



UNIVERSITY
OF TRENTO - Italy

Dipartimento di Ingegneria e Scienza dell'Informazione



World and Representation (T2MP)

Index

- **World and representation**
 - Perception, percepts, facts.
 - Conceptualization, words expressing concepts, words naming percepts.
 - Knowledge, entities, entity types, properties, sentences in a language, formed by composing word via formation rules.
 - Reasoning, from knowledge to more knowledge.
- **Representations**
 - Analogical (mental) representations
 - Linguistic (mental) representations
 - Partiality and number of mental representations
 - Diversity of mental representations
 - (Mutual) (in)consistency of mental representations

World and representation - recap

- **Perception.** From *reality* (the source of what we perceive) to *percepts* (e.g. *the images of a smiling face, the face of an old/young woman*) and *facts* (e.g. *the “complex” images of a smiling face in a plug, an old woman looking down and left*) that is, our **mental representations** of reality.
- **Conceptualization.** From percepts to **words**, that is, an **alphabet**, expressing **concepts**, that is, the percepts **named by** words (e.g., the words: *collided, bumped, hit, smashed*).
- **Representation.** From words to **properties, entities, entity types** ... and more ... describing facts, that is, **knowledge**, expressed using **sentences** of a **language** constructed, via **formation rules**, using words, (e.g., the sentences: *the plug looks like a smiling face, people living vs. people dying*).
- **Reasoning:** From **existing** knowledge to **new** knowledge (e.g., reasoning: *if people get saved it is better to use a safer program, if people die it is better to use a more risky program.*)

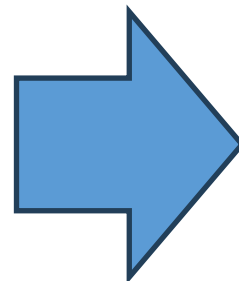
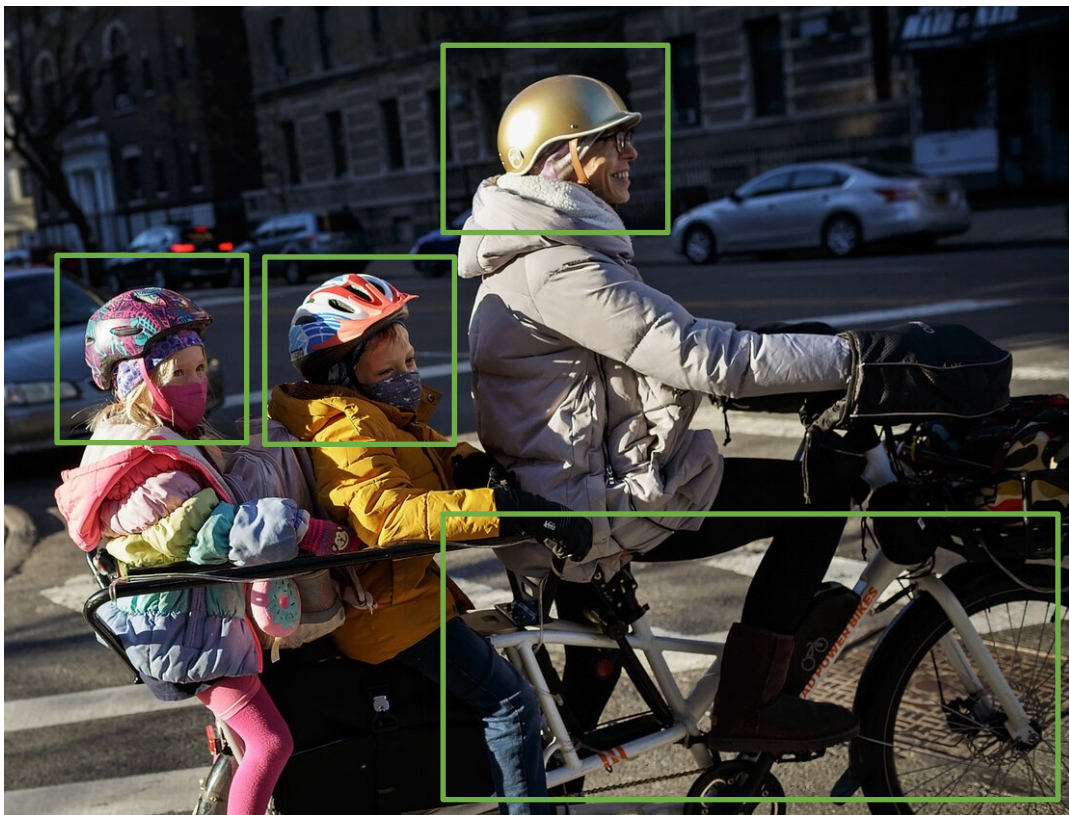
These activities co-occur in any complex mental activity



