

## A Twenty Questions Approach to Using an upper Ontology: Part 1 Baseline Study

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### Preliminaries

Robert Stevens, James Malone and Phil Lord

Upper ontologies seek to provide a domain independent way of classifying any type of object. Proponents of their use seek a consistent way of classifying objects and their classes within an ontology. Such upper ontologies are conceptually complex and are often seen as hard to use. This research study addresses this issue by adapting a well-known form of knowledge elicitation to generate a set of ordered questions the answers to which will guide a user of an upper ontology to place a class of objects correctly under that upper ontology. The study will use the "20 questions" knowledge elicitation approach in which a knowledge engineer has an object in his or her mind and the domain expert asks a series of yes/no questions in order to identify the object. The questions and their ordering then give the essential criteria for recognising that type of object and the place in which it belongs within the ontology. In this study the domain expert will be an expert in the Basic Formal Ontology (BFO) a widely used upper ontology. The aim is to find the set of questions that will guide an ontology user to classify classes of objects correctly under BFO. The study will be in three parts: 1) Creating a baseline "gold standard" of classified objects made by BFO experts by which the effectiveness of the set of questions can be judged; 2) Asking BFO experts to ask a series of yes/no questions in order to identify the series of objects used in part (1) 3) Using the set of questions generated in part (3) with a set of ontology authors to evaluate the effectiveness of this question answering technique as a means of classifying classes of objects under BFO.

#### Study Details:

The first step in this investigation is to create a gold-standard set of classifications of objects under BFO 1.1 and a baseline of agreement that our technique would have to achieve. For this first stage we seek your help to take a set of objects from the domain of travel and classify them under BFO 1.1. We will take your and others' classification to form our gold-standard and agreement level that will form the foundation of this investigation.

This study has been approved by the ethics committee at the University of Manchester, UK. All data is held securely in a data repository located at the University of Manchester. Published results will not include individual names or email addresses, or any other personal meta-data. For more information about the experiment data, see the [personal information sheet](#).

By proceeding to answer the following questions and submitting ("Next" button), you give consent to participate in the study.

1. Use of survey responses\*  
☐ I agree to make my anonymised, deidentified responses available to support this research.
2. What is your name?\*
3. What is your preferred email address?\*
4. What is your gender?\*
5. What is your self-rated level of expertise w.r.t BFO 1.1?\*  
1: Novice 5: Expert

	1	2	3	4	5
Expertise	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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### Find appropriate BFO 1.1 classes for terms

In the following questions, you will be asked to identify the appropriate BFO 1.1 classes for a number of terms. These terms, such as **airplane flight**, **dining** or **end of flying**, are highlighted. For each such question, you will select the appropriate class from the dropdown menu, and rate your confidence in the correctness of your selection.

6. **airplane flight** as in "What is happening between the time the plane takes off and the time it lands."

7. How confident are you in the correctness of your previous answer?  
1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

8. Comments

9. **drinking a beer** as in "I like drinking a beer with my pizza."

10. How confident are you in the correctness of your previous answer?  
1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

11. Comments

12. **clubbing** as in "We went clubbing every night, because I like many people dancing together."



13. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

14. Comments

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15. **dining** as in "We enjoyed the shared experience of dining together every evening."



16. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

17. Comments

18. **the end of the cooking** as in "At the end of the evening, the restaurant stops serving dinner because the kitchen has stopped cooking."



19. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

20. Comments

21. **the end of the flying** as in "When we landed I was glad that the flying had come to an end."

-- None --

22. How confident are you in the correctness of your previous answer?  
1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

23. Comments

24. **vacation location** as in "The part of the world to which I am travelling for my vacation."

-- None --

25. How confident are you in the correctness of your previous answer?  
1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

26. Comments

27. **space** as in "We walked through the space where Hadrians throne room used to be."

-- None --

28. How confident are you in the correctness of your previous answer?  
1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

29. Comments

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30. **vacation weekend** as in "A time at the end of the week during which people go on vacation."

-- None --

31. How confident are you in the correctness of your previous answer?  
1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

32. Comments

33. **take off time** as in "The slot in which the aircraft is scheduled to take off."

-- None --

34. How confident are you in the correctness of your previous answer?  
1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

35. Comments

36. **timetable** as in "A set of facts about the times that, for example, a bus travels along a particular route."

-- None --

37. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

38. Comments

39. **vacation brochure** as in "Vacation Brochure as in a online collection of information and advertisements about available hotels and package tours."

40. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

41. Comments

42. **digital photograph** as in "A digital recording of an image of someone or something."

43. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

44. Comments

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45. **warmth** as in "I like to take my holidays in a country where there is a lot of warmth."

