and techniques of cinema by looking at real experience , true life, that which is indiscreet and subtle."	(Kaczynska, married, Kaczynski) → (Maria Kaczynska, per:spouse, Kaczynski) (Afp Chabrol, was, director) → (Claude Chabrol, per:title, film director); (Chabrol, director, Producer) → (Claude Chabrol, per:title, producer)	•
SF13_ENG_038	Cunningham's survivors include a brother, Jack Cunningham of Centralia.		(Cunningham'S Survivors, brother, Jack Cunningham) → (Merce Cunningham,
SF13_ENG_038	Mercier Philip Cunningham was born in Centralia, Wash., on April 16, 1919.		per:siblings, Jack Cunningham)  (Mercier Philip Cunningham, was born in, April) → (Merce Cunningham per:date.of.birth, 1919-04-16)
SF13,ENG,041 SF13,ENG.041	A year after enrolling in New York University on a track scholarship , Hewitt dropped out .	$(\text{Hewitt, },, \text{New York University}) \rightarrow (\text{Don Hewitt, per:schools\_attended}, \text{New York University})$	•
SF13,ENG,043 SF13,ENG,044	By the time Hewitt was 6, his family was living in New Rochelle, N.Y. Greenwich also worked as an arranger and singer, a role that saw her working with artists including Frank Sinatra and Ella Fitzgerald.  Dunne was born in 1925 in Hartford. Connecticut, to a wealthy Roman Catholic	(Greenwich, worked as an, Singer) → (Ellie Greenwich, per:title, singer)	(Hewitt, in, New Rochelle) → (Don Hewitt, per:cities, of residence, New Rochelle  (Dunne, was born in 1925 in, Connecticut) → (Dominick Dunne
SF13.ENG.044 SF13.ENG.044	Dunne was born in 1925 in Hartford, Connecticut, to a wealthy Roman Catholic family and grew up in some of the same social circles as the Kennedys. In 1957, Dunne moved to Los Angeles to work on the CBS showcase "Playhouse	.  (Dunne, moved to, Los Angeles) → (Dominick Dunne, per:cities_of_residence, Los	(Dunne, was born in 1925 in, Connecticut) → (Dominick Dunne per:stateorprovince.of.birth, Connecticut)
SF13_ENG_044	90."  Dune found his greatest prominence as a celebrity journalist while covering the 1905 murder trial of football star and actor O.I. Simpson, who had been accused of	(Danne, moved to, Los Angeles) — (Donnines Dunie, per crites Di Jesticire, Los Angeles)	(Dunne, as, A Celebrity Journalist) → (Dominick Dunne, per-title, celebrity journalist)
SF13_ENG_045 SF13_ENG_046	killing his ex-wife Nicole Brown Simpson and her friend Ronald Goldman. Goldstein died in New York on Aug. 28. After acting in movies and television. Meredith receded into a quiet life in Santa Fe, writing, painting, golfing and acting in a stage production of "The Odd Couple.	$\begin{split} &(Goldstein, died, Aug.) \rightarrow (Adam  Goldstein, per:date.of.death, XXXX-08-28) \\ &(Meredith, in, Santa  Fe) \rightarrow (Don  Meredith, per:cities.of.residence, Santa  Fe) \end{split}$	•
SF13_ENG_046	In high school and at Southern Methodist University , where , already known as Dandy Don (a mickname bestowed on him by his brother), Meredith became an	(Dandy Don, where ,, Southern Methodist University) $\rightarrow$ (Don Meredith, per:schools_attended, Southern Methodist University)	•
SF13_ENG_046	all - American . He spent much of his life backing away from the nickname Dandy Don , particularly during his secluded later decades in New Mexico .	(He, the nickname, Dandy Don) → (Don Meredith, per:alternate_names, Dandy Don)	-
SF13_ENG_048	during his secluded later decades in New Mexico.  The group, known variously as the Five or the Whites (for the color of most of their buildings) or the New York School, consisted of Gwathmey, Michael Graves, Eisenman, John Hejduk and Richard Meier.	-	(Gwathmey, of, The New York School) → (Charles Gwathmey, per:employee_or_member_of, New York School)
SF13_ENG_048	Meier, who said he had known Gwathmey for 50 years, has particularly fond memories from the time when Gwathmey was first courting his second wife, Bette - Ann Damson, and they all picked corn for dinner in a field adjacent to a barn Meier was renting on the East End of Long Island.	(Gwathmey, his second wife "Bette-Ann Damson) → (Charles Gwathmey, per:spouse, Bette-Ann Damson)	-
SF13_ENG_057	By 2013, automakers will have dozens of plug-in electric hybrid vehicles and fully electric vehicles, said Jason Forcier, a vice president at battery maker A123 Systems Inc.		(A123 Systems Inc., a vice president, Jason Forcier) → (A123 Systems Inc., org:top_members_employees, Jason Forcier)
SF13_ENG_058	Access Industries , a privately held company founded in 1986 by Len Blavatnik , has a diverse portfolio of investments in industry , real estate , media and telecommunications .	(Access Industries, founded in 1986 by, Len Blavatnik) → (Access Industries, org:founded_by, Len Blavatnik)	
SF13_ENG_069 SF13_ENG_082	"The indications are positive," said Vincent Cogliano, director of the Monographs program at IARC, which decides on carcinogen classifications. "There hasn't been a concerted push to open doors for Muslim orphans because the	•	$ \begin{array}{ll} (\text{Iarc},, \text{director of the, Vincent Cogliano}) \rightarrow (\text{International Agency for Research on Cancer, org:top.members.employees, Vincent Cogliano}) \\ (\text{Adoption,} & \text{in, Alexandria}) \rightarrow & (\text{National Council for Adoption}) \\ \end{array} $
SF13_ENG_084	expectation would be that those efforts would fall flat," said Chuck Johnson, chief executive of the National Council for Adoption, a policy group in Alexandria, Va. "The scenario itself is secret," said Elicen McMenamin, vice president of communications for the Bipartisan Policy Center (BPC), which is hosting the event	(The Bipartisan Policy Center, , vice president of, Eileen Mcmenamin) → (Bipartisan Policy Center, org.top_members_employees, Eileen McMenamin)	org:city.of.lheadquarters, Alexandria)
SF13.ENG.088	dubbed "Cyber ShockWave." Bank Julius Baer Co., based in Basel, Switzerland, sued because WikiLeaks posted accountholder information from its Cayman outpost amid allegations of money		(Bank Julius Baer Co., based, Basel) → (Bank Julius Baer org:city_of_headquarters, Basel)
SF13_ENG_094	laundering and tax evasion.  The other manufacturers are two US companies, L-3 Communications and Rapiscan		(Raniscan Two Us Companies) → (Raniscan Systems
SF13_ENG_096	Systems, a unit of OSI Systems, and British rival Smiths Detection.  Freedom was founded in the 1930s by R.C. Hoiles and is still majority owned by the Hoiles family.	•	org:country_of_headquarters, US)  (Freedom, was founded in the, R.C. Hoiles) → (Freedom Communications.org:founded_by, R.C. Hoiles)
SF13_ENG_098	Shares of Millipore have more than doubled since Martin D . Madaus took over as chief executive in January 2005 .	(Millipore, have, Martin D.) → (Millipore Corp., org:top_members_employees, Martin D. Madaus)	•

Figure 7: Mapped facts: MaMa-BERT  $_{\rm LARGE}$  vs. MaMa-GPT-2  $_{\rm XL}$  on TAC KBP.

ID	Sentence	Candidate facts to unmapped facts
SF13_ENG_001	Bashardost was born in 1965 in the southern Ghanzi province and his family migrated to Iran and then to Pakistan after	(Bashardost, in, The Southern Ghanzi Province) → (Ramazan Bashardost, per:stateorprovince_of_birth, The Southern
	successive coup and factional fighting in Afghanistan .	Ghanzi Province)
SF13_ENG_012	Gadahn, also known as Azzam the American, was born in 1978.	(Gadahn, ,, Azzam) → (Adam Gadahn, per:alternate_names, Azzam)
SF13_ENG_015	Besides her sister, Philip, survivors include a son, Graham; three daughters, Sidney, Gillian and Alexia; and three	(Her Sister, "Philip) → (Lucille Clifton, per:siblings, Philip)
	grandchildren .	
SF13_ENG_015	The poet laureate of Maryland from 1979 to 1985, Clifton was a writer in residence at Coppin State College, now	(Clifton, in, Coppin State College) → (Lucille Clifton, per:school_attended, Coppin State College)
	Coppin State University, a historically black college in Baltimore.	
SF13_ENG_015	Her father, Samuel, was a steelworker; her mother, Thelma, worked in a laundry.	(Her Father, "Samuel) → (Lucille Clifton, per:parents, Samuel)
SF13_ENG_015	Lucille Clifton, a distinguished American poet whose work trained lenses wide and narrow on the experience of being	(Lucille Clifton, ,, poet) → (Lucille Clifton, per:title, poet)
	black and female in the 20th century, exploring vast subjects like the indignities of history and intimate ones like the	
	indignities of the body, died on Saturday in Baltimore.	
SF13_ENG_015	The precise cause of death had not been determined, her sister, Elaine Philip, told The Associated Press on Sunday.	(Her Sister, "Elaine Philip) → (Lucille Clifton, per:siblings, Elaine Philip)
SF13_ENG_037	CLAUDE CHABROL, PIONEER FRENCH FILMMAKER, DIES AT 80 Joseph Berger contributed reporting from	(Claude Chabrol, "Pioneer French Filmmaker) → (Claude Chabrol, per:title, Pioneer French Filmmaker)
	New York, and Maia de la Baume contributed from Paris.	
SF13.ENG.037	Chabrol 's survivors also include his third wife, Aurore Pajot, who acted as his script supervisor on nearly all of his	(His Third Wife, ,, Aurore Pajot) → (Claude Chabrol, per:spouse, Aurore Pajot)
	movies from 1968 on and whom he married in 1981; and Pajot's daughter, Cecile Maistre, who was an assistant	
	director on his films and wrote the script with him for "The Girl Cut in Two" (2007).	
SF13_ENG_044	Dominick Dunne, a novelist and journalist who chronicled true - crime tales of the rich and infamous, including O. J	(Dominick Dunne, ,, A Novelist) → (Dominick Dunne, per:title, A Novelist)
	. Simpson and Claus von Bulow, and in turn became a celebrity in his own right, died of bladder cancer Aug. 26 at	
	his home in New York City .	
SF13_ENG_044	Dunne and his wife, Ellen Griffin Dunne, known as Lenny, were married in 1954.	(His Wife, "Ellen Griffin Dunne) → (Dominick Dunne, per:spouse, Ellen Griffin Dunne)
SF13_ENG_044	Dunne was born in 1925 in Hartford, Connecticut, to a wealthy Roman Catholic family and grew up in some of the	(Dunne, "Connecticut) → (Dominick Dunne, per:stateorprovince_of_birth, Connecticut)
	same social circles as the Kennedys .	
SF13_ENG_049	A professor emeritus at Yale University, Mandelbrot was born in Poland but as a child moved with his family to France	(Mandelbrot, ,, Yale University) → (Benoit Mandelbrot, per:employee_or_member_of, Yale University)
	where he was educated .	
SF13_ENG_058	Access Industries, a privately held company founded in 1986 by Len Blavatnik, has a diverse portfolio of investments	(Access Industries, ,, A Privately Held Company) → (Access Industries, properties, A Privately Held Company)
	in industry , real estate , media and telecommunications .	
SF13_ENG_079	Water and its links to development, peace and conflict were key words in the annual sessions, Anders Berntell,	(Stockholm International, " Anders Berntell) → (Stockholm International Water Institute,
	executive director of Stockholm International Water Institute ( SIWI ) , said in his opening address .	per:top_members_or_employees, Anders Berntell)

Figure 8: Unmapped facts: MAMA-BERT  $_{\rm LARGE}$  on TAC KBP.

ID	Sentence	Candidate facts to unmapped facts
SF13_ENG_009	He took office in 2006 by defeating longtime incumbent Anwar Chowdhry from Pakistan, who was later barred for alleged financial corruption.	$(Long time\ Incumbent\ Anwar\ Chowdhry,\ from,\ Pakistan) \rightarrow (Anwar\ Chowdhry,\ per: countries\_of\_residence,\ Pakistan)$
SF13_ENG_012	The message also featured several appearances of Adam Gadahn, also known as Azzam al-Amriki, an American who grew up in Riverside County and converted to Islam and joined al-Qaida.	(Adam Gadahn, also, Azzam Al-Amriki) → (Adam Gadahn, per:alternate_names, Azzam Al-Amriki); (Adam Gadahn, "Azzam Al-Amriki) → (Adam Gadahn, "Azzam Al-Amriki)
SF13_ENG_014	Mohammed Oudeh, a former math teacher who became the mastermind of the deadly attack on Israeli athletes at the 1972 Munich Olympics, died Friday in Damascus.	$(Mohammed\ Oudeh,\ ,,\ teacher) \rightarrow (Mohammed\ Oudeh,\ per: title,\ teacher)$
SF13.ENG.014	He settled in the West Bank town of Ramallah, but in 1999, after a trip to Jordan, he was barred by Israel from returning.	(He, in, The West Bank Town) → (Mohammed Oudeh, per:cities_of_residence, The West Bank Town)
SF13_ENG_014	Mohammed Oudeh, a former math teacher who became the mastermind of the deadly attack on Israeli athletes at the 1972 Munich Olympics, died Friday in Damascus.	(Mohammed Oudeh, ,, A Former Math Teacher) → (Mohammed Oudeh, per:title, A Former Math Teacher)
SF13_ENG_014	In later years, as a graying member of the Palestinian old guard, Oudeh, most commonly known by his guerrilla name, Abu Daoud, showed no remorse for the botched hostage taking and killings of 11 members of the Israeli Olympic team that shook the world.	(Oudeh, ,, Abu Daoud) → (Mohammed Oudeh, per:alternate_names, Abu Daoud)
SF13_ENG_015	After her husband died in 1984, Clifton taught at the University of California at Santa Cruz before returning to Maryland in 1989.	(Clifton, of, Santa Cruz) → (Lucille Clifton, per:cities_of_residence, Santa Cruz)
SF13_ENG_015	Lucille Clifton, a National Book Award-winning poet and Pulitzer finalist, has died.	(Lucille Clifton, ,, poet) → (Lucille Clifton, per:title, poet)
SF13_ENG_015	When she was a girl, Lucille Clifton sat on her mother's lap and listened to her recite poetry.	(Lucille Clifton, ,, A Girl) → (Lucille Clifton, gender, A Girl)
SF13_ENG_015	In 1967, they moved to Baltimore, and Clifton worked in Washington for the old U.S. Office of Education.	(They, to, Baltimore) → (Lucille Clifton, per:cities_of_residence, Baltimore)
SF13_ENG_015	Clifton's sister, Elaine Philip, said the former poet laureate of Maryland passed away Saturday morning at Johns Hop- kins University Hospital in Baltimore.	(Clifton'S Sister, ,, Elaine Philip) → (Lucille Clifton, per:siblings, Elaine Philip)
SF13_ENG_018	Harvey Pekar, the writer of comics whose autobiographical comic book series "American Splendor" chronicled his life as a filing clerk, record collector, freelance jazz critic and one of life's all-around misfits, was found dead July 12 at his home near Cleveland.	(Harvey Pekar, ,, writer) → (Harvey Pekar, per:title, writer)
SF13_ENG_018	Pekar attended what became Case Western Reserve University, served in the Navy in the late 1950s and worked a series of menial jobs before taking a 30-year jobas a filing clerk at a VA hospital in Cleveland.	(Pekar, what became, Case Western Reserve University) → (Harvey Pekar, per:schools_attended, Case Western Reserve University)
SF13_ENG_025	Kissel, 46, of Adrian, Michigan, was convicted of drugging then bashing her husband Robert to death in a luxury Hong Kong apartment and sentenced to life in prison in September 2005.	(Kissel, "Adrian) → (Nancy Kissel, percities_of_residence, Adrian); (Kissel, "Michigan) → (Nancy Kissel, per:statesorprovinces_of_residence, Michigan)
SF13_ENG_038	Mercier Philip Cunningham was born in Centralia, Wash., on April 16, 1919.	(Mercier Philip Cunningham, was born in, Centralia) → (Merce Cunningham, was born in, Centralia); (Mercier Philip Cunningham, in, Wash.) → (Merce Cunningham, per-stateorprovince of birth, Wash.); (Mercier Philip Cunningham, in, April) → (Merce Cunningham, per-date of, birth, 1919-04-16)
SF13_ENG_038	Cunningham's survivors include a brother, Jack Cunningham of Centralia.	(Cunningham'S Survivors, ,, Jack Cunningham) → (Merce Cunningham, per:siblings, Jack Cunningham)
SF13_ENG_041	By the time Hewitt was 6, his family was living in New Rochelle, N.Y.	(Hewitt, in, New Rochelle) → (Don Hewitt, per:cities_of_residence, New Rochelle)
SF13.ENG.041	He is survived by his third wife, former television news correspondent Marilyn Berger; his sons, Steven and Jeffrey; his daughter, Lisa Cassara; his stepdaughter, Jilian Childers Hewitt, whom Hewitt adopted; and three grandchildren.	(Hewitt, "Jilian Childers Hewitt) → (Don Hewitt, per:children, Jilian Childers Hewitt)
SF13_ENG_044	Dunne was born in 1925 in Hartford, Connecticut, to a wealthy Roman Catholic family and grew up in some of the same social circles as the Kennedys.	(Dunne, was born in 1925 in, Connecticut) → (Dominick Dunne, per:stateorprovince_of_birth, Connecticut)
SF13.ENG.044	Dunne was part of a famous family that also included his brother, novelist and screenwriter John Gregory Dunne; his brother's wife, author Joan Didion; and his son, Griffin.	$(\text{His Brother, },, \text{Novelist}) \rightarrow (\text{His brother, per:title, Novelist})$
SF13_ENG_044	Dunne and his wife, Ellen Griffin Dunne, known as Lenny, were married in 1954.	(Dunne, and, Ellen Griffin Dunne) → (Dominick Dunne, per:spouse, Ellen Griffin Dunne)
SF13_ENG_047	The women were accompanied by Reyna Luisa Tamayo, the mother of political prisoner Orlando Zapata, who died at age 42 in a hunger strike February 23 to protest prison conditions.	(Political Prisoner Orlando Zapata, ,, Reyna Luisa Tamayo) → (Orlando Zapata, per:children, Reyna Luisa Tamayo)
SF13_ENG_061	InterContinental Hotels Group, owners of Holiday Inn Worldwide, has been ordered by a court to pay \$25 million in damages to a franchisee for fraud.	(Intercontinental Hotels Group, ,, Holiday Inn Worldwide) → (InterContinental Hotels Group, org:parents, Holiday Inn Worldwide)
SF13_ENG_079	Water and its links to development, peace and conflict were key words in the annual sessions, Anders Berntell, executive director of Stockholm International Water Institute (SIWI), said in his opening address.	(Stockholm International, director, Anders Berntell) → (Stockholm International Water Institute, pertop, members, ozenployees, Anders Berntell); (Stockholm International, executive director, Anders Berntell) → (Stockholm International) Water Institute, pertop, members_or_employees, Anders Berntell)
SF13_ENG_090	ECO member countries include Afghanistan, Azerbaijan, Iran, Kazakhstan, Kyrgyzstan, Pakistan, Tajikistan, Turkey, Turkmenistan and Uzbekistan.	(Eco Member Countries, "Azerbaijan) → (Economic Cooperation Organization, org:members, Azerbaijan)
SF13_ENG_096	A phone message left Sunday at Freedom's Irvine, California, headquarters was not immediately returned.	(Freedom'S Irvine, ,, California) → (Freedom Communications, org:stateorprovince_of_headquarters, California)
SF13_ENG_097	STX Finland is part of the international STX Europe Group, with shipyards in Brazil, Norway, France, Romania and Vietnam.	(Stx Finland, of, The International Stx Europe Group) → (STX Finland, org:subsidaries, The International Stx Europe Group)

Figure 9: Unmapped facts: MAMA-GPT-2 $_{\rm XL}$  on TAC KBP.