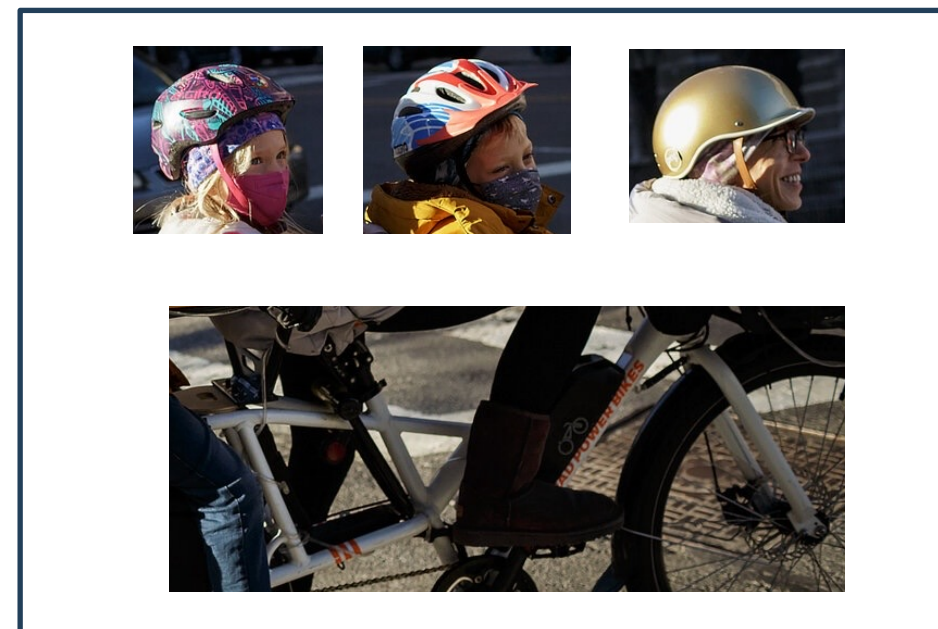
Running example



Perception - Percepts

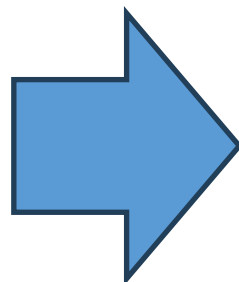
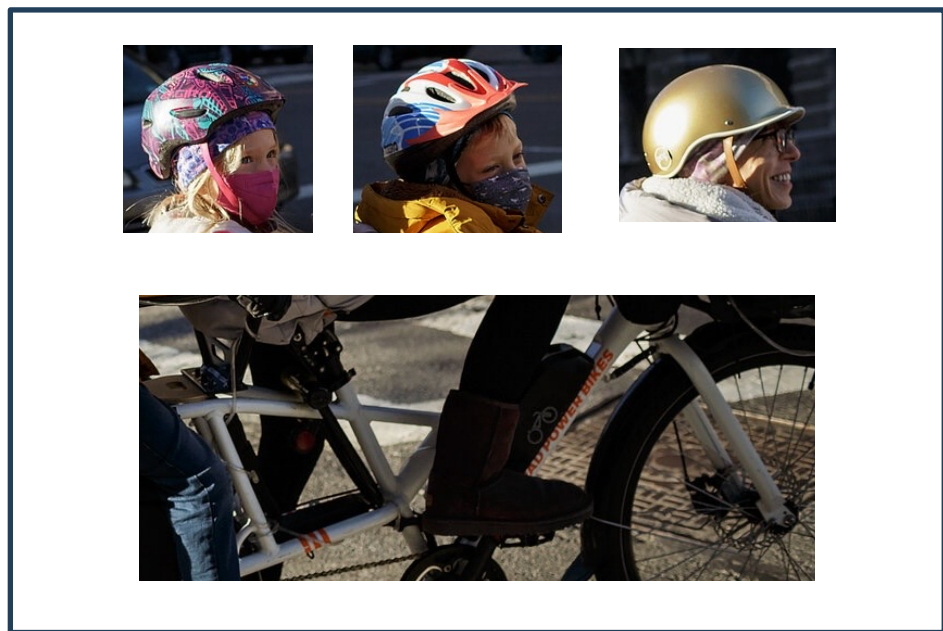


