

Supplement to: The Jazz Ontology: A semantic model and large-scale RDF repositories for jazz

1. Requirements: competency questions

CQ1 Where and when were the tracks on a CD recorded?

CQ2 What is the band line-up for the given performance?
Who played which instruments?

CQ3 Which bands played/recorded a given tune?

CQ4 Which instruments has a given performer played?

CQ5 Find performances whose recordings resulted in the same audio (to identify duplications or metadata irregularities)

CQ6 Find all solos and their timestamps in a performance

CQ7 Find all performances which have solos with attributed musicians

CQ8 Find all solos by a given musician over a given period

CQ9 What musical instruments played a solo on a given CD?

CQ10 For a given lick, find the date when it was played/recorded and the dates when it was released

CQ11 For a given lick, find all matches by musicians who played together with the lick's musician

CQ12 For a given lick, find all matches within a given time period, and musicians who played them

CQ13 For a given lick, find all matches played by the same musician

2. Jazz Ontology semantic concept definitions

Dataset is a set of all audio files present in a collection, for which metadata can be captured.

Track is implemented as the Music Ontology class Track (mo:Track), corresponds to the track tag in MusicBrainz. Stands for a track on a CD or an audio file, usually containing one song/composition. It is a publication of a SoundSignal.

Medium is implemented as mo:Record, corresponds to the medium tag in MusicBrainz. Medium is a part of the Release, e.g. if the Release is a Series; it can correspond to the content of a CD or LP if the Release contains more than one of those.

Release corresponds to the release tag in MusicBrainz. It can contain one or several Media and is a publication of an Album.

ReleaseEvent from the Music Ontology has a date and a place.

SoundSignal is implemented as a subclass of mo:Signal, corresponds to the recording tag in MusicBrainz. This is the sound of a song/composition captured in the signal. It can have signal attributes such as fingerprint or duration.

Album is implemented as mo:SignalGroup, corresponds to the release group tag in MusicBrainz. It is a collection of SoundSignals that constitutes an artistic (or commercial) entity. It can be published in various releases. It should have an unambiguous list of SoundSignals.

Performance is implemented as mo:Performance. This is an event in which Performers perform together a song/piece/composition which is captured in a SoundSignal. It can have musical and stylistic attributes such as chord progression or style (e.g. Blues or Latin).

Session is a subclass of mo:Performance. Session is an event consisting of sub-events which are Performances of a single song/piece/composition. It has a date (which can be approximate), a place (Area, Venue), one or more Bands can play in a session.

Tune is implemented as mo:MusicalWork, corresponds to the work tag in MusicBrainz. Tune is the composition performed in a Performance. It is identified by a title, can have a composer and a chord/functional progression. Tune is the basis of a jazz performance, which provides a melodic theme and/or a chord progression for improvisation.

Label is the music label which releases a Release in a ReleaseEvent. It is implemented as mo:Label, corresponds to the MusicBrainz tag label.

