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Taking a detour on the path to human thinking

Thinking—not just a brain thing

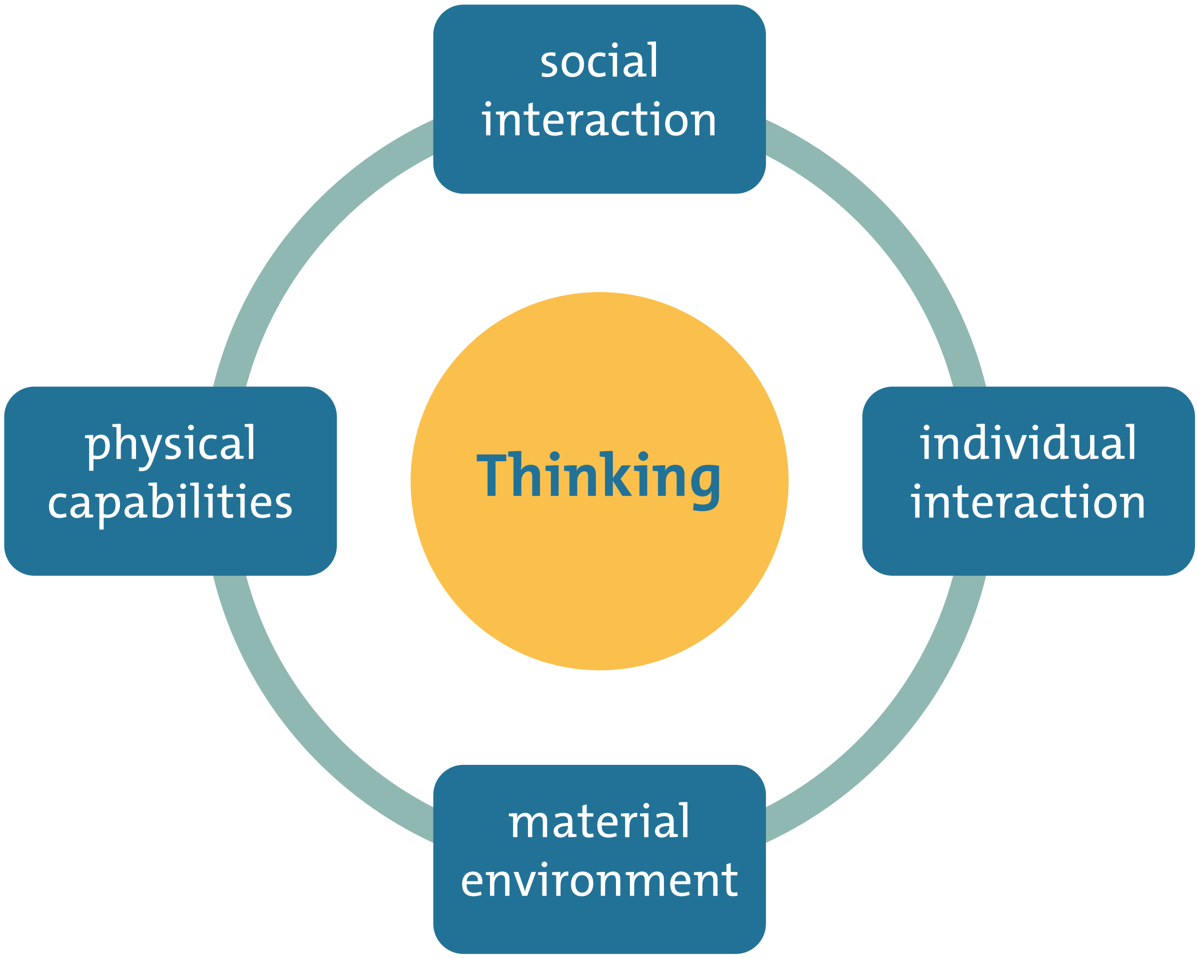
We think with our heads, or more precisely with our brains, right? In our brain, sensory impressions are bundled, filtered, linked with one another, compared, and evaluated. New plans are forged and reactions postponed so that we can think things over. But does all this only take place in the brain? Is our brain a biological central computer, our thinking simply information processing? *Fig. 2*