Percepts



Perception - Facts

Percepts



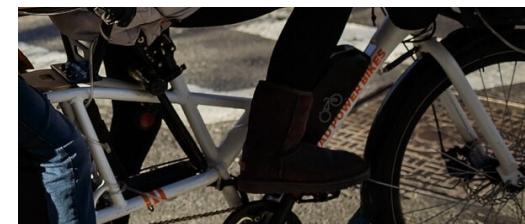
On



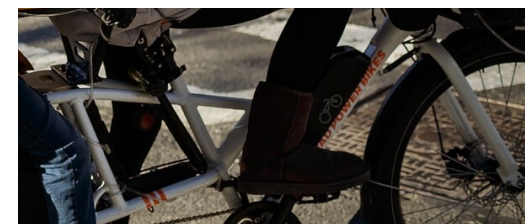
On



On

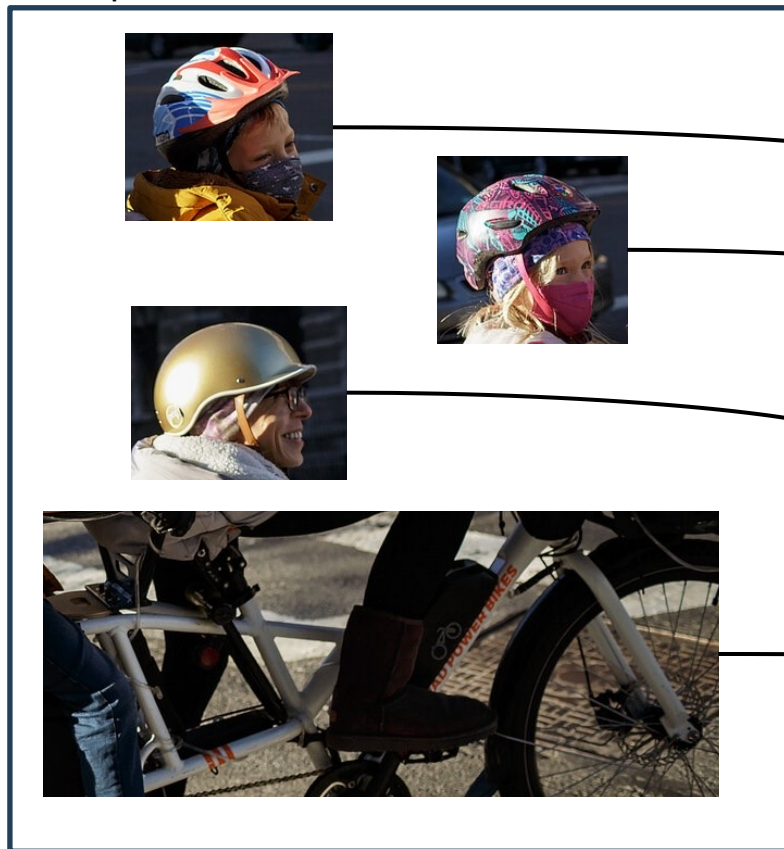


Drives

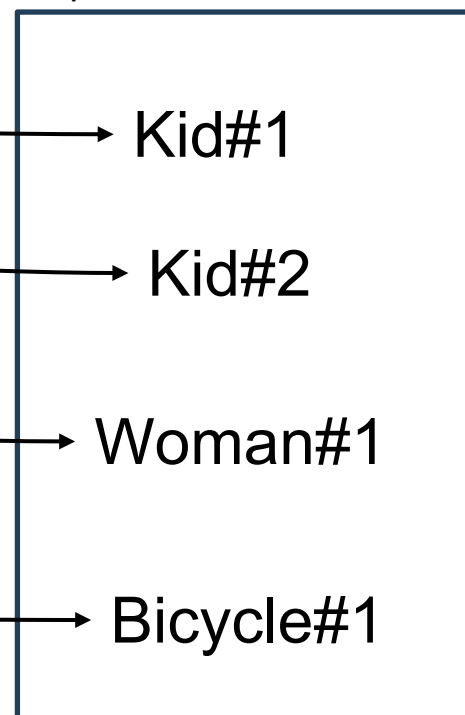


Conceptualization - from percepts to words

Percepts



Alphabet



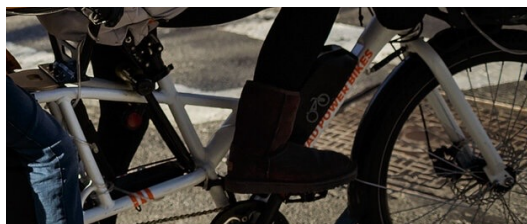
Representation - from words to sentences



On



On



On

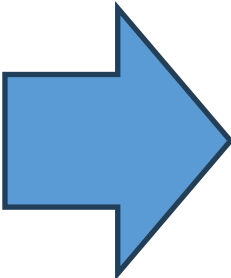


Drives



Alphabet

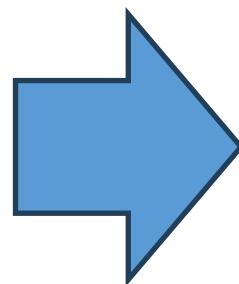
Kid#1
Kid#2
Woman#1
Bicycle#1



- On(Kid#1, Bicycle#1)
- On(Kid#2, Bicycle#1)
- On(Woman#1, Bicycle#1)
- Drives(Woman#1, Bicycle#1)
- CityBike(Bicycle#1)

Reasoning - from knowledge to more knowledge

- On(Kid#1, Bicycle#1)
- On(Kid#2, Bicycle#1)
- On(Woman#1, Bicycle#1)
- Drives(Woman#1, Bicycle#1)
- CityBike(Bicycle#1)



- CanDrive(Woman#1, CityBike)

Exercise



- Build a representation using sentences describing the facts in the picture.
- Starting from those sentences generate new sentences through reasoning (informally).

Exercise



isWearing(Man#1, Gi#1)
IsWearing(Man#2, Gi#2)
isWearing(Man#3, RefereeSuit#1)
isCelebrating(Man#2)



isReferee(Man#3)



isCompetitor(Man#1)
isCompetitor(Man#2)



wonCompetition(Man#2)



didMorePointThan(Man#2, Man#1)

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Analogical (Mental) representation

Intuition 2.5 (Analogical mental representations) Analogical mental representations are mental representations that **depict** the world as we perceive it through *perception*. They are complex articulations of **percepts** into **facts**.

Examples (Analogical mental representations). What we represent (from hearing and sight) using photos, videos, paintings, recordings (what about taste, tact, smell?)

Observation 2.3 (Analogical mental representations). They enable us to acquire information about the world, directly from the world. They allow humans

- to act in the world,
- to learn from what has been previously perceived and
- to build an understanding of the world itself.

Linguistic (Mental) representation

Intuition 2.7 (Linguistic mental representations) Linguistic mental representations are mental representations that **describe** mental analogical representations using language.