ID	Sentence	Candidate facts to mapped facts BERT <sub>LARGE</sub> GPT-2 <sub>XL</sub>		
SF13_ENG_001	Bashardost was born in 1965 in the southern Ghanzi province and his family mi- grated to Iran and then to Pakistan after successive coup and factional fighting in Afehanistan.	(Bashardost, in, The Southern Ghanzi Province) → (Ramazan Bashardost, per:stateorprovince_of_birth, The Southern Ghanzi Province)	· ·	
SF13.ENG.009	He took office in 2006 by defeating longtime incumbent Anwar Chowdhry from Pakistan, who was later barred for alleged financial corruption.	(Longtime Incumbent Anwar Chowdhry, from, Pakistan) $\rightarrow$ (Anwar Chowdhry, per.origin, Pakistan)	(Longtime Incumbent Anwar Chowdhry, from, Pakistan) $\rightarrow$ (Anwar Chowdhry, per:countries_of_residence, Pakistan)	
SF13_ENG_012 SF13_ENG_012	Gadahn, also known as Azzam the American, was born in 1978.  The message also featured several appearances of Adam Gadahn, also known as Azzam al-Amriki, an American who grew up in Riverside County and converted to Islam and joined al-Qaida.	(Gadahn, "Azzam) → (Adam Gadahn, per:alternate.names, Azzam) (Adam Gadahn, also known as, Azzam Al-Amriki) → (Adam Gadahn, per:alternate.names, Azzam Al-Amriki)	(Gadahn, also known as, Azzam) → (Adam Gadahn, per:alternate_names, Azzam) (Adam Gadahn, also, Azzam Al-Amriki) → (Adam Gadahn, per:alternate_names, Azzam Al-Amriki); (Adam Gadahn, "Azzam Al-Amriki) → (Adam Gadahn, per:alternate_names, Azzam Al-Amriki)	
SF13_ENG_014	Mohammed Oudeh, a former math teacher who became the mastermind of the deadly attack on Israeli athletes at the 1972 Munich Olympics, died Friday in Damaseus.	$(Mohammed\ Oudeh,\ teacher) \rightarrow (Mohammed\ Oudeh,\ per: title,\ teacher)$	-	
SF13_ENG_014	He settled in the West Bank town of Ramallah, but in 1999, after a trip to Jordan, he was barred by Israel from returning.	(He, in, The West Bank Town) $\rightarrow$ (Mohammed Oudeh, per-cities_of_residence, The West Bank Town)	(He, settled in, The West Bank Town) → (Mohammed Oudeh, per.cities_of_residence, The West Bank Town)	
SF13_ENG_014	Mohammed Oudeh, a former math teacher who became the mastermind of the deadly attack on Israeli athletes at the 1972 Munich Olympics, died Friday in Dam- ascus.	(Mohammed Oudeh, ,, A Former Math Teacher) → (Mohammed Oudeh, per:title, A Former Math Teacher)	$(Mohammed\ Oudeh,\ _{,i}\ teacher) \rightarrow (Mohammed\ Oudeh,\ per:title,\ teacher)$	
SF13_ENG_014	In later years, as a graying member of the Palestinian old guard, Oudeh, most com- monly known by his guerrilla name, Abu Daoud, showed no remorse for the botched hostage taking and killings of 11 members of the Israeli Olympic team that shook the world.	$({\sf Oudeh},,{\sf Abu}\;{\sf Daoud}) \rightarrow ({\sf Mohammed}\;{\sf Oudeh}, {\sf per:alternate\_names}, {\sf Abu}\;{\sf Daoud})$	•	
SF13.ENG.015	The precise cause of death had not been determined, her sister, Elaine Philip, told The Associated Press on Sunday.	•	$(Her\ Sister, ., Elaine\ Philip) \rightarrow (Lucille\ Clifton, per:siblings, Elaine\ Philip)$	
SF13.ENG.015	After her husband died in 1984, Clifton taught at the University of California at Santa Cruz before returning to Maryland in 1989.	$(Clifton, of, Santa\ Cruz) \rightarrow (Lucille\ Clifton, per: cities\ of\ residence, Santa\ Cruz)$	(Clifton, taught at, the University) → (Lucille Clifton, per:employee_or_member_of, the University of California)	
SF13_ENG_015 SF13_ENG_015	Lucille Clifton, a National Book Award-winning poet and Pulitzer finalist, has died.  When she was a girl, Lucille Clifton sat on her mother's lap and listened to her recite poetry.		(Lucille Clifton, ,, poet) → (Lucille Clifton, pertitle, poet) (Lucille Clifton, ,, A Girl) → (Lucille Clifton, gender, A Girl)	
SF13_ENG_015 SF13_ENG_015	In 1967, they moved to Baltimore, and Clifton worked in Washington for the old U.S. Office of Education.  Clifton's sister, Elaine Philip, said the former poet laureate of Maryland passed	(Clifton, worked in, old U.S. Office) → (Lucille Clifton, per:employee_or_member_of, U.S. Office of Education)	(They, to, Baltimore) → (Lucille Clifton, per:cities_of_residence, Baltimore) (Clifton'S Sister, ,, Elaine Philip) → (Lucille Clifton, per:siblings, Elaine Philip)	
SF13_ENG_018	away Saturday morning at Johns Hopkins University Hospital in Baltimore.  Harvey Pekar, the writer of comics whose autobiographical comic book series	•	(Harvey Pekar, ,, writer) → (Harvey Pekar, per-title, writer)	
SF13.ENG.018	"American Splendor" chronicled his life as a filing clerk, record collector, free- lance jazz critic and one of life's all-around misfits, was found dead July 12 at his home near Cleveland.  Pekar attended what became Case Western Reserve University, served in the Navy		(Pekar, what became, Case Western Reserve University) → (Harvey Pekar,	
SF13.ENG.025	in the late 1950s and worked a series of menial jobs before taking a 30-year jobas a filing clerk at a VA hospital in Cleveland.		per:schools_attended, Case Western Reserve University)	
	Kissel, 46, of Adrian, Michigan, was convicted of drugging then bashing her hus- band Robert to death in a luxury Hong Kong apartment and sentenced to life in prison in September 2005.	•	(Kissel, ,, Adrian) → (Nancy Kissel, per.cities,of,residence, Adrian): (Kissel, ,, Michigan) → (Nancy Kissel, per.statesorprovinces,of,residence, Michigan)	
SF13,ENG,037	CLAUDE CHABROL, PIONEER FRENCH FILMMAKER, DIES AT 80 Joseph Berger contributed reporting from New York, and Maia de la Baume contributed from Paris.	(Claude Chabrol, "Pioneer French Filmmaker) → (Claude Chabrol, per:title, Pioneer French Filmmaker)	-	
SF13_ENG_037	Chabrol's survivors also include his third wife, Aurore Pajot, who acted as his script supervisor on nearly all of his movies from 1968 on and whom he married in 1981; and Pajot's daughter, Cecile Maistre, who was an assistant director on his films and wrote the script with him for "The Girl Cut in Two" (2007).	(His Third Wife, ,, Aurore Pajot) $\rightarrow$ (Claude Chabrol, per:spouse, Aurore Pajot)	(Chabrol's survivors, third wife, Aurore Pajot) $\rightarrow$ (Claude Chabrol, per:spouse, Aurore Pajot)	
SF13_ENG_038	Mercier Philip Cunningham was born in Centralia, Wash., on April 16, 1919.		(Mercier Philip Cunningham, was born in, Centralia) → (Merce Cunningham, was born in, Centralia); (Mercier Philip Cunningham, in, Wash.) → (Merce Cunningham, perstateorprovince, of, birth, Wash.); (Mercier Philip Cunningham, in, April) → (Merce Cunningham, perdate, of, birth, 1919-04-16)	
SF13_ENG_038	Cunningham's survivors include a brother, Jack Cunningham of Centralia.	•	(Cunningham'S Survivors, " Jack Cunningham) → (Merce Cunningham, per:siblings, Jack Cunningham)	
SF13_ENG_041 SF13_ENG_041	By the time Hewitt was 6, his family was living in New Rochelle, N.Y.	•	(Hewitt, in, New Rochelle) → (Don Hewitt, per:cities_of_residence, New Rochelle)	
	He is survived by his third wife, former television news correspondent Marilyn Berger; his sons, Steven and Jeffrey; his daughter, Lisa Cassara; his stepdaughter, Jilian Childers Hewitt, whom Hewitt adopted; and three grandchildren.	•	(Hewitt, "Jilian Childers Hewitt) $\rightarrow$ (Don Hewitt, per.children, Jilian Childers Hewitt)	
SF13_ENG_044	Dominick Dunne, a novelist and journalist who chronicled true - crime tales of the rich and inflamous, including O. J. Simpson and Claus von Bulow, and in turn became a celebrity in his own right, died of bladder cancer Aug. 26 at his home in New York City.	$(Dominick\ Dunne, A\ Novelist) \rightarrow (Dominick\ Dunne, per:title, A\ Novelist)$	$(Dunne, ., novelist) \rightarrow (Dominick Dunne, per:title, novelist)$	
SF13_ENG_044	Dunne and his wife , Ellen Griffin Dunne , known as Lenny , were married in 1954	(His Wife, ,, Ellen Griffin Dunne) → (Dominick Dunne, per:spouse, Ellen Griffin Dunne)	(Dunne, and, Ellen Griffin Dunne) → (Dominick Dunne, per:spouse, Ellen Griffin Dunne)	
SF13.ENG.044	Dunne was born in 1925 in Hartford, Connecticut, to a wealthy Roman Catholic family and grew up in some of the same social circles as the Kennedys.	(Dunne, was born in 1925 in, Connecticut) → (Dominick Dunne, per:stateorprovince_of_birth, Connecticut)	(Dunne, was born in 1925 in, Connecticut) → (Dominick Dunne, per:stateorprovince_of_birth, Connecticut)	
SF13.ENG.044	Dunne was part of a famous family that also included his brother, novelist and screenwriter John Gregory Dunne; his brother's wife, author Joan Didion; and his son, Griffin.	•	(His Brother, ,, Novelist) $\rightarrow$ (His brother, per:title, Novelist)	
SF13.ENG.047	The women were accompanied by Reyna Luisa Tamayo, the mother of political prisoner Orlando Zapata, who died at age 42 in a hunger strike February 23 to protest prison conditions.	(Political Prisoner Orlando Zapata, ,, Reyna Luisa Tamayo) $\to$ (Orlando Zapata, per:children, Reyna Luisa Tamayo)	(Political Prisoner Orlando Zapata, ,, Reyna Luisa Tamayo) $\to$ (Orlando Zapata, per:children, Reyna Luisa Tamayo)	
SF13.ENG.049	A professor emeritus at Yale University, Mandelbrot was born in Poland but as a child moved with his family to France where he was educated.	(Mandelbrot, ,, Yale University) → (Benoit Mandelbrot, per:employee_or_member_of, Yale University)	(Mandelbrot, was born in, Poland) → (Benoit Mandelbrot, per:country_of_birth, Poland)	
SF13_ENG_058	Access Industries, a privately held company founded in 1986 by Len Blavatnik, has a diverse portfolio of investments in industry, real estate, media and telecommunications.	(Access Industries, A Privately Held Company) → (Access Industries, properties, A Privately Held Company)	(Access Industries, founded in 1986 by, Len Blavatnik) → (Access Industries, org:founded_by, Len Blavatnik)	
SF13.ENG.061	InterContinental Hotels Group, owners of Holiday Inn Worldwide, has been ordered by a court to pay \$25 million in damages to a franchisee for fraud.	(Intercontinental Hotels Group, ,, Holiday Inn Worldwide) $\rightarrow$ (InterContinental Hotels Group, org:parents, Holiday Inn Worldwide)	(Intercontinental Hotels Group, ,, Holiday Inn Worldwide) $\rightarrow$ (InterContinental Hotels Group, org:parents, Holiday Inn Worldwide)	
SF13_ENG_079	Water and its links to development, peace and conflict were key words in the an- nual sessions, Anders Berntell, executive director of Stockholm International Water Institute (SIWI), said in his opening address.	(Stockholm International, director, Anders Berntell) → (Stockholm International Water Institute, per:top_members_or_employees, Anders Berntell)	-	
SF13_ENG_079	Water and its links to development, peace and conflict were key words in the an- nual sessions, Anders Berntell, executive director of Stockholm International Water Institute (SIWI), said in his opening address.	(Stockholm International, , executive director, Anders Berntell) → (Stockholm International Water Institute, per:top_members_or_employees, Anders Berntell)	(Stockholm International, , executive director, Anders Berntell)   (Stockholm International Water Institute, per.top_members_or_employees, Anders Berntell)	
SF13_ENG_090	ECO member countries include Afghanistan, Azerbaijan, Iran, Kazakhstan, Kyr- gyzstan, Pakistan, Tajikistan, Turkey, Turkmenistan and Uzbekistan.	(Eco Member Countries, include, Azerbaijan) → (Economic Cooperation Organization, org:members, Azerbaijan)	(Eco Member Countries, "Azerbaijan) → (Economic Cooperation Organization, org:members, Azerbaijan)	
SF13.ENG.096	Freedom was founded in the 1930s by R.C. Hoiles and is still majority owned by the Hoiles family.	(Freedom, was founded in, The 1930S)→ (Freedom Communications, org:date_founded, 1930-XX-XX)	(Freedom, was founded in, The 1930S)→ (Freedom Communications, org:date,founded, 1930-XX-XX)	
SF13_ENG_096	A phone message left Sunday at Freedom's Irvine, California, headquarters was not immediately returned.	•	(Freedom'S Irvine, , California) → (Freedom Communications, org:stateorprovince_of_headquarters, California)	
SF13_ENG_097	STX Finland is part of the international STX Europe Group, with shipyards in Brazil, Norway, France, Romania and Vietnam.	(Stx Finland, of, The International Stx Europe Group)→ (STX Finland, org:subsidaries, The International Stx Europe Group)	org:stateotyprovinceon aleanquariets, Cantonials (Stx Finland, of, The International Stx Europe Group)→ (STX Finland, org:subsidaries, The International Stx Europe Group)	

Figure 10: Unmapped facts: MAMA-BERT  $_{\rm LARGE}$  vs. MAMA-GPT-2  $_{\rm XL}$  on TAC KBP.