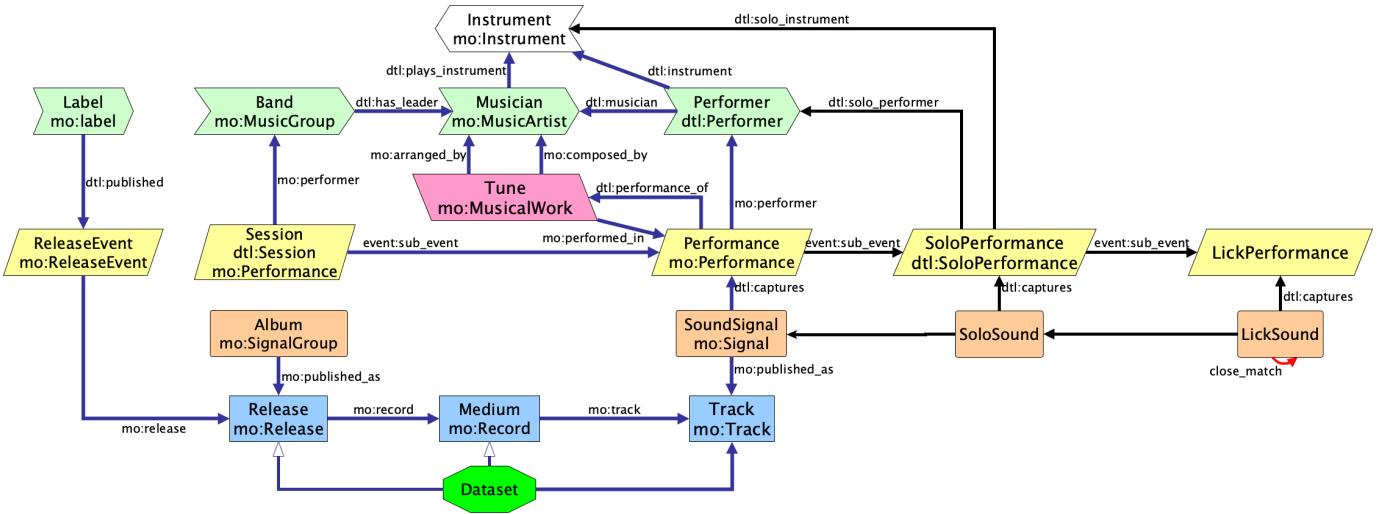


Figure 1: The complete Jazz ontology semantic concepts diagram, including basic FRBR layers, agents, solos and licks. Each shape represents a class, with its semantic concept, and the class definition that was implemented. The form/colour coding is retained throughout the paper to illustrate FRBR layers. See Section S2 of this Supplement for jazz semantic concepts definitions. For more details of the ontology implementation see Section 4 of the paper.

Musician is implemented as mo:MusicArtist, can be a playing musician, an arranger, a composer.

Performer A Performer is a triple of the form (Performance, Musician, Instrument), there can be more than one Performer relating a Performance to a given Musician, if that Musician plays more than one Instrument in that Performance. This is to reflect the prevalence of multi-instrumentalism in jazz.

Instrument is a musical instrument. This class can be linked to any music instrument ontology.

Band is a group of musicians playing together. It can have a Leader (or in some cases more than one leader) and is labeled by a title which often includes the leader's name. The lineup of a band in jazz can be fluid therefore the exact lineup needs to be inferred for each Performance in a Session.

SoloPerformance - part of a Performance, with its own timeline, associated with a particular Performer or, if Performer unknown, with an instrument.

LickPerformance - part of a SoloPerformance with its own timeline. It is used to indicate repeating or recognisable patterns within a SoloPerformance. For an in-depth discussion of the definition of Lick see the dedicated bibliography in Dig That Lick project deliverable.¹

3. Sparql queries to competency questions and their results

The results of sparql queries presented here were obtained on the "100 years of jazz" dataset. We chose the queries that would run on the "DTL1000" dataset as well, though the results differ for some of the queries. In particular, for CQ4 query the list of instruments played by Dizzy Gillespie obtained from the "100 years of jazz" dataset is longer, because the "DTL1000" dataset only contains performances for which we have solo transcriptions, whereas the "100 years of jazz" dataset is more complete.

Not all competency questions could be queried, since our datasets did not contain licks.

CQ1 Where and when were the tracks on a CD recorded?

```

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dc: <http://purl.org/dc/elements/1.1/>
PREFIX dtl: <http://www.DTL.org/schema/properties/>
PREFIX event: <http://purl.org/NET/c4dm/event.owl#>
PREFIX mo: <http://purl.org/ontology/mo/>
PREFIX tl: <http://purl.org/NET/c4dm/timeline.owl#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>

SELECT ?bandname ?tracktitle ?startdate ?place ?track
WHERE {
    ?release rdf:type mo:Release .
    ?release dc:title "On Broadway, Vol. 1" .

    ?release mo:record ?medium .
    ?medium mo:track ?track .
    ?track dc:title ?tracktitle .
}

```

¹<http://dig-that-lick.eecs.qmul.ac.uk/Docs/DTL-Lit%20Review.docx>

```

?signal mo:published_as ?track .
?signal dtl:captures ?performance .
?session event:sub_event ?performance .
?session mo:performer ?band .
?band foaf:name ?bandname .

?session event:time ?date .
?date tl:at ?startdate .
?session event:place ?place .
}

```

bandname	tracktitle	startdate	place
Paul Motian	My heart belongs to daddy	1988-11-01	New York
Paul Motian	Someone to watch over me	1988-11-01	New York
Paul Motian	So in love	1988-11-01	New York
Paul Motian	Last night when we were young	1988-11-01	New York
Paul Motian	They didn't believe me	1988-11-01	New York
Paul Motian	What is this thing called love	1988-11-01	New York

Figure 2: Query result for CQ1: list of bands and sessions for the CD "On Broadway, Vol. 1"

