

HOW DO WE LEARN AND WHY DO WE USE ABSTRACT CONCEPTS AND WORDS

Anna M. Borghi^{1,2*}, Ilenia Falcinelli³, Chiara Fini¹, Angelo Mattia Gervasi³ and Claudia Mazzuca¹

¹Department of Dynamic and Clinical Psychology, and Health Studies, Sapienza University of Rome, Rome, Italy

²Institute of Cognitive Sciences and Technologies, Italian National Research Council, Rome, Italy

³Department of Psychology, Sapienza University of Rome, Rome, Italy

YOUNG REVIEWERS:



DEREK

AGE: 16



GIGI

AGE: 9

Grouping things together, also called categorizing, is fundamental for humans. We can form categories such as people, tools, and buildings. Concepts are what we mentally associate with categories. For example, we associate cats with what they look like and how they behave. “Cat” is a concrete concept, meaning that it refers to a specific animal that we can point to. Some concepts, such as “truth” or “sympathy,” do not refer to concrete objects you can point to. These are called abstract concepts. Abstract words—the words that we use to express abstract concepts—make up more than 70% of adult speech. Children use fewer abstract words because they are harder to learn. How do we learn and use abstract concepts, from emotions to numbers? Do we need more help from others to learn abstract concepts? In this article, we address these questions and discuss current research on abstract concepts.

CATEGORIES, CONCEPTS, AND WORDS

To survive, animals must learn to categorize, which means group things together. For example, to approach prey and avoid predators, animals must have mental categories for “prey” and “predator.” Unlike other animals, humans use words to label their categories (Figure 1). For example, we use the word “animals” to refer to birds, fishes, and mammals. Naming a category makes us feel that the category members are more similar to each other.

Figure 1

The ability to categorize, that is, to group similar items, is fundamental for survival. For example, we humans categorize animals into “birds”, “mammals”, and “fish.” Categories allow us to make inferences about group members we may be unfamiliar with—for example, if a duck has wings, we “infer” that other birds have wings, not that horses have wings. Even if we have never seen a lynx, we know it will probably have whiskers like other cats because we categorize it as a feline. Animals and humans have different categories because we use language. Language helps create subcategories (e.g., “mammals” vs. “birds”) and make their members more similar (Figure created using [Biorender.com](https://www.biorender.com)).