ID Appropriate_Rural_Technology_Institute	Sentence Appropriate Rural Technology Institute Appropriate Rural Technology Institute is an Indian non - governmental orga-	Candidate facts to mapped facts  (Appropriate Rural Technology Institute, is, An Indian Non-Governmental Organization) → (appropri-
Ayatollah (Record Producer)	nization founded by a group of about 20 scientists and technologists to develop innovative and environmentally friendly rural technologies based on modern scientific knowledge in 1996.  Ayatollah Lamont Dorrell , known as Ayatollah , is a hip - hop record producer from Queens , New York who has produced for predominantly New York - based rappers including Moss Def , Tailb Kweli , R. A. The Rugged Man , Tragedy Khadiki Wordsworth , Nastire, Afu - Ra, Gurm, M. O. P. , Importab Deck , Corenga, Gnostface Killah or Articles of the Control of	ate.urual.achnology_institute.Q16245764, country.P17, india.Q668)  (Ayatollah, is, A Hip-Hop Record Producer)   — (ayatollah, frecord_producer).Q4830984, occupation.P106, record_producer).Q393945)
Benjamin_Darbelet	Hagety Minatal, Workswith, Vast Ane. Adv. Ra., Onto, W. O. F., Hispectali Deck., Cornega., Ontonace Minatas well as many others.  Benjamin Darbelet Benjamin Darbelet is a French judoka.	(Benjamin Darbelet, is, A French Judoka) → (benjamin_darbelet,Q2456207, country_of_citizenship,P27, france,Q142);
Bharat_Khawas	He plays for club Tribhuvan Army in Martyr * s Memorial A - Division League as a striker .	(Benjamin Darbelet, is, A French Judoka) — (benjamin,darbelet/Q2455207, sport-P641, judo,Q11420) (He, plays, Clab Tribhuvan Army) — (bharat/khwaxQ4901128, member_of_sports_teamP54, nepal_army_club,Q9994327); (He, plays, Club Tribhuvan Army) — (bharat/khawaxQ4901128, sport-P641, association_football_Q2736)
Bill_White_(Shortstop)	White was born on May 1, 1860 in Bridgeport, Ohio, and he began his professional baseball career in 1883 with the Pottsville Antharcites of the International Association.	sociation_tootcain.Q2736) (White, in, Bridgeport)   (bill_white_(shortstop),Q4911357, place_of_birth.P19, bridgeport,_ohio.Q2062947)
Bob Dylan Q392	Dylan married Sara Lownds , who had worked as a model and a secretary to Drew Associates , on November 22 , 1965 .	(Dylan, married, Sara Lownds) → (Bob.Dylan Q392, spouse.P26, Sara.Lownds.Q457433)
Bob_Dylan.Q392	In 1991, Dylan received a Grammy Lifetime Achievement Award from American actor Jack Nicholson.	(Dylan, received, Grammy Lifetime Achievement Award) → (Bob_Dylan,Q392, award_received.P166, Grammy.Lifetime_Achievement_Award.Q935843)
Boog_Powell	He also played for the Cleveland Indians and the Los Angeles Dodgers.  He played in Major League Baseball as a first baseman and left fielder from through, most notably as a member of	(He, also played for the, Cleveland Indians) → (boog.powell,Q4942810, member.of.sports.team.P54, cleveland.indians.Q642553) (He, played, A. First Baseman) → (boog.powell.Q4942810, position.played.on.team.f.speciality.P413,
Bouchraya_Hammoudi_Bayoun	the Baltimore Orioles dynasty that won four American League pennants and two World Series championships between 1966 and 1971.  He studied Economics at the University of Havana , Cuba .	first_baseman.Q1326154)  (He, studied Economics, Havana) → (bouchraya_hammoudi_bayoun.Q4949324, educated_at.P69, univer-
Cezaro_Rossetti Chan_Sau_Ying	Of Italian - Swiss derivation , he was born in Glasgow and lived in Britain .  Chan Sau Ying Chan Sau Ying is a retired athlete from Hong Kong who specialised in the 100 metres hurdles .	sity_of_havana_(Q837320)  (He, was, Glasgow) → (cezaro_rossetti.Q2947206, place_of_birth.P19, glasgow.Q4093)  (Chan Sau Ying, is, A Retired Athlete) → (chan_sau_ying.Q21858345, sport_P641, sport_of_athletics.Q542)
Christian_Mcgrath Cliff_Michelmore	He was born in the Bronx in 1972 and became interested in art and illustration as a small child.  He was born in the Bronx in 1972 and became interested in art and illustration as a small child.  He was a regular presenter on BBC1's "Holiday" programme from 1969 to 1986, and presented other shows for BRCTV ITV and BRC 780.	(He, was form in, The Bronx) → (christian-magrath, 5210897, place, of birth, P19, the bronx, O18426) (He, was form in, The Bronx) → (christian-magrath, 5210897, place, of birth, P19, the bronx, O18426) (He, was, A Regular Presenter) → (cliff_michelmore, Q5132704, occupation, P106, television_presenter, Q947873)
Crooked_I	Crooked I Dominick Antron Wickliffe, better known by his stage name Crooked I or Kxng Crooked, is an American rapper from Long Beach, California.	(Kxng Crooked, "An American Rapper) →(crooked,i.Q253695, country,of,citizenship.P27, united_states.Q30)
Denise_Johns Diana_Rast	She graduated in 2002, and moved to Atlanta, playing amateur beach volleyball on the east coast of America.  She also competed at the 1996 Summer Olympics.	(She, playing, Amateur Beach Volleyball) → (denise_johns,Q5257690, sport,P641, beach,volleyball,Q4543) (She, competed at, The 1996 Summer Olympics) → (diana_rast,Q2491787, participant_of,P1344, 1996_summer_olympics,Q8531)
Eduard_Friedrich_Poeppig Edward_LRomero	Eduard Friedrich Poeppig Eduard Friedrich Poeppig was a German botanist, zoologist and explorer.  After the Vietnam war, he became a county chairman of Democratic Party.	(Eduard Friedrich, was, A German Botanist) → (eduard_friedrich_poeppig.Q61501, field_of_work.P101, botany.Q441) (A County Chairman, of, Democratic Party) → (edward_l_romero.Q5344025, member_of_political_party.P102, demo-
Endre_Tilli	Endre Tilli Endre Tilli was a Hungarian fencer .	cratic_party_(united_states), Q29552)  (Endre Tilli, was, A Hungarian Fencer) → (endre.tilli,Q1642140, country_of_citizenship.P27, hungary.Q28); (Endre Tilli, was, A Hungarian Fencer) → (endre.tilli,O1642140, sport,P641, fencine,O12100)
Enrico_Porro	Porro competed at the 1908 Summer Olympics in London where he won the gold medal in Greco - Roman wrestling , the lightweight class .	(Porro, competed, The 1908 Summer Olympics) → (enrico_porro.Q1343905, participant_of.P1344, 1908 summer olympics Q8111)
Erfan Zeneli  Erminio_Favalli	Erfan Zeneli Erfan Zeneli is a Finnish footballer of Kosovar Albanian descent who currently plays for HJK Helsinki as a striker or left winger.  He then moved to Mantova before to join Palermo , where he spent seven seasons as a "rosanero" mainstay .	(Brian-Zenel), a Finnish Footballer) — (erfan zeneli (2053387, country of_citizrenship P27, finland Q33); (Brian-Zeneli, is, A Finnish Footballer) — (erfan zeneli (2053387, sport P641, association_football Q2736); (Brian-Zeneli, is, A Finnish Footballer) — (erfan zeneli (2053387, country for_sport P152); finland Q33)  (He, then moved to, Mantova) — (erminio_faralliQ1405871, member_of_sports_team_P54, man-
George Dowty Harald Fairhair	Dowty was born in Pershore , Worcestershire in 1901 .	tova_1911_s.s.dQ430993) (Dowty, was born in, Pershore) → (george_dowty.Q1507239, place_of_birth.P19, pershore.Q767858)
	In the Saga of Handl Fairhair in "Heimskringla", which is the most elaborate although not the oldest or most reliable source to the fir of Handl, it is written that Pland succeeded, on the death of his Pland Falfalan the Black Gudridsmon, to the sovereignty of several small, and somewhat scattered kingdoms in Vestfold, which had come into his father "is known through conquest and inheritance."	$(Harald\ Fairhair,\ of\ his\ father,\ Halfdan\ the\ Black)\ \rightarrow\ (harald\ Jairhair\ Q206123,\ father\ P22,\ halfdan\ , the\ Jblack\ Q504932)$
Hector, Dyer Henny-Magnussen	Born in Los Angeles , California , Hector Dyer enrolled at the Stanford University and won the IC4A championships in in 1930.  Thanks to the support she received , she was able to practise in all the courts of Denmark from 1909 , becoming the	(Hector Dyer, enrolled at, The Stanford University) $\rightarrow$ (hector_dyer_Q1364518, educated_at_P69, stanford_university_Q41506) (The First Woman, , Denmark) $\rightarrow$ (henny_magnussen_Q56577333, country_of_citizenship P27, denmark_Q35)
Hina_Pervaiz_Butt	first woman to do so.  Hina Pervaiz Butt Hina Pervaiz Butt is a Pakistani politician who was a Member of the Provincial Assembly of the Punjab, since May 2013.	(Hina Pervaiz Butt, is, A Pakistani Politician) → (hina pervaiz butt.Q47918210, occupation.P106, politician.Q82955)
Isabella.Of_Valois,_Duchess_Of_Bourbon  Isbir Butrón	She was the wife of Peter I, Duke of Bourbon.	(She, was the wife of, Peter I) → (isabella_of_valois_duchess_of_bourbon.Q2363495, spouse.P26, peter_i,_duke_of_bourbon.Q444668)
Jahir_Butron  Lahir_Butrón	Then from 1995, he played for Peruvian Second Division side Guardia Republicana.  Jahir Butrón Jahir Butrón Gotuzzo is a Peruvian footballer who plays as a center back.	(He, played for, Peruvian Second Division Side Guardia Republicana) → (jahir,butrón,Q6123259, member-of,sports, learn. P54, guardia_republicana_Q5614012) (Jahir Butrón Gotzzzo, is, A Peruvian Footballer) → (jahir,butrón,Q6123259, country_of_citizenship,P27, peru,Q419);
Joan_Of_France,_Duchess_Of_Berry	She was the second daughter of King Louis XI of France and of his second wife Charlotte of Savov : her surviving	(Jahir Butrón Gotuzzo, is, A Peruvian Footballer) → (jahir_butrón.Q6123259, sport.P641, association_football.Q2736) (She, was the second daughter, King Louis Xi) → (joan_of_france_duchess_of_berry.Q236220, father.P22,
John Ogilvie (Footballer)	siblings were King Charles VIII of France and Anne of France .  He played for Hibs in their most successful era renowned for their front five known as The Famous Five .	louis.xi.of.france.Q8058) (He. played for. Hibs) → (john.ozilvie.ffootballer).O6251147, member.of.sports.team.P54, hibernian.f.cO192597)
Johnedel./Cardel Joseph.WNega José_Alejandro_Aguilar.López	He moved to Sta.  Joseph W. Nega Joseph W. Nega is a Judge of the United States Tax Court.  José Alejandro Aguilar López José Alejandro Aguilar López is a Mexican politician from the National Action Party.	(He, to, Sa) → (jóhnedel, azudel, Ójós99981, membera da, gorta, semn PS-4, ta, hacia-zealton, (Öj57751) (hogy h. W. Ega, t. A. Indige) → (jónedel, sa-aga, Ql(573324, coguntian-P106, jánel) (Ql(533)) (hogá Alejando Aguilur López, is, A. Mexican Politician) → (jóts. alejando aguilur Aprez, Ql(83859)), (moz Alejando Aguilur López, is, A. Mexican Politician) → (jóts. alejando aguilur Aprez, Ql(83859)), (jót. alejando aguilur Aprez, Ql(838590)), occupation P106, politician (982055); (José Alejando Aguilur Aprez, Marian-Para), politician (982055); (José Alejando Aguilur Aprez, Marian-Para), politician (982055); (José Alejando Aguilur Aprez, Marian-Para), politician (982055); (José Alejando Aguilur Aprez, Ql(838590)), mem- hory (Jónes), politician (1982055); (Jónes), politician (1982055); (José Alejando Aguilur Aprez, Ql(838590)), mem-
Juan_Bautista_Azopardo	Juan Bautista Azopardo was born in Senglea , Malta , the son of Rosina and Salvatore Azopardo .	ber.of.political.party.P102, national.action.party.(mexico).Q851087) (Juan Bautista Aropardo, "Malla» → (juan Austista.azopardo,2808564, country.of.citizenship.P27, malta.Q233); (Juan Bautista Azopardo, was born, Senglea) → (juan.bautista.azopardo,Q3805864, place.of.birth.P19, sen- glea.Q346593)
Kevin_Kerr_(Scottish_Footballer)	He signed for AGOVV Apeldoorn of Netherlands ' Eerste Divisie in January 2012 after his contract in Bielefeld had expired the previous summer.	(He, signed for, Agovv Apeldoorn) → (kevin_kerr_(scottish_footballer).Q326761, member_of_sports_team.P54, agovv.apeldoorn.Q292618)
Lachezar_Kotev	Lachezar Kotev Lachezar Kotev is a Bulgarian footballer who plays as a midfielder for Vitosha Bistritsa .	(Lachezar Kotev, is, A Bulgarian Footballer) → (lachezar kotev Q49560773, sport P641, association_football, Q2736); (Lachezar Kotev, is, A Midfielder) → (lachezar_kotev,Q49560773, position_played_on_team_/_speciality,P413, mid-fielder_Q193592)
Marc_Zeno  Marcel_Dheere	In 1988, Zeno was drafted in the 7th round by the Pittsburgh Steelers.  Marcel Dheere Marcel Albert "Ching" Dheere was a Canadian professional ice hockey forward who played 11 games	(Zeno, was drafted in the, The Pittsburgh Steelers) → (marc_zeno.Q16196353, member_of_sports_Jeam.P54, pitts-burgh_steelers.Q191477) (Marcel Albert "Ching, in, A Canadian Professional Ice Hockey) → (marcel_dheere.Q6756083, coun-
maccapacit	index delices and the Control Congress of the Mentreal Canadiens.	try.of.citizenship.P27, canada.Q16): (The National Hockey League, for, The Montreal Canadiens) → (marcel.dheree, Q6756083, member.of.sports.cam.P54, montreal.canadiens.Q188143): (A Canadian Professional Ice Hockey, played. The National Hockey League) → (marcel.dherer.Q6756083, league.P118, national brokey League.Q1718.9897): (Marcel Albret" (Thine played A Canadian Professional Ice Hockey) → (marcel.dhere)
Mark_Schultz_(Wrestler)	Mark Schultz was born in 1960 in Palo Alto , California to Dorothy Jean St . Germain and Philip Gary Schultz .	cel.dheere.Q6756083, sport.P641, ice.hockey.Q41466) (Mark Schultz, was born in 1960 in, Derothy Jean St. Germain) → (mark.schultz.(wrestler).Q3487332, place.of.birth.P19, palo.alic.g.alifornia.Q47263
Michael_Jones_(Footballer)	Michael Jones Michael Jones is an English footballer , who plays for Cefn Druids .	(Michael Jones, is, An English Footballer) → (michael jones (footballer).Q6831707, sport.P641, association football.Q2736)
Mike_Bellotti	He is an alumnus of the Delta Sigma Phi fraternity .	(He, is an alumnus of, The Delta Sigma Phi Fraternity) → (mike.bellotti.Q14950800, educated_at.P69, california_state_university_east_bay.Q1026916)
Olga_Semenova_Tyan-Shanskaya Owen_Paterson	She learned to play chess at the age of 18; four years later she won the Leningrad city women's chess championship.  Owen Paterson Owen William Paterson is a British Conservative Party politician who was the Secretary of State for Environment, Food and Rural Affairs from 2012 to 2014.	(She, to play, Chess) → (olga_semenova_tyan-shanskaya_Q2392240, sport.P641, chess.Q718) (Owen Paterson, is, A British Conservative Party Politician) → (owen_paterson_Q197894, occupation.P106, politician_Q82955)
Pan Gongsheng Paul Carrington (American Football)	Pan Gongsheng Pan Gongsheng is a Chinese economist, banker, reformist and bureaucrat.  Paul Carrington Paul Carrington is a former American football defensive end.	(Pan Gongsheng, is, A Chinese Economist) → (pan.gongsheng Q9309080, country_of_citizenship.P27, china Q148) (Paul Carrington, is, A Former American Football Defensive End) → (naul_carrington_famerican_football).09057011.
Peter_Jebsen	Peter Jebsen Peter Jebsen was a Norwegian businessperson and politician .	sport.P641, american.football.Q41323) (Peter Jebsen, was, A Norwegian Businessperson) → (peter jebsen.Q1774966, country_of_citizenship.P27, norway.Q20); (Peter Jebsen, was, A Norwegian Businessperson) → (peter jebsen.Q1774966, occupation.P106, businessperson)
Pina_Piovani	Pina Piovani Pina Piovani was an Italian stage and film actress .	nessperson Q43845); (Peter Jebsen, was, Politician) → (peter jebsen Q1774966, occupation.P106, politician.Q82955) (Pina Piovani, was, An Italian Stage And Film Actress) → (pina_piovani.Q3388583, country_of_citizenship.P27, italy.Q38)
Robert_GCole	Rapidly advancing through the ranks at Fort Benning as the parachute infantry battalions were expanded to regiments, he was a licutenant colonel commanding the 3rd Battalion of the 502nd Parachute Infantry Regiment on June 6, 1944, the date of his unit 5 first combat jump.	(He, was, A Lieutenant Colonel) → (robert_g_cole Q969944, military_rank.P410, lieutenant_colonel.Q493898)
Robert_Holt_Carpenter	Robert Holt Carpenter Robert Holt Carpenter was a New Zealand bookbinder, local politician, bookseller and character.	(Robert Holt Carpenter, was, A New Zealand Bookbinder) → (robert_holt_carpenter.Q7345593, country_of_critizenship.P27, new_zealand.Q664)
Robert_Van_Boxel Rolf_Maurer	He joined amateur side FC Lisse in summer 2015 from Sparta .  Rolf Maurer Rolf Maurer was a Swiss road racing cyclist who competed professionally between 1960 and 1969 .	(He, joined, Amateur Side Fe Lisse) → (robert-van hoxel Q2017870, member of sports_team P54, f.e. lisse, Q978325) (Rolf Maurer, was, A Swiss Road Racing Cyclist) → (rolf_maurer_Q870132, country_of_citizenship?gysitzerland,Q39); (Rolf Maurer, was, A Swiss Road Racing Cyclist) → (rolf_maurer_Q870132, sport_P641,
Ron_Maudsley	Maudsley was born in Lostock Gralam , Cheshire , and educated at Malvern College and Birmingham University , then served in the Royal Army Service Corps during World War II .	road bisycle nacing (33699) (Maudsley, was born in, Lostock Gralam) → (ron_maudsley,Q16009653, place_of_birth_P19, lostock_gralam_Q4640202)
Safa_Al-Safi Salvador_Luria	Safa al - Safi Safa al - Din Mohammed al - Safi is an Iraqi politician and former Justice Minister who is currently Minister of State for the Council of Representatives.  In 1959, he became chair of Microbiology at the Massachusetts Institute of Technology.	(Mohammed Al-Safi, is, An Iraqi Politician) → (safa_al-safi,Q7398343, occupation.P106, politician,Q82955)  (He, became chair of, Microbiology) → (salvador Juria,Q205667, field_of_work.P101, microbiology,Q7193)
Sanele_Vavae_Tuilagi Seth_Plum	In 1527. The Ockanife Claim or anticonomy is the avaissactiments institute or rectinionogy.  He now plays for US Carrassonom.  Seth Plum Seth Lewis Plum was an English international footballer who played as a wing half.	(He, now plays, Us Carcassonne) → (sanele vavae tuilagi Q3472139, member of sports team P54, us_carcassonne.Q3550526) (Seth Lewis Plum, was, An English International Footballer) → (seth.plum,Q7456581, sport.P641, associa-
Sofija_Korkutytė	Sofija Korkutytė Sofija Korkutytė was a Lithuanian rower who won three European titles in the eights event in 1963,	tion football Q2736): (Seth Lewis Plum, was, An English International Footballer) → (seth.plum,Q7456581, member_of_sports_team_P54, england_national_football_team_Q47762) (Sofija Korkulyté, was, A Lithuanian Rower) → (sofija_korkulyté,Q16014909, sport_P641, rowing_(sport),Q159354)
Thomas_Rogne	1965 and 1967; she finished second in 1964 and 1966.  He made his first start for Celtic at home against Dundee United in a 1 – 0 victory on 20 February 2010, he played very well and impressed the coach Tony Mowbray.	(He, at, Celtic.) → (thomas.rogne.Q609801, member.of.sports.leam.P54, celtic.f.c.,Q19593)
Uri_Avnery	Avnery was born in Beckum, near Münster in Westphalia, as Helmut Ostermann, the youngest of four children, to a well - established German Jewish family, his father being a private banker in the town.	(Westphalia, in, Beckum) → (uri_avnery.Q325679, place_of_birth.P19, beckum,_germany.Q2707)
Ursula.Lehr Valdívia.(Brazilian_Footballer)	She was a member of the Christian Democratic Union.  Valdivia Wanderson Ferreira de Oliveira, commonly known as Valdivia, is a Brazilian footballer who plays as an	(She, of, The Christian Democratic Union) → (ursula_lehr.Q290708, member_of_political_party_P102, chris- tian_democratic_union_of_germany_Q49762) (A Brazilian_footballer, who plays as, An Attacking Midfielder) → (valdivia_(brazilian_footballer)_Q18176477, posi-
Victor-François, 2Nd Duc De Broglie	attacking midfielder for Avai, on loan from Internacional. His victory over Prince Ferdinand at Bergen won him the rank of marshal of France from the French King Louis XV and the title of Prince of the Holy Roman Empire. "Reichsfinst" from Holy Roman Emperre Francis 1. In 1799, he won the Battle of Bergen and followed that with the capture the city of Minden, later fighting at the Battle of Minden under the command of Contades, whom he would succeed in command.	tion.played.on.team.J.apociality.P413, midfielder.Q193592) (His victory, won him the, Marshal) → (victor-françois, 2nd.duc.de.broglie,Q695929, award.received.P166, marshals.of.france.Q474485)

Figure 11: Mapped facts: MAMA-BERT  $_{\rm LARGE}$  on Wikidata.

