

IL

ATLAN

Introduction to a philosophical
international auxiliary