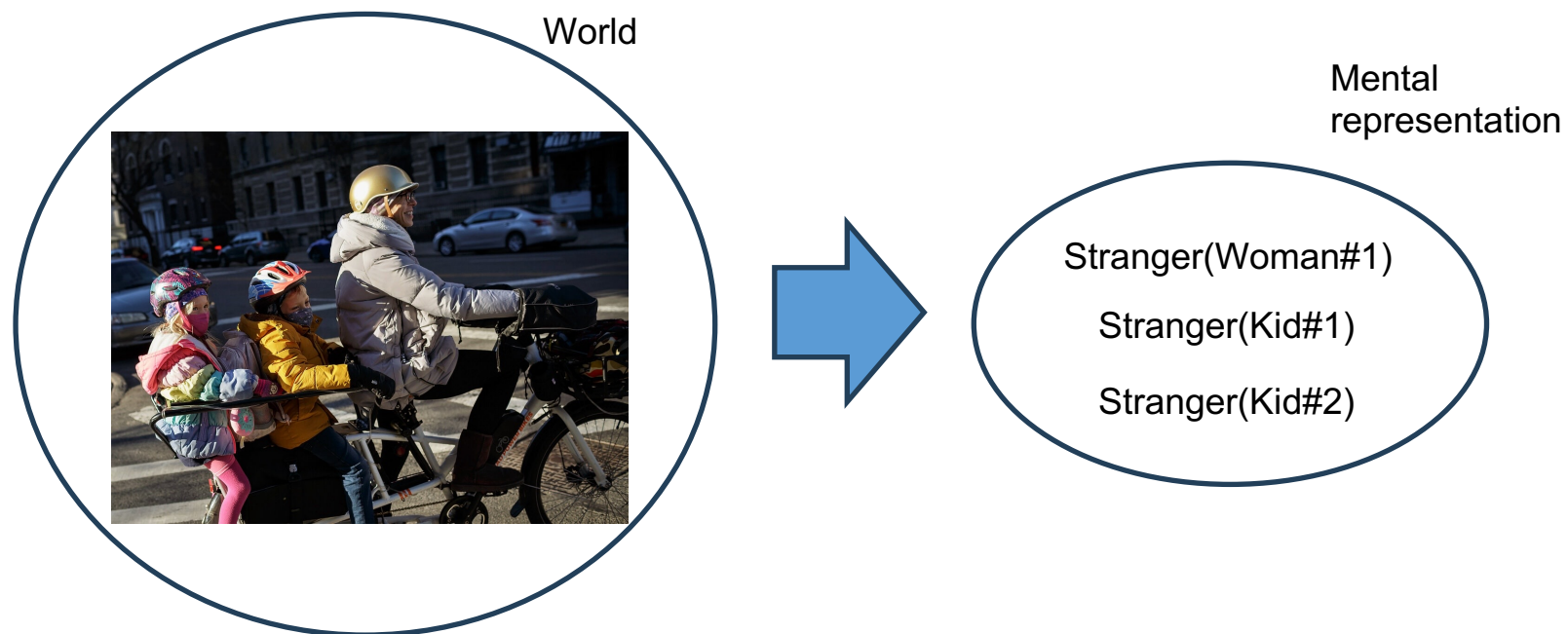
Examples (Linguistic mental representations). What we mentally represent using any natural language, the language of signs, Java, Python, ER / EER Graphs, tables.

Observation 2.4 (Linguistic mental representations) Linguistic mental representations are used to describe what is happening in analogical mental representations. They allow humans

- to communicate to other humans about our mental representations (and, thus, indirectly about the world),
- to learn from what has been previously described or perceived, and
- to reason in order to derive unknown facts from what we already know.

Partiality of mental representations

Observation 2.6 (Partiality of mental representations) Because of the semantic gap, mental representations never describe the world completely.