In addition to our brain, our whole body plays an important role in the way we think. Our senses supply us with impressions. As humans, we see three-dimensionally and in color, we hear particularly well in the frequency range of human speech, we perceive clear smells, and have a good sense of balance, which helps to precisely control our movements. With the proverbial "eagle eye", eagles see sharply at much greater distances and can also perceive ultraviolet light. Bats and dolphins orientate themselves and communicate with each other with the help of ultrasound. Dogs can sniff out much finer scents than we can. Birds have different organs of equilibrium for flight on the one hand and standing and walking on the other.

Thinking by acting

Our sensory organs are not simply suppliers of information. They are not static, any more than our nervous system and its particularly conspicuous part, the brain. They can change to a certain extent, depending on how they are used in the course of our lives. We learn. Babies explore their environment by touching as much as possible, experiencing cold, hot, wet, sharp, and cuddly things, by putting everything in their mouths and experiencing mixtures of sour, salty,

1 Aside from the brain, various senses and hand motor skills are also necessary to perceive, remember, and plan in the production of tools.



2 The ability to think is influenced by many factors.

sweet, and dusty, by throwing things around, by pulling themselves up and falling down. We don't just see blue things as blue but learn to pay attention to certain sensory impressions and classify them as blue. Through our actions, we learn to control our bodies and to think: through different perceptions, the comparison of sensory stimuli with familiar ones, evaluations, resulting reactions and the generation of new perceptions.

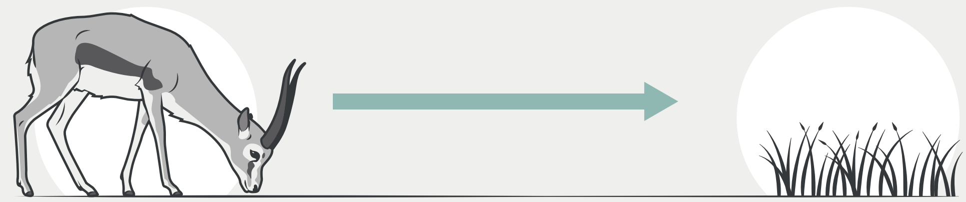
Thinking embedded in the environment

Our thinking is embedded in how we deal with our environment. When a child learns to ride a bike, it won't do so if we tell it how it is done. It has to sit on the saddle, learn how to pedal, steer, brake, and stay upright all at the same time. It has to get a feeling for the vehicle. The muscles and senses develop routines so that the riders can focus their attention on special events ("a ball rolls into its path!"). It is said that once you have learned to ride a bike, you will not forget it. This applies to many things that have become a habit. In this case, our body is thinking, supported by the specific properties of things it interacts with. In addition, tools can support our way of thinking. A blind person can "see" their surroundings through a cane. A shopping list reminds me to buy the yogurt. In these cases, our perception and memory, i.e. parts of our thinking, are expanded by things outside of our body. And our way of thinking is only partly individual. As social beings, we benefit from the knowledge and experience of others, take on classifications and assessments, learn from others to pay attention to things, and think in certain ways. Our way of thinking is not trapped in our person but distributed within the group.

Development of thinking

In the course of a lifetime, the way we think develops and changes. We are continuously collecting knowledge, gaining experience, rearranging things accordingly, starting to be interested in something, pursuing a thought and expanding it, losing the thread, or completely rethinking something. We develop our way of thinking individually, each with his/her mix of personal and shared experiences, suggestions, and inhibitions. And we develop our way of thinking in an environment shaped by history and social contacts. Depending on the group to which I belong, I adopt different values, experiences, actions, and explanations. A single mother working in a shop who organizes her everyday life with a smartphone thinks differently than a farmer who lived during the Middle Ages and could neither write nor read. The mixture of prevailing traditions in attitudes, actions, and material environment defines our respective culture. In the course of the past three million years of human history, our physical prerequisites for thinking have changed alongside and with cultures. Human brains have grown from the size of a fist to the volume of a packet of milk and beyond. The density of nerve cells has increased, the relationship between different areas of the brain and their metabolism has changed. Our hands have become increasingly suitable for powerful grips on the one hand, and very precise handling of things on the other. Both hand-eye coordination and the fine motor skills of the hands have increased.