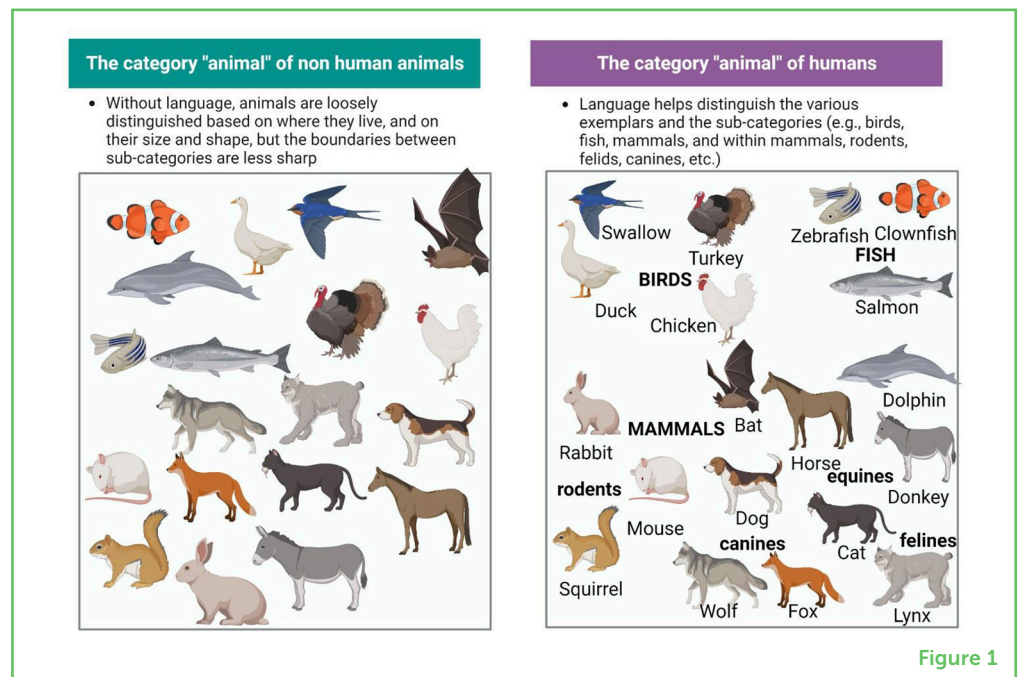


Figure 1

Categories also allow us to extend our knowledge by making inferences. For example, knowing that robins are birds tells us robins probably fly, have beaks, and lay eggs. Finally, words that name categories help people interact and communicate—we can speak of birds and understand each other, even when there are no birds around to point to. Concepts, which we express using words, are the mental aspects of categories: they consist of what we know about objects and entities, the brain areas that are activated when we use them, and the actions we perform when thinking of them. Depending on the concept we are thinking about, various areas of the brain might be activated. For example, when thinking of the appearance and chirping of robins, we might activate the areas of the brain responsible for sight and hearing. Similarly, when thinking of hammers, we might imagine their color, shape, where we might find them, and the actions we typically perform with them. Hence, thinking of hammers activates areas of the brain involved in vision and in planning and controlling movement.

CONCRETE CONCEPTS

Ideas that typically refer to single objects or animate beings, like “hammer” or “cat.”

ABSTRACT CONCEPTS

Ideas that do not refer to single objects but instead are more complex and detached from the senses but evoke inner bodily signals and emotions more. Examples include “justice”, “democracy”, or “thinking.”

ABSTRACT WORDS

Words used to express abstract concepts.

Figure 2

Differences between concrete and abstract concepts. **(A)** Members of abstract concepts differ more. **(B)** Abstract concepts activate the five senses less. **(C)** Abstract concepts activate more feelings and bodily signals. **(D)** Abstract concepts are harder to imagine. **(E)** Children learn abstract concepts through language. **(F)** People trust their knowledge about abstract concepts less and need others more to learn them. **(G)** Abstract concepts vary more across contexts, cultures, and languages (Figure created using [Biorender.com](https://www.biorender.com/); images from [pixabay.com](https://www.pixabay.com/) and [flickr.com](https://www.flickr.com/)).

CONCEPTS: ABSTRACT AND CONCRETE

Both “robin” and “hammer” are **concrete concepts**, meaning that we could point to an actual robin or hammer. In this article, we focus instead on **abstract concepts**, i.e., concepts expressed by **abstract words** like “fantasy,” “thinking,” “shame,” and “addition.” (see [Figure 2](#)). Abstract concepts are interesting because, unlike concrete concepts, their meaning is not entirely set and is often open to discussion. Generally, abstract concepts do not refer to a single object but to multiple components that interact and have complex relationships. For example, the concept of “justice” might evoke a judge, a courtroom, and a person being judged.














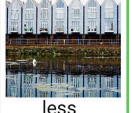
	A	B	C	D	E	F	G
	Commonalities and differences	Five senses	Inner bodily signals & emotions	Imagination of the concept	Learning age and modality	Social metacognition	Variability
ABSTRACT	 few common properties, dissimilar members	 activate the five senses less	 more inner bodily signals and emotions	 harder to imagine	 learned later, and through language	 lower confidence and more need of others	 more variable across contexts and cultures
CONCRETE	 many common properties, similar members	 activate the five senses more	 less inner bodily signals and emotions	 easier to imagine	 learned earlier, and through perception	 higher confidence and less need of others	 less variable across contexts and cultures

Figure 2

If you think abstract concepts are just more difficult to imagine than concrete objects and do not involve our five senses and the areas of the brain that control them, then you are wrong! Abstract concepts *do* involve the five senses, although sometimes less than concrete concepts do. Abstract concepts can also generate feelings and inner bodily responses, sometimes even more strongly than concrete concepts do. This is particularly true for abstract concepts that convey emotions, such as “love” and “optimism.”

Along with abstract concepts, we also have abstract words. Abstract words have their own uniqueness. Children learn them later than they learn concrete words, typically by using language and words to explain abstract words, rather than simply pointing at an object. Importantly, people tend to feel less confident about knowing the meaning of abstract words, they consider the meanings of those words more open

to debate or discussion, and they believe that they need help from others to understand their true meaning [1, 2].

WHY ARE ABSTRACT CONCEPTS INTERESTING

Scientifically, abstract words and the concepts they express are very interesting. We call abstraction our ability to group things forming more general and specific categories (e.g., “animal” vs. “Siamese cat”). This is different from our capability of learning and using abstract concepts (e.g., “justice” and “beauty”), which we call abstractness, and on which we are focusing in this article. Hence, abstraction and abstractness are linked but are different. Using abstract concepts and words is a very sophisticated ability, and a large part of adult speech—up to 70%—is composed of abstract words. So, it is very important to understand how we learn and use abstract concepts. Abstract words are sometimes so difficult to learn and use properly that they create or influence our relationships with others. For example, people often ask others to explain the meaning of abstract words, and this can generate interesting discussions!