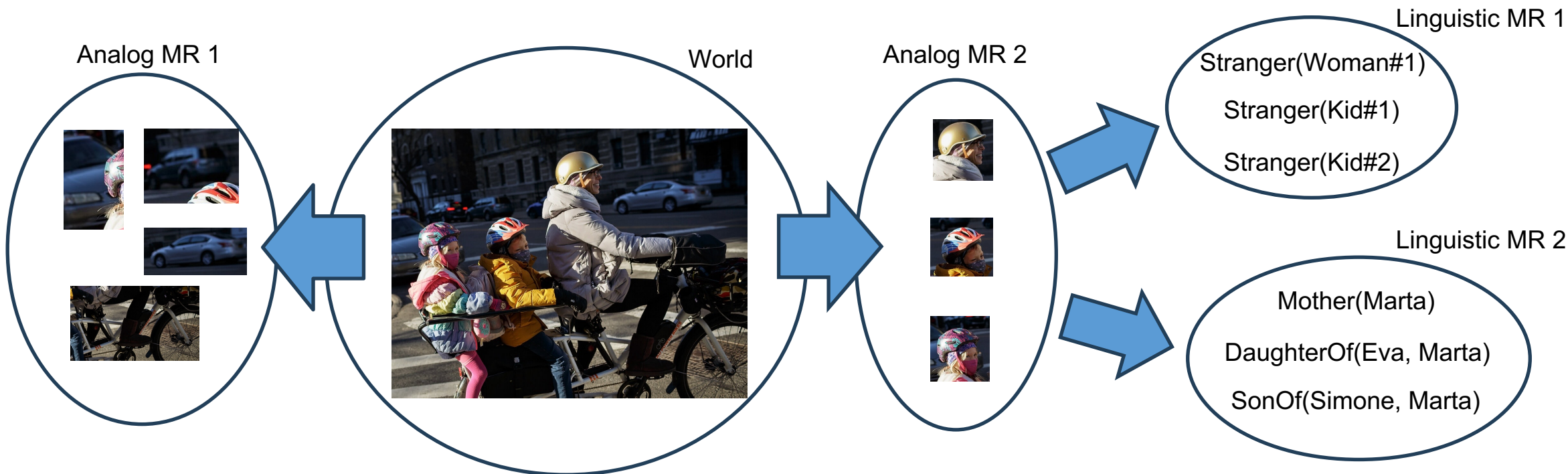
Let's build a mental representation focusing on the people in the picture (maybe because we are looking for someone). We are not representing the vehicles (which would be instead represented if we were looking for moving objects before crossing the road), making thus our mental representation partial.

Number of mental representations

Observation 2.7 (Number of mental representations). Because of partiality

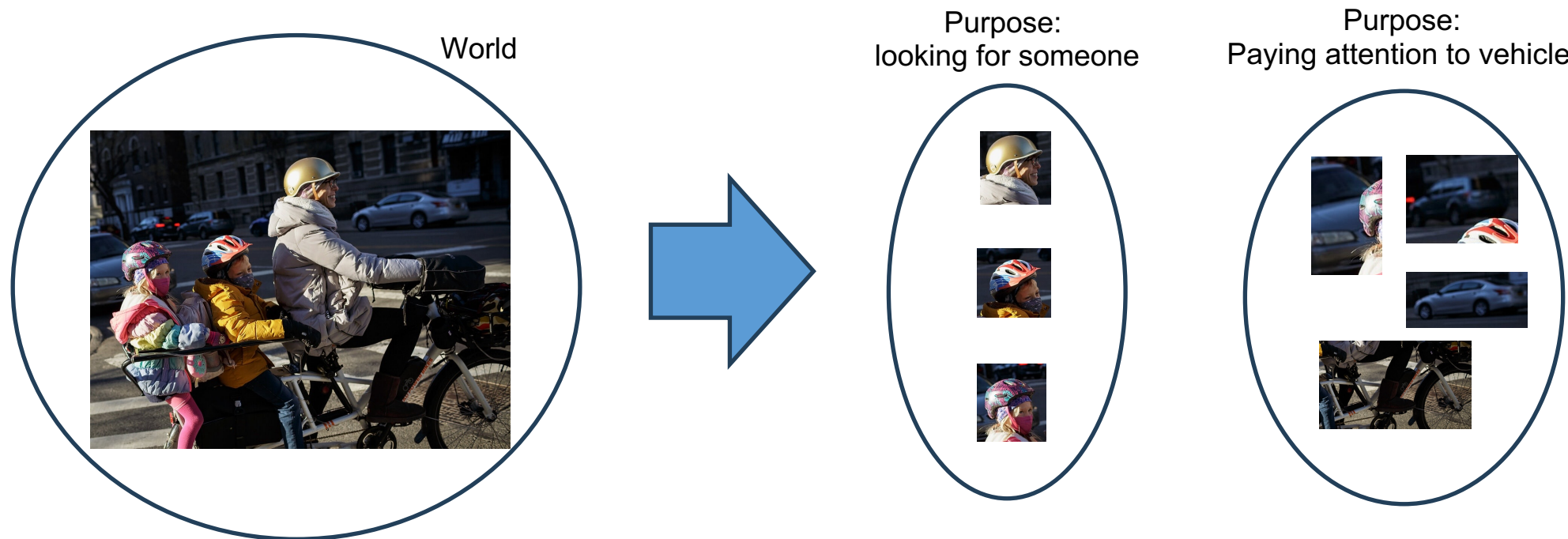
There are *indefinitely many analogical mental representations* that describe the same real world situation.