ID	Sentence	Candidate facts to mapped facts
Appropriate_Rural_Technology_Institute	Appropriate Rural Technology Institute Appropriate Rural Technology Institute is an Indian non-governmental organi- zation founded by a group of about 20 scientists and technologists to develop innovative and environmentally friendly rural technologies based on modern scientific knowledge in 1996.	(Appropriate Rural Technology Institute, is, An Indian Non-Governmental Organization) → (appropriate_rural_technology_institute_Q16245764, country_P17, india_Q668)
Ayatollah_(Record_Producer)	Ayatoliah Lamon Dorrell, known as Ayatoliah, is a hip-hop record producer from Queens, New York who has produced for predominantly New York-based rappers including Mos Def, Talifs New, B.A. The Rugged Man, Tragedy Khadafi, Words-worth, Vast Aire, Afur-Ra, Gurm, M.O.P., Impectab Deck, Cormega, Ghostface Killah as well as many others.	$(Ayatollah, is, A Hip-Hop Record \ Producer) \rightarrow (ayatollah, (record, producer), Q4830984, \ occupation. P106, record, producer, Q183945)$
Benjamin_Darbelet Bharat_Khawas	Benjamin Durbelet Benjamin Durbelet is a French judoka.  He plays for club Tribhuvan Army in Martyr's Memorial A-Division League as a striker.	Benjamin Durbels, is, A French Judoka) — (benjamin akarbelst (2345037, country, of.citizendisp P.7, france (142); Benjamin Durbelst, is, A French Judoka) — (benjamin albarbelst (2345037), sport F841, 1846, 011420) (He, plays for, Club Tribliuvan Army) — (bharat, khawas (24901128, member, of.sports, seam F84, nepal.amy_ctdw) — (bharat, khawas, Q8901128, port F841,
Bill_White_(Shortstop)	White was born on May 1, 1860 in Bridgeport, Ohio, and he began his professional baseball career in 1883 with the	nepal_army_clubQb99452/f; (He, plays for, Club Iribhuvan Army) → (bharal_khawas.Q4901128, sport.P641, association_football_Q2736) (White, in, Bridgeport) → (bill_white_(shortstop).Q4911357, place_of_birth.P19, bridgeport_obiro.Q2062947)
Bob.Dylan.Q392	Pottsville Antharcites of the International Association.  Dylan married Sara Lownds, who had worked as a model and a secretary to Drew Associates, on November 22, 1965	(Dylan, married, Sara Lownds) → (Bob.Dylan,Q392, spouse,P26, Sara,Lownds,Q457433)
Bob_Dylan.Q392	In 1991, Dylan received a Grammy Lifetime Achievement Award from American actor Jack Nicholson.	(Dylan, received, A Grammy Lifetime Achievement Award) → (Bob,Dylan,Q392, award_received,P166, Grammy_Lifetime_Achievement_Award,Q935843)
Boog_Powell Boog_Powell	He also played for the Cleveland Indians and the Los Angeles Dodgers.  He played in Major League Baseball as a first baseman and left fielder from through, most notably as a member of	(He, also played for, The Cleveland Indians) → (boog_powell,Q4942810, member.of_xports_team.P54, cleveland_indians_Q642553) (He, played in, A First Baseman) → (boog_powell,Q4942810, position_played_on_team_/_speciality,P413.
Bouchraya_Hammoudi_Bayoun	the Baltimore Orioles dynasty that won four American League pennants and two World Series championships between 1966 and 1971.  He studied Economics at the University of Havana, Cuba.	first.baseman.Q1326154)  (He, studied, University of Havana) → (bouchraya,hammoudi,bayoun.Q4949324, educated_at.P69, univer-
Cezaro_Rossetti	Of Italian-Swiss derivation, he was born in Glasgow and lived in Britain.	sity_of_havana_Q837320)  (He, was born in, Glasgow) → (cezaro_rossetti,O2947206, place_of_birth,P19, glasgow,O4093)
Chan_Sau_Ying Christian_Mcgrath Cliff_Michelmore	Chan Sau Ying Chan Sau Ying is a retired athlete from Hong Kong who specialised in the 100 metres hurdles.  He was born in the Bronx in 1972 and became interested in art and illustration as a small child.  He was a regular presenter on BBC1's "Holiday" programme from 1969 to 1986, and presented other shows for BBC	(Sau Ying, is, A Retired Athlete) → (chan.sau.ying Q21858345, sport.P641, sport.of_athletics.Q542) (He, was born in, The Bronx) → (christian.megrath.Q510987, place.of_birth.P19, the_bronx.Q18426) (He, was, A Regular Presenter) → (chiff_michelmore.Q5182704, occupation.P106, elevision_presenter.Q947873)
Crooked_I	TV, ITV and BBC Radio.  Crooked I Dominick Antron Wickliffe, better known by his stage name Crooked I or Kxng Crooked, is an American rapper from Long Beach, California.	$(Crooked\ I, is, An\ American\ Rapper) \rightarrow (crooked\ J.\ Q253695, country\ of\ \ \ critizenship. P27, united\ \ \ \ cstates. Q30)$
Denise Johns Diana M. Fennell	rapper from Long Beach, California.  She graduated in 2002, and moved to Atlanta, playing amateur beach volleyball on the east coast of America.  Fennell was born in Emporia, Virginia and attended the public schools there.	(She, playing, Amateur Beach Volleyball) → (denise johns Q\$257690, sport.P641, beach.volleyball.Q4543)  (Fennell was horn in Emporia) → (diana.m. fennell Q\$037779, place of birth P19, emporia, virginia Q177678)
Diana_Rast	She also competed at the 1996 Summer Olympics.	(Fennell, was born in Emporia) → (diana, m. fennell Q28037279, place, of Lbirth, P19, emporia, virginia Q177678)  (She, also competed at, The 1996 Summer Olympics) → (diana_rast, Q2491787, participant_of, P1344, 1996_aummer_olympics, Q8531)
Eduard_Friedrich_Poeppig Edward_LRomero	Eduard Friedrich Poeppig Eduard Friedrich Poeppig was a German botanist, zoologist and explorer.  After the Vietnam war, he became a county chairman of Democratic Party.	[Eduard Friedrich, was, A German Botanist) → (eduard_friedrich_poeppig_Q61501, field_of_work_P101, botany_Q441) (He, of, Democratic Party) → (edward_J_romero_Q5344025, member_of_political_party_P102, democratic_party_dmind_states(_Q29552)
Endre_Tilli Enrico_Porro	Endre Tilli Endre Tilli was a Hungarian fencer.  Porro competed at the 1908 Summer Olympics in London where he won the gold medal in Greco-Roman wrestling,	-(Endre Tilli, was, A Hungarian Fencer) → (endre. Lilli, Q1642140, country.of.citizenship.P27, hungary.Q28); (Endre Tilli, was, A Hungarian Fencer) → (endre. Lilli, Q1642140, sport.P641, fencing.Q12100); (Porro, competed at, The 1908 Summer Olympics) → (enrico.porro,Q1343905, participant.of.P1344,
Erfan-Zeneli	the lightweight class.  Erfan Zeneli Erfan Zeneli is a Finnish footballer of Kosovar Albanian descent who currently plays for HJK Helsinki as a striker or left winger.	1908.aummer.olympics.Q8111) (Erfan Zeneli, 18, A Finnish Footballer) → (erfan zeneli.Q2053367, country of critizenship.P27, finland.Q33); (Erfan Zeneli, 18, Chrinish Footballer) → (erfan zeneli.Q2053367, sport.P641, association_football.Q2736); (Erfan Zeneli, 2005)
Erminio_Favalli	He then moved to Mantova before to join Palermo, where he spent seven seasons as a "rosanero" mainstay.	Zeneri, S. A Finish Frobialler) → (erfain_zeneri\(\text{Qco_3000}\), (spoin_1001, spoin_1001, spoin_zeneri\(\text{Qco_3000}\), (spoin_1001, spoin_zeneri\(\text{Qco_3000}\), (spoin_1001, spoin_2001, spoin_zeneri\(\text{Qco_3000}\), (spoin_2001, spoin_2001, s
George Dowty Harald Fairhair	Dowty was born in Pershore, Worcestershire in 1901.  In the Saga of Harald Fairhair in "Heimskringla", which is the most elaborate although not the oldest or most reliable	tova_1911_cs.aQ409993)  (Dowty, was born in, Pershore) → (george_dowty.Q1507239, place_of_birth.P19, pershore.Q767858)  (Harald, of his father, Halfdan the Black) → (harald_fairhair,Q206123, father.P22, halfdan_the_black.Q504932)
	source to the life of Harald, it is written that Harald succeeded, on the death of his father Halfdan the Black Gudrödarson, to the sovereignty of several small, and somewhat scattered kingdoms in Vestfold, which had come into his father's hands through conquest and inheritance.	
Hector_Dyer	Born in Los Angeles, California, Hector Dyer enrolled at the Stanford University and won the IC4A championships in in 1930.	(Hector Dyer, at, The Stanford University) → (hector_dyer.Q1364518, educated_at.P69, stanford_university.Q41506)
Henny_Magnussen Hina_Pervaiz_Butt	Thanks to the support she received, she was able to practise in all the courts of Denmark from 1909, becoming the first woman to do so. Hina Pervaiz Butt Hina Pervaiz Butt is a Pakistani politician who was a Member of the Provincial Assembly of the	(She, , she, Denmark) → (henny_magnussen.Q56577333, country_of_citizenship.P27, denmark.Q35) (Hina Pervaiz Butt, is, A Pakistani Politician) → (hina_pervaiz_butt.Q47918210, occupation.P106, politician.Q82955)
Isabella Of Valois, Duchess Of Bourbon	Punjab, since May 2013.  She was the wife of Peter I, Duke of Bourbon.	(She was the wife of Peter I) → (isabella of valois duchess of bourbon 02363495 snouse P26 ne-
Jahir_Butrón	Then from 1995, he played for Peruvian Second Division side Guardia Republicana.	ter.j.,duke.of.bourbon.Q444668)  (He, played for, Peruvian Second Division Side Guardia Republicana) → (jahir,butrón.Q6123259, member.of.sports.team.P54, guardia.republicana.Q5614012)
Jahir_Butrón	Jahir Butrón Jahir Butrón Gotuzzo is a Peruvian footballer who plays as a center back.	(Jahir Butrón Gotuzzo, is, A Peruvian Footballer) → (jahir butrón Q6123259, country of citizenship.P27, peru.Q419); (Jahir Butrón Gotuzzo, is, A Peruvian Footballer) → (jahir butrón Q6123259, sport.P641, association football.Q2736)
Janina_Altman  Joan_Of_France,_Duchess_Of_Berry	In 1950, Hescheles emigrated to Israel, where she eventually carned a doctorate in chemistry at Technion .  She was the second daughter of King Louis XI of France and of his second wife Charlotte of Savoy; her surviving	(She, earned a doctorate in, Technion) → (janina_altman,Q22574794, educated_at.P69, technion_israel.institute_of.technology_Q333705) (She, was the second daughter of, King Louis Xi) → (joun_of.france_duchess.of.berry,Q236220, father.P22,
John "Ogilvie "(Footballer)	siblings were King Charles VIII of France and Anne of France.  He played for Hibs in their most successful era renowned for their front five known as The Famous Five.	louis_xi_of_france.Q8058)  (He, played for, Hibs) → (john_ogilvie_(footballer).Q6251147, member_of_sports_team.P54, hibernian_f.cQ192597)
Johnedel "Cardel Joseph "W. "Nega José "Alejandro "Aguilar "López	He moved to Sta.  Joseph W. Nega Joseph W. Nega is a Judge of the United States Tax Court.  Jose Alejandro Aguilar López José Alejandro Aguilar López is a Mexican politician from the National Action Party.	(He, moved to, Sta) → (johnedel_cardel_Q56599981, member_of_sports_team_P54, sta_lucia_realtors_Q3547751) (Joseph W. Nega, is, A Judge) → (joseph_w_nega_Q16733242, occupation_P106, judge_Q16533) (José_Alciandro Aguilar Lónez, is a Mexican politician. The National Action Party) →
		(josé_alejandro.aguilar_lópez_Q18385891, member_of_political_party.P102, national_action_party_(mexico).Q851087); (José_Alejandro Aguilar López, is, A Mexican Politician) → (josé_alejandro.aguilar_lópez_Q18385891; (country of_citizenship P7_mexico_Q96); (José_Alejandro_Aguilar_López_is_A Mexican_Politician) →
Juan_Bautista_Azopardo	Juan Bautista Azopardo was born in Senglea, Malta, the son of Rosina and Salvatore Azopardo.	(josé_alejandro_aguilar_Jópez_Q18385891, occupation.P106, politician.Q82955)  (Juan Bautista Azopardo, was born in, Senglea) → (juan_bautista_azopardo.Q3805864, place_of_birth.P19, sen
		glea.Q846593); (Juan Bautista Azopardo, was born in, Malta) → (juan_bautista_azopardo.Q3805864, coun-
Kevin_Kerr_(Scottish_Footballer)	He signed for AGOVV Apeldoorn of Netherlands' Eerste Divisie in January 2012 after his contract in Bielefeld had expired the newions summer	try_of_citizenship.P27, malta.Q233)  (He, signed for, Agovv Apeldoorn) → (kevin_kerr_(scottish_footballer).Q326761, member_of_sports_team.P54,
	He signed for AGOVV Apeldoors of Netherlands' Eerste Divisie in January 2012 after his contract in Bielefeld had expired the previous summer.  Lachear Keter Lachear Kotev is a Bulgarian footballer who plays as a midfielder for Vitosha Bistritsa.  La 1988, Zero was drafted in the 7th Found by the Pittsburgh Steeders.	try of critizenship P27, malta (Q233) (He. signed for Agow Apploborn) → (kevin,kerr_(scottish,footballer), Q326761, member_of_sports_leamP54, agow_apeldoom_Q92618) (Lachezar Kotev, ts, A Bulgarian Footballer) → (lachezar_Astev_Q49560773, sport_P641, association_football_Q2736) (Zeno, by, The Pittsburgh Steelers) → (marc_zeno_Q16196333, member_of_sports_leamP54, pitts-
Lachezar_Kotev	expired the previous summer.  Lachezar Kotev Lachezar Kotev is a Bulgarian footballer who plays as a midfielder for Vitosha Bistritsa.	try of editorobly P.7, mulus (2023). (Georgia Control of Control o
Lachezar.Kotev Marc Zeno Marcel_Dheere	expired the previous sammer.  Lachezur Kotev Lachezur Kotev is a Bulgarian footballer who plays as a midfielder for Vitosha Bistritsa.  In 1988, Zeno was drafted in the 7th round by the Pitisburgh Steelers.  Marcel Dheere Marcel Albert "Ching" Dheere was a Canadian professional ice hockey forward who played 11 games	try of climenship F27, multa (253)  (K. sigued for A, Goyov Apoldssom) → (Levin,kerr_Locotish,foodsuller) (3)26761, member_of_aports_seam F34, [K. sigued for A, Goyov Apoldssom) → (Levin,kerr_Locotish,foodsuller) (3)26761, member_of_aports_seam F34, [L. sigued for_aports_seam F34, [L.
Lachezar.Kotev Marc Zeno Marcel_Dheere	expired the previous summer.  Leckezz Koetz Lezkez Koets is a Bidgarian footballer who pilays as a midflielder for Vitoola Bistritus.  In 1986, Caeo was darded in the 7th round by the Pittolough Stockers.  Marcel Pheere Marcel Abbert Ching Theore was a Canadian professional see backey forward who played 11 games in the National Hockey League for the Montreal Canadiens.	try of citizenship 27, mulus (2533)  (Ke. tigued for, Agowa Ngoldsons) → (tevin, heart_fection), footbuller) (2026)(i), member_of_opens_hearn P54, (iii., tigued for, Agowa Ngoldsons) → (televate_heart_fection), post_P54, post_P541, association_doubtill_(272), iii the property of the
Lachezar Kotev Marc Zeno Marcel_Dheere Mark_Schultz_(Wrestler) Michael_Jones_(Footballer)	expired the previous summer.  Lackerar Kore I cabar Kore is a Bulgarian footballer who plays as a midfielder for Vitosha Bistrius.  In 1988, Zeno was drahed in the 7th round by the Pittsburgh Steelers.  Marcel Theore Marcel Abort "Ching" Done was a Canadian professional ice bockey forward who played 11 games in the National Hockey League for the Montreal Canadiens.  Mark Schulz was born in 1960 in Palo Alto, California to Dorothy Jean St. Germain and Philip Gary Schulz.  Michael Jones Michael Jones is an English footballer, who plays for Cefn Draids.  She Earned to play cleas at the age of 18 four years later the won the Leningard city women's cleas championship.  She Earned to play cleas at the age of 18 four years later the won the Leningard city women's cleas championship.	try of citizenship 277, multa (2233)  (Ick. signed for A, gown Apiddsom) → (Levin, kerr_koorlish, foodballer) (032676). member_of_aports_neamP54, agovs_apeldsom (022618)  (Lexizezz-Kores, + A Bingiratar Foodballer) → (lachezar_kores, Q89560773, your P641, susccitation_doorball (22736)  (Lexizezz-Kores, + A Bingiratar Foodballer) → (lachezar_kores, Q89560773, your P641, susccitation_doorball (22736)  (Lexizezz-Kores, + A Bingiratar Foodballer) → (marz_neam, Q1696353), member_of_aport_absempth (22736)  Marcel Abert Trining, was (A canadian Froofessional Lexi Beckey) → (marcel_abert_of_aport_abert_of_aport_absempth (22736))  Marcel Abert Trining, was (A canadian Froofessional Lexi Beckey) → (marcel_abert_of_aport_abert_abert_of_aport_abert_of_aport_abert_abert_of_aport_abert
Lachezar Kotev Marc/Zeno Marcel_Dheere Mark_Schultz_(Wrestler) Michael_Jones_(Foothaller) Often_Semenora_Tyan_Shanskaya	expired the previous nummer.  Leckezar Kore Leakzar Kore is an Bulgarian footballer who pilays as a midflielder for Vitoolan Bistritus.  In 1986, Econ was durfted in the 7th round by the Pintodrugh Stockers.  Marker Dheere March Alburs Chaige Bousee was a Camadian professional see backey forward who played 11 games in the National Hockey League for the Montreal Camadien.  Mark Schuler was born in 1960 in Palo Albu, California to Downly Jean St. Germani and Philip Gary Schultz.  Michael Jones Wichael Jones is an English footballer, who plays for Cerla Dradds.  Michael Jones Michael Jones is an English footballer, who plays for Cerla Dradds.	usy of, citizenship F27, multa (2353)  (bl. signed for, Agowa Apadison) → (kevin,kerr_icontinh,footballer) (932676), member of appent neum P34, agova apadison, (202610), member of appent neum P34, agova Apadison (202610), member of appent neum P34, agova Apadison (202716), fears, by The Pittsbergh Steelers) → (man. zeno Q16196535), member of appent neum P34, pittsbergh steelers (191477)  Marcel Abhert Thing, was, A Canadian Professional Ice Hockey) → (mancel_alherere(6)756838, country_of_citizenship P27, canada (1916); Marcel Abhert Ching, was, A Canadian Professional Ice Hockey) → (mancel_alherere(6)756838, country_of_citizenship P27, canada (1916); Marcel Abhert Ching, was, A Canadian Professional Ice Hockey) → (mancel_alherere(6)756838, country_of_citizenship P27, canada (1916); Marcel Abhert Ching, was, A Canadian Professional Ice Hockey) → (mancel_alherere(6)756838, country_of_citizenship P27, canada (1916); Marcel Abhert Ching, was, A Canadian Professional Ice Hockey) → (mancel_alherere(6)756838, country_of_citizenship P27, canada (1916)); Marcel Abhert Ching, was, A Canadian Professional Ice Hockey) → (mancel_alherere(6)7568038, country_of_citizenship P27, china Q1810); Marcel Abhert Ching, was, A Canadian Professional Ice Hockey) → (mancel_alherere(6)7568038, country_of_citizenship P27, china Q1810); Marcel Abhert Ching, was, A Canadian P30, country_of_citizenship P27, china Q1810, country_of_citize
Lachezar Korev Mare-Zeno Mare-Callonere Mare-Schultz-(Westeller) Michael Jones (Footballer) Olgo, Zemenva-Yano Shandaya Oneo, Dieteral Pan Compilore Pan Compilore Pan Compilore (Kontrican Football)	expired the previous summer.  Lachezar Kore Leabur Kore is a Bulgarian footballer who plays as a midfielder for Vitrosha Bistrina.  In 1988, Zazo was drahed in the 7th round by the Phitsburgh Steelers.  Marier Blewer, March Albur "Chaige" flower was a Canadian professional ice hockey forward who played II games in the National Hockey League for the Membreal Canadiens.  Mark Schulz was born in 1960 in Palo Alto, California to Dorenthy Jean St. Germain and Philip Gary Schulzz.  Michael Jones Michael Jones is an English footballer, who plays for Cefn Draids.  She learned to play closes at the age of 18 Gur years later the won the Leningard city women's closes championship.  Owers Barron Own William Patrons to B in Brilled Closeraring Party politician who was the Secretary of State for Environment, Food and Raral Affairs from 2012 to 2014.	usy ad citizenship F27, multa (253)  (bl. sugued for A, gover Apeldosom) → (taevin.kerr_(contish_footballer) (035076), member ad apoets Jeann P54, (bl. sugued for A, gover Apeldosom) → (taevin.kerr_(contish_footballer) (035076), member ad apoets Jeann P54, (bl. super for A, gover
Lachezar Korev Mare-Zeno Mare-Callonere Mare-Schultz-(Westeller) Michael Jones (Footballer) Olgo, Zemenva-Yano Shandaya Oneo, Dieteral Pan Compilore Pan Compilore Pan Compilore (Kontrican Football)	expired the previous nummer.  Lackezar Kore Lackezar Kore is an Bidgarian footballer who pilays as a midflielder for Vitooha Bistritus.  In 1986, Caroo was durfuel in the 7th round by the Pintodrugh Stockers.  Mark Caroo was durfuel on the 7th round by the Pintodrugh Stockers.  Mark Caroo was durfuel on the Pintodrugh Caroo was a Camadian professional see backey forward who played 11 games in the National Hockey League for the Montreal Camadien.  Mark Schulut was born in 1960 in Palo Alto, California to Downly Jean St. Germania and Philip Gary Schultz.  Michael Jones Michael Jones is an English footballer who plays for Cefa Dradol.  Michael Jones Michael Jones is an English footballer, who plays for Cefa Dradol.  Michael Jones William Palecron is a Brighth Construier who may be Leaning and city women's cless championship.  Owen Paterson Oven William Palecron is a Brighth Connervative Party politicism who was the Secretary of State for Environment, Flood and Real Affair from 2012 to 2014.  Pan Congploy Pan Groupshorp is a Chinese economist, banker, reformist and boreaucen.	ury ad citizenship F27, multa (2533)  (Ke. tagued fin. Agowa Ngolikom) → (kevin.kerr /centish.footballer) (25276), member ad apoets.heam P54, file. tagued fin. Agowa Ngolikom) → (kevin.kerr /centish.footballer) (25276), sport.P641, association/orball (2726)  (Lackera Kore, K. A Balgarian Footballer) → (lackeraz Actors (26256)), sport.P641, association/orball (2726)  (Lackera Kore, K. A Balgarian Footballer) → (material footballer) → (material footballer) (26768), sport.P641, pitch burgh_teckera_(191477)  (Material Abert - Change van, A Candina Protocoutal to Hockey) → (material-footballer) (267568), countries (26768), countries (26
Lacherar Kotev Marc Zeno Marcel "Dheere Mark, Schultz "Wrestler) Mark, Schultz "Wrestler) Michael Jones "Footballer) Olga, Semenova, Jyan Shanskaya Onea, Platerson Pant, Gongsbeng Pant Carmignen (American Football) Feter "Jebsen	expired the previous nummer.  Lackezar Kore Lackezar Kore is all Bidgartan footballer who pilays as a middledder for Vitooha Bistritos.  In 1986, Zeno was durfied in the 7th round by the Pintoduph Steelers.  March Therest March Albert Ching Bostere was a Canadian professional set hockey forward who played 11 games in the National Hockey Longue for the Montreal Canadien.  Mark Schalte was born in 1960 in Palo Alto, California to Doresthy Jean St. Germain and Pfillip Gary Schultz.  Michael Jones Michael Jones is an English footballer, who plays for Cafa Draids.  Michael Jones Michael Jones is an English footballer, who plays for Cafa Draids.  Michael Jones Michael Jones is an English footballer, who plays for Cafa Draids.  Michael Jones Michael Jones is an English footballer, who plays for Cafa Draids.  Michael Jones Michael Jones is a English footballer, who plays for Cafa Draids.  Michael Jones Michael Jones is a English footballer, who plays for Cafa Draids.  Michael Jones Michael Jones is a Brajish footballer, who plays for Cafa Draids.  Michael Jones Michael Jones is a Brajish footballer, who plays for Cafa Draids.  Michael Jones Michael Jones is a Brajish footballer, who plays for Cafa Draids.  Michael Jones Michael Jones is a Brajish footballer, who plays for Cafa Draids.  Michael Jones Michael Jones is a Brajish footballer, who plays for Cafa Draids.  Michael Jones Michael Jones is a Brajish footballer, who plays for Cafa Draids.  Michael Jones Michael Jones is a Brajish footballer, who plays for Cafa Draids.  Michael Jones Michael Jones Michael Jones International Jones In	usy of citizenship F27, multa (253)  (bl. sigued for A, gover Apeldoson) → (kevin.kerr./continh.footballer) (9350/6), member.of. apoets.seam P54, bl. sigued for A, gover Apeldoson) → (kevin.kerr./continh.footballer) (9350/6), member.of. apoets.seam P54, classic footballer) → (leabreza.deev. (94850/773, yort.P641, association.dorball (2672b))  (Jackteer Koers, is, A Bilgraine Footballer) → (leabreza.deev. (94850/773, yort.P641, association.dorball (2672b))  (Jackteer Koers, is, A Bilgraine Footballer) → (leabreza.deev. (94850/77), yort.P641, association.dorball (2672b))  (Morard Albert T-Ohing, was, A Canadiun Professional for Hockey) → (marcel_alberter_06756085, country.docistreship F27, canada_fo)), footballer (1684), footb
Lachezar Korev Mare Zeno Mare Calbarer  Mark Schultz (Wewtler)  Michael Jones (Footballer)  Olga Sentenova, Yyao Shandaya  Owen Paterson  Pan Completing  Fan Fan Carmignon (American Football)  Peter Jebsen  Pan Jovann  Pan Jovann	expired the previous summer.  Lackerar Kore Leabur Krote is all Bulgartan footballer who plays as a midfielder for Vitosha Bistrius.  In 1988, Zeno was drankel in the 7th round by the Pittsdurgh Steelers.  In 1988, Zeno was drankel in the 7th round by the Pittsdurgh Steelers.  Markel Dheren Hared Abort Ching [Pittscre was a Canadian professional see hockey forward who played II games in the National Hockey League for the Montreal Canadiens.  Mark Schulz was born in 1960 in Palo Alio, California to Dorothy Jean St. Germain and Philip Gary Schultz.  Michael Roses Michael Jones is an English footballer, who plays for Crift Druds.  She learned to play chess at the age of 18; four years later the won the Lennigrad city women's clees championship.  Ower Palerson Own William Paterons is Britlish Conservative Party Posifician who was the Secretary of State for Environment, Food and Brain Affairs from 301 to 3014.  Pan Congluing Pan Gongeloug is a Chinese consonais, banker, reformist and boreaucra.  Pan Carrington Part Carrington is a former American Industrius Industrius and Distriction.  Part Carrington Part Polsen was a Norwegian bounescaperson and politician.  Pina Povant Pina Brovant was an Italian stage and Illin actives.  English advancing through the enable at Federation of the parts and parts an	tay of alimenship P27, mulus (2353)  (He. sugued far, Agourt Negolston) → (Levin Aerr Acortisch Josebuller) (235976), member of apperts Jeann P54, [He. sugued far, Agourt Negolston) → (Levin Aerr Acortisch Josebuller) (235976), member of apperts Jeann P54, [Lexicater Kiere, i. A. Bulgarian Footballer) → (Lachezer Actore (29586077), port. P541, association (Lorden) (247) in the part of the Part Negolston (195807) → (Lachezer Kiere, i. A. Bulgarian Footballer) → (Lachezer Actore (29586071), port. P541, por
Lacherar Kotev Mare Zeno Mare Cl Bhore Mare Schultz (Westler) Michael Jones (Footballer) Olgo Zentenova Yano Shandaya Owen Pateron Pan Gongshore Pan Conseguin (American Football) Pan Zengsino (American Football) Past John	expired the previous nummer.  Lackezar Kore Lackezar Kore is an Balgarian footballer who pilays as a midflielder for Vitooha Bistritus.  In 1986, Caro was durful in the 7th round by the Pittodaugh Stockers.  In 1986, Caro was durful on the 7th round by the Pittodaugh Stockers.  Mark Caro was durful on the 7th round by the Pittodaugh Stockers.  Mark Schalter was brean in 1960 in Paloc Alto, California to Dowethy Jean St. Germania and Philip Gary Schultz.  Michael Jones Michael Jones is an English footballer, who plays for Cerla Dradok.  Michael Jones Michael Jones is an English footballer, who plays for Cerla Dradok.  Michael Jones Michael Jones is an English footballer, who plays for Cerla Dradok.  Michael Jones Michael Jones is an English footballer, who plays for Cerla Dradok.  Michael Jones Michael Jones is an English footballer, who plays for Cerla Dradok.  Michael Jones Michael Jones is an English footballer, who plays for Cerla Dradok.  Michael Jones Michael Jones is an English footballer, who plays for Cerla Dradok.  Michael Jones Michael Jones is an English footballer, who plays for Cerla Dradok.  Michael Jones Michael Jones is a Bright Michael Jones who was the Secretary of State for Environment, Food and Renal Affair from 2012 to 2014.  Plan Complemy Pan Gongelweigh is a Chinese economistis, bander, reforminat and boreament.  Plan Carnington Was Carner Journal and Affair from American Johnst Enderwoor end.  Plan Carnegop who Carnington is a former Janariera forball delicative end.  Plan Poroma Plan Poromi was an Indian stage and film acress.  Rapidly advancing through the ranks at Fort Benning as the parachete infanity butations were expanded to regiments the was a descented colonnal commanding the Ab Bhailation of the 505hal Parachate Infanity Regiment on Inne 6, 1944.	tray of, citizenship P27, multa (2533)  (Ke. tigued for, Agowa Apoldsons) → (taevin, kerr (aconish, foodbuller) (2020/61), member of, apoets, seam P54, (Ke. tigued for, Agowa Apoldsons) → (taekera, Acore (2025/61)), aport P641, association dorbull (227)) (Laekera Kotev, to, & Bulgarian Foodbuller) → (taekera, Acore (2025/61)), aport P641, association dorbull (227) (Laekera Kotev, to, & Bulgarian Foodbuller) → (taekera) (1040/61), aport P641, association dorbull (227) (Laekera Kotev, to, & Bulgarian Foodbuller) → (taekera) (1040/61), aport P641, association (1040/61), ap
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Lacherar Korev Mare Lemo Mare Librere  Mare Librere  March Schultz (Westler)  Michael Jones (Footballer)  Olga Semnova, Yjan Shankaya  Owen Paterson  Pan Gongsheng  Pan Gongsheng  Pan Gongsheng  Pan Gongsheng  Robert Alonic Coole  Robert John Lorder  Robert John Lorder  Robert Man Josed  Robert Man	expired the previous nummer.  Lackezar Kore Lackezar Kore is al Bidgarian footballer who pilays as a midflielder for Vitooha Bistritos.  In 1986, Earon was durfuled in the 7th round by the Printeduply Societies.  Mark Schale Kore was durfuled in the 7th round by the Printeduply Societies.  Mark Schale was born in 1960 in Pole Alto, California to Doenthy Jean St. Germani and Philip Gary Schultz.  Mark Schale was born in 1960 in Pole Alto, California to Doenthy Jean St. Germani and Philip Gary Schultz.  Michael Jones Michael Jones is an English footballer, who plays for Crist Drada.  Michael Jones Michael Jones is an English footballer, who plays for Crist Drada.  Michael Jones Michael Jones is an English footballer, who plays for Crist Drada.  Michael Jones Michael Jones is an English footballer, who plays for Crist Drada.  Michael Jones Michael Jones is an English footballer, who plays for Crist Drada.  Michael Jones Michael Jones is an English footballer, who plays for Crist Drada.  Michael Jones Michael Jones is an English footballer, who plays for Crist Drada.  Michael Jones Michael Jones is an English footballer, who plays for Crist Drada.  Pan Comployed Pan Germany Drada Parkers on Intelled Michael Jones School, and Pan Comployed Pan Parkers on Pan Pan Comployed Pa	try of citizenship P27, mulus (2353)  (K. signed for A., Agrow Applishorm) → (taviru.Aerr Lecotish.foodbuller) (235076), member of apoets Jeann P54, (L. signed for A., Agrow Applishorm) → (taviru.Aerr Lecotish.foodbuller) (235076), member of apoets Jeann P54, (L. signed for A., Agrow Applishorm) → (taviru.Aerr Aerr Aerr Aerr Aerr Aerr Aerr Aerr
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Figure 12: Mapped facts: MaMa-GPT- $2_{\rm XL}$  on Wikidata.