TO LEARN ABSTRACT CONCEPTS, WE NEED OTHERS

Researchers think that to learn abstract concepts, people need others more than they do when they learn concrete concepts [1]. Why is this the case? Children generally learn concepts by noticing similarities among objects, making mental connections, and forming categories. For example, we might form the concept of “table” by noticing the similarities between various tables: a flat surface and four legs. Although there are wooden tables, plastic tables, garden tables, and kitchen tables that all differ to some extent, all tables look similar. As another concrete example, think of the category “things to take on a trip.” This category might include a mix of objects that differ in shape, color, size, and texture: books, clothing, bags, and maps, for example. Although these things do not look similar, they are all objects that can be used for a common goal or in a common setting (traveling).

The learning process is much more difficult for abstract concepts. Think of the abstract concept “justice.” Things that belong to the concept “justice” are not similar in terms of what they look like, the sounds they produce, the tastes they have, or any other quality. In addition, the members of “justice” might refer to different goals or situations, for example, to a courtroom where a judge must make a verdict, or to a group of friends who want to share some candy equally. To learn what kinds of things make up the concept of “justice,” we need others to explain to us what justice means. People might have quite different ideas about what “justice” or other abstract concepts mean, and this can lead to discussions in which ideas are compared or even

debated. Sometimes, discussions about abstract concepts can even change our minds about what we think they mean (Figure 3).

Figure 3

Discussion of the meaning of abstract concepts, such as justice, is necessary for a shared understanding of what the concepts mean (Image from pixabay.com).

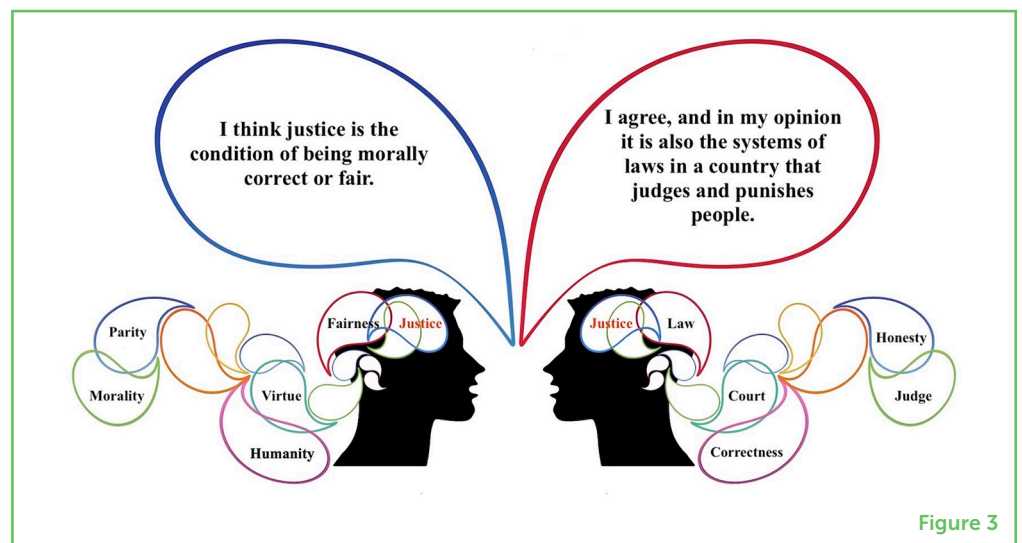


Figure 3

INNER SOCIAL METACOGNITION

An inner process that involves “talking to ourselves” to figure out what we know about a concept. For example, we might ask ourselves, “Do I really know the meaning of “democracy”?”

COGNITION

The process of acquiring knowledge using our senses and experience; it includes paying attention, perceiving the world, memorizing, reasoning, and using language.

METACOGNITION

The process of thinking about our thoughts and reasoning and evaluating them. For example, using metacognition we might decide that we have good memory, or that our knowledge is insufficient.

Studies on children show that to learn abstract concepts, language and the help of other people are particularly important. Other people help children to learn by using words and providing explanations. For example, hearing a single word, i.e., “freedom,” helps us keep together different experiences related to freedom, such as running on a field, exiting from prison, and having no limitations. Because the words and explanations of others are crucial to learning abstract concepts, learning these concepts might increase the sense of social connectedness among people. Maybe abstract concepts emerged in language over time *because* they increase social connectedness, which helps us survive as a species!

