

Chapter 1

One world, Many representations

1.1 Basic Notions

1.1.1 Conceptualizing the World

We, as humans, understand the world in terms of entities that are described with attributes. Entities are connected with each other via relations.

Exercise 1.1 (Entities) Briefly describe the scenario and provide 3 examples of types of entities that you may need to deal with universities.

Exercise 1.2 (Entities) Briefly describe the scenario and provide 3 examples of types of entities that you may need to deal with car selling.

Exercise 1.3 (Entities) Briefly describe the scenario and provide 3 examples of types of entities that you may need to deal with the telecommunication sector.

Exercise 1.4 (Entities) Briefly describe the scenario and provide 3 examples of types of entities that you may need to deal with the energy sector.

Exercise 1.5 (Entities) In the publishing section, say which of the following entity types are endurants and which of them are perdurants: conference, paper, organizer, author, editor, publisher, speech.

Exercise 1.6 (Entities) In the educational section, say which of the following entity types are endurants and which of them are perdurants: course, student, professor, teaching material, exam.

Exercise 1.7 (Properties: attributes and relations) Provide 3 examples of attributes and relations of a course and of a professor, in the educational sector.

Exercise 1.8 (Properties: attributes and relations) Provide 3 examples of attributes and relations of a movie and of an actor, in the cinematographic sector.

Exercise 1.9 (Properties: attributes and relations) Provide 3 examples of attributes and relations of people and administrative units in a university.

Exercise 1.10 (Properties: attributes and relations) Provide 3 examples of attributes and relations of people and organizations in the telecommunication sector.

1.1.2 Sensing and representing the world in the human's mind

Through our senses, we create mental representations in our memory. Analogical mental representations depict the world. Linguistic mental representations describe the world.

Exercise 1.11 (Analogical and linguistic models) Given the models below say if they are coherent with the observed phenomenon. ANALOGICAL MODEL:



LINGUISTIC MODEL:

- a) "apples fall from trees"
- b) "apples can be eaten"
- c) "the reason why an apple falls from its tree is that the apple is attracted by Earth"

Exercise 1.12 (Analogical and linguistic models) Given the observed phenomenon, say which of the following are good examples of semantic gap: Weather, for the purpose of modelling human behavior.

- a) the number of people observed is irrelevant
- b) we cannot count the exact number of rain drops
- c) there is no need to describe the actions of people
- d) the color of umbrellas is irrelevant



OBSERVATION#1



OBSERVATION#2

Exercise 1.13 (Analogical and linguistic models) Given the previous observed phenomenon, say which of the following are good examples of models.

e)

(#1) "it rains heavily, and 3 persons with no umbrella are running to avoid to get wet";

(#2) "it rains softly, and 2 persons with umbrella are walking quietly";

f)



g)



Exercise 1.14 (Analogical and linguistic models) Given the previous observed phenomenon, say which of the following are good examples of theories.

h)

"if it rains heavily, people with no umbrella must run to avoid to get wet";
"if it rains softly, people with umbrella can walk quietly";

i)

"female like running when it rains";
"male like walking when it rains";

j)

"if it rains heavily, people always run to avoid to get wet";
"if it rains softly, people still need an umbrella to avoid to get wet";

Exercise 1.15 (Analogical and linguistic models) Design plausible linguistic models from the following observations:



Exercise 1.16 Say which of the following theories is complete, i.e. denotes all the sentences of the following models:

- M1: Alice lives in Trento; Alice is 1,65m tall; Alice is female
- M2: Bob lives in Bologna; Bob is 1,89 tall; Bob is male
- M3: Sam lives in Trento; Sam is 1,75m tall; Sam is male
- T1: Males are taller than females;
- T2: in Trento and Bologna, males are taller than females;
- T3: People only live in Trento or Bologna; In Trento all people are male; People is at least 1,65m tall
- T4: Trento and Bologna are in Italy; People is at least 1,65m tall, regardless whether they are male or female

Exercise 1.17 How many analogical and linguistic representations you can derive from a single observed phenomenon?

- exactly one
- infinite
- zero
- it depends on the phenomenon

Exercise 1.18 (Use ER diagrams as a language for theories) Translate the following theory into an ER diagram Each company own a website. A website is characterized by a name and a URL. Each company employs a manager who manages both the website and the employees that work for the company. Both the manager and the employees have a name. Employees occupy specific roles within the company.

Exercise 1.19 (From perception to knowledge) Provide an informal list of entities and properties of those entities that you can detect in the picture below.



Exercise 1.20 (From perception to knowledge) Provide an informal list of entities and properties of those entities that you can detect in the picture below.

Exercise 1.21 (From perception to knowledge) Provide an informal list of entities and properties of those entities that you can detect in the picture below.



Exercise 1.22 (Linguistic and analogical mental representations) Create a linguistic representation for the analogical mental representation in Figure 1.22.

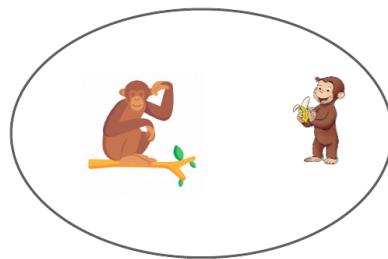


Fig. 1.1: Monkey and banana.