ID	Sentence	BERT <sub>LARGE</sub> Candidate facts	to mapped facts $\mathrm{GPF}\text{-}2_{\mathrm{XL}}$
Andy_Hilbert	In the same season he was claimed off waivers by the Pittsburgh Penguins on March 9, 2006	LANGE	(He, by, The Pittsburgh Penguins) → (andy_hilbert,Q526158, mem-
Bob.Dylan.Q392	Dylan married his backup singer Carolyn Dennis on June 4, 1986.		ber of sports team.P54, pittsburgh penguins.Q193643)  (Dylan, married, Carolyn Dennis) → (Bob.Dylan.Q392, spouse.P26, Car
Bones_Hillman	During the hiatus of Midnight Oil , Hillman returned to New Zealand , working as	(Hillman, returned, New Zealand) → (bones_hillman.Q2910026, coun-	olyn,Dennis,Q5045345)
	During the matus of Midnight Oil, Hillman returned to New Zealand, working as a studio and live musician with Dave Dobbyn and recorded the album " Available Light ".	try_of_citizenship.P27, new_zealand.Q664)	
Brent_Hinds	Hinds continues to concentrate on Mastodon, with the majority of his time spent touring or in the studio.	•	(His Time, with, Mastodon) → (brent_hinds.Q909746, member_of.P463, mastodon_(band).Q548844)
Butch_Vig	Their debut album, "Garbage", was an unexpected smash, selling over 4 million copies and certified double platinum in the UK. United States and Australia.	•	(mastodon_band) Q548844) (Over 4 Million Copies, in, United States) → (butch_vig.Q451084, country of citizenship P21 united states) 3(0)
C-Kan	Their debut album, "Garbage", was an unexpected smash, selling over 4 million copies and certified double platinum in the UK, United States and Australia. In addition to being known as a rapper, C.Kan is also known for supporting the free use of marijuana in México.	•	try_of_citizenship.P27, united_states.Q30)  (Marijuana, in, México) → (c-kan.Q27734073, country_of_citizenship.P27, mexico.Q96)
Charles_Gratiot_Sr.	Gratiot died of a stroke in St. Louis .	(Gratiot, died, St. Louis) → (charles_gratiot_srQ2959257, place_of_death.P20, stlouis.O38022)	
Cheryl_Chan	Cheryl Chan Cheryl Chan Wei Ling , PBM , is a Singaporean politician .	stjouis.Q38022) (Cheryl Chan Wei Ling, is, A Singaporean Politician) → (cheryl_chan.Q22003605, occupation.P106, politician.Q82955)	
Cyba_Audi	Audi is an experienced moderator and presenter at local, regional, and international	occupation.P106, politician.Q82955)	(Audi, is, Presenter) → (cyba_audi.Q18921358, occupation.P106, televi
Douglas Lenat	business events.  He is a Fellow of the AAAS, AAAI, and Cognitive Science Society, and an editor	(He, is a Fellow, Aaai) → (douglas,lenat.Q559334, member,of.P463, associa-	sion_presenter.Q947873)
Douglas Lenat	of the J. Automated Reasoning, J. Learning Sciences, and J. Applied Ontology.  While attending the University of Panarchysnia, Language reported binself through	tion_for_the_advancement_of_artificial_intelligence.Q2739680)	(Lenat, ,, The University of Pennsylvania) → (douglas Jenat Q559334, edu
-	of the J. Automated Reasoning , J. Learning Sciences , and J. Applied Ontology . While attending the University of Pennsylvania, Lenat supported himself through programming, notably designing and developing a natural language interface to a U.S. Navy data base question–answering system serving as an early online ship-board operations manual used on US aircraft carriers.		cated_at.P69, university_of_pennsylvania.Q49117)
Fred_Stewart_(Football_Manager)	board operations manual used on US aircraft carriers.  Despite managing for 39 years he only ever took charge of two clubs, Stockport County and Cardiff City, and he holds the record for longest serving manager in the history of both clubs.	•	(He, charge of, Stockport County) → (fred_stewart_(football_manager).Q\$496345 member_of_sports_team P\$4, stockport_county_f.cQ18526)
Félix_Tanco	Rom Eillis Manuel de Jarrie Tanco y Rosmanial in Rosotti Colombia ha arrivad	(Bogotá, "Cuba) → (félix_tanco.Q5511649, country_of_citizenship.P27, cuba.Q241)	
Gary_Ablett_Jr.	in Cuba at a very young age.  He also won his second Brownlow Medal , becoming the first Gold Coast player to win the award and the 14th player in VFL / AFL history to win it twice .	(He, also won, His Second Brownlow Medal) $\rightarrow$ (gary_ablett,jr.Q3098509, award_received P166, leigh_matthews_trophy_Q6519632); (He, also won, His Second Brownlow Medal) $\rightarrow$ (gary_ablett,jr.Q3098509, award_received P166, brownlow_medal_Q3853498)	•
Geeto_Mongol	After meeting his would - be tag team partner, Bepo Mongol, Tattrie returned to the WWWF as Geto Mongol and The Mongols were brought to the United States in 1968.	(The Mongols, were, The United States) → (geeto_mongol.Q11324907, country_of_citizenship.P27, united_states.Q30)	•
Georgi_Plekhanov	Georgi Plekhanov Georgi Valentinovich Plekhanov was a Russian revolutionary ,	$(Georgi\ Valentinovich\ Plekhanov,\ was,\ A\ Marxist\ Theoretician)\ \rightarrow$	
Győző "Drozdy	philosopher and a Marxist theoretician . Győző Drozdy Győző Drozdy was a Hungarian teacher , journalist , and politician .	(Georgi valentinoven Fielmanov, was, A markis incorectain) → (georgi pickanov, Q18200, occupation P106, philosopher Q4964182) (Győző Drozdy, was, Politician) → (győző drozdy, Q910001, occupation P106, politician, Q82955)	
Horace_Rawlins	Rawlins died on 22 January 1935 in a nursing home in Reading , Berkshire .	(Rawlins, died, Reading) → (horace_rawlins.Q4436/11, place_ot_death.P20, read-	
Horace_Rawlins	He played in a professional event at Stanmore Golf Club in June 1894 but finished	ing, berkshire.Q161491)	(He, played in, Stanmore Golf Club) → (horace_rawlins.Q4436711, sport.P641
Hugo Winterhalter	well out of the prizes.  Winterhalter remained with RCA Victor until 1963, at which time he moved to	<u> </u>	(Winterhalter, to, Kapp) → (hugo_winterhalter.Q1635872, record_label.P264
riugo_winternanter	Kapp, that same year, he also penned the main title theme for the film, "Diamond		kapp_records.Q1728690)
Ioannis_Talianos	Head". He competed in the men's 4 × 100 metres relay at the 1924 Summer Olympics.	(He, competed in the, The 1924 Summer Olympics) → (ioan-	
Joan_Of_France,_Duchess_Of_Berry	The nuns of the Order of the Annunciation of the Blessed Virgin Mary still maintain	nis alianos.Q35692847, participant of.P1344, 1924 summer olympics.Q8132)	(Their Way, in, France) → (joan of france, duchess of berry Q236220, coun
John Maynard Keynes	their way of life in monasteries in France Releium Costa Rica and Poland	(John Maynard Keynes was A British Economist) ->	try_of_citizenship.P27, france.Q142)
70m2mymacacyncs	John Maynard Keynes John Maynard Keynes , 1st Baron Keynes , was a British economist , whose ideas fundamentally changed the theory and practice of macroe-	(John Maynard Keynes, was, A British Economist) → (john_maynard_keynes.Q9317, occupation.P106, economist.Q188094)	
Jonathan Culler	conomics and the economic policies of governments.  Currently , he is Class of 1916 Professor of English and Comparative Literature at  Cornell University .	(He, is, English) → (jonathan_culler.Q933332, languages spoken written or signed P1412 english language Q1860)	
Jordi_Cañas_Pérez	In the regional elections of Catalonia in November 2010, he was chosen in the	guages_spoken_writen_or_signed.P1412, english_language.Q1860)  (The Province, of, Barcelona) → (jordi_cañas_pérez.Q557693, mem-	•
Jules_Deligny	primary as number three for Ciutadans' candidacy in the province of Barcelona.  He competed in the freestyle lightweight event at the 1920 Summer Olympics.	ber_of_political_party.P102, citizens_(spanish_political_party).Q1393123)  (He, competed in the, The 1920 Summer Olympics) → (jules_deligny.Q16207961.	
Liz_Mcgregor		guages, spoken, switten oz. signed P1412. engink. language (J1860) (The Province, G. Barcelons) — (sordi, calas, sperze (J58760), mem- ber of spolitical party P102. citterns (sponish, spotifical, party) (J189121), enter- (He, competed in the The 1923 Stamert (Jympics) – (plies. deligney (J16207961), participant of P1244, 1920. comment of sympics – (plies. deligney (J16207961), participant of P1244, 1920. comment of Stamert (J78760), enter- cipant (J78760), comment of Stamert (J78760), enter- cipant (J78760), enter	
Lin_incpregor	Liz McGregor Liz McGregor is a South African author and a journalist who worked for leading South African newspapers such as the "Sunday Times" and the "Rand Daily Mail".	journalist.Q1930187)	
Louise,Shropshire	The granddaughter of slaves, Louise Shropshire was born Louise Jarrett on February		(Louise Shropshire, was, Coffee County, Alabama)  → (louise_shropshire.Q15430857, place_of_birth.P19, cof-
	15, 1913 in Coffee County, Alabama.		→ (louise_shropshire.Q15430857, place_ot_birth.P19, cot- fee_county,_alabama.Q485660)
Macit_Gürdal	He competed in the men's tournament at the 1952 Summer Olympics.	(He, competed in the, The 1952 Summer Olympics) → (macit_gürdal.Q57313835, participant_of.P1344, 1952_summer_olympics.Q8407)	•
Markus_Pröll	At the beginning of his career, Pröll became a target of some ridicule because his name "Pröll " literally means something like " lout " in German .  Their Round Four match against the saw Hadebe score the first senior try of his	participant_of_P1344, 1952_summer_olympics_Q8407)  ("Pr0II," in, German) → (markus_pr0II,Q704630, country_of_citizenship_P27, germany_Q183)  (His_Career,	
Monde_Hadebe		(His Career, ,, The Sharks Xv) → (monde_hadebe.Q6898677, mem- ber_of_sports_team.P54_sharks_(currie_cup).Q744636)	
Neville_Southall	career in a 21 – 10 victory, and the Snarks XV again minimed top of the Southern Section log.  He moved on to Everton for £150,000 in 1981 and established himself as the club's		(He, moved on to, Everton) → (neville_southall.Q436650, mem
	first-choice goalkeeper by the 1983-84 season.		(He, moved on to, Everton) → (neville_southall.Q436650, member_of_sports_team.P54, everton_f.cQ5794)
Olga_Semenova_Tyan-Shanskaya	She died in Leningrad .	(She, died, Leningrad) → (olga semenova tyan-shanskaya Q2392240, place of death P20, saint petersburg Q656)	•
Parvathy.Ratheesh	Parvathy Ratheesh made her film acting debut in 2015 similar to that of her younger brother, Padmaraj Ratheesh who also made his acting debut in the same year through "Fireman".  In 1993, he was inducted into the Canadian Football Hall of Fame.	(Her Film, that of her younger brother, Padmaraj Ratheesh) → (par- vathy_ratheesh_Q19895785, sibling_P3373, padmaraj_ratheesh_Q19895782)	•
Peter,Dalla,Riva	through "Fireman".  In 1993, he was inducted into the Canadian Football Hall of Fame.		(He, was inducted into the, Fame) → (peter_dalla_riva.Q7173528
Pierre Dubem			award_received.P166, canadian_football_hall_of_fame.Q3517653)
Pietre_Dunein	Unlike many former historians, who denigrated the Middle Ages, he endeavored to show that the Roman Catholic Church had helped foster Western science in one of		(He, was inducted into the, Fame) → (peter_daila_riva_Q7173528 award_received_P166, camadian_football_hall_of_fame_Q3517653) (The Roman Catholic Oburch, bad, Foster Western Science) → (pierre_duhem_Q314172, field_of_work_P101, philosophy_of_science_Q59115)
Rafael Arcadio Remal Sunelano			
Karaei_Arcadio_Bernai_Supeiano	its most fruitful periods.  He then served as bishop of the Roman Catholic Diocese of Arauca, Colombia,		(The Roman Catholic Diocese, ,, Colombia) -
	He then served as bishop of the Roman Catholic Diocese of Arauca, Colombia, from 1990 to 2003 and as bishop of the Roman Catholic Diocese of Libano–Honda, Colombia, from 2003 to 2004.		(rafael arcadio-bernal supelano Q2126904, country of citizenship P27, colom
Rajeshwar_Dayal	He then served as histop of the Roman Catholic Diocese of Arauca, Colombia, from 1990 to 2003 and as bishop of the Roman Catholic Diocese of Libano-Honda, Colombia, from 2003 to 2004.  The Government of India awarded him the second highest civilian award of the Padma Vibbushan in 1969.	•	(rafael.arcadio_bernal_supelano.Q2126904, country_of_citizenship.P27, colom bia.Q739)  (Him, award, The Padma Vibhushan) → (rajeshwar,dayal.Q15448539
Rajeshwar_Dayal Ray_Johnson_(American_Football)	He then served as bishep of the Roman Catholic Diocese of Aranca, Colombia, from 1990 to 2003 and as bishop of the Roman Catholic Diocese of Libano-Honda, Colombia, from 2003 to 2004.  The Government of India awarded him the second highest civilian award of the Padma Vibhushan, in 1969.  Rey Johnson Reymond Robert Johnson was an American football defensive book Rey Johnson Reymond Robert Johnson was an American football defensive book.	. (The National Football League, back who played, Raymond Robert Johnson) — (ray-johnson_/american_football_Q121077889, sport_P641, american_football_Q12107889).	(rafael arcadio-bernal supelano Q2126904, country of citizenship P27, colom
Rajeshwar_Dayal Ray_Johnson_(American_Football)	He then served as bishop of the Roman Catholic Diocese of Arauca, Colombia, from 1990 to 2003 and as bishop of the Roman Catholic Diocese of Libano-Henda, Colombia, from 2003 to 2004.  The Government of India awarded him the second highest civilian award of the Padma Vibbushan, in 1969.  Ray Johnson Raymond Robert Johnson was an American football defensive back	son) → (ray_onnson_damerican_tootbaii).Q2107/889, sport.P641, american_football.Q41323) (Sean Hanish, is, An American Film Writer) → (sean_hanish.Q19867622, country_of_citizenship.P27, united_states.Q30); (Sean Hanish, is, An American Film	(rafael.arcadio_bernal_supelano.Q2126904, country_of_citizenship.P27, colom bia.Q739)  (Him, award, The Padma Vibhushan) → (rajeshwar,dayal.Q15448539
Rajeshwar_Dayal  Ray_Johnson_(American,Football)  Sean_Hanish  Seth_Plum	He then served as bishop of the Reman Calholic Discose of Aranca, Colombia, from 1990 to 2010 and a bishop of the Roman Calholic Discose of Hames, Colombia, from 2001 to 2004. The General Calholic Discose of This assurated Inim the second highest civilian award of the The General Calholic Discose was an American football defensive back boy loyed of the secons in the Mariand Forbull Largae with Re-Celevalar Rams and Chicago Cardinals.  Sen Hatinh Sean Hamis is an American film writer, producer and director best laxons for "Saint Jody", "Reman Sezon" and "Sainter Cities".	son) → (ray_jonnson_(american_tootbaii).Q2107/889, sport.P041, ameri-	(rafiel arcado-bernal supelano Q2126904, country of editerable P27, colon bio Q799) (Ilin, ward, The Padina Vibbushan) → (rajeshwar_dayal_Q15448539) availareceived P166, padina_vibbushan_Q6/2792)
Rajeshwar Dayal Ray Johnson (American Football) Sean Hanish Seth Plum	He then served as bishop of the Reman Catholic Discose of Aranca, Colombia, from 1990 to 2030 and a bishop of the Roman Catholic Discose of Hames, Colombia, from 2000 to 2004.  The Covernment of Indias sourced Inim the second highest civilian award of the Padna Vibrabasha, in 1909.  The Covernment of Indias sourced Inim the second highest civilian award of the Padna Vibrabasha, in 1909.  The Covernment of Indias sourced Inim to second highest civilian award of the Padna Vibrabasha, in 1909.  The Covernment of Indias award Indias Indias award Chicago Cardinnis.  Sona Hamids Sear Binais is an American film writer, producer and directive best known for "Santi July", "Remun to Zero" and "Sister Cities".  Sona Hamids Sear Binais is an American film writer, producer and directive best known for "Santi July", "Remun to Zero" and "Sister Cities".  Son Hamids Sear Binais is an American film writer, producer and directive best known for "Santi July", "Remun to Zero" and "Sister Cities".  Son Hamids Sear Binais is an American film writer, producer and directive best known for "Santi July", "Remun December 1997, and "Sister Cities".	son) — (na), goineon, american Josotsani, Q2101/1889, sport.1941, ameri- can football Q41323) (Sean Hanish, is, Anderican Film Writer) — (sean, hanish, Q19867622, coun- try, of_citizenship P.72, mited-states Q30); (Sean Hanish, is, An American Film Writer) — (sean, Junish, Q19867622, occupation, P106, screenwriter, Q28389)	(rafael.arcadio_bernal_supelano.Q2126904, country_of_citizenship.P27, colom bia.Q739)  (Him, award, The Padma Vibhushan) → (rajeshwar,dayal.Q15448539
Rajeshwar,Dayal Ray,Johnson,(American,Football) Sean,Hanish Seth,Plum Seth,Plum	He then served as bishop of the Reman Calholic Discose of Aranca, Colombia, mon 1900 to 200 and a bishop of the Roman Calholic Discose of Hames-Honda, Roman 1900 to 200 and a bishop of the Roman Calholic Discose of Hames-Honda, Park Correnation of Todas awarded bin the second hiptical for the Roman Vibindusian, in 1909.  Ray Johnson Regimend Roberts Holmon was an American foundal defensive back played first essencia in the National Foodball League with net Cerclard Rama being leading to the Roman Regimen of Roberts Honday and State League with net Cerclard Rama Sean Hamish Sean Hamish Sean American film writer, producer and director best known for "Sand Lay", "Restons 200" and "Sister Clies".  Hen in Edinastina, Plina played professionally for Charlon, Alderic, Chelesa and Control Chirolic.  Plum recovered his only cap for England at age 22 while playing for Charlon Alderic, Andrea and Canting and playing the full 90 minutes in a 1-1 win over France on 10May 1922 strating and playing the full 90 minutes in a 1-1 win over France on 10May 1922 strating and playing the full 90 minutes in a 1-1 win over France on 10May 1922 strating and playing the full 90 minutes in a 1-1 win over France on 10May 1922 strating and playing the full 90 minutes in a 1-1 win over France on 10May 1922 strating and playing the full 90 minutes in a 1-1 win over France on 10May 1922 strating and playing the full 90 minutes in a 1-1 win over France on 10May 1922 strating and playing the full 90 minutes in a 1-1 win over France on 10May 1922 strating and playing the full 90 minutes in a 1-1 win over France on 10May 1922 strating and playing the full 90 minutes of 10May 1922 strating and playing the full 90 minutes of 10May 1922 strating and 10May	son from the physical properties of the physica	(rafiel arcado-bernal supelano Q2126904, country of editerable P27, colon bio Q799) (Ilin, ward, The Padina Vibbushan) → (rajeshwar_dayal_Q15448539) availareceived P166, padina_vibbushan_Q6/2792)
