

Knowledge Graphs

Lecture 1 – Knowledge Representation with Graphs

1.2 Knowledge and how to represent it

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Lecture 1: Knowledge Representation with Graphs

1.1 From Data to Knowledge

1.2 Knowledge and how to represent it

1.3 The Art of Understanding

1.4 Graphs and Triples

1.5 Knowledge Graphs

1.6 The Semantic Web

1.7 Linked Data and the Web of Data



42



There are many other references and meanings of the number 42 in various fields and disciplines, including:

- In the Maya calendar, the number 42 represents the end of a cycle, as well as the beginning of a new cycle.
- In the field of psychology, the number 42 is often used as a control for various variables.
- In computer science, the number 42 is often used as a placeholder or default value in programming when working with arrays or other data structures.
- In physics, the number 42 is the atomic number of molybdenum, a chemical element with the symbol Mo.
- In popular culture, the number 42 has been referenced in a variety of media, including music, film, television, and literature. It is often used as a symbol of mystery or as a reference to "The Hitchhiker's Guide to the Galaxy."

calendar

psychology

computer
science

physics

pop culture

different
contexts



What does 42 mean in the context of chemistry?



In the field of chemistry, the number 42 is the atomic number of the element with the symbol Mo. The atomic number of an element is the number of protons in the nucleus of an atom of that element, and it is used to determine the position of an element in the periodic table. Molybdenum is a metallic element that is commonly used in a variety of industrial and technological applications, including the production of steel alloys, catalysts, and electrical conductors. Molybdenum has an atomic mass of 95.95 g/mol and is located in Group 6 of the periodic table, along with other elements such as tungsten and chromium. It is a relatively hard, strong, and ductile metal that is resistant to corrosion and has a high melting point. Molybdenum compounds are also used in a range of chemical reactions, including catalytic processes, and they have been studied for their potential use in the treatment of cancer and other diseases.

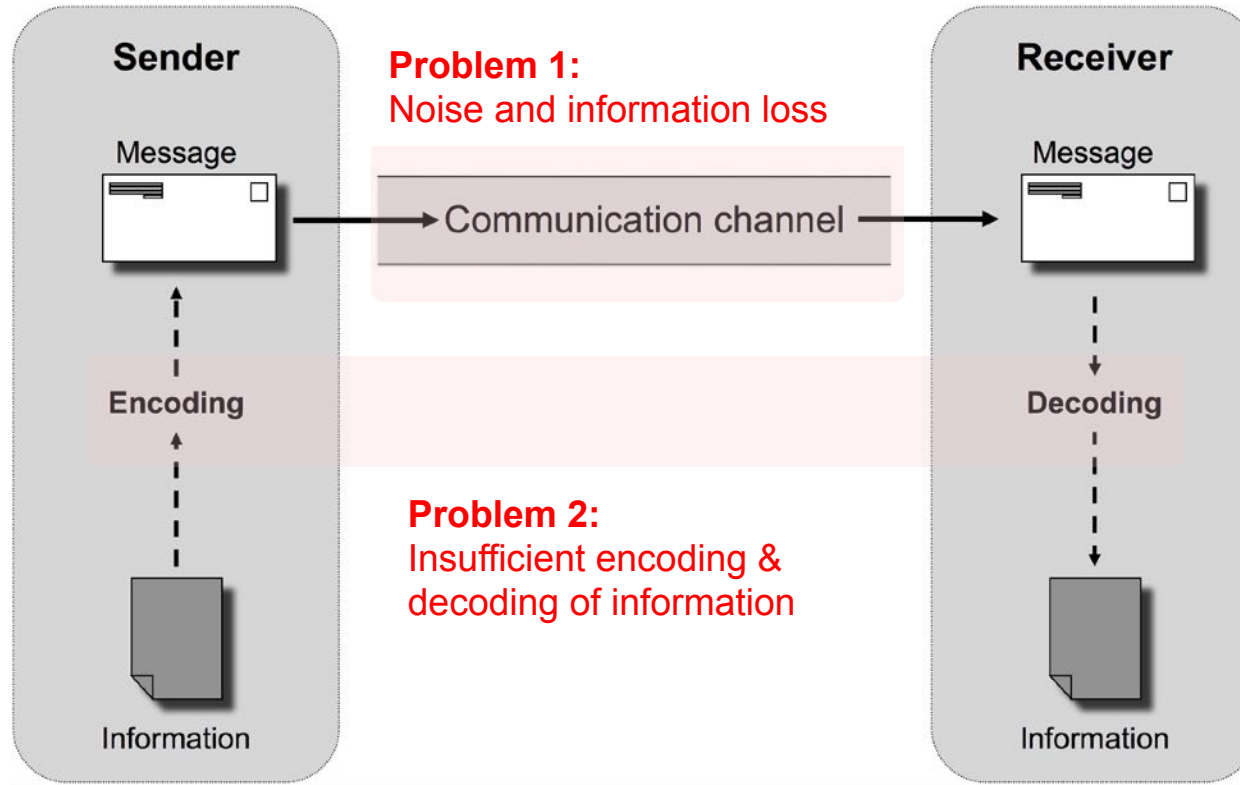
With language we can represent knowledge



