

A comparison of the cognitive difficulties posed by SPARQL query constructs

Supporting material: study screenshots

Paul Warren and Paul Mulholland

paul.warren@open.ac.uk, paul.mulholland@open.ac.uk

© Paul Warren and Paul Mulholland, 2020



Introduction

This report shows the screens used in the SPARQL study reported in:

Warren, P. and Mulholland, P. *A comparison of the cognitive difficulties posed by SPARQL query constructs*

The study is divided into five sections:

- An initial explanatory section
- A section with questions to gain some information about the participants' previous experience with query languages
- A practice question
- Four sections containing the actual questions used for subsequent analysis
- A final section enabling the participants to provide feedback

The four actual question sections, and the questions within those sections, were shown to participants in random order. Here the sections are shown in the order as described in the paper.

Introductory section

Introduction

The object of this study is to compare different language syntaxes for querying data, in particular linked data.

All the information you need to know about the language syntaxes is provided in the handout. Please read this before you start to answer the questions and refer to it whilst answering. All the information you need will be available when you need it. There is no need to memorize any information.

After this introductory section there is a section in which you will be asked some questions about your previous experience with query languages. No previous experience is necessary to answer the questions, but knowing whether you do have such experience will help us interpret the study results.

You will then be presented with a set of questions. Each question presents a set of facts and a query in the query language. The facts are presented both as a set of statements, at the top left, and in a graphical representation at the top right. The two representations are absolutely identical. You may use just the statements, or just the graphical representation, or you may find it useful to make use of both.

Please click on 'Continue' when you are ready to move on to the next page.

Continue ►

All the questions ask you to identify between one and four variables. You will also be presented with four possible sets of values for these variables. There may be no correct answers; there may be one, two, or three correct answers; or all four answers may be correct. Please click on those which you think are correct. Then click on 'Continue' to move on to the next question.

The first question is a practice question for illustration; your response to this question is not used in the analysis. After that, there are four sections which form the study proper. At the end of the quiz there is a final section which provides you with an opportunity to give feedback.

Please note:

- (i) If you wish to remove an answer before moving on to the next page, you must click on that answer to remove it; you may then click on another answer or answers, if you wish.
- (ii) In some cases there may be other correct answers which are not amongst the proposed solutions. Please just ignore these.

The object of the quiz is to compare various alternative syntaxes. You are not being tested. Individual results will be treated completely confidentially and all published results will be based on aggregated scores.

Please click on 'Continue' when you are ready to move on to the next page.

Continue ►

Please rate your knowledge of SPARQL on the following scale:

- ☐ No knowledge at all
- ☐ A little knowledge
- ☐ Some knowledge
- ☐ Expert knowledge

Continue ►

How many years have you been using SPARQL?

- ☐ less than 1
- ☐ 1 to 2
- ☐ 2 to 3
- ☐ 3 to 4
- ☐ 4 to 5
- ☐ 5 to 6
- ☐ 6 to 7
- ☐ 7 to 8
- ☐ 8 to 9
- ☐ more than 9

Continue ►

Please rate your knowledge of SQL

- ☐ No knowledge at all
- ☐ A little knowledge
- ☐ Some knowledge
- ☐ Expert knowledge

Continue ►

How many years have you been using SQL?

- ☐ less than 1
- ☐ 1 to 2
- ☐ 2 to 3
- ☐ 3 to 4
- ☐ 4 to 5
- ☐ 5 to 6
- ☐ 6 to 7
- ☐ 7 to 8
- ☐ 8 to 9
- ☐ more than 9