-- None --



46. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

47. Comments

48. **distance** as in "The distance from one end to the other of the swimming pool in my hotel."

-- None --



49. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

50. Comments

51. **tendency to deflate** as in "The water wings tend to deflate after a while."

-- None --



52. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

53. Comments

54. **tendency to be mosquito bitten** as in "I tend to get easily bitten by mosquitos when abroad."



55. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

56. Comments

57. **to wash** as in "The beach shower is meant to allow me to wash salt water of myself but today it was broken."



58. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

59. Comments

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60. **tourist** as in "When a person is on vacation away from home, they are a tourist."



61. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

62. Comments



63. **bus-driver** as in "What a person is when they are driving a bus."

-- None --

64. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

65. Comments

66. **tourist area** as in "I like to stay in the tourist area of the city."

-- None --

67. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

68. Comments

69. **hotel beach** as in "The section of the beach reserved for use by hotel guests."

-- None --

70. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

71. Comments

72. **person** as in "A person was there to meet us of the tour bus."

-- None --

73. How confident are you in the correctness of your previous answer?  
1 = no confidence; 5 = totally confident

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

74. Comments

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75. **bus** as in "A ground vehicle meant to carry many people with a single driver."

-- None --

76. How confident are you in the correctness of your previous answer?  
1 = no confidence; 5 = totally confident

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

77. Comments

78. **deckchairs on the beach** as in "A collection of all the deckchairs on the beach."

-- None --

79. How confident are you in the correctness of your previous answer?  
1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

80. Comments

81. **tour party** as in "A group of people on a tour together."

-- None --

82. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

83. Comments

84. **border** as in "The border between France and Germany."

-- None --

85. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

86. Comments

87. **edge** as in "The edge of the road."

-- None --

88. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

89. Comments

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90. **my hotel room** as in "My hotel room had a beautiful view."

-- None --

91. How confident are you in the correctness of your previous answer?  
1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

92. Comments

93. **bay** as in "The dolphins like to swim in the bay by my hotel."

-- None --

94. How confident are you in the correctness of your previous answer?  
1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

95. Comments

96. **line of latitude** as in "We fly along a line of latitude."

-- None --

97. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

98. Comments

99. **tan line** as in "The tan line between the white skin under my watch and the rest of my arm."

-- None --

100. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

101. Comments

102. **place on wall where the postcard is put** as in "When a friend sends a postcard from his or her vacation I always place it on an area of a wall."

-- None --

103. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

104. Comments

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105. **surface of pool table** as in "The surface of the pool table in the bar of the hotel where a vacation is taken."

-- None --

106. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

107. Comments

108. **air space** as in "We flew the airspace of three countries before we arrived."

-- None --

109. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

110. Comments

111. **area where the hotel will be built** as in "If the hotel is built, it will spoil the view, as it will be next to a lovely area."

-- None --

112. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

113. Comments

114. **point** as in "The point at which a line of longitude and latitude cross."

-- None --

115. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

116. Comments

117. **kilometre zero** as in "In Spain, roads are marked with the distance from a kilometre zero in the centre of Madrid."

-- None --

118. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

119. Comments

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120. **why I had problems sleeping** as in "I had problems sleeping because there were a large number of people getting drunk outside my hotel."

-- None --

121. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## 122. Comments

123. **situation** as in "It was difficult to find my seat on the flight because everyone one else was trying to do the same at the same time."

-- None --

124. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## 125. Comments

126. **airspace tomorrow** as in "Hopefully, the French air traffic controllers will not go on strike tomorrow, as I am flying through their airspace."

-- None --

127. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## 128. Comments

129. **flood plain** as in "The river floods a different part of the plain every year."

-- None --

130. How confident are you in the correctness of your previous answer?

1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## 131. Comments



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132. **time and place** as in "In the brief time and place that it passed through the mouth of the oven, I could see that the pizza was perfectly cooked."

-- None --

133. How confident are you in the correctness of your previous answer?  
1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

134. Comments

135. **moment** as in "The moment I stepped out of the door of the plane, the air smelt good."

-- None --

136. How confident are you in the correctness of your previous answer?  
1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

137. Comments

138. **uncovered parts of the beach** as in "I always like to run along the uncovered parts of the beach at low tide where the sand is damp."

-- None --

139. How confident are you in the correctness of your previous answer?  
1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

140. Comments

141. **patches on the floor** as in "There were many wet patches on the floor after I split my beer."

-- None --

142. How confident are you in the correctness of your previous answer?  
1 = no confidence; 5 = totally confident

	1	2	3	4	5
Confidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

143. Comments