CQ2 What is the band line-up for a given track? Who played which instruments?

```

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dc: <http://purl.org/dc/elements/1.1/>
PREFIX dtl: <http://www.DTL.org/schema/properties/>
PREFIX event: <http://purl.org/NET/c4dm/event.owl#>
PREFIX mo: <http://purl.org/ontology/mo/>
PREFIX tl: <http://purl.org/NET/c4dm/timeline.owl#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>

SELECT ?musicianname ?instrumentlabel
WHERE {
  ?track rdf:type mo:Track .
  ?track dc:title "Zealot" .
  ?signal mo:published_as ?track .
  ?signal dtl:captures ?performance .
  ?session event:sub_event ?performance .
  ?session mo:performer ?band .
  ?band foaf:name ?bandname .
  ?performance mo:performer ?performer .
  ?performer dtl:musician ?musician .
  ?musician foaf:name ?musicianname .
  ?performer dtl:instrument ?instrument .
  ?instrument dtl:dtl_inst_label ?instrumentlabel .
}

```

CQ3 Which bands played/recorded a given tune?

```

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dc: <http://purl.org/dc/elements/1.1/>
PREFIX event: <http://purl.org/NET/c4dm/event.owl#>
PREFIX mo: <http://purl.org/ontology/mo/>
PREFIX tl: <http://purl.org/NET/c4dm/timeline.owl#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>

SELECT DISTINCT ?bandname ?startdate
WHERE {
  ?tune rdf:type mo:MusicalWork .
  ?tune dc:title "Caravan" .
  ?tune mo:performed_in ?performance .
  ?performance dc:title ?perft .
  ?session event:sub_event ?performance .
  ?session event:time ?date .
  ?date tl:at ?startdate .
  ?session mo:performer ?band .
  ?band foaf:name ?bandname .
}
ORDER BY (?startdate)

```

CQ4 Which instruments has a given performer played?

```

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dtl: <http://www.DTL.org/schema/properties/>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
PREFIX mo: <http://purl.org/ontology/mo/>

SELECT DISTINCT ?instrumentlabel
WHERE {
  ?musician rdf:type mo:MusicArtist .
  ?musician foaf:name "Dizzy Gillespie" .
  ?performer dtl:musician ?musician .
  ?performer dtl:instrument ?instrument .
  ?instrument dtl:dtl_inst_label ?instrumentlabel .
}

```

CQ5 Find performances whose recordings resulted in the same audio (to identify duplications or metadata irregularities)

```

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dtl: <http://www.DTL.org/schema/properties/>
PREFIX mo: <http://purl.org/ontology/mo/>

SELECT ?fprint ?signal1 ?signal2
WHERE {
  ?signal1 rdf:type mo:Signal .
  ?signal1 dtl:fingerprint_short ?fprint .
  ?signal2 rdf:type mo:Signal .
  ?signal2 dtl:fingerprint_short ?fprint .
}
FILTER (?signal1!=?signal2)

```

CQ6 Find all solos, their timestamps and performers in a performance

musicianname	instrumentlabel
Chris Strik	dr
Tom Beek	as
Wiro Mahieu	b
Marcel Reys	flg
Tom Beek	ss
Bart Platteau	fl
Marcel Reys	tp
Amina Figarova	p
Amina Figarova	other
Amina Figarova	other
Kurt Van Herck	ts

Figure 3: Query result for CQ2: lineup for the performance of "Zealot" by Amina Figarova's band recorded in November 2004

bandname	startdate
Barney Bigard And His Jazzopators	1936-12-19
Duke Ellington And His Famous Orchestra	1937-05-14
Duke Ellington And His Orchestra	1945-05-11
Dizzy Gillespie Sextet	1951-10-25
Clifford Brown All Stars	1954-08-11
Stuff Smith	1965-03-23
Kenny Burrell	1975-02-04
Tommy Flanagan	1989-01-17
Duke Ellington Legacy	2007-04-01
Mason Razavi	2016-12-28