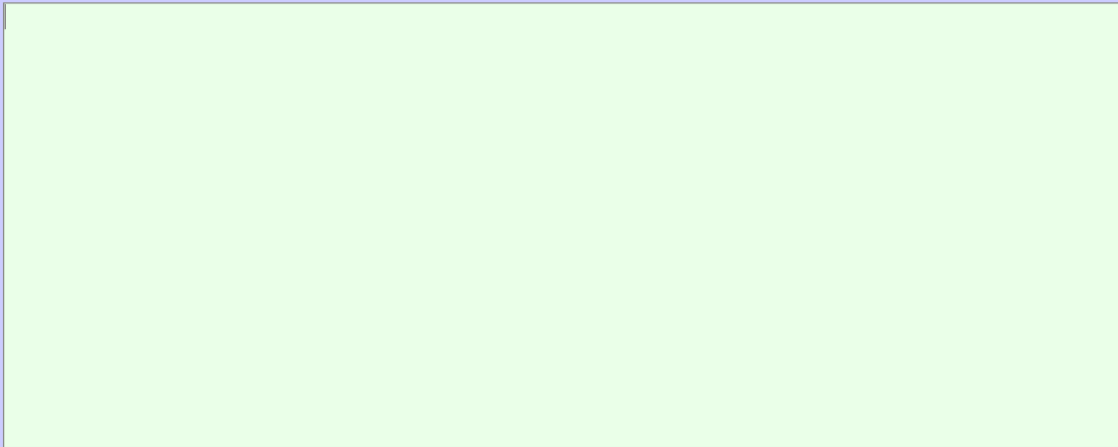
Continue ►

Do you use any other query language, besides SPARQL and SQL?

- ☐ Yes
☐ No

Continue ►

Which other query language (besides SPARQL and SQL) do you use most?



Continue ►

Please rate your knowledge of this other query language

- ☐ A little knowledge
- ☐ Some knowledge
- ☐ Expert knowledge

Continue ►

How many years have you been using this other language?

- ☐ less than 1
- ☐ 1 to 2
- ☐ 2 to 3
- ☐ 3 to 4
- ☐ 4 to 5
- ☐ 5 to 6
- ☐ 6 to 7
- ☐ 7 to 8
- ☐ 8 to 9
- ☐ more than 9

Continue ►

Practice questions

Practice question

The next question is not part of the study proper, but a practice question designed to get you used to the format. After you have attempted the question, a page will appear providing the correct answer and explaining how the answer was arrived at.

Please click on 'Continue' when you are ready to move on to the next page.

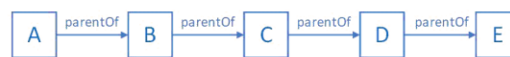
Continue ►

Please indicate which of the pairs on the left are correct values for ?x and ?y

- ☐ A, D
- ☐ A, C
- ☐ D, E
- ☐ B, D

A	parentOf
B	parentOf
C	parentOf
D	parentOf

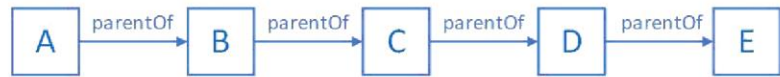
B
C
D
E



```
SELECT ?x ?y
WHERE
{
  ?x parentOf / parentOf ?y
}
```

Continue ►

A	parentOf	B
B	parentOf	C
C	parentOf	D
D	parentOf	E



The query asked for two nodes, ?x and ?y, which are separated by two successive 'parentOf' predicates. Of the four options shown, the correct answers were (A, C) and (B, D). (A, D) is not a correct answer, because the two nodes are separated by three 'parentOf' predicates. (D, E) is not a correct answer because the two nodes are only separated by one such predicate. Another correct answer would have been (C, E), which was not included in the list of options.

A fully correct response would have been to have ticked (A, C) and (B, D). A 'half-correct' response would have been to have ticked one of these. The other two options should not have been ticked.

```

SELECT ?x ?y
WHERE
{
  ?x parentOf / parentOf ?y
}
  
```

Continue ►

End of practice section

This is the end of the practice section. Data from all the following questions will be used in the analysis of the study.

Please click on 'Continue' when you are ready to move on to the next page.

Continue ►

Declarative versus property path, forward versus inverse

Family relationships

The next four questions are concerned with queries about family relationships.

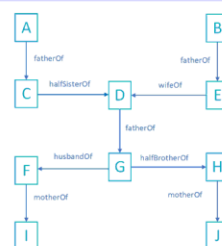
Please click on 'Continue' when you are ready to move on to the next page.