There are *indefinitely many linguistic mental representations* for the same analogical representation.



Diversity of mental representations

Observation 2.8 (Diversity of mental representations) Because of partiality, any two mental representations are necessarily *different*, depending on the *spacetime* coordinates under which they are generated, and the *purpose* of the person who generates them.

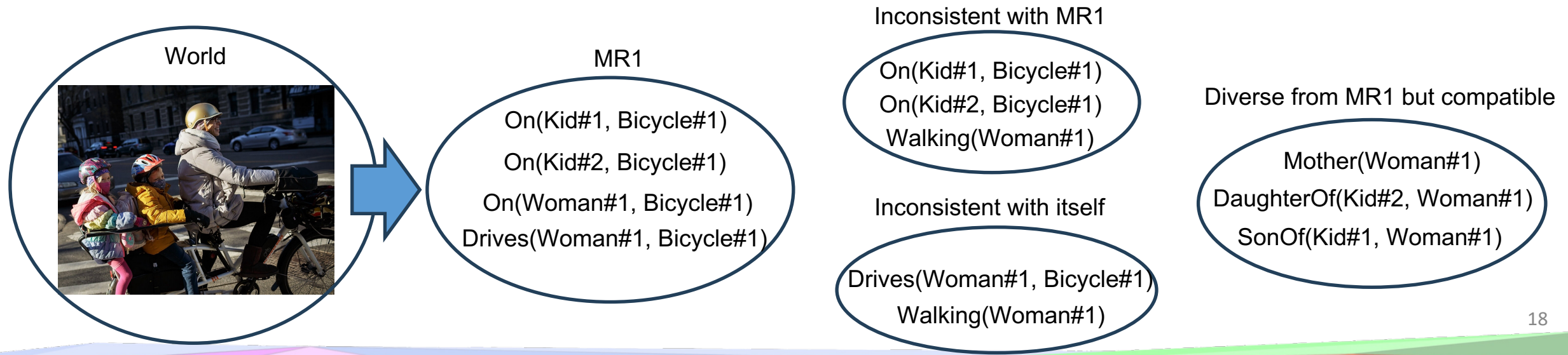


Inconsistency of mental representations

Intuition 2.9 (Consistency and inconsistency of mental representations) A mental representation is ***inconsistent*** when it represents a state of the world which is impossible for how we know it. ***Consistency*** means absence of inconsistency.

Two mental representations are ***(mutually) inconsistent*** when it is impossible for those two mental representations to represent the (same part of the) world, as he know it.

Two consistent mental representations can be diverse but still ***compatible*** in the sense that there is a (analogical representation of the) world which is described by both.



Key Notions

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