Ray_Johnson_(American_Football) Sean_Hanish Seth_Plum Seth_Plum	He then served as bishop of the Reman Calholic Discess of Aranca, Colombia, from 1990 to 2010 and a bishop of the Roman Calholic Discess of Hames-Honda, Colombia, from 2001 to 2004.  The Colombia, from 2001 to 2004.  Ray Jehnon Raymond Robert Johnson was an American football deference back boy loyed three secons in the Arisand Forball Largae with Re-Celenda Ram and Chicago Candinuls.  San Hamids Seat Hunds is an American film writer, producer and director best loaves for "Sant Judy", "Resture Sean" and "States Critics".  San Hamids Seat Hunds is an American film writer, producer and director best loaves for "Sant Judy", "Resture Sean" and "States Critics".  San Hamids Seat Hunds is an American film writer, producer and director best loaves for "Sant Judy", "Resture Sean" and "States Critics".  San Hamids Seat Hunds is an American film writer, producer and director best loaves for "Sant Judy", "Resture Sean" and "States Critics".  Mary Mary Mary Mary Mary Mary Mary Mary	To Joya Charles and John Charles and Charl	(rafiel arcado-bernal supelano Q2126904, country of editerable P27, colon bio Q799) (Ilin, ward, The Padina Vibbushan) → (rajeshwar_dayal_Q15448539) availareceived P166, padina_vibbushan_Q6/2792)
Rajeshwar "Dayal  Ray Johnson "American "Football)  Sean Hanish  Seth Plum  Seth Jum  Stanishav Nedkov	He then served as bishop of the Reman Catholic Discose of Aranca, Colombia, from 1990 to 2010 and a bishop of the Roman Catholic Discose of Hames-Honda, Colombia, from 2001 to 2004.  The Genemack of Todas awarded him the second highest civilian award of the The Genemack of Todas awarded him the second highest civilian award of the Eary Jehono Raymond Robert Dolmoo was an American football defertives back boy loyed offere secons in the Mariand Forball Langae with Re-Celevalda Rama and Chicago Canfinals.  Sean Hamid Sean Hunsi is an American film writer, producer and director best laxons for "Saint Johy", "Reman to Zero" and "Satter Cities".  Ben in Edimonto, "Pun Episcap Investigation of Satter Cities" and Southerd United.  Pun received him tondy cap for England at age 23 while playing for Charlton Adhletic, Attaring and playing the full 90 minutes in a 4 – 1 win one France on 10 May 1923.  A two - time national champton in Ecropia vestuling, he has also faster, place finishes in international tournaments in Enzois Modifors, Turkey, and Bulgaria.  Baddison his Bulgaria's 41 distint most expend player with 10 Separaments for	son from the physical properties of the physica	crafied accide Sernal septiano (2/12094). country of chiteconhip P27, evlem has (2789)  (Bins, ward. The Padina Vibbushan) → (ajeshwar_daysa] (15448519  annular-accided P166, padina-vibbushan Q672292)  (Plum, played professionally for, Charlton Afhirtie) → (seth-plum Q745681)  member of approximation P54, charlton afhirtie.) → (seth-plum Q745681)  member of approximation P54, charlton afhirtie.) ∠ (19462)  (Bic. is, Bulganta' S All-Time Most Capped Player) → (stillyan_aptrox)166263.
Rajeshwar "Doyal Ray Johnson "American "Football) Sean "Hanish Sesh. Plum Sesh. Plum Statishar "Vedkov Stiliyas "Petrov	He then served as bishop of the Reman Calbolic Discose of Aranca, Colombia, mon 1900 to 2003 and a bishop of the Roman Calbolic Discose of Hames, Colombia, from 2001 to 2004.  Colombia, from 2001 to 2004.  Rep Johnson Reprosed Reberty Disson was an American froubil defensive backward of the property of the Parkins Vibinshamia, in 1909.  Rey Johnson Reprosed Reberty Disson was an American football defensive backward property of the Parkins Vibinshamia, and Parkins Vibinshamia, and Parkins Vibinshamia, and Parkinshamia Sana Hamish is an American film writer, producer and director best known for "Sana Day", "Restorm 1907 and "Sister Clies".  Sana Hamish Sana Hamish is an American film writer, producer and director best known for "Sana Day", "Restorm 1907 and "Sister Clies".  Been in Edinantion, Plan played professionally for Charlton Ablletic, Chelvan and Southerd Usinsid.  Plant received his only cap for England at age 22 valide playing for Charlton Ablletic, Andreas and Charleting and playing the full 900 minutes in a 1-1 win over France on 10May 1923.  A two-time autional champton in Freetyle wredling, he has also had feet place in the control convenients in Section Monthly and Department of the side.	ton — in Psychological Contention (1997), sport. 1984.  1603. — in Psychological Contention (1997), sport. 1984.  1604. — in Psychological Contention (1997), sport. 1984.  1604. — in Psychological Contention (1997), sport. 1984.  1605. — in Psychological Contention (1997), sport. 1984.  1605. — in Psychological Contention (1997), sport. 1984.  1606. — in Psychological Contention (1997), sport. 1984.  1607. — in Psychol	rafiel arcadio Jernal supelino Q2126994, country of eitteenship P27, colors has Q789)  (Him, saward, The Padina Vibbushau) → (rajeshwar_dayal.Q1544859)  availarceeved P166, padina-vibbushau Q672392;  (Plans, played professionally for Charlon Athletic) → (seth-plum Q745658)  member_of-ports-aram P54, charlon_athletic d c. Q19462)
Rajeshwar Dayal  Ray Johnson / American / Football)  Sean / Hanish  Seth / Plum  Seth / Plum  Seth / Plum  Siliyan / Petrov  Siliyan / Petrov	He then served as bishop of the Reman Calholic Discose of Aranca, Colombia, toma 1990 to 2003 and a bishop of the Roman Calholic Discose of Hames-Honda, Colombia, from 2001 to 2004.  Colombia, from 2001 to 2004.  But Johnson Reymond Robert Johnson was an American football clarensive back both policy differences in the Mariand Chould League with the Celevidar Rams and Chicago Casilinaba.  An American Grant State of the Casilinaba Callondon Carlon Callondon.  Bern in Edimonton, Plum played professionally for Charlton Athletis, Checkes and Southern Callondon.  Southern Callondon, Plum played professionally for Charlton Athletis, Checkes and Southern Callondon.  A two - time national champton in freestyle weretling, he has also had foret - place finishes in international terminances in Kussia, Madolary, Tarkey, and Budgata.  A two - time national champton in freestyle weretling, he has also had first - place finishes in international terminances in Kussia, Madolary, Tarkey, and Budgata Callondon.	man Joseph (24125).  Son Hainish, A., A. American Film Wireley — (sean Jamint Sport 2020 search y J. Clark Hainish, A., A. American Film Wireley — (sean Jamint Sport 2020 searcy J. Clark Hainish, A., A. American Film Wireley — (sean Jamint Sport 2020 searcy J. Clark Hainish (2016)).  (Bis Chaly Cap, playing for, Charlton Adhletis) → (seth Jahm Q745588), member J. Copets, Jean Fy-8, Charlton Adhletis) → (seth Jahm Q745588), member J. Copets, Jean Fy-8, Charlton Adhletis) → (seth Jahm Q745588), member J. Copets, Jean Fy-8, Charlton Adhletis) → (seth Jahm Q745588), member J. Copets, Jean Fy-8, Charlton Adhletis) → (seth Jahm Q745588), member J. Copets, Jean Fy-8, Charlton Adhletis) → (seth Jahm Q745588), member J. Copets, Jean Fy-8, Charlton Adhletis) → (seth Jahm Q745588), member J. Copets, Jean J. Charlton Adhletis) → (seth Jahm Q745588), member J. Copets, Jean J. Charlton Adhletis) → (seth Jahm Q745588), member J. Copets, Jean J. Charlton Adhletis) → (seth Jahm Q745588), member J. Charlton Adhletis) → (seth Jahm Q7455888), member J. Charlton Adhletis) → (seth Jahm Q74558888), member J. Charlton Adhletis) → (seth Jahm Q745588888888888888888888888888888888888	rafic laradio Jernal sapelano Q2126904, country af actitembig P27, colom bia Q789)  (Ilim, sawrd. The Padma Vibbushan) → (rajeshwar_dayal_Q1544859)  availareceived P166, padma-vibbushan_Q6272921  (Plun, played professionally for, Charlton Athletic) → (seth-plun Q7456581)  member of aport acam P54, charlton athletic f.e. Q194621  (Ilic, is, Bulgara's Ail: Time Most Capped Player) → (stiliyan_apetrovQ166265)  country of_activeneys.
Rajeshwar Dayal Ray Johnson (American Football) Sean Hanish Seth Plum	He then served as bishop of the Reman Calbolic Discose of Aranca, Colombia, mon 1900 to 2003 and a bishop of the Roman Calbolic Discose of Hames, Colombia, from 2001 to 2004.  Colombia, from 2001 to 2004.  Rep Johnson Reprosed Reberty Disson was an American froubil defensive backward of the property of the Parkins Vibinshamia, in 1909.  Rey Johnson Reprosed Reberty Disson was an American football defensive backward property of the Parkins Vibinshamia, and Parkins Vibinshamia, and Parkins Vibinshamia, and Parkinshamia Sana Hamish is an American film writer, producer and director best known for "Sana Day", "Restorm 1907 and "Sister Clies".  Sana Hamish Sana Hamish is an American film writer, producer and director best known for "Sana Day", "Restorm 1907 and "Sister Clies".  Been in Edinantion, Plan played professionally for Charlton Ablletic, Chelvan and Southerd Usinsid.  Plant received his only cap for England at age 22 valide playing for Charlton Ablletic, Andreas and Charleting and playing the full 900 minutes in a 1-1 win over France on 10May 1923.  A two-time autional champton in Freetyle wredling, he has also had feet place in the control convenients in Section Monthly and Department of the side.	Son Hainki, K., An American Film Wirer— (som Jamich Quifer Size).  Son Hainki, K., An American Film Wirer— (som Jamich Quifer Size Custry of distinctualty PZ).  Son Hainki, K., An American Film Wirer— (som Jamich Quifer Size Custry of distinctualty PZ).  Wirer—) (emb. Jamich Quifer Size).  Gen Hainki, K., An American Film Wirer—) (emb. Jamich Quifer Size).  Gen Hainki, K., An American Film Wirer—) (som Jamich Quifer Size).  Gen Jamich Quifer Size—) (som Jamich Quifer Size).  Gen Jamich Quifer Size—) (som Jamich Quifer Size).  General	crafied accide Joernal septima (Q120904, country of extirembig P27, colorn bia Q789)  (Bins, ward. The Padina Vibbinshan) — (sigoshwar_daysa) Q1544850 sound-accided P160, padina-vibbinshan Q672292)  (Plum, played professionally for, Charlton Athletie) — (seth-plum Q745681) member of aperts atom P54, charlton athletie Jz. Q19462)  (Ble. is, Bulgaria* S All-Time Most Capped Player) — (stillyan_petrox Q16520) country of extirembig P27, bulgaria Q19)
Rajeshwa Dayal Ray Johnson / American Football) Sean Manish Seth Plum Seth Plum Seth Plum Stillyan Ptrov Sililyan Ptrov Thomas / A. Dune Thomas / Scot / Commentator)	Its then served as bishop of the Reman Calholic Discose of Aranca, Colombia, toma 1990 to 2030 and a bishop of the Roman Calholic Discose of Hames, Colombia, from 2001 to 2004.  Colombia, from 2001 to 2004.  But Johnson Rymond Robert Johnson was an American football clarens's beach on played three secons in the Mariand Crobinal League with the Celevidar Rams and Chicago Candinals.  An American Grant State of the Colombia State of the Celevidar Rams and Chicago Candinals.  An American Grant State of the Celevidar Rams and Chicago Candinals.  Born in Edimonton, Plum played professionally for Charlton Abletic, Chelsea and Sondread United.  Sondread United.  Sondread United.  A two-time antional champion in Feestyle weretling, he has also had first - place finishes in international tearmanness in Kassid, Madolava, Tackey, and Budgaria charles and the Colombia Candinals.  A two-time antional champion in Feestyle weretling, he has also had first - place finishes in international tearmanness in Kassid, Madolava, Tackey, and Budgaria charles and the Candinal Candina	To July 2009. A process of the Control of the Control of the Control of Contr	crafied areados Jeernal superlano (2/12694), country of editeranhip P.27, colom has (2789)  (Him. ward. The Padina Vibbanhan) → (rajeshwar dayal Q154485)9  annul arcceved P160, padina-vibbanhan Q672392)  **  (Plum. played professionally for, Charlton Athletic) → (seth-plum.Q745681)  member of a portal arcceved P160, padina-vibbanhan Q672392)  (Him. played professionally for, Charlton Athletic) → (seth-plum.Q745681)  member of a portal archive P160, padina-vibbanhan Q6745681)  (Hit. is, Bidgaria's All-Time Most Capped Player) → (follysas-petrosyl166265)  country of aditernology P27, bolgaria Q219)  (Hit. graduated from Dayan University College) → (followas-petrosyl166265)
Rajeshwa_Dayal  Ray_Johnson_(American_Football)  Sean_Hanish  Seth_Flum  Seth_Flum  Seth_Flum  Sanislar_Nedlarv  Salisyan_Futorv  Silityan_Futorv  Thomas_A_Datan  Thomas_A_Cota(Commentator)  Thor_Heyershall	Its then served as bishop of the Reman Calholic Discose of Aranca, Colombia, toma 1990 to 2030 and a bishop of the Roman Calholic Discose of Hames, Colombia, from 2001 to 2004.  Colombia, from 2001 to 2004.  But Johnson Rymond Robert Johnson was an American football clarens's beach on played three secons in the Mariand Crobinal League with the Celevidar Rams and Chicago Candinals.  An American Grant State of the Colombia State of the Celevidar Rams and Chicago Candinals.  An American Grant State of the Celevidar Rams and Chicago Candinals.  Born in Edimonton, Plum played professionally for Charlton Abletic, Chelsea and Sondread United.  Sondread United.  Sondread United.  A two-time antional champion in Feestyle weretling, he has also had first - place finishes in international tearmanness in Kassid, Madolava, Tackey, and Budgaria charles and the Colombia Candinals.  A two-time antional champion in Feestyle weretling, he has also had first - place finishes in international tearmanness in Kassid, Madolava, Tackey, and Budgaria charles and the Candinal Candina	Seas Bandis, A., A. American Film Wirey — (seas Bandis (1987-22); super-law (1987-22); super-	rafic laradio Jernal sapelano Q2126904, country af actitembig P27, colom bia Q789)  (Ilim, sawrd. The Padma Vibbushan) → (rajeshwar_dayal_Q1544859)  availareceived P166, padma-vibbushan_Q6272921  (Plun, played professionally for, Charlton Athletic) → (seth-plun Q7456581)  member of aport acam P54, charlton athletic f.e. Q194621  (Ilic, is, Bulgara's Ail: Time Most Capped Player) → (stiliyan_apetrovQ166265)  country of_activeneys.
Rajeshwar Doyal  Ray Johnson / American / Feetball)  Sean Jianish  Sesh Plum  Sesh Plum  Senh Plum  Sanislav Nedlarv  Slanislav Ardisav  Slanislav Ardisav  Thoman A. Joan  Thoman A. Joan  Thorath Sest of Commentator)  Thor I skyenlatal  Ventaresh Kulkarni	He then served as bishop of the Reman Catholic Discose of Aranca, Colombia, mon 1900 to 200 and a bishop of the Roman Catholic Discose of Human-Honda, mon 1900 to 200 and a bishop of the Roma Catholic Discose of Human-Honda, December 1900 and the Catholic Control of the Catholic Ca		crafied areafus Jerenia sapelano Q.212094. country of entirennisp P.27, colom has Q.739)  Glim, savad. The Padina Vibinshan Q. (rajeshwa "Jayal Q1544859 annudareceved P160, padina-vibinshan Q072392)  Glims, played professionally for, Charlton Ahlette) → (seth-plum Q735681)  Glims, played professionally for, Charlton Ahlette) → (seth-plum Q735681)  member of aports atom P54, charlton athletic Je. Q19462)  Glie, is, Bolgaria S. All-Time Most Capped Phyrry → (stiliyan-periox Q16020 country of entirennisp P27, bulgaria Q219)  Glie, is, Bolgaria S. All-Time Most Capped Phyrry → (stiliyan-periox Q16020 country of entirennisp P27, bulgaria Q219)  Glie, is, Bolgaria S. All-Time Most Capped Phyrry → (stiliyan-periox Q16020 country of entirennisp P27, bulgaria Q219)  Glie, have the proposal professional profe
Rajohwar Doyal  Ray Johnson American Jeotball)  Sean Jianish  Sedh Jiam  Sedh Jiam  Sedh Jiam  Sedh Jiam  Sedh Jiam  Stanislar Nedhov  Shanislar Nedhov  Shilyan Jetrov  Thomas A, Joan  Thomas A, Joan  Thomas A, Sott (Commentator)  Thort Alcycolabl  Ventatesh Kulkarni	Its then served as bashop of the Reman Calobalc Discose of Aranca, Colombia, 1900 to 2000 and a bishop of the Roman Calobalc Discose of Hames, Colombia, from 2001 to 2004.  Colombia, from 2001 to 2004.  But all the Calobalc Calo	Seas Bandis, A., A. American Film Wirey — (seas Bandis (1987-22); super-law (1987-22); super-	crafied accides Joernal septelino (2/12094). country of Leitzenship P.77, colom has Q789)  (Hins, varied. The Padina Vibbinshian) → (eigeshwar_daysa) Q15448519  accident P.66, padina-vibbinshian Q672392)  **  **  **  **  **  **  **  **  **
Rajeshwa Dayal  Ray Johnson / American Jeothall)  Sean Jianish  Seth Plum  Seth Plum  Seth Plum  Stanislav Nedlavv  Stanislav Nedlavv  Staliyan Petrov  Thoman / A. Dunt  Thoman / A. Dunt  Thoran / A. Dunt  Thoran / A. Dunt  Thoran / A. Dunt  Venkatesh / Kulkarni  Vitor / Castro Jbe / Souza	He then served as bishop of the Reman Caldotic Discose of Aramaca. Colombia. To min 1900 to 200 and a bishop of the Roman Caldotic Discose of Hames-Honda, non-1900 to 200 and a bishop of the Roma Caldotic Discose of Hames-Honda, December 1900 and the Caldotic Cald	in Jacobs and Jacobs a	crafied areados Jerenda sepetima (2) (2) (2004). country of chiterenhisp P.27; colom has (2789).  (Hins, ward. The Padina Vibhushan) → (rajeshwar dayal Q154485)9 and dayaccered P160, padma-vibhushan Q27232).  **  (Plans, Jahyad professionally for, Charlton Althetic) → (seth_shum,Q7456581 member of aporto-sheam P54, tharlton adhletic) → (seth_shum,Q7456581 member of aporto-sheam P54, tharlton adhletic) ∠ (Q19462).  (Ble. is, Bulgatia's All-Time Mont Capped Player) → (stillyan_section/Q166265 country of achitemship P27, Palugfaria Q219).  (Ble. graduated from, Depaid University College) → (thomas a_abium,Q31081899).  (Ble. graduated from, Depaid University College) → (thomas a_abium,Q31081899).  (Ble. graduated from, Depaid University College) → (thomas a_abium,Q31081899).  (Ble. graduated from, Depaid University College) → (thomas a_abium,Q31081899).  (Ble. graduated from, Depaid University College) → (thomas a_abium,Q31081899).  (Ble. graduated from, Depaid University College) → (thomas a_abium,Q31081899).  (Ble. graduated from, Depaid University College) → (thomas a_abium,Q31081899).  (Ble. graduated from, Depaid University College) → (thomas a_abium,Q31081899).  (Ble. graduated from, Depaid University College) → (thomas a_abium,Q31081899).
Rajeshwar Doyal  Ray Johnson / American / Feetball)  Sean Jianish  Sesh Plum  Sesh Plum  Senh Plum  Sanislav Nedlarv  Slanislav Ardisav  Slanislav Ardisav  Thoman A. Joan  Thoman A. Joan  Thorath Sest of Commentator)  Thor I skyenlatal  Ventaresh Kulkarni	Its then served as bashop of the Reman Calobalc Discose of Aranca, Colombia, 1900 to 2000 and a bishop of the Roman Calobalc Discose of Hames, Colombia, from 2001 to 2004.  Colombia, from 2001 to 2004.  But all the Calobalc Calo		crafied acrades Jeernal superlam Q2126904, country of editeranhip P27, colon has Q789)  Glim, sawrid, The Pasima Vibhushas) → (rajeshwar_daysal_Q15448539 avail_arcevived P166, padma.vibhushasha_Q672392)  GPinn, played professionally for, Charlton Adhletic) → (seth.plum_Q7456581 member_of_aport_atem_P54, charlton_adhletic_f_c_Q19462)  GHin, is, Bulganis' Sall/Time Most Capped Player) → (stillyam_petror_Q165281 country_of_aditionablep P27, labigatic_Q219)  (He, graduated from, Depail University College) → (thomas_a_dnum_Q3308299 educated_L1709, depail_amivenity_college_of_lam_Q524034)  (Thor Heyeddal, was, A Norwegian Adventure) → (thor Leyendal_Q135622 country_of_aditionablep P27, arrays_Q20)