Continue ►

Please indicate which of the options on the left are correct values for ?x and ?y

- ☐ A, I
- ☐ A, J
- ☐ B, I
- ☐ B, J

A	fatherOf	C
B	fatherOf	E
C	halfSisterOf	D
E	wifeOf	D
D	fatherOf	G
G	husbandOf	F
F	halfBrotherOf	H
H	motherOf	I
I	motherOf	J



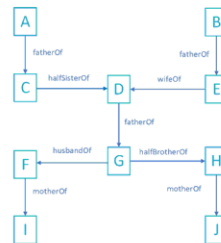
```
SELECT ?x ?y
WHERE
{
  ?x    fatherOf    ?v1 .
  ?v1   wifeOf      ?v2 .
  ?v2   fatherOf    ?v3 .
  ?v3   husbandOf   ?v4 .
  ?v4   motherOf     ?y
}
```

Continue ►

Please indicate which of the options on the left are correct values for ?x and ?y

- ☐ I, A
- ☐ I, B
- ☐ J, A
- ☐ J, B

A	fatherOf	C
B	fatherOf	E
C	halfSisterOf	D
E	wifeOf	D
D	fatherOf	G
G	husbandOf	F
G	halfBrotherOf	H
F	motherOf	I
H	motherOf	J



```

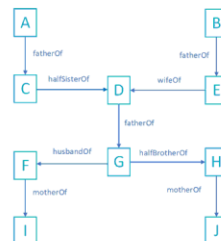
SELECT ?x ?y
WHERE
{
  ?x ^motherOf ?v1 .
  ?v1 ^halfBrotherOf ?v2 .
  ?v2 ^fatherOf ?v3 .
  ?v3 ^halfSisterOf ?v4 .
  ?v4 ^fatherOf ?y
}
  
```

Continue ►

Please indicate which of the options on the left are correct values for ?x and ?y

- ☐ A, I
- ☐ A, J
- ☐ B, I
- ☐ B, J

A	fatherOf	C
B	fatherOf	E
C	halfSisterOf	D
E	wifeOf	D
D	fatherOf	G
G	husbandOf	F
G	halfBrotherOf	H
F	motherOf	I
H	motherOf	J



```

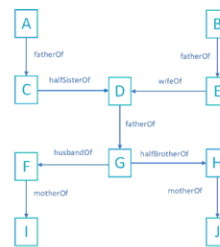
SELECT ?x ?y
WHERE
{
  ?x fatherOf / wifeOf / fatherOf / husbandOf / motherOf ?y
}
  
```

Continue ►

Please indicate which of the options on the left are correct values for ?x and ?y

- ☐ I, A
- ☐ I, B
- ☐ J, A
- ☐ J, B

A	fatherOf	C
B	fatherOf	E
C	halfSisterOf	D
D	wifeOf	D
E	fatherOf	G
G	husbandOf	F
G	halfBrotherOf	H
F	motherOf	I
H	motherOf	J



```

SELECT ?x ?y
WHERE
{
  ?x ^motherOf / ^halfBrotherOf / ^fatherOf / ^halfSisterOf / ^fatherOf ?y
}
  
```

Continue ►

Disjunction

Friendship and films

The next seven questions are concerned with queries about the friendship relations between a group of people, and the films they like.

Please click on 'Continue' when you are ready to move on to the next page.

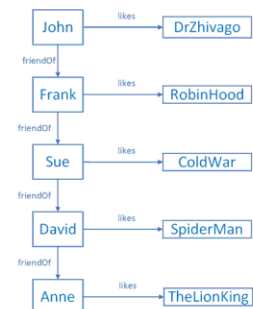
Continue ►

Please indicate which of the options on the left are correct for ?friend and ?film

- ☐ Frank, RobinHood
- ☐ Sue, Cold War
- ☐ David, SpiderMan
- ☐ Anne, The LionKing

John	friendOf	Frank
Frank	friendOf	Sue
Sue	friendOf	David
David	friendOf	Anne
John	likes	DrZhivago
Frank	likes	RobinHood
Sue	likes	ColdWar
David	likes	SpiderMan
Anne	likes	TheLionKing

```
SELECT ?friend ?film
WHERE
{
  {
    (John friendOf ?friend) UNION
    (John friendOf ?x . ?x friendOf ?friend)
  } .
  ?friend likes ?film
}
```