TO UNDERSTAND AND USE ABSTRACT CONCEPTS, WE NEED OTHERS

Recent studies support the idea that not only do we need others to *learn* abstract concepts but also to fully understand and use them. Imagine a conversation with someone who uses an abstract word like “desire.” Because of the complexity of this concept, you might be more uncertain about the word’s meaning than if the person mentioned “cats.” Therefore, you might have to move through two main phases to understand the abstract concept.

Phase 1: You might talk to yourself (in your head) to search for the word’s meaning, maybe even as if you were two different people (dialogic inner speech). For example, you might ask yourself, “What does this word mean?” This process is called **inner social metacognition**, that concerns both **cognition** and **metacognition**. It involves examining your knowledge through a process that is both inner and social [3]. If the inner search is not successful, meaning

you still do not understand the meaning of the word, the next phase can help.

Phase 2: If you do not find a response by inner social metacognition, you can ask someone who understands the word's meaning better than you do, or you can debate the word's meaning with others. This process is called **social metacognition**. In this phase, you search for knowledge elsewhere and rely on the knowledge of other people (**knowledge outsourcing**). There are three basic ways to do this. First, you might not know the meaning of a word and simply ask others what it means. For example, children might ask their teacher what the word "philosophy" means. Second, you might want to know whether others have the same thoughts about the meaning of a word as you do. So, you might ask others what the word means to them. For example, does "desire" mean the desire for food (hunger), desire for a person (love), or desire for knowledge (curiosity)? The meaning of abstract words can evolve and change across a person's lifespan, so the meaning of "desire" can differ between children, adolescents, and adults. Third, you might want to define a word with other people. Imagine you are a scientist and want to come up with a clear definition of "representation." You might debate its meaning with colleagues to arrive at a shared definition. Asking others what an abstract concept means could lead to discussion or debate about the word's meaning, which can help people come up with a shared definition.

Which scientific evidence supports these processes? First, we have found that people feel more uncertain about what abstract concepts mean, feel that they need others to learn them, and think that these concepts are so complex that they do not fully trust even the knowledge of experts [2]. Second, when people respond to sentences featuring abstract concepts, they use more expressions signaling doubts and uncertainty, ask more "why" and "how" questions, and tend to continue the interaction longer [4]. Third, when people receive help from others to guess which concept an image refers to, they feel more socially connected, i.e., they move at the same time and speed, as others who gave them suggestions about abstract than concrete concepts. It is more difficult to see an image and guess that it represents "beauty" instead of "table," so others are more important in the first case [5]. Finally, evidence shows that, when using abstract concepts, their mouth motor system is more involved [6]. This suggests that people talk to themselves to find the possible meaning or, if they realize they do not know what the word means, they do so to prepare themselves to ask others the word's meaning or to discuss it with them.

CONCLUSION: USING ABSTRACT CONCEPTS MIGHT STRENGTHEN OUR RELATIONSHIPS

Abstract concepts include category members that can be very different from each other, and their meaning is not fixed and stable

SOCIAL METACOGNITION

The process of depending on others for information about concepts. It could involve simply asking them ("What does democracy mean?") or debating the meaning with them ("What do you mean by democracy?").

KNOWLEDGE OUTSOURCING

The reliance on other people, possibly experts in a domain, to enrich our knowledge. For example, to learn the meaning of "democracy," we would refer to an expert in politics.

but varies a lot depending on the situation and the person who uses them. So, to learn abstract concepts, we rely more on others than we do when we learn concrete concepts and when we use abstract concepts, they can easily lead to discussion or debate. For this reason, abstract concepts might contribute to creating stronger social bonds with others. Many questions are open, though. There might be different kinds of abstract concepts, for example, philosophical-spiritual concepts, that relate to deep questions about life and the nature of knowledge (for example, "religion," "moral," and "destiny"), emotional and social abstract concepts ("love" and "shame"), and abstract concepts related to space, time, and numbers ("area," "day," and "sum"). Do the different types of abstract concepts strengthen our relationships in different ways? Do concepts that we have different opinions about, like politics, increase our sense of social connectedness or not? How do we form and use concepts, such as gender, that include both biological aspects and aspects that vary depending on the place and society in which people live? How do we learn scientific and technological concepts? Also, how do abstract concepts change across situations, languages, and cultures? Continued study of abstract concepts is important because they constitute an important part of how we think, how we speak, and how we interact with others.