Figure 13: Mapped facts: MAMA-BERT\_{\rm LARGE} vs. MAMA-GPT-2 $_{\rm XL}$  on Wikidata.

ID	Sentence	Candidate facts to unmapped facts
Nick_Aldis	He was also a co - presenter of "Britain's Strongest Man" on Challenge TV in the United Kingdom.	(Challenge Tv, in, The United Kingdom) → (Challenge TV, in, united_kingdom.Q145)
Douglas_Bader	At the age of two, Bader joined his parents in India for a year.	(His Parents, in, India) → (douglas_bader.Q348780, in, india.Q668)
Douglas_Bader	He remained in France after the war, where, having attained the rank of major, he died in 1922 of complications from	(He, in, France) → (douglas_bader.Q348780, in, france.Q142)
	those wounds in a hospital in Saint - Omer, the same area where Bader would bail out and be captured in 1941.	
Douglas_Bader	On 2 July 1941 he was awarded the bar to his DSO.	(He, was awarded the bar, his DSO) → (douglas.bader.Q348780, was awarded the bar, distin-
		guished_service_order.Q615838)
Helen_Storrow	His father, also named James Jackson Storrow, was a prominent attorney, whose clients included Alexander Graham	(His Father, was, A Prominent Attorney) → (His Father, occupation.P106, lawyer.Q40348)
	Bell and the government of Venezuela; his mother, Ann Maria Perry, was the grandchild of naval hero Commodore	
	Oliver Hazard Perry, and a distant cousin of President Thomas Jefferson.	
Helen_Storrow	Helen Storrow Helen Osborne Storrow was a prominent American philanthropist, early Girl Scout leader, and chair	(Helen Osborne Storrow, was, A Prominent American Philanthropist) → (helen_storrow.Q5703224, place_of_birth.P19
	of the World Committee of the World Association of Girl Guides and Girl Scouts for eight years .	united_states.Q30)
Jacob_Van_Ruisdael	His cousin Jacob was a registered Mennonite in Amsterdam .	(His Cousin, was, A Registered Mennonite) → (His Cousin, was, A Registered Mennonite)
Jacob_Van_Ruisdael	He appears to have been strongly influenced by other contemporary local Haarlem landscapists, most notably Cornelis	(He, have been strongly influenced by, landscape painting) → (jacob_van_ruisdael.Q213612, have been strongly influ-
	Vroom and Allaert van Everdingen .	enced by, landscape_art.Q191163)
Liaquat_Ali_Khan	Liaquat Ali Khan was educated at the Aligarh Muslim University in India, and then at Oxford University in the United	(Liaquat Ali Khan, in, India) → (liaquat_ali_khan.Q295713, in, india.Q668)
	Kingdom.	
Pauline_Baynes	Baynes began her education at a convent school .	(Her Education, at, A Convent School) → (pauline_baynes.Q101951, at, catholic_school.Q1138671)
Pauline_Baynes	Her most vivid recollection of their New Year's Eve lunch at Magdalen College was of his gleefully picking nuts out	(Their New Year'S Eve Lunch, at, Magdalen College) → (pauline_baynes.Q101951, at, mag-
	of a bowl of Brussels sprouts .	dalen_college,_oxford.Q81162)
Pauline_Baynes	By the time that she left, she had already formed the ambition of becoming an illustrator.	(She, formed the ambition of becoming, An Illustrator) → (pauline_baynes.Q101951, formed the ambition of becom-
		ing, illustrator.Q644687)
Thor_Heyerdahl	He was an atheist .	(He, was, An Atheist) → (thor_heyerdahl.Q133622, was, An Atheist)
Thor. Heyerdahl	He is buried in the garden of the family home in Colla Micheri .	(He, is buried, Colla Micheri) → (thor_heyerdahl.Q133622, is buried, colla_micheri.Q3647771)
Neville_Southall	He moved on to Cheshire County League club Winsford United at the age of 20.	(He, to, Cheshire County League Club Winsford United) → (neville_southall.Q436650, to, wins-
		ford_united_f.cQ5213266)
Neville_Southall	He later became a player - coach at York City , Rhyl , Shrewsbury Town and Dagenham & Redbridge .	(He, became, A Player-Coach) → (neville_southall.Q436650, occupation.P106, A Player-Coach)
John_Maynard_Keynes	After the war, Winston Churchill attempted to check the rise of Keynesian policy - making in the United Kingdom and	(Keynesian Policy-Making, in, The United Kingdom) → (john_maynard_keynes.Q9317, in, united_kingdom.P145)
	used rhetoric critical of the mixed economy in his 1945 election campaign.	
John_Maynard_Keynes	Apart from Great Britain, Keynes' s attention was primarily focused on the United States.	(Keynes'S Attention, was, The United States) → (john_maynard_keynes.Q9317, was, united_states.Q30)
John_Maynard_Keynes	John Maynard Keynes John Maynard Keynes , 1st Baron Keynes , was a British economist , whose ideas fundamentally	(John Maynard Keynes, was, A British Economist) → (john maynard keynes.Q9317, was, united kingdom.P145)
	changed the theory and practice of macroeconomics and the economic policies of governments .	
Emst_Haeckel	Ernst Haeckel Ernst Heinrich Philipp August Haeckel was a German zoologist , naturalist , philosopher , physician ,	(August Haeckel, was, A German Zoologist) → (ernst_haeckel.Q48246, was, germany.Q183)
	professor, marine biologist, and artist who discovered, described and named thousands of new species, mapped a	
	genealogical tree relating all life forms, and coined many terms in biology, including "ecology", "phylum", "	
	phylogeny", and "Protista."	
Emst_Haeckel	Haeckel was awarded the title of Excellency by Kaiser Wilhelm II in 1907 and the Linnean Society of London's	(Haeckel, was awarded the, Excellency) → (ernst_haeckel.Q48246, award_received.P166, Excellency)
	prestigious Darwin - Wallace Medal in 1908 .	
Emst Haeckel	He was also a pacifist until the First World War, when he wrote propaganda in favor of the war.	(He, was, A Pacifist) → (ernst_haeckel.Q48246, was, A Pacifist)

Figure 14: Unmapped facts: MAMA-BERT  $_{\rm LARGE}$  on Wikidata.