Figure 4: Query result for CQ3: bands that played "Caravan"

instrumentlabel
voc
tp
other
p
tb

Figure 5: Query result for CQ4: instruments Dizzy Gillespie played

```

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dc: <http://purl.org/dc/elements/1.1/>
PREFIX dtl: <http://www.DTL.org/schema/properties/>
PREFIX event: <http://purl.org/NET/c4dm/event.owl#>
PREFIX mo: <http://purl.org/ontology/mo/>
PREFIX tl: <http://purl.org/NET/c4dm/timeline.owl#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>

SELECT ?startdate ?solostart ?soloend
      ?solo_instrument_label ?soloist_name
WHERE {
  ?performance rdf:type mo:Performance .
  ?performance dc:title "Scapple from the apple" .
  ?session event:sub_event ?performance .
  ?session event:time ?date .
  ?date tl:at ?startdate .
  ?session mo:performer ?band .
  ?band foaf:name "Curtis Fuller" .

  ?performance event:sub_event ?solo .
  ?solo event:time ?solotime .
  ?solotime tl:beginsAt ?solostart .
  ?solotime tl:endsAt ?soloend .
  ?solo dtl:solo_instrument ?solo_instrument .
  ?solo_instrument dtl:dtl_inst_label
    ?solo_instrument_label .
  ?solo dtl:solo_performer ?soloperformer .
  ?soloperformer dtl:musician ?soloist .
  ?soloist foaf:name ?soloist_name .
} ORDER BY (?solostart)

```

solo start	solo end	instrument	soloist name
0:00:33.090113	0:01:25.081224	tb	Ake Persson
0:01:25.081224	0:02:16.085841	bs	Sahib Shihab
0:02:16.085841	0:03:08.008163	tp	Benny Bailey
0:03:08.008163	0:03:59.035129	as	Phil Woods
0:03:59.035129	0:04:50.052807	tp	Benny Bailey
0:04:50.052807	0:05:41.042621	ts	Eric Dixon
0:05:41.042621	0:06:32.032435	tb	Ake Persson
0:07:46.016380	0:07:52.094403	tb	Ake Persson
0:07:58.084190	0:08:04.083265	bs	Sahib Shihab
0:08:10.059120	0:08:16.072126	tp	Benny Bailey
0:08:22.047981	0:08:28.093496	ts	Eric Dixon
0:08:34.032199	0:08:40.073070	tp	Benny Bailey
0:08:46.039637	0:08:52.066575	ts	Eric Dixon
0:08:58.070294	0:09:05.025097	tb	Ake Persson

Figure 6: Query result for CQ6: solos in the performance of "Scapple from the apple" by Curtis Fuller's band in November 1961

CQ7 Find all performances which have solos with attributed musicians

```

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dc: <http://purl.org/dc/elements/1.1/>
PREFIX dtl: <http://www.DTL.org/schema/properties/>
PREFIX event: <http://purl.org/NET/c4dm/event.owl#>
PREFIX mo: <http://purl.org/ontology/mo/>
PREFIX tl: <http://purl.org/NET/c4dm/timeline.owl#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>

SELECT ?bandname ?performance_title ?startdate
      ?solostart ?solo_instrument_label ?soloist_name
WHERE {
  ?performance rdf:type mo:Performance .
  ?performance dc:title ?performance_title .
  ?session event:sub_event ?performance .
  ?session event:time ?date .
  ?date tl:at ?startdate .
  ?session mo:performer ?band .
  ?band foaf:name ?bandname .

  ?performance event:sub_event ?solo .
  ?solo event:time ?solotime .
  ?solotime tl:beginsAt ?solostart .
  ?solotime tl:endsAt ?soloend .
  ?solo dtl:solo_performer ?soloperformer .
  ?soloperformer dtl:musician ?soloist .
  ?soloist foaf:name "Dizzy Gillespie" .

  FILTER (YEAR(?solodate) < 1950)
}
ORDER BY (?solodate)

```

```

?performance event:sub_event ?solo .
?solo event:time ?solotime .
?solotime tl:beginsAt ?solostart .
?solotime tl:endsAt ?soloend .
?solo dtl:solo_performer ?soloperformer .
?soloperformer dtl:musician ?soloist .
?soloist foaf:name "Dizzy Gillespie" .

FILTER (YEAR(?solodate) < 1950)
}
ORDER BY (?solodate)

```

bandname	performance title	solo date	solo start	solo end
Lionel Hampton And His Orchestra	Hot Mallets	1939-09-11	0:00:07.066476	0:00:23.026634
Lionel Hampton And His Orchestra	Hot Mallets	1939-09-11	0:00:31.075346	0:00:39.058802
Red Norvo And His Selected Sextet	Get Happy	1945-06-06	0:01:48.025142	0:02:19.041260
Red Norvo And His Selected Sextet	Hallelujah	1945-06-06	0:02:14.042031	0:02:40.081269