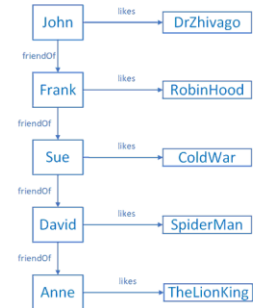


Continue ►

Please indicate which of the options on the left are correct for ?friend and ?film

- ☐ Frank, RobinHood
- ☐ Sue, ColdWar
- ☐ David, SpiderMan
- ☐ Anne, TheLionKing

John	friendOf	Frank
Frank	friendOf	Sue
Sue	friendOf	David
David	friendOf	Anne
John	likes	DrZhivago
Frank	likes	RobinHood
Sue	likes	ColdWar
David	likes	SpiderMan
Anne	likes	TheLionKing



```

SELECT ?friend ?film
WHERE
{
  John friendOf | (friendOf / friendOf) ?friend .
  ?friend likes ?film
}

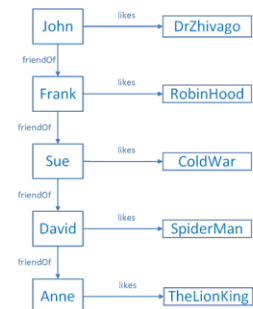
```

Continue ►

Please indicate which of the options on the left are correct for ?friend and ?film

- ☐ Frank, RobinHood
- ☐ Sue, Cold War
- ☐ David, SpiderMan
- ☐ Anne, The LionKing

John	friendOf	Frank
Frank	friendOf	Sue
Sue	friendOf	David
David	friendOf	Anne
John	likes	DrZhivago
Frank	likes	RobinHood
Sue	likes	ColdWar
David	likes	SpiderMan
Anne	likes	TheLionKing



```

SELECT ?friend ?film
WHERE
{
  John friendOf{1, 2} ?friend .
  ?friend likes ?film
}

```

Continue ►

Please indicate which of the options on the left are correct for ?friend and ?film

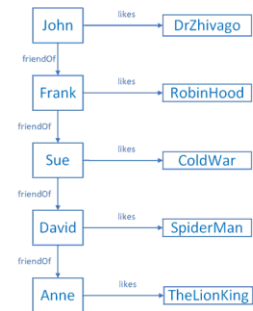
- ☐ Frank, RobinHood
- ☐ Sue, Cold War
- ☐ David, SpiderMan
- ☐ Anne, TheLionKing

John	friendOf	Frank
Frank	friendOf	Sue
Sue	friendOf	David
David	friendOf	Anne
John	likes	DrZhivago
Frank	likes	RobinHood
Sue	likes	ColdWar
David	likes	SpiderMan
Anne	likes	TheLionKing

```

SELECT ?friend ?film
WHERE
{
  {
    {John friendOf ?friend} UNION
    {John friendOf ?x . ?x friendOf ?friend} UNION
    {John friendOf ?x . ?x friendOf ?y . ?y friendOf ?friend} UNION
    {John friendOf ?x . ?x friendOf ?y . ?y friendOf ?z . ?z friendOf ?friend}
  } .
  ?friend likes ?film
}

```



Continue ►

Please indicate which of the options on the left are correct for ?friend and ?film

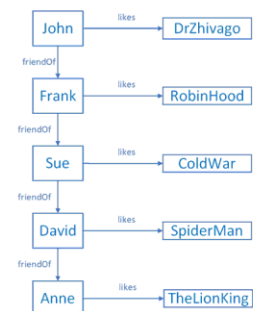
- ☐ Frank, RobinHood
- ☐ Sue, ColdWar
- ☐ David, SpiderMan
- ☐ Anne, TheLionKing

John	friendOf	Frank
Frank	friendOf	Sue
Sue	friendOf	David
David	friendOf	Anne
John	likes	DrZhivago
Frank	likes	RobinHood
Sue	likes	ColdWar
David	likes	SpiderMan
Anne	likes	TheLionKing

```

SELECT ?friend ?film
WHERE
{
  John friendOf | (friendOf / friendOf) | (friendOf / friendOf / friendOf)
  | (friendOf / friendOf / friendOf / friendOf) ?friend .
  ?friend likes ?film
}