ID	Sentence	Candidate facts to unmapped facts
Douglas_Bader	He left St Edward's in early 1928, aged 18.	(He, left, St Edward) → (douglas_bader.Q348780, left, st_edward's_school,_oxford.Q128260)
Douglas_Bader	Group Captain Sir Douglas Robert Steuart Bader, was a Royal Air Force flying ace during the Second World War.	(Douglas Bader Group Captain Sir Douglas Robert Steuart Bader, was, A Royal Air Force Flying Ace) → (douglas bader,Q348780, was, flying_ace,Q222982)
Douglas_Bader	On 2 July 1941 he was awarded the bar to his DSO.	(He, was awarded the bar to, his DSO) → (douglas_bader.Q348780, was awarded the bar to, distinguished_service_order.Q615838)
Helen_Storrow	His father, also named James Jackson Storrow, was a prominent attorney, whose clients included Alexander Graham Bell and the government of Venezuela; his mother, Ann Maria Perry, was the grandchild of naval hero Commodore Oliver Hazard Perry, and a distant cousin of President Thomas Jefferson.	(His Father, was, A Prominent Attorney) → (His Father, occupation.P106, lawyer.Q40348)
Helen_Storrow	Helen Osborne Storrow was a prominent American Philanthropist, carty Girl Scout leader, and chair of the World  Committee of the World Association of Girl Guides and Girl Scouts for eight years. (Helen Osborne Storrow, was, A Prominent American Philanthropist)   Helen Association of Girl Guides and Girl Scouts for eight years.	
Jacob_Van_Ruisdael	Ruisdael lived and worked in Amsterdam for the rest of his life.	(Ruisdael, lived, Amsterdam) → (jacob_van_ruisdael.Q213612, lived, amsterdam.Q727); (Ruisdael, lived and worke in, Amsterdam) → (jacob_van_ruisdael.Q213612, lived and worked in, amsterdam.Q727)
Liaquat_Ali_Khan	Liaquat Ali Khan was educated at the Aligarh Muslim University in India, and then at Oxford University in the United Kingdom.	(Liaquat Ali Khan, was educated at, The Aligarh Muslim University) → (liaquat_ali_khan.Q295713, was educated a aligarh_muslim_university.Q196544)
Liaquat_Ali_Khan	After the death of his father in 1919, Ali Khan, with British Government awarding the grants and scholarship, went to England, attending Oxford University's Exeter College to pursue his higher education.	(His Higher Education, pursue, Oxford University'S Exeter College) → (liaquat_ali_khan.Q295713, pursue, university_of_oxford.Q34433)
Liaquat_Ali_Khan	In 1940, Khan was made the deputy leader of the Muslim League Parliamentary party.	(Khan, was made the deputy leader of, The Muslim League Parliamentary Party) → (liaquat_ali_khan.Q295713, deput leader, all-india_muslim_league.Q223898)
Pauline Baynes	When Baynes's father retired, he left India and returned to England, settling with Baynes's mother in a house close to Baynes's own near Farnham in southwest Surrey.	(He, left, India) → (pauline baynes.Q101951, left, india.Q668)
Pauline_Baynes	Baynes began her education at a convent school. (Her Education, at, A Convent School)   (pauline_baynes.Q101951, at, catholic_school.Q1138671)	
Pauline_Baynes	Her most vivid recollection of their New Year's Eve lunch at Magdalen College was of his gleefully picking nuts out of a bowl of Brussels sprouts.	(Their New Year'S Eve Lunch, at, Magdalen College) → (pauline_baynes.Q101951, at, magdalen_college_oxford.Q81162)
Pauline_Baynes	She was not a diligent student, frittering away her time on coffee and parties; and she left the Slade without a qualifica- tion, But she did achieve the distinction, one shared with her sister, of exhibiting at the Royal Academy of Arts in 1939. In 1940, a year into World War II, both Bayrues sisters joined the Women's Voluntary Service.	(She, without a qualification, The Slade) → (pauline_baynes.Q101951, without a qualification slade_school_of_fine_art.Q1399299)
Thor_Heyerdahl	His theories rarely won any scientific acceptance, whereas Heyerdahl himself rejected all scientific criticism and con- centrated on publishing his theories in popular books aimed at the general public.	(His Theories, at, The General Public) → (thor_heyerdahl.Q133622, at, general_public)
Thor_Heyerdahl	He was an atheist.	(He, was, An Atheist) → (thor heyerdahl Q133622, was, An Atheist)
Neville_Southall	As a teenager, Southall had unsuccessful trials at Wrexham, Crewe Alexandra and Bolton Wanderers.	(Southall, at, Wrexham) → (neville_southall.Q436650, at, wrexham_a.f.cQ18529); (Southall, at, Crewe Alexandra → (neville_southall.Q436650, at, crewe_alexandra_f.cQ19587)
John_Maynard_Keynes	John Maynard Keynes, 1st Baron Keynes, was a British economist, whose ideas fundamentally changed the theory and practice of macroeconomics and the economic policies of governments.	(John Maynard Keynes, was, A British Economist) → (john maynard keynes Q9317, was, united kingdom Q145)
John_Maynard_Keynes	In January 1889 at the age of five and a half, Keynes started at the kindergarten of the Perse School for Girls for five mornings a week.	(Keynes, at, The Perse School) → (john_maynard_keynes.Q9317, at, the_perse_school.Q7756751)
John_Maynard_Keynes	In January 1892, at eight and a half, he started as a day pupil at St Faith's preparatory school.	(He, at, St Faith'S Preparatory School) → (john_maynard_keynes.Q9317, at, st_faith's_school.Q7593056)
John_Maynard_Keynes	Keynes was a lifelong member of the Liberal Party, which until the 1920s had been one of the two main political parties	(Keynes, was a lifelong member of, The liberal party) → (john_maynard_keynes.Q9317, was a lifelong member of)
	in the United Kingdom, and as late as 1916 had often been the dominant power in government.	liberal.party.(uk).Q622441)
Emst_Haeckel	Haeckel was awarded the title of Excellency by Kaiser Wilhelm II in 1907 and the Linnean Society of London's prestigious Darwin-Wallace Medal in 1908.	(Haeckel, was awarded the, Excellency) → (ernst_haeckel.Q48246, award_received.P166, Excellency)
Ernst_Haeckel	He was also a pacifist until the First World War, when he wrote propaganda in favor of the war.	(He, was, A Pacifist) → (ernst_haeckel.Q48246, was, A Pacifist)
Emst_Haeckel	He was also a social Darwinist who believed that "survival of the fittest" was a natural law, and that struggle led to improvement of the race.	(He, was, A Social Darwinist) → (ernst_haeckel.Q48246, was, A Social Darwinist)
Ernst_Haeckel	Ernst Haeckel was born on 16 February 1834, in Potsdam.	(Haeckel, was born on 17 February 1834, in, Potsdam) → (ernst_haeckel.Q48246, was born on 17 February 1834, in potsdam.Q1711)

Figure 15: Unmapped facts: MAMA-GPT- $2_{\rm XL}$  on Wikidata.

ID	Sentence	BERT <sub>LARGE</sub> Candidate facts	GPT-2×1
Nick_Aldis	He was also a co - presenter of "Britain's Strongest Man" on Challenge TV in	(Challenge Tv, in, The United Kingdom) → (Challenge TV, in,	· ·
	the United Kingdom .	united_kingdom.Q145)	
Douglas,Bader	Group Captain Sir Douglas Robert Steuart Bader, was a Royal Air Force flying ace during the Second World War.		(Douglas Bader Group Captain Sir Douglas Robert Steuart Bader, was, A Royal A: Force Flying Ace) → (douglas bader, Q348780, was, flying ace. Q222982)
Douglas_Bader	At the age of two, Bader joined his parents in India for a year.	(His Parents, in, India) → (douglas_bader.Q348780, in, india.Q668)	
Douglas_Bader	On 2 July 1941 he was awarded the bar to his DSO.	(He, was awarded the bar, his DSO) → (douglas_bader.Q348780, was awarded the bar, distinguished_service_order.Q615838)	(He, was awarded the bar to, his DSO) → (douglas bader.Q348780, was awarde the bar to, distinguished service order.Q615838)
Helen,Storrow	His father, also named James Jackson Storrow, was a prominent attorney, whose clients included Alexander Graham Bell and the government of Venezuela; his mother. Ann Maria Perry, was the grand-child of naval hero Commodore Oliver Hazard Perry, and a distant cousin of President Thomas Jefferson.	(His Father, was, A Prominent Attorney) $\rightarrow$ (His Father, occupation.P106, lawyer.Q40348)	(His Father, was, A Prominent Attorney) → (His Father, occupation.P106 lawyer.Q40348)
Helen_Storrow	Helen Osborne Storrow was a prominent American philanthropist, early Girl Scout leader, and chair of the World Committee of the World Association of Girl Guides and Girl Scouts for eight years.	(Helen Osborne Storrow, was, A Prominent American Philanthropist) $\rightarrow$ (helen_storrow.Q5703224, was, united_states.Q30)	(Helen Osborne Storrow, was, A Prominent American Philanthropist) → (helen_storrow.Q5703224, was, united_states.Q30)
Jacob_Van_Ruisdael	Ruisdael lived and worked in Amsterdam for the rest of his life.	-	(Ruisdael, lived, Amsterdam) → (jacob,van,ruisdael,Q213612, lived, am sterdam,Q727); (Ruisdael, lived and worked in, Amsterdam) → (ja cob,van,ruisdael,Q213612, lived and worked in, amsterdam,Q727)
Jacob_Van_Ruisdael	His cousin Jacob was a registered Mennonite in Amsterdam .	(His Cousin, was, A Registered Mennonite) → (His Cousin, was, A Registered Mennonite)	•
Jacob_Van_Ruisdael	He appears to have been strongly influenced by other contemporary local Haarlem landscapists, most notably Cornelis Vroom and Allaert van Everdingen.	(He, have been strongly influenced by, landscape painting) → (jacob,van,ruisdael,Q213612, have been strongly influenced by, landscape,art,Q191163)	-
Liaquat_Ali_Khan	Liaquat Ali Khan was educated at the Aligarh Muslim University in India, and then at Oxford University in the United Kingdom.	(Liaquat Ali Khan, in, India) → (liaquat_ali_khan.Q295713, in, india.Q668)	(Liaquat Ali Khan, was educated at, The Aligarh Muslim University) → (liaquat_ali_khan,Q295713, was educated at, aligarh_muslim_university,Q196544)
Liaquat_Ali_Khan	After the death of his father in 1919, Ali Khan, with British Government awarding the grants and scholarship, went to England, attending Oxford University's Exeter College to pursue his higher education.		(His Higher Education, pursue, Oxford University'S Exeter College) → (li aquat_ali_khan.Q295713, pursue, university_of_oxford.Q34433)
Liaquat_Ali_Khan	In 1940, Khan was made the deputy leader of the Muslim League Parliamentary party.	•	(Khan, was made the deputy leader of, The Muslim League Parliamentary Party → (liaquat,ali,khan.Q295713, deputy leader, all-india,muslim,league.Q223898)
Pauline_Baynes	When Baynes's father retired, he left India and returned to England, settling with Baynes's mother in a house close to Baynes's own near Farnham in southwest Sur- rey.		(He, left, India) → (pauline_baynes.Q101951, left, india.Q668)
Pauline_Baynes	Baynes began her education at a convent school.	(Her Education, at, A Convent School) → (pauline_baynes.Q101951, at, catholic_school.Q1138671)	(Her Education, at, A Convent School) → (pauline_baynes.Q101951, at catholic_school.Q1138671)
Pauline,Baynes	Her most vivid recollection of their New Year's Eve lunch at Magdalen College was of his gleefully picking nuts out of a bowl of Brussels sprouts.	(Their New Year'S Eve Lunch, at, Magdalen College) → (pauline.baynes.Q101951, at, magdalen.college,.oxford.Q81162)	(Their New Year'S Eve Lunch, at, Magdalen College) — (pauline_baynes.Q101951, at, magdalen_college_oxford.Q81162)
Pauline_Baynes	She was not a diligent student, frittering away her time on coffee and parties; and she left the Slade without a qualification, But she did achieve the distinction, one shared with her sister, of exhibiting at the Royal Academy of Arts in 1939, In 1940, a year into World War II, both Baynes sisters joined the Women's Voluntary Service.		(She, without a qualification, The Slade) → (pauline_baynes.Q101951, without qualification, slade_school_of_fine_art.Q1399299)
Pauline_Baynes	By the time that she left, she had already formed the ambition of becoming an illustrator.	(She, formed the ambition of becoming, An Illustrator) → (pauline baynes, Q101951, formed the ambition of becoming, illustrator, Q644687)	•
Thor_Heyerdahl	His theories rarely won any scientific acceptance, whereas Heyerdahl himself re- jected all scientific criticism and concentrated on publishing his theories in popular books aimed at the general public.		(His Theories, at, The General Public) → (thor_heyerdahl.Q133622, at, general_public)
Thor_Heyerdahl	He was an atheist .	(He, was, An Atheist) → (thor_heyerdahl.Q133622, was, An Atheist)	(He, was, An Atheist) → (thor_heyerdahl.Q133622, was, An Atheist)
Thor_Heyerdahl	He is buried in the garden of the family home in Colla Micheri .	(He, is buried, Colla Micheri) → (thor_heyerdahl.Q133622, is buried, colla_micheri.Q3647771)	
Neville_Southall	As a teenager, Southall had unsuccessful trials at Wrexham, Crewe Alexandra and Bolton Wanderers.		(Southall, at, Wrexham) → (neville-southall.Q436650, at wrexham,a.f.cQ18529); Osuthall, at, Crew Alexandra) → (neville-southall.Q436650, at, crewe_alexandra.f.c.Q19587)
Neville_Southall	He moved on to Cheshire County League club Winsford United at the age of 20.	(He, to, Cheshire County League Club Winsford United) → (neville_southall.Q436650, to, winsford_united_f.cQ5213266)	
Neville_Southall	He later became a player - coach at York City , Rhyl , Shrewsbury Town and Da- genham & Redbridge .	(He, became, A Player-Coach) → (neville_southall.Q436650, occupation.P106, A Player-Coach)	•
John_Maynard_Keynes	In January 1889 at the age of five and a half, Keynes started at the kindergarten of the Perse School for Girls for five mornings a week.	•	(Keynes, at, The Perse School) → (john_maynard_keynes.Q9317, at the_perse_school.Q7756751)
John_Maynard_Keynes	In January 1892, at eight and a half, he started as a day pupil at St Faith's preparatory school.		(He, at, St Faith'S Preparatory School) → (john_maynard_keynes.Q9317, at st_faith's_school.Q7593056)
John_Maynard_Keynes	After the war, Winston Churchill attempted to check the rise of Keynesian policy- making in the United Kingdom and used rhetoric critical of the mixed economy in his 1945 election campaign.	(Keynesian Policy-Making, in, The United Kingdom) → (john.maynard.keynes.Q9317, in, united.kingdom.P145)	
John_Maynard_Keynes	Keynes was a lifelong member of the Liberal Party, which until the 1920s had been one of the two main political parties in the United Kingdom, and as late as 1916 had often been the dominant power in government.		(Keynes, was a lifelong member of, The liberal party) — (john,maynard,keynes,Q9317, was a lifelong member of, lib eral,party,(uk),Q622441)
Ernst.Haeckel	Ernst Hacckel Ernst Heinrich Pfülipp August Hacckel was a German zoologist , naturalist , philosopher , physician , professor , marine biologist , and artist who discovered , described and named thousands of new species , mapped a genealogical tree relating all life forms , and coined many terms in biology , including "ecology ", "phylum", "phylogeny" , and "Protista ."	(August Haeckel, was, A German Zoologist) $\rightarrow$ (ernst.haeckel.Q48246, was, germany.Q183)	•
Ernst_Haeckel	Ernst Haeckel was born on 16 February 1834, in Potsdam.	•	(Haeckel, was born on 17 February 1834, in, Potsdam) → (ernst.haeckel.Q48246 was born on 17 February 1834, in, potsdam.Q1711)
Ernst_Haeckel	Haeckel was awarded the title of Excellency by Kaiser Wilhelm II in 1907 and the Linnean Society of London's prestigious Darwin-Wallace Medal in 1908.	(Haeckel, was awarded the, Excellency) → (ernst_haeckel.Q48246, award_received.P166, Excellency)	(Haeckel, was awarded the, Excellency) → (ernst_haeckel.Q48246 award_received.P166, Excellency)
Ernst_Haeckel	He was also a pacifist until the First World War, when he wrote propaganda in favor of the war.	(He, was, A Pacifist) → (ernst_haeckel.Q48246, was, A Pacifist)	(He, was, A Pacifist) → (ernst_haeckel.Q48246, was, A Pacifist)

Figure 16: Unmapped facts: MAMA-BERT\_{\mathrm{LARGE}} vs. MAMA-GPT-2xL on Wikidata.

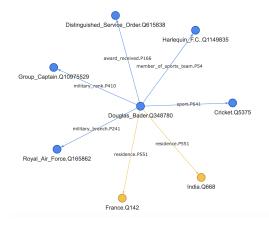


Figure 17: A snapshot subgraph of the open KG generated by MAMA-BERT $_{\rm LARGE}$  from the Wikipedia page "Douglas\_Bader".

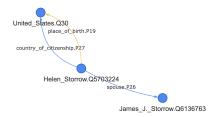


Figure 18: A snapshot subgraph of the open KG generated by MAMA-BERT $_{\rm LARGE}$  from the Wikipedia page "Helen\_Storrow".

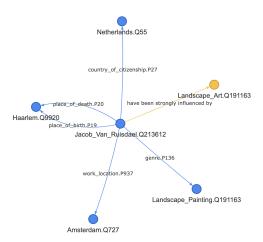


Figure 19: A snapshot subgraph of the open KG generated by MAMA-BERT $_{\rm LARGE}$  from the Wikipedia page "Jacob\_van\_Ruisdael".

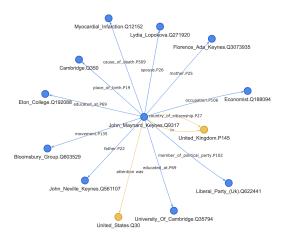


Figure 20: A snapshot subgraph of the open KG generated by MAMA-BERT $_{\rm LARGE}$  from the Wikipedia page "John $_{\rm May}$ nard $_{\rm Keynes}$ ".

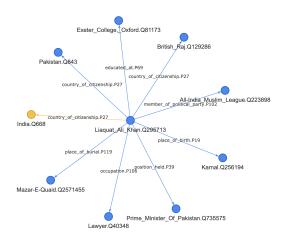


Figure 21: A snapshot subgraph of the open KG generated by MAMA-BERT  $_{\rm LARGE}$  from the Wikipedia page "Liaquat\_Ali\_Khan".

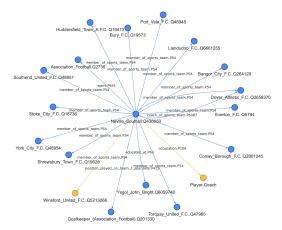


Figure 22: A snapshot subgraph of the open KG generated by MAMA-BERT $_{\rm LARGE}$  from the Wikipedia page "Neville\_Southall".

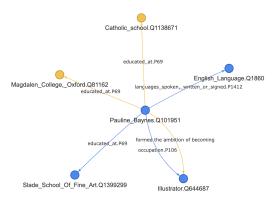


Figure 23: A snapshot subgraph of the open KG generated by MAMA-BERT  $_{\rm LARGE}$  from the Wikipedia page "Pauline\_Baynes".

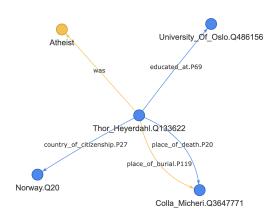


Figure 24: A snapshot subgraph of the open KG generated by MAMA-BERT  $_{\rm LARGE}$  from the Wikipedia page "Thor\_Heyerdahl".

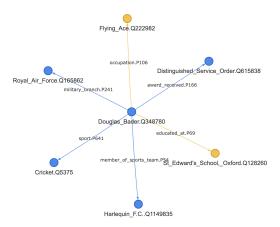


Figure 25: A snapshot subgraph of the open KG generated by MAMA-GPT- $2_{\rm XL}$  from the Wikipedia page "Douglas\_Bader".

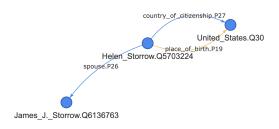


Figure 26: A snapshot subgraph of the open KG generated by MAMA-GPT- $2_{\rm XL}$  from the Wikipedia page "Helen\_Storrow".

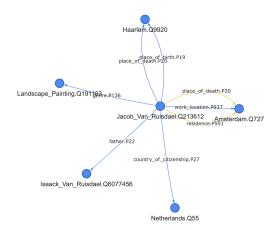


Figure 27: A snapshot subgraph of the open KG generated by MAMA-GPT- $2_{\rm XL}$  from the Wikipedia page "Jacob\_van\_Ruisdael".

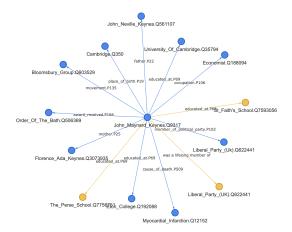


Figure 28: A snapshot subgraph of the open KG generated by MAMA-GPT- $2_{\rm XL}$  from the Wikipedia page "John\_Maynard\_Keynes".

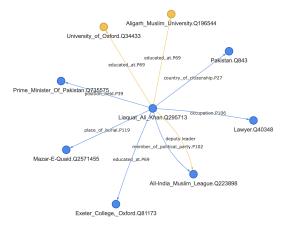


Figure 29: A snapshot subgraph of the open KG generated by MAMA-GPT- $2_{\rm XL}$  from the Wikipedia page "Liaquat\_Ali\_Khan".

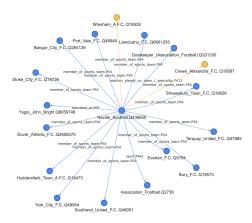


Figure 30: A snapshot subgraph of the open KG generated by MAMA-GPT- $2_{\rm XL}$  from the Wikipedia page "Neville\_Southall".

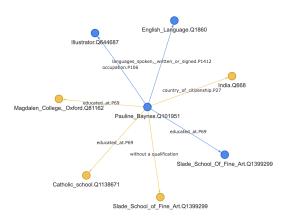


Figure 31: A snapshot subgraph of the open KG generated by MAMA-GPT- $2_{\rm XL}$  from the Wikipedia page "Pauline\_Baynes".



Figure 32: A snapshot subgraph of the open KG generated by MAMA-GPT- $2_{\rm XL}$  from the Wikipedia page "Thor\_Heyerdahl".