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REFERENCES

1. Borghini, A. M. 2022. Concepts for which we need others more: the case of abstract concepts. *Curr. Dir. Psychol. Sci.* 31:238–46. doi: 10.1177/09637214221079625
2. Mazzuca, C., Falcinelli, I., Michalland, A. H., Tummolini, L., and Borghini, A. M. 2022. Bodily, emotional, and public sphere at the time of COVID-19. An investigation

- on concrete and abstract concepts. *Psychol. Res.* 86:2266–77. doi: 10.1007/s00426-021-01633-z
3. Borghi, A. M., and Fernyhough, C. 2023. Concepts, abstractness and inner speech. *Phil. Trans. R. Soc. B.* 378:20210371. doi: 10.1098/rstb.2021.0371
 4. Villani, C., Orsoni, M., Lugli, L., Benassi, M., and Borghi, A. M. 2022. Abstract and concrete concepts in conversation. *Sci. Rep.* 12:1–15. doi: 10.1038/s41598-022-20785-5
 5. Fini, C., Era, V., Da Rold, F., Candidi, M., and Borghi, A. M. 2021. Abstract concepts in interaction: the need of others when guessing abstract concepts smooths dyadic motor interactions. *R. Soc. Open Sci.* 8:201–5. doi: 10.1098/rsos.201205
 6. Borghi, A. M., Barca, L., Binkofski, F., Castelfranchi, C., Pezzulo, G., and Tummolini, L. 2019. Words as social tools: language, sociality and inner grounding in abstract concepts. *Phys. Life Rev.* 29:120–53. doi: 10.1016/j.plrev.2018.12.001

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YOUNG REVIEWERS

DEREK, AGE: 16

Hi, I am Derek, and I currently live in Vancouver, Canada. I love science, but outside of that, I can be found staring at a map, trying to wrap my head around math problems, desperately attempting to memorize ancient vocabulary moments before a test, or hitting the buzzer far too late in quiz competitions.



**GIGI, AGE: 9**

My name is Gigi. I play piano and like art. My favorite thing to do is art and crafts. I have a tuxedo cat named Athena. And my favorite color is yellow!

AUTHORS**ANNA M. BORGHINI**

I am a researcher and a teacher of cognition. I work in Rome, a city I love. Since adolescence, I have always been interested in language as a tool for thinking and interacting. In the Body, Action, Language Lab (BALLab), we study bodily and social experiences that objects and words evoke, especially abstract words, like “freedom.” We use various experimental methods, including asking people to list and rate word features, measuring response time, eye and hand movements, and activated brain areas, and simulating language in robots. Aside from research, I enjoy being with my children, swimming, singing, and reading novels. *anna.borghini@gmail.com

**ILENIA FALCINELLI**

I am a doctoral student in psychology and neuroscience at Sapienza University of Rome. I am interested in studying how people represent concepts referring to nature (such as “forest”) and ecological issues (like “climate change”). I am convinced that investigating this topic can help us to behave better toward our planet. For this purpose, I use various experimental methods, ranging from asking people to produce free associations for given concepts to investigating the time required to process words. I also investigate the brain waves occurring during the processing of words and concepts, using electroencephalography (EEG).

**CHIARA FINI**

I am a researcher and a psychologist at Sapienza University of Rome. I was a child when I realized that I wanted to be a psychologist. However, I did not plan to be a researcher—that happened during my internship after I got a master’s degree in neuropsychology. At that point, I discovered how exciting it was to study human behaviors. My research interests are about the role of the body in shaping our mental life: how much our motor system is involved in brain processes such as perception, language, and social interactions. Is our body a bridge through which we can connect to others?

**ANGELO MATTIA GERVASI**

I graduated with a degree in psychology from the University of Bologna, and I moved to Rome to begin a Ph.D. in neuroscience at Sapienza University, in collaboration with the Lyon Neuroscience Research Center. Since my childhood, I have always loved sports, and I developed an interest in the effect of sports on the brain. For this reason, I study the brain mechanisms underlying our actions. In particular, I focus on the interaction between action and language. During my free time, I love playing tennis and football, watching matches, and taking pictures of the gorgeous monuments of Rome.

**CLAUDIA MAZZUCA**

I am a postdoctoral researcher at Sapienza University of Rome. I have always been fascinated by the capability of language to shape and create reality, so I study the interplay between language(s) and cognition. Abstract concepts are where this magic happens in the most exceptional way, as they require language to exist. So, I try to understand the role that the body and social factors play in the representation of abstract and concrete concepts across languages and cultures. I am passionate about science overall, and to this end I try to practice and communicate principles of open science.