```

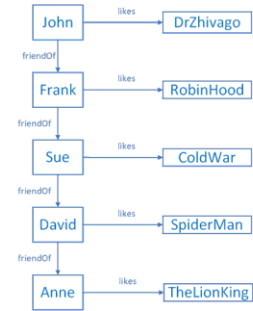


Continue ►

Please indicate which of the options on the left are correct for ?friend and ?film

- ☐ Frank, RobinHood
- ☐ Sue, Cold War
- ☐ David, SpiderMan
- ☐ Anne, The LionKing

John	friendOf	Frank
Frank	friendOf	Sue
Sue	friendOf	David
David	friendOf	Anne
John	likes	DrZhivago
Frank	likes	RobinHood
Sue	likes	ColdWar
David	likes	SpiderMan
Anne	likes	TheLionKing



```

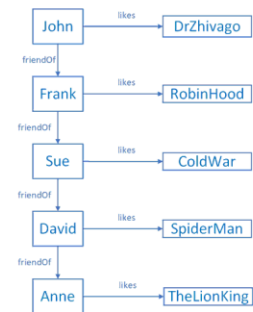
SELECT ?friend ?film
WHERE
{
  John friendOf{1, 4} ?friend .
  ?friend likes ?film
}
  
```

Continue ►

Please indicate which of the options on the left are correct for ?friend and ?film

- ☐ John, DrZhivago
- ☐ Sue, Cold War
- ☐ David, SpiderMan
- ☐ Anne, The LionKing

John	friendOf	Frank
Frank	friendOf	Sue
Sue	friendOf	David
David	friendOf	Anne
John	likes	DrZhivago
Frank	likes	RobinHood
Sue	likes	ColdWar
David	likes	SpiderMan
Anne	likes	TheLionKing



```

SELECT ?friend ?film
WHERE
{
  John friendOf+ ?friend .
  ?friend likes ?film
}
  
```

Continue ►

MINUS and negated property sets

Parents and teachers

The next six questions are concerned with queries about the relationships of being a parent of someone and being a teacher of someone.

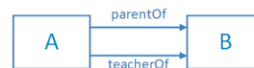
Please click on 'Continue' when you are ready to move on to the next page.

Continue ►

Please indicate which of the options on the left are correct values for ?x and ?y

- ☐ A, B
- ☐ B, A
- ☐ C, D
- ☐ D, C

A	parentOf	B
A	teacherOf	B
C	teacherOf	D
D	parentOf	C



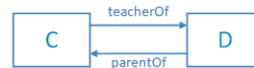
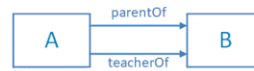
```
SELECT ?x ?y
WHERE
{
  {?x teacherOf ?y}
  MINUS {?x parentOf ?y}
}
```

Continue ►

Please indicate which of the options on the left are correct values for ?x and ?y

- ☐ A, B
- ☐ B, A
- ☐ C, D
- ☐ D, C

A	parentOf	B
A	teacherOf	B
C	teacherOf	D
D	parentOf	C



```

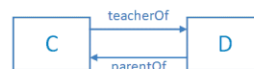
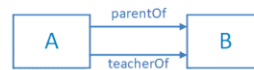
SELECT ?x ?y
WHERE
{
  {?x ^teacherOf ?y}
  MINUS {?x ^parentOf ?y}
}
  
```

Continue ►

Please indicate which of the options on the left are correct values for ?x and ?y

- ☐ A, B
- ☐ B, A
- ☐ C, D
- ☐ D, C

A	parentOf	B
A	teacherOf	B
C	teacherOf	D
D	parentOf	C



```

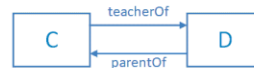
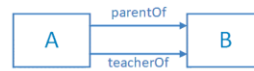
SELECT ?x ?y
WHERE
{
  {?x teacherOf | ^teacherOf ?y}
  MINUS {?x parentOf | ^parentOf ?y}
}
  