Figure 7: Query result for CQ8: solos from Dizzy Gillespie's early years (before 1950)

CQ9 What musical instruments played a solo on a given CD?

```

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dc: <http://purl.org/dc/elements/1.1/>
PREFIX dtl: <http://www.DTL.org/schema/properties/>
PREFIX event: <http://purl.org/NET/c4dm/event.owl#>
PREFIX mo: <http://purl.org/ontology/mo/>
PREFIX tl: <http://purl.org/NET/c4dm/timeline.owl#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>

```

```

SELECT ?title ?instrument_label ?pname
WHERE {
  ?performance rdf:type mo:Performance .
  ?session event:sub_event ?performance .
  ?session mo:performer ?band .
  ?band dtl:has_leader ?leader .
  ?leader foaf:name "Peter Appleyard" .

  ?signal dtl:captures ?performance .
  ?signal mo:published_as ?track .
  ?track dc:title ?title .
  ?medium mo:track ?track .
  ?release mo:record ?medium .
  ?release dc:title "The Lost 1974 Sessions" .

  ?performance event:sub_event ?solo .
  ?solo dtl:solo_instrument ?instrument .
  ?instrument dtl:dtl_inst_label ?instrument_label
  .
  ?solo dtl:solo_performer ?performer .
  ?performer dtl:musician ?musician .
  ?musician foaf:name ?pname .
}

```

CQ8 Find all solos by a given musician over a given period

```

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dc: <http://purl.org/dc/elements/1.1/>
PREFIX dtl: <http://www.DTL.org/schema/properties/>
PREFIX event: <http://purl.org/NET/c4dm/event.owl#>
PREFIX mo: <http://purl.org/ontology/mo/>
PREFIX tl: <http://purl.org/NET/c4dm/timeline.owl#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>

SELECT ?bandname ?performance_title ?solodate
      ?solostart ?soloend
WHERE {
  ?performance rdf:type mo:Performance .
  ?performance dc:title ?performance_title .
  ?session event:sub_event ?performance .
  ?session event:time ?date .
  ?date tl:at ?solodate .
  ?session mo:performer ?band .
  ?band foaf:name ?bandname .
}

```

instrument_label
ts
ts
ts
vib
cor
tb
voc
vib
ts
cor
tb
tp
ts
ts
vib
tb
cor

Figure 8: Query result for CQ9: solo instruments on Peter Apple-
yard's "The Lost 1974 Sessions"

Dig That Lick
Pattern Similarity Search

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Pattern Similarity Search

Similarity search

Pattern:

Transformation:

Pattern properties

Preserve contour (descending)

Preserve pitch range (6)

Pattern elements

Pin first Pin last

Search

Similarity options

Minimum similarity (80%)

Maximum length difference

Maximum edit distance

General options

Minimum frequency

Within single phrase

Preserve pattern

Keep overlapping instances

Databases

Dig That Lick

Weimar Jazz Database

Charlie Parker Omnibook

ESAC Folksong Database

Metadata filter

Metadata filter

Metadata filter

Metadata filter

Found 432 similar (51 unique) pattern instances: [\(206\)](#) [\(92\)](#) [\(7\)](#) [\(127\)](#)

#	Pattern	Performer/Collection	Title	Recording year	Instrument	Style	Similarity	Edit distance	
1	2,-3,-2,2,-3 (5)	Charlie Parker	Billie's Bounce	1945	Alto saxophone	Bebop	1.00	0	
		Charlie Parker	Billie's Bounce	1945	Alto saxophone	Bebop	1.00	0	
		Charlie Parker	Card Board	1949	Alto saxophone	Bebop	1.00	0	
		Charlie Parker	Now's The Time ((No.2))	1945	Alto saxophone	Bebop	1.00	0	

Show columns

Raw frequency Pitch range Contour Start position Duration

Show Timeline

Show networks

Group by

Pattern Performer

Figure 9: The “pattern similarity search” interface to the system created in the Dig That Lick project. It is driven by our “100 Years of Jazz” RDF dataset among other technology. The corresponding audio tracks were segmented and solos were automatically transcribed and afterwards analysed for patterns. Our RDF datasets place the retrieved licks in context through referring to correct metadata – as displayed alongside the results at the bottom of the screen. Additionally, metadata can be used as a pre-filter for the search (upper right part of the screen), setting constraints such as a particular musician, instrument, date range or style.