A growing ability to communicate finally culminated in many thousands of languages through which we can exchange ideas about the past and the future as well as about concrete things like cucumber salad or ideas like justice. Human thinking developed in the interplay of individual, historical-social, and evolutionary-biological developments with an environment increasingly shaped by humans.



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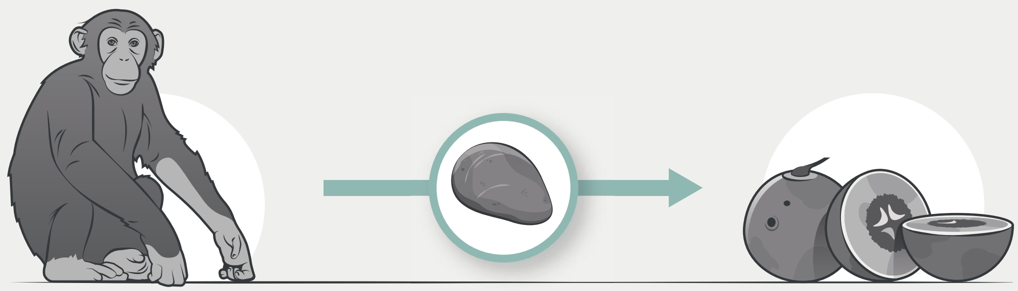
Immediate food intake
(without tools)



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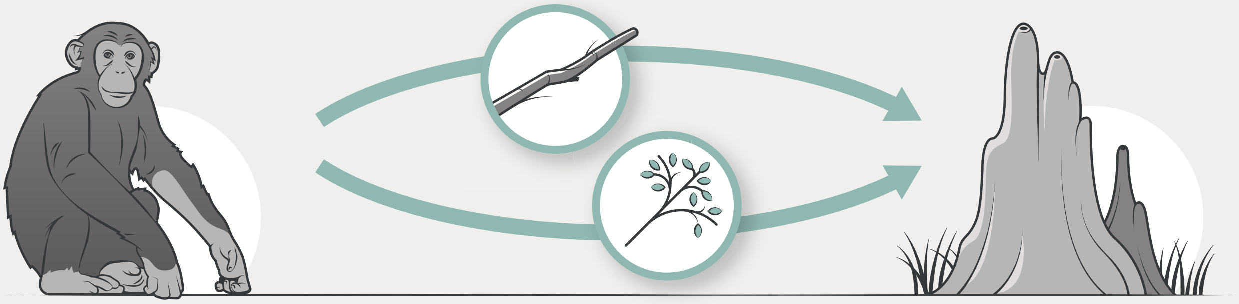
Simple use of tools
can be observed among multiple animal species.

3 When an antelope is hungry, she grazes grass—without detours.

4 If a chimpanzee wants to eat nuts surrounded by a hard shell, it must first find a suitable hammerstone to crack the nutshells. It must think about a detour before reaching its goal.

Development of human thought—the basics

The further we go back in time, the more difficult it becomes to figure out how and what people thought about. For periods without a written language, only the results of people's actions can provide us with clues about their ways of thinking. The production and use of tools offer a place to start. Different animals use tools and also make them. They use the tools for purposes that they could not achieve based on their physical abilities: the woodpecker finch pokes cactus spines into the wood to catch insects and maggots; capuchin monkeys crack hard nuts and clams with stones; orangutans use leaf cushions to protect themselves when climbing thorny trees. No species (except humans) is more proficient in handling tools than chimpanzees (see Wittig's article in this volume), who use them to get to hard-to-reach food, to draw liquids, to impress others, to cleanse and defend themselves. In terms of thinking, what makes tool behavior significant is the mental detour that an individual takes to reach its goal. While a hungry antelope only looks for grass and eats it as soon as it has found it, tool users must first look for a suitable device before they can start working on their actual object of desire. To do this, they have to put aside their actual goal and first focus their attention on the tool. The distance between problem (e.g. hunger) and solution (e.g. food) increases. Chimpanzees can use various tools to reach one goal.



