

The "why" of human reasoning and
communication:
Cognitive capacities through the lens of evolution

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Introduction

{sec:introduction}

Don't overuse passive voice. Don't make sentences too long. Don't abuse semicolons. Don't have too long NPs before the VP comes. Watch out for Dutch word order.

Two cognitive skills that are often considered to set humans apart from their evolutionarily closest relatives are on the one hand our outstanding capacity for reasoning, and on the other our profound communicative abilities. Broadly considered to be unmatched in the animal kingdom (Cheney and Seyfarth, 1997) are on the one hand our sophisticated reasoning abilities

This paragraph is saying the same thing twice, and word order is funky

Explicate this; cite a source

and on the other hand our communication using languages that are infinitely creative in enabling the production of complex sentences.

Our reasoning and communication are intertwined with each other in different ways; it is hard to imagine our communication without reasoning. In our everyday lives, a lot of the content we intend to convey to others, we relay pragmatically: we do not literally spell out these things, but rather hope and expect our interlocutors to infer the intended message from the communicated content. When I ask my dinner partner if they can pass me the salt, they infer that I am not interested in learning about their ability to pass me the salt but rather that I am requesting to be passed the salt. When I give feedback on an interlocutor's behavior, I first reason about how my words will come across to her in order to minimize social conflict.

It is thus easy to see that reasoning and communication are intricately linked. But what exactly is the extent and nature of this link? In 2011, Hugo Mercier and Dan Sperber proposed a revolutionary theory of reasoning that intended to account for a number of long-standing issues in the experimental psychology of reasoning. According to their *argumentative theory of reasoning*, the main function of reasoning in humans is argumentative; that is, reasoning evolved in humans in order to devise arguments and evaluate those of others. Their theory is able to explain a number of purported 'flaws' of human reasoning, such as poor performance on standard reasoning tasks such as the Wason selection task; confirmation bias; and the phenomenon of motivated reasoning leading to attitude polarization.

In the words of Mercier and Sperber,

Reasoning has evolved and persisted mainly because it makes hu-

man communication more effective and advantageous. (Mercier and Sperber, 2011, p. 60)

In this thesis, I will scrutinize this position in order to ultimately answer the question of whether advanced reasoning skills in humans evolved because they facilitate more advanced communication.

A few words about why it is worth scrutinizing

1 | The chicken and the egg: the evolutionary approach

{ch:evolution}

Before we are able to answer any *why*-questions about humans' cognitive capacities, some groundwork needs to be laid out. For what does it mean for some trait to evolve 'for the purpose of' another trait? Are we even justified in using this kind of terminology when it comes to evolution, a process which cannot be said to be intentional or purposeful? And what intermediate questions will we need to ask ourselves in order to ultimately answer the question of why we reason and communicate?

Explicate why "why we communicate" is also an important question (maybe elsewhere)

This chapter attempts to answer these questions. It by no means provides an overview of issues in evolutionary theory, a large field of research in its own right with widely diverging opinions on a number of specifics of the process (see Ariew et al. (2002) and Uller and Laland (2019) for overviews of topics in evolutionary theory). This chapter will merely serve to get a number of issues 'out of the way' before we can continue our investigation into the cognitive mechanisms of reasoning and communication.

Rephrase:
don't use definite article

This wildly undersells this chapter

1.1 Causation in evolution

{sec:causation-evolution}

First, we will dip our toes into the waters of causation in evolution.

Evolutionary causation is a subfield of philosophy of biology that has continued to see widely diverging opinions (Baedke, 2021; Uller and Laland, 2019). In this section I will restrict focus on three topics in evolutionary causation that are of interest to this thesis: proximate vs. ultimate causation; Tinbergen's four questions; and reciprocal causation and niche construction. The former two will serve to illuminate some basic aspects of the issues evolutionary causation concerns itself with, and the latter is of particular interest in considering the evolution of human cognition.

Too much like bullet points

In evolutionary causation, one may distinguish *proximate* from *ultimate* causes. Proximate causes are the *immediate* influences on a trait: they explain how the trait results from the internal and external factors causing it. Ultimate causes on the other hand are the higher-level historical and evolutionary explanation

of those traits (Mayr, 1961)

Add an example to illustrate

. In other words, these two different causes answer two different explanatory questions : the proximate cause is the answer to the *how*-question, whereas the ultimate cause answers the *why*-question. According to Mayr , who pioneered the distinction (Laland et al., 2013), one needs to answer both of these questions in order to obtain a complete understanding of the phenomenon at hand .

Do causes answer questions? I know what you mean but it doesn't sound right

In an influential proposal considered by some to be an extension of this distinction, Tinbergen (1963) outlined four questions or problems central to the study of animal behavior. In order to fully understand a pattern of behavior, one must consider (1) the proximate causation of the behavior, (2) the lifetime development of the behavior, (3) the function¹ of the behavior, and (4) the evolutionary history of the behavior.