```

Continue ►

Please indicate which of the options on the left are correct values for ?x and ?y

- ☐ A, B
- ☐ B, A
- ☐ C, D
- ☐ D, C

A	parentOf	B
A	teacherOf	B
C	teacherOf	D
D	parentOf	C



```

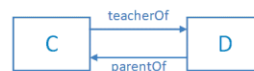
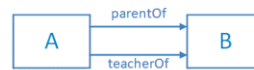
SELECT ?x ?y
WHERE
{
  ?x !parentOf ?y
}
  
```

Continue ►

Please indicate which of the options on the left are correct values for ?x and ?y

- ☐ A, B
- ☐ B, A
- ☐ C, D
- ☐ D, C

A	parentOf	B
A	teacherOf	B
C	teacherOf	D
D	parentOf	C



```

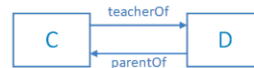
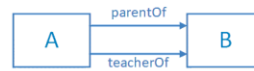
SELECT ?x ?y
WHERE
{
  ?x !^parentOf ?y
}
  
```

Continue ►

Please indicate which of the options on the left are correct values for ?x and ?y

- ☐ A, B
- ☐ B, A
- ☐ C, D
- ☐ D, C

A	parentOf	B
A	teacherOf	B
C	teacherOf	D
D	parentOf	C



```
SELECT ?x ?y
WHERE
{
  ?x !(parentOf | ^parentOf )?y
}
```

Continue ►

Negated property sets and braces

Parents, teachers and managers

The next three questions are concerned with queries about the relationships of being a parent, teacher and manager.

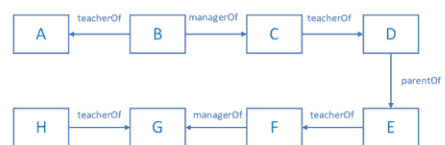
Please click on 'Continue' when you are ready to move on to the next page.

Continue ►

Please indicate which of the options on the left are correct for ?x and ?y

- ☐ A, D
- ☐ B, D
- ☐ G, E
- ☐ H, E

B	teacherOf	A
B	managerOf	C
C	teacherOf	D
D	parentOf	E
E	teacherOf	F
F	managerOf	G
H	teacherOf	G



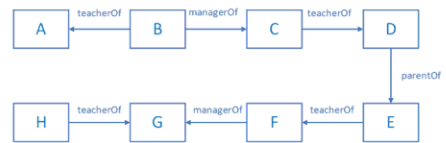
```
SELECT ?x ?y
WHERE
{
  ?x (!parentOf){1, 3} ?y
}
```

Continue ►

Please indicate which of the options on the left are correct for ?x and ?y

- ☐ A, D
- ☐ B, D
- ☐ G, E
- ☐ H, E

B	teacherOf	A
B	managerOf	C
C	teacherOf	D
D	parentOf	E
E	teacherOf	F
F	managerOf	G
H	teacherOf	G



```

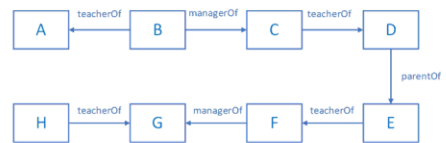
SELECT ?x ?y
WHERE
{
  ?x (!^parentOf){1, 3} ?y
}
  
```

Continue ►

Please indicate which of the options on the left are correct for ?x and ?y

- ☐ A, D
- ☐ B, D
- ☐ G, E
- ☐ H, E

B	teacherOf	A
B	managerOf	C
C	teacherOf	D
D	parentOf	E
E	teacherOf	F
F	managerOf	G
H	teacherOf	G



```

SELECT ?x ?y
WHERE
{
  ?x (!(parentOf | ^parentOf)){1, 3} ?y
}
  
```

Continue ►

Final section

Final section

Thank you for answering the study questions.