Language as Knowledge Representation

- (Natural) Language can be used to represent knowledge.
- What is Language?
 - **Language** is a system of conventional **spoken, manual, or written symbols** that combine to **convey meaning**, and by means of which human beings, as members of a social group and participants in its culture, **express** themselves.
 - One of the most important functions of language is **communication**.

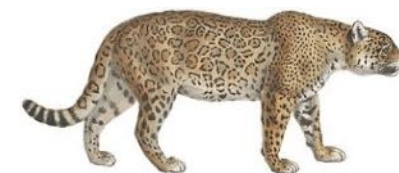
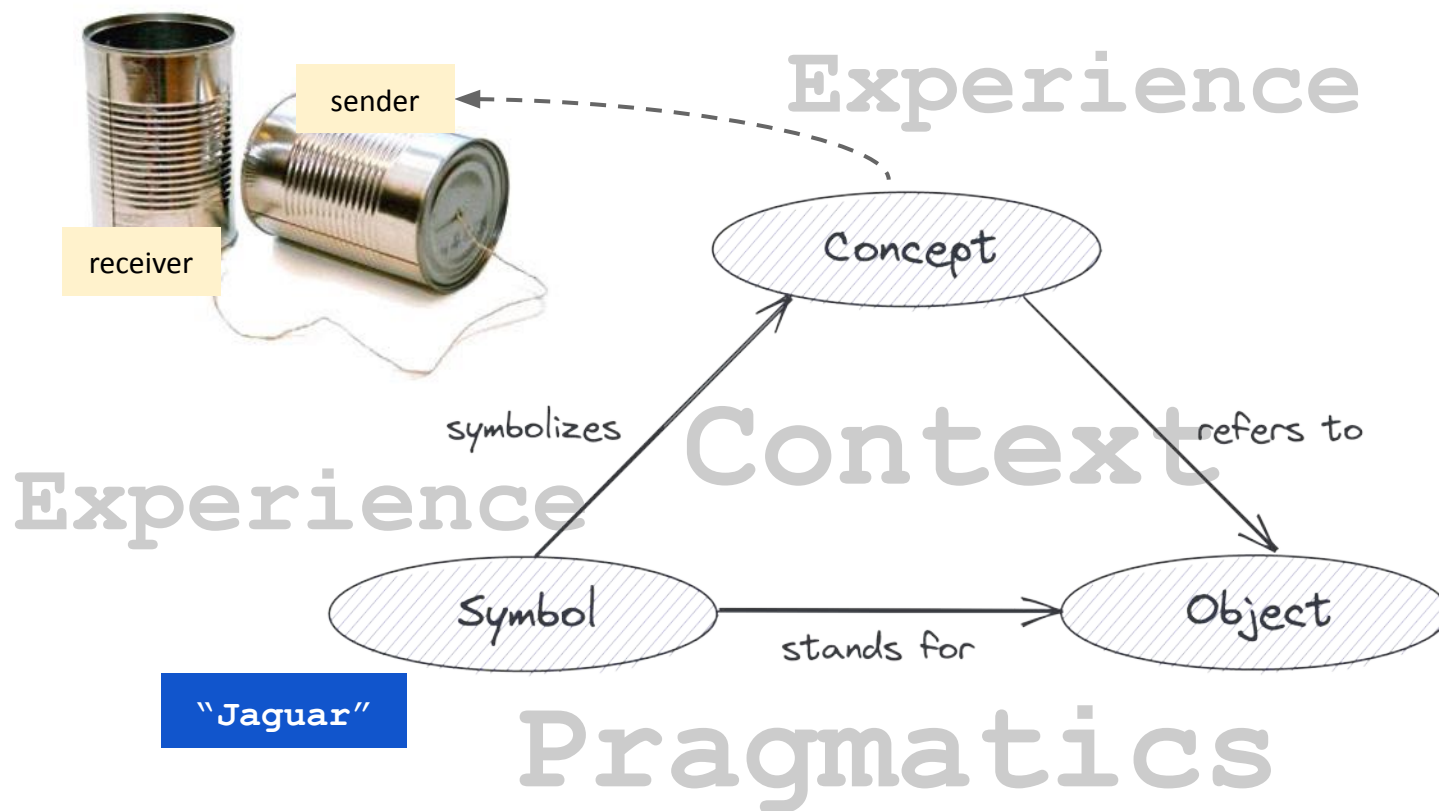
Language and Communication