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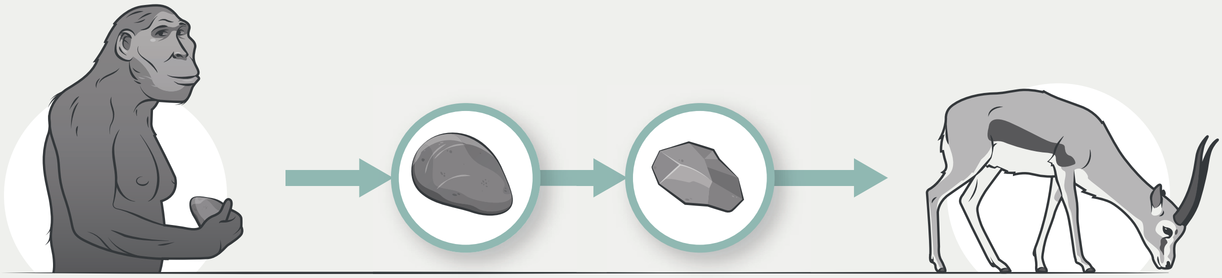
Multicomponent toolsets composed of primary tools are used by chimpanzees to collect ants or extract termites or honey.



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Using a tool to produce a tool to reach a certain goal – since at least 3.3 million years ago.

Extended detour-thinking

The first evidence for an even greater detour in thought is around 3.3 million years old. In Lomekwi, Kenya, stones were used to chop off sharp flakes from other stones to work something with them. The use of tools to make tools to do something else has only been documented for hominins. This trick of the again expanded detour made it possible to create new tools with previously unknown properties that opened up new possibilities. With cutting edges, for example, humans could quickly cut off parts of a carcass or prepare wood for other tasks, without having to use sharp teeth. The greater the detour, however, the more thought and, in cases, planning is involved. To make a cutting stone flake, you needed a good hammerstone and raw material suitable for knapping. If you were lucky, both were close at hand when you wanted to steal a piece of the leopard's prey. But if you first need to start an elaborate search for materials, food competitors like hyenas got there first. Those who could pay attention to several things at the same time, remember places with good raw materials, and think ahead, had to rely less on luck and had an advantage.

5 If a chimpanzee wants to treat itself to a termite snack, he often has to use two different tools: a stick to break open the termite mound and a thin twig to fish for termites.

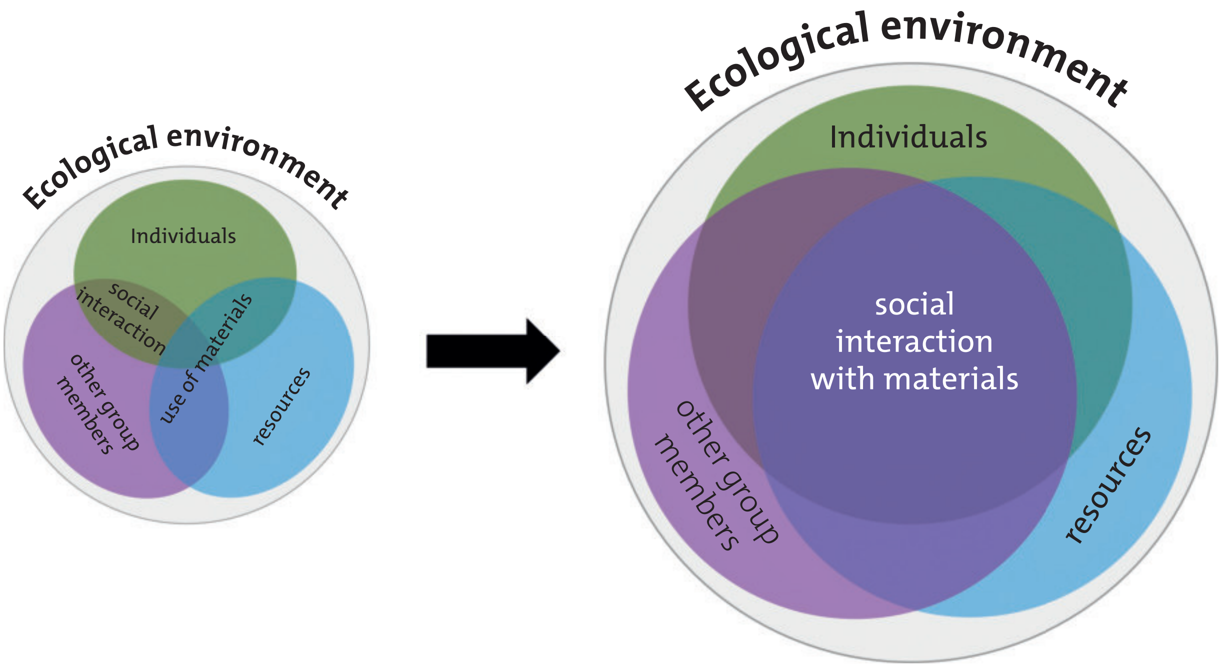
6 The manufacture of stone tools with a hammerstone, for example, to dissect an antelope, requires extended thinking along with multiple detours. So far, this is only known for hominins.