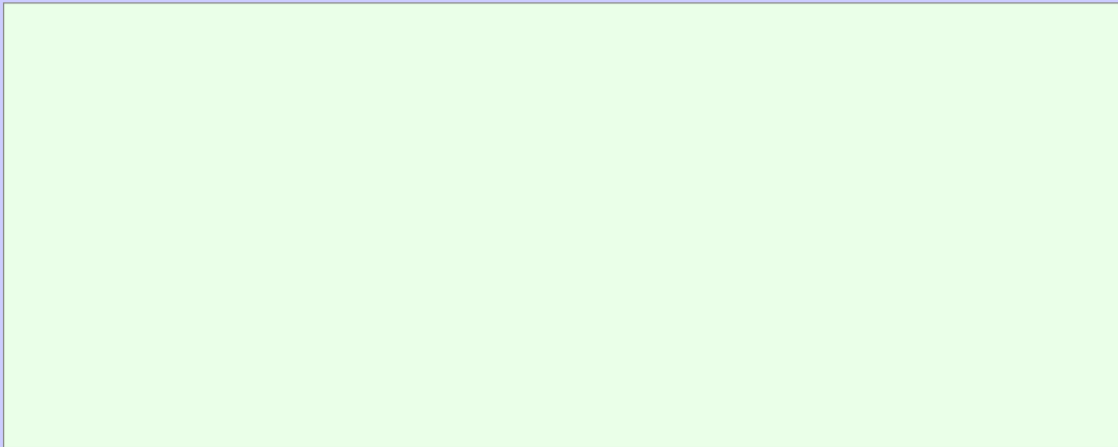
This final section provides an opportunity for you to give feedback about how you found the study, and how you answered the questions. Please provide as much or as little information as you like.

There are five feedback questions. Please click on 'Continue' to go to the first of these.

Please note that the software used does require that you make some input to each question in order to move on. In the questions requiring comments, if you have no comments to make, simply hit the spacebar once before clicking on 'Continue'.

Continue ►

What did you find difficult about the study?



Continue ►

What did you find easy about the study?



Continue ►

Which of the following best describes how you used the information provided?

- ☐ I used only the textual information.
- ☐ I used mostly the textual information, but also made some use of the graphical information.
- ☐ I used the textual and graphical information about equally.
- ☐ I used mostly the graphical information, but also made some use of the textual information.
- ☐ I used only the graphical information.

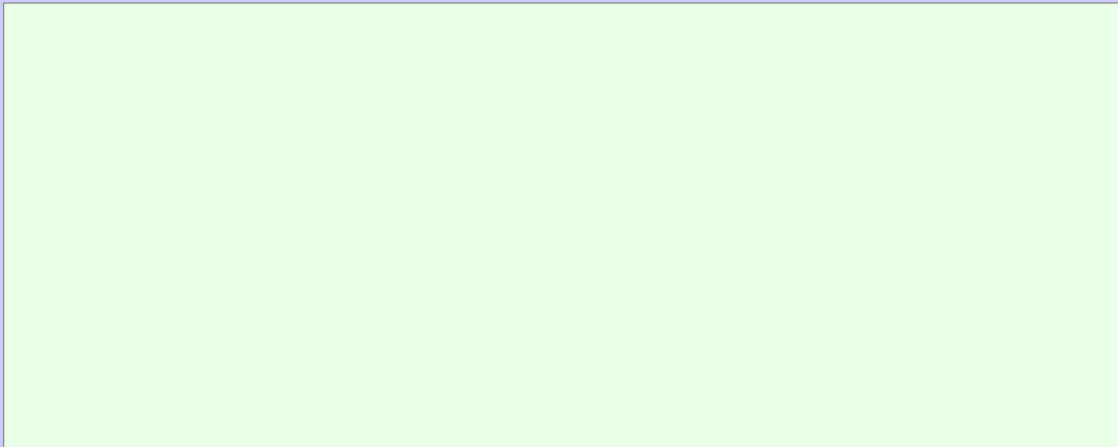
Continue ►

Do you have any comments on the respective value of the textual and graphical information, e.g. did you find that for some questions it was better to use the textual information whilst for other questions it was better to use the graphical information?



Continue ►

Do you have any further comments about the study?



Continue ►

End of study

Many thanks for taking part in this study.

The responses will be analysed to obtain a better understanding of how people use languages for querying data.

All reporting of the results will be anonymised.

Please click on 'Continue' to close the study.

Continue ►