Ch. Meinel, H. Sack:
Digital Communication -
Communication Multimedia,
Security, Springer, 2014. [2]

Communication and Meaning

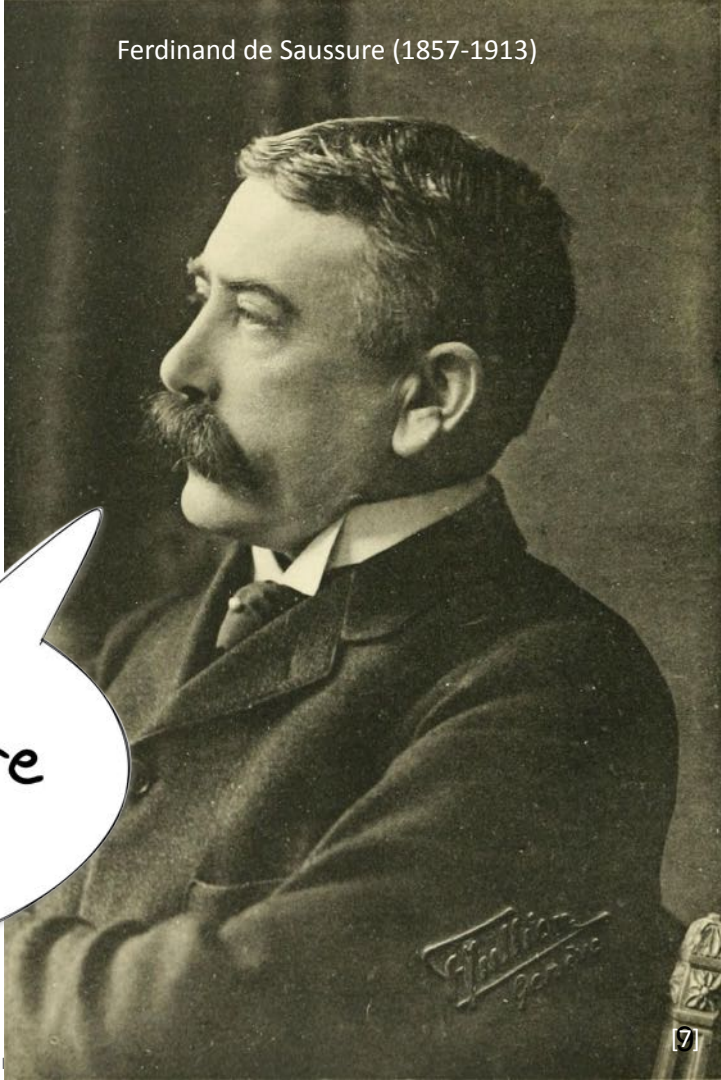
[3,4,5,6]