Bit by bit

To be able to master further thought detours, it helped to break them down into small stages and arrive at the goal step by step. The time span between a need and its satisfaction became longer due to the detours. They diverged more and more until independent small units of action emerged. These fulfilled intermediate goals such as the procurement of raw materials or the production of tools—regardless of whether they were required immediately or not. These small units, called modules, had many advantages. Detached from an urgent need, the materials or tools could more easily be used for other purposes. They could be linked to one another in different ways. And broken down into small units, even more complex actions could be learned more easily.

Chimpanzee children take about three years to master the cracking of nuts with a stone. This is an indication of how long it may have taken hominins to learn the longer detours and to acquire the various skills and knowledge associated with them. By learning individual modules bit by bit, it was easier to acquire longer detours in thinking. With the help of flakes, children were able to practice cutting before they managed to make such devices themselves. They grew up in a group with the idea that stones could be shaped and knapped. Together with the elders, they would hike to places with good raw materials. They would learn about suitable stones when they helped carry the stones selected by their experienced elders back home. When the children were finally big enough to try their hand at stone knapping, they had already learned a lot about what it takes to produce and use the tools.

7 In the course of human history, humans not only strengthened their connection to members of their group on the one hand and improved upon the materials used on the other. The interaction of humans and objects became more and more intermingled, and the human ecological environment expanded.



Together

If there is some space between a need and its satisfaction, if detours become conceivable, group members can also be more easily included in one's thoughts and actions. If I can break down my path from problem to solution into little modules and put them back together into large chains of action, then I can let other people take over individual parts. Different knowledge and different skills among different group members can be linked more easily. It is easier for everyone to benefit from the skills of others. In the beginning, hominins may have only used what others had left behind to continue with their actions: unused raw material, for example, or a reasonably sharp flake. Then several individuals might carry raw material to a production site, but one person was more successful at stone-knapping and allowed others to use the surplus tools. To contribute to a common solution to a problem, not just by chance, but intentionally, different people had to be able to focus their attention on one thing: I carry this for you and you make this out of it for me. Gradually, real cooperation became conceivable. It was increasingly possible to think together with others, and others could be included in plans. By extending detour thinking to group members, the social bonds within groups were strengthened.

Different—and therefore more

Monkeys, and especially great apes, build strong social relationships with the members of their group. They are full of ideas when dealing with their environment. Through special actions (for example, processing nettles before eating among gorillas) and the use of tools (for example, making leaf sponges to scoop up liquids among chimpanzees) they can make use of a wide range of resources. Compared to other animals, their ecological environment is large and varied. In the course of human developmental history, extended detour thinking increased the degree of interaction with group members as well as tools and resources, and the communal sharing of materials opened up further possibilities. The entire ecological environment of early humans expanded by thinking in further detours. Each new thing that was included in the thought process and actions could become a bridge to another. *Fig. 7*

From simple stone tools to machines, from supporting sounds to entire novels, from the use of natural fire to electricity, clothing, agriculture, art, religion, school, and science ... Everything that we take for granted today has its origin in the fundamental extension in detour thinking that began around three million years ago. By taking detours, humans were able to meet their environment more flexibly, adapt to new conditions, and thus colonize regions far away from their African origins.

Further reading

Fingerhut, J./Hufendiek, R./Wild, M. 2013 Philosophie der Verkörperung. Grundlagentexte zu einer aktuellen Debatte (Berlin 2013).

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Tomasello, M./Melis, A. P./Tennie, C./Wyman, E./Herrmann, E./Gilby, I. C./Hawkes, K./Sterelny, K. 2012 Two key steps in the evolution of human cooperation: The interdependence hypothesis. Current Anthropology 53(6), 2012, 673–692.

Varela, F. J./Thompson, E./Rosch, E. 2017 The embodied mind. Cognitive science and human experience. Revised edition (Cambridge/Mass. 2017).

Homo ergaster

Profile

Discovery

Richard Leakey discovered the first remains of a *Homo ergaster* in 1971 in Koobi Fora, Kenya. Some of the fossils described by John Robinson in 1949 were subsequently assigned to the newly named species *Homo ergaster* in 1975.

Sites

Kenya: Koobi Fora, Lake Turkana.

South Africa: Swartkrans.

Finds

Skull with lower jaw bone, pelvic bones, shoulder bones, spinal column, arm and leg bones, skeleton of the "Turkana-Boy".

Age

1.9–1.4 million years.

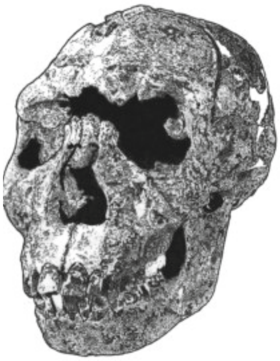
Brain size

510–900 cm^3.

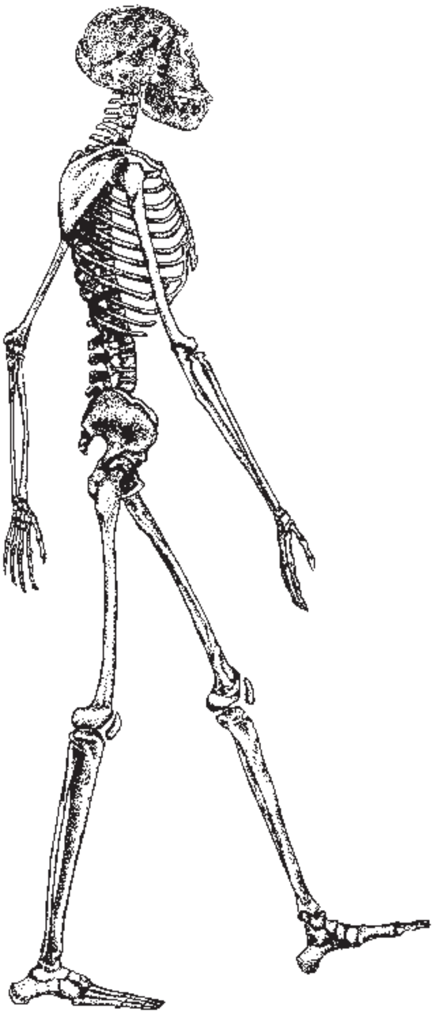
Characteristics

Many researchers consider *Homo ergaster* to be the early African form of *Homo erectus*. The physical characteristics are very similar. In general, *Homo ergaster* were tall and graceful. They moved completely upright and were persistent runners. Based on the 1.6 million year old partial skeleton of the "Turkana Boy", which was 1.59 m tall, the size for adult individuals was calculated to be around 1.85 m. Although there is no clear evidence, tool use is assumed for *Homo ergaster*. However, in every complex in which stone tools were found in connection with these fossils, fossils of *Paranthropus boisei* are also found. They may also be considered as potential makers of the tools.

Skull KNM-ER 3733 from Koobi Fora, Kenya



Skull of the Turkana Boy



Turkana Boy KNM-WT 15000 from Kenya