



The analogy that builds human thought



Abstracting relations between objects: a primary cognitive ability

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Only human beings (with rare exceptions) are able to grasp analogies. A study carried out in collaboration with SISSA (and the Northwestern University) has investigated the origin of this ability, which precedes linguistic ability and forms the basis of highly sophisticated reasoning. The study has been published in the journal *Child Development*.

When Niels Bohr hypothesised his model of atom with the electrons orbiting the nucleus just like satellites orbit a planet, he was engaging in analogical reasoning. Bohr transferred to atoms the concept of “a body orbiting another”, that is, he transferred a relation between objects to other,



new objects. Analogical reasoning is an extraordinary ability that is unique to the human mind, is not seen in animals (except very rarely in primates) and that forms the basis of highly sophisticated human thoughts. Scientists have wondered about the origin of this cognitive function: for example, is it necessary to have developed linguistic abilities or are we born already cognitively equipped for this type of abstraction? According to a new study carried out with the collaboration of the International School for Advanced Studies (SISSA) of Trieste and just published in *Child Development*, the second hypothesis is probably true: analogical abilities precede language and are already present in infants just a few months old.

"We worked with the same-different relation, which, as the simplest abstract relation, has been a focus of research on analogical thinking", explains Alissa Ferry, SISSA research fellow and first author of the study. "We investigated two different questions about how humans start to think analogically: First, we asked if language is required to understand abstract relations or if this skill is independent of language. Second, if this is independent of language and humans are born with analogical skills, do humans also naturally possess some knowledge of relations that they use to start thinking analogically? Or are humans born with analogical skills and that their understanding of relations is built from scratch using only these analogical skills.

To answer these questions, Ferry worked with prelinguistic infants aged 7 to 9 months who were trained on *same* or *different* pairs of puppets and then tested on their ability to generalize the observed property to novel pairs of objects.

"Even children of that age are able to identify the 'abstract' relation between objects and then recognize it in novel objects, but a single trial in the training phase is not sufficient: they need several trials to understand the relation". This, according to Ferry, means two things: that analogical reasoning is independent of linguistic ability (which it precedes) but we are not born with *same-different* templates encoded in our brains and we need some experience before we learn it.

More in detail...

By definition, a prelinguistic child is unable to speak and carry out tasks based on instructions given by an experimenter. So how do neuroscientists understand what happens in the child's mind?

"When we work with very young children we use a special technique based on the fact that after a child looks at a cue for a while, his attention will drop in a fairly typical fashion", explains Ferry. Attention is measured by monitoring gaze: if the child's gaze is fixed on the cue, that means the child is paying attention, but when his gaze starts to wander he is no longer paying attention.

"We know from the literature that when a child becomes habituated to a stimulus and no longer



looks at it, presenting him with something new will bring his gaze back to the stimulus. This gives us a clue to understand whether the child is experiencing something different from before”.

In Ferry’s study, the children were trained on a pairs of identical (or different, in the alternative condition) objects. The pairs of *same* objects were left in view until the child’s attention started to wane. At that point, the experimenters showed the children two pairs of objects simultaneously: one with two identical puppets and one with different puppets. If the child’s gaze went towards the pair of different objects, then the researchers understood that the child had grasped the sameness relation in the training pair and considered the *different* pair as “novel”.

USEFUL LINKS:

- Original Paper in Child Development: <http://goo.gl/8s3xQO>

IMAGES:

- Credits: Photogramma1 (Flickr: <https://goo.gl/cDzHel>)

VIDEO:

- Titolo video con link su Youtube

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- Titolo del file audio con link al file Mp3

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