Why (natural) language is so difficult

Ferdinand de Saussure (1857-1913)

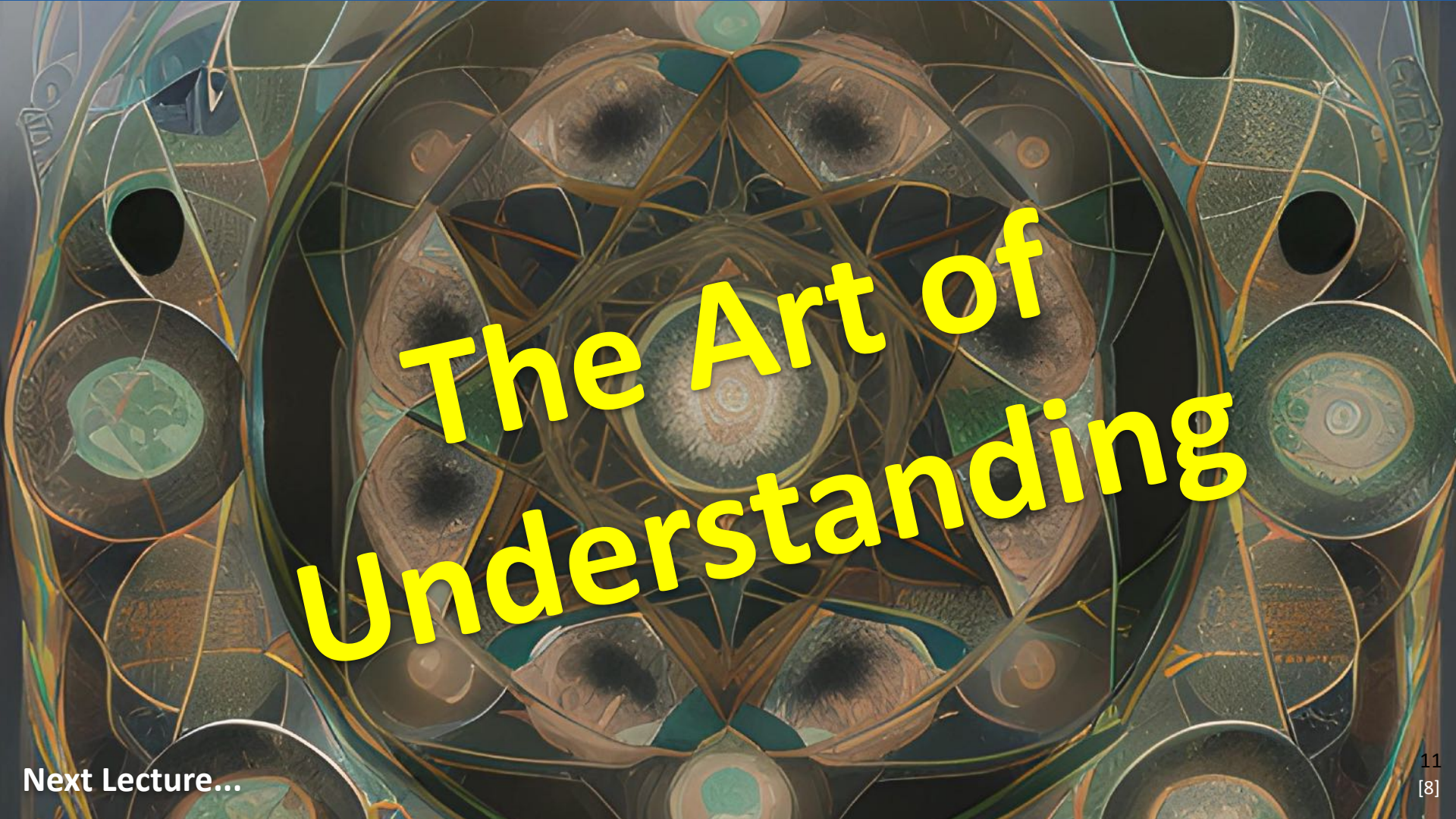
1. Paraphrasing
2. Ambiguity



I am a linguist.
I love ambiguity more
than most people.

Formal Knowledge Representation

- **Formal Knowledge Representation**
 - is a field of **artificial intelligence (AI)**,
 - which (unambiguously) captures the **semantics of concepts, properties, relationships, and entities**
 - of specific **knowledge domains**, i.e., fields of interest or areas of concern,
 - as **structured data**.
- **Machines (computers)** must be able to **understand** formal knowledge representations.
- To “**understand**” a knowledge representation, the machine must be able to **interpret it correctly**.

The background is a complex, abstract artwork. It features a central mandala-like pattern with a circular motif in the center, surrounded by concentric rings of organic, leaf-like shapes. The color palette is dominated by earthy tones: browns, greens, and blues, with some darker, almost black, areas. The overall effect is one of intricate, layered complexity, reminiscent of a microscopic view of a cell or a detailed botanical illustration. Overlaid on this artwork is the text 'The Art of Understanding' in a large, bold, yellow font, which is slightly tilted to the right.

The Art of Understanding

Next Lecture...

Bibliographic References:

- OpenAI ChatGPT: <https://chat.openai.com/chat>
- Meinel, Christoph & Sack, Harald (2014). *Digital Communication - Communication Multimedia, Security*, Springer.