Add reference to Mayr

Trait? Behavior? Ability? This is vague

While Mayr's and Tinbergen's frameworks have had considerable explanatory value in the field of evolutionary causation, it has been argued (Laland et al., 2013) that biologists would be better off rejecting them in favor of a framework of *reciprocal causation*. In reciprocal causation, there is feedback between the organism and its environment: not only does the environment influence the organism through the process of natural selection, but the organism in turn influences its environment through the process of *niche construction* (Svensson, 2018), where organisms actively partake in modifying their environment and shaping their niche, usually to their own benefit.

Add an example to illustrate. Also, define niche

It has been argued that niche construction is at least as important as natural selection in shaping evolution, and moreover that especially in evolutionary processes involving interactions between organisms, reciprocal causation is very frequent (Svensson, 2018).

1.2 Evolutionary psychology and its issues

{sec:evol-psych}

In order to answer our question , we will also need to zoom out to consider the field of evolutionary psychology as a whole. What is the merit, and the validity, of adopting an evolutionary approach in our endeavor?

Worth restating

The field of evolutionary psychology concerns itself with trying to understand human behavior using evolutionary theory, by looking into the past and considering how our ancestors must have adapted to their environment in order to survive and reproduce. Researchers in the social sciences and humanities have historically been wary of using evolutionary approaches to study human behavior, because evolutionary theory has been abused for prejudiced ends in the past; see Laland and Brown (2002, pp. 19–20) for an overview. Moreover, evolutionary-psychological research has received the criticism that too much of

Ask Karolina about feedback here: didn't understand

¹See Section 1.3 for a discussion of function in biology.

it is "just-so" storytelling and post-hoc explanation of known phenomena, sometimes accompanied by a sensationalist spin on the story (Laland and Brown, 2002). However, if these pitfalls are avoided, looking at human psychology from the evolutionary perspective can be an illuminating endeavor.

Let us now consider some of the central concepts and assumptions of evolutionary psychology.

In order to explain humans' psychological mechanisms, evolutionary psychologists look to the concept of an *environment of evolutionary adaptedness* (EEA). The EEA is the environment in which these psychological mechanisms must have come into being; usually the EEA is identified as hunting and gathering groups on the African savannah in the second half of the Pleistocene, between 1.7 million and ten thousand years ago (Laland and Brown, 2002)

Are the groups the EEA or the savannah?

. The assumptions underlying the use of the concept of an EEA are that (1) our modern-day environment is too different from that of our ancestors for us to use it to explain why and how our psychological mechanisms evolved in the past; and (2), for our psychological mechanisms to be as complex as they are, they must have evolved slowly – and thus a considerable amount of time ago, without changing significantly since the Stone Age.

There are a number of issues associated with the use of the concept of the EEA (Laland and Brown, 2002). Firstly, we do not know very much about the environment of our ancestors, so the specifics of the EEA may be filled in as is seen fit for one's purpose. Secondly, we do not know enough about the process of evolution to make assumption (2); while evolution does in general operate on a large timescale, research has shown that it can also be faster, operating on a time scale of thousands of years, or less than 100 generations (Laland and Brown, 2002, pp. 190–191 and references therein). Thirdly, the argument can be made that for our species to have flourished and dominated in the way that it did, we must have remained adaptive to our changing modern environments after the Stone Age. Lastly, the EEA argument does not take into account reciprocal causation or niche construction.

Elaborate on this

The following section warrants a larger discussion about domain-specificity; define it and give examples

Another topic of discussion in evolutionary psychology that is of importance to our investigation, is that of domain-specificity of the psychological mechanisms. The argument has been made that these adaptive mechanisms are necessarily problem- or domain-specific, because the evolutionary process would not favor general solutions to specific problems (Buss, 2015, p. 50). However, as with the EEA, issues with this stance have been raised: the push to domain-specificity can be said to rely on overly strong assumptions about the modularity of the brain; and moreover, there is also a push to domain-generalism of cognitive skills because domain-general skills are neurologically more cost-efficient than domain-specific skills (Laland and Brown, 2002).

Lastly, a criticism raised to evolutionary psychology is that not only biological evolution, but also cultural evolution can be said to have played a role in shaping human behavior and human cognitive capacities; it is a joint endeavor facilitated by nature and nurture.

Add references:
where did you
read this?

1.3 Teleological notions in evolutionary theory

{sec:teleology}

This section needs quite some work: see notes from discussion with Karolina

Next, it is useful to scrutinize the terminology that I will be using throughout this thesis. Biological literature frequently makes use of *teleological* terminology, that is, terminology that implies goal-directedness of the processes it describes. Such terminology includes concepts like the *design* of a trait, and *function*, *purpose*, or *utility* of a trait. At first glance, the usage of these terms in discussing evolution would seem to be inappropriate; evolution is a natural process, that is not purposefully performed by an agent, and is without any intentionality or goals. And indeed, this teleological terminology has its origin in pre-Darwinian and creationist views on the origin of species.