1.1.3 The Semantic Gap

Due to the limitations of our senses, subjectivity that is given by our past experience and our goals, our representations of the world are always partial and approximate.

Exercise 1.23 (Limits in perception and modelling - 1) Provide an example of limits of our senses in perceiving the world.

Exercise 1.24 (Limits in perception and modelling - 2) Provide examples of limits in modelling posed by approximation.

Exercise 1.25 (Limits in perception and modelling - 3) Provide examples of SEMANTIC GAP (i.e. the fact that there is a loss of meaning when you describe the phenomenon).

Exercise 1.26 Which of the following sentences about PERCEPTION is true?

- a) Perception is an error-free process
- b) Perception can give us a complete understanding of the observed phenomenon
- c) We use perception to detect objects, their properties and relations between them
- d) We reason about a certain phenomenon by means of perception

Exercise 1.27 Answer to the following questions:

- Why, in modeling, it is so important to consider the role of perception?
- What is the relation between our senses and the way we describe the world?
- What is the role of abstraction in describing the world?
- What exactly do we focus on when we describe a phenomenon?
- What are the limits of a natural language in describing the world?
- What kind of tools can be used to codify a language and the meaning of its words?
- What is knowledge?

Exercise 1.28 Provide examples about the following types of fallacies:

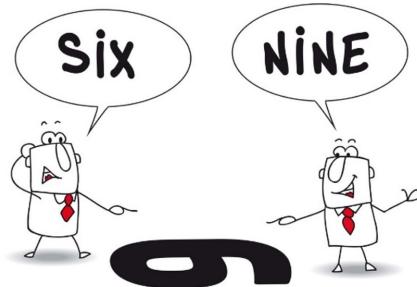
- Optical illusion (characterized by a visual percept that arguably appears to differ from reality)
- Cognitive bias (systematic patterns of deviation from norm and/or rationality in judgment)
- Map - Territory confusion (when someone confuses the semantics of a term with what it represents.)
- Correlation/causation fallacy (when people believe that correlation equals causation)
- Bandwagon fallacy (if many people agree on the same point, it must be true)
- Anecdotal evidence fallacy (rather than using hard facts, people base their arguments on their own experiences)
- Proof fallacy (you assume something is true simply because there is no evidence against it)

Exercise 1.29 (Representing the world) What are the consequences of the semantic gap when representing a certain phenomenon? Are there also positive consequences?

1.2 Diversity of individual representations

Due to the Semantic Gap, different people (or even a single individual) typically generate different representations of the world. Disagreement comes when such representations are mutually inconsistent.

Exercise 1.30 Why it can be so difficult to find an agreement between individual persons in describing the same observed phenomenon?



Exercise 1.31 Which of the following sentences about AMBIGUITY in natural language is false?

- a) A sentence in natural language might be ambiguous because of the multiple ways it can be interpreted grammatically
- b) A certain degree of ambiguity is unavoidable in natural languages
- c) A sentence in natural language might be ambiguous because of the presence of words that have synonyms
- d) Polysemy generates ambiguity

Exercise 1.32 (Mental representations) Indicate which of the following statements concerning representations are TRUE (one or more):

1. Due to the semantic gap it is impossible to construct representations of the world for which there is certainty that the mental representation generated in different people is the same
2. Analogical mental representations describe the world
3. It is not possible to construct a linguistic or analogical representation of the world
4. It is not possible to construct a linguistic or analogical representation of the world that is complete, in the sense that it describes it in all its details
5. It is impossible to have an analogue representation of the world that is described by two different linguistic representations

Exercise 1.33 (Mental representations) Say which of the following statements are true (one or more):

- Assuming two persons can have the same analogical mental representation, these persons can have two different linguistic representations of the same analogical mental representation
- What we perceive can be modelled in terms of sets and elements of sets
- An interpretation function can be polysemous, i.e. assigning two elements of the domain to the same element of the language
- An interpretation function can be synonymous, i.e. assigning the same domain element to two different language elements

Exercise 1.34 (Analogical and linguistic models) Given the observations below, come up with corresponding linguistic representations, compare them with those designed by a colleague and discuss differences and possible reason of differences.



Exercise 1.35 (Analogical and linguistic models) Given the observations below, come up with corresponding linguistic representations, compare them with those designed by a colleague and discuss differences and possible reason of differences.



Exercise 1.36 (Ambiguity) Indicate which of the following statements concerning the modeling process are TRUE (one or more):

1. Given an observed phenomenon, there are always different models of this same phenomenon, due to differences in perception or conceptualizations by different people.
2. One source of ambiguity is the use of two different terms in language to denote the same object in the world.

Exercise 1.37 (Ambiguity) Indicate which of the following statements concerning the modelling process are TRUE (one or more):

- Given an analogue representation there is always only one representation linguistic representation that describes it
- Two mental representations that the same person makes of the same representation of the world, e.g. at different times, are not necessarily identical
- A model is an analogue representation of the world