- Ogden, Charles Kay, & Richards, Ivor Armstrong (1923). *The Meaning of Meaning: A Study of the Influence of Language upon Thought and of the Science of Symbolism*, K. Paul, Trench, Trubner & co., Ltd, Harcourt, Brace & company, inc.

Picture References:

- [1] "...to speak a common Language: common symbols and concepts (Syntax)...", created via ArtBot, Anything Diffusion - generic scifi, 2023, [CC-BY-4.0], <https://tinybots.net/artbot>
- [2] Ch. Meinel, H. Sack: *Digital Communication - Communication Multimedia, Security*, Springer, 2014.
- [3] Phone Conversation Indicating Chit Chat And Discussion, [CC0], <https://www.piqsels.com/en/public-domain-photo-iradox>
- [4] Car Jaguar Vehicle, OpenClipart-Vectors (pixabay.com), <https://www.needitpix.com/photo/101821/car-jaguar-vehicle-automobile-transportation>
- [5] Felis onca, Geoffroy-Saint-Hilaire & Cuvier, Histoire naturelle des mammifères, pl. 170, [public domain], https://commons.wikimedia.org/wiki/File:Felis_onca_-_1818-1842_-_Print_-_Iconographia_Zoologica_-_Special_Collections_University_of_Amsterdam_-_%28white_background%29.jpg
- [6] Default Jaguar Desktop, Grant Hutchinson, flickr, [CC BY-NC-ND 2.0], <https://www.flickr.com/photos/splorp/75563891/>
- [7] The Swiss linguist Ferdinand de Saussure (1857–1913), photo by F. Jullien Genève, [public domain], https://commons.wikimedia.org/wiki/File:Ferdinand_de_Saussure_by_Jullien.png
- [8] "to speak a common Language: common symbols and concepts (Syntax) agreement about their meaning (Semantics) classification of concepts (Taxonomy) associations...", created via ArtBot, Anything Diffusion, 2023, [CC-BY-4.0], <https://tinybots.net/artbot>