This sentence
needs rewriting,
it's convoluted
and too long

However, explanations in terms of goals and function have considerable instrumental value in describing evolutionary processes. Throughout this thesis, I will be adhering to the conception of teleological explanations of Ayala (1999), which is as follows:

The actual ultimate
origin of
it is Aristotle;
make mention
of this

Teleological explanations account for the existence of a certain feature in a system by demonstrating the feature's contribution to a specific property or state of the system, in such a way that this contribution is *the reason why the feature or behaviour exists at all*. (p. 13)

In this respect, the evolutionary process of adaptation merits a teleological explanation: the function of a trait (its 'contribution to a specific property or state of the system') is the reason that the trait exists, because it exists as a consequence of natural selection.

Add example
here

What about reciprocal causation and niche construction? Or cultural learning?

The distinction between proximate and ultimate causes we saw in Section 1.1 can be applied to teleological explanation as well, yielding the distinction between proximate and ultimate *ends* of features. The proximate end is then the 'immediate' function the feature serves, and the ultimate end is the reproductive success of the organism.

Add example

A footnote to this account is that not all features of organisms can be explained teleologically; only if the feature has arisen and persisted as a direct result of natural selection, a teleological explanation is in place.

This "direct result of natural selection" is very vague; elaborate on this

In general, teleological explanations in biology are quite controversial: not only is the usage of the specific terminology itself debated (Ayala, 1999, p. 27 and references therein), the concept has been criticized for its apparent lack

of formalization and insufficient argumentative persuasiveness (Baedke, 2021, p. 83).

Address the controversy around teleological explanations

Move this bit upwards

1.4 An evolutionary foundation

Now that we have gathered the puzzle pieces, let us return focus to our field of investigation and lay its groundwork. In particular, before we can continue with our evolutionary approach to human reasoning and communication in the next chapters, we will need to outline and justify the assumptions made.

It has become apparent that for none of the topics in evolutionary theory discussed here consensus has been reached among its practitioners. Since the purpose of this thesis will not be to provide a complete causal framework for the evolution of reasoning and communication, we will be able to cast aside some of the issues plaguing the frameworks discussed in this chapter. We will proceed cautiously, using the concepts outlined without needing to account in detail for their shortcomings.

Why can we consider these cognitive capacities from an evolutionary perspective? In choosing to explore human reasoning and communication from the evolutionary perspective, I am working on the assumption that it is appropriate to the endeavor: reasoning and communication are two key features of the homo sapiens that must have arisen at some point in our evolutionary history, shaped by natural selection, niche construction, and perhaps (cultural) learning. Moreover, it is justified to assume that the cognitive abilities underlying human reasoning and communication are heritable, either genetically or culturally.

Change structure to drop headings: make sure that the content of the paragraph is still clear without using the headings

What do we mean when we say 'evolution'?

Add a section on culture to this chapter (where?): add things from Heyes (2018), and maybe some things from Laland et al. (2013) and Laland and Brown (2002).

So far, we have mostly considered the concepts and issues surrounding *biological* evolution, and the role of *culture* has remained largely undiscussed. In this thesis, I will use the term 'evolution' and associated terminology to talk about the development of cognitive capacities in humans over time, remaining agnostic about whether this evolution is due to biological processes like natural selection, or cultural processes like cultural learning.

What are our assumptions about the evolutionary process? I accept the concept of the EEA in a general sense despite the flaws discussed in Section 1.2; for our purposes, we need not commit to any strong assumptions about the nature and properties of the EEA. The most important assumption I will make is that

homo sapiens throughout history has been dependent on strong social groups for survival.

Missing: strong argument for making this assumption; see Laland and Brown (2002, p. 178) for doubts about this assumption

Moreover, I will adopt a reciprocal causal framework along the lines of Laland et al. (2013) and Svensson (2018), maintaining that humans throughout history have not only been the object of natural selection, but that they have also been the subject in shaping their environments through the formation of social groups and development of technology.

What does it entail for one trait to evolve for the purpose of another? In using Ayala's (1999) definition of teleological explanation, we can speak of some feature of an organism having a certain function or purpose, that ultimately contributes to its reproductive success. In the case of our investigation, we are interested in what evolutionary benefits one feature (reasoning) may have to another feature (communication). In order to answer this question, we should first consider what the function of communication is to humans; only then can we consider whether the function of reasoning could be to advance communication and in doing so improve the reproductive fitness of humans.

What questions will we need to answer?

Rewrite this: first reformulate Tinbergen's questions (in enumeration with (i) would be appropriate), then say the first one is out of scope. Also note that Tinbergen's paper was seminal, here or at first mention

In exploring cognitive capacities in more detail from an evolutionary perspective, I will loosely follow Tinbergen's (1963) questions by considering the following aspects of reasoning and communication:

- How does the capacity to reason and the capacity to communicate develop throughout childhood?
- What would advancements in reasoning or communication contribute to the reproductive success of humans? In other words, what is the function of reasoning and the function of communication?
- What is the evolutionary history of reasoning and of communication? To what extent and how do they present in our nearest evolutionary relatives?

One may note that we will skip Tinbergen's first question about what the proximate causation of the behavior in question is; I consider the neurological mechanisms underlying reasoning and communication to be out of the scope of this thesis, not in the least because not nearly enough is known about the human brain and mind to be able to give a satisfactory account of the proximate causation of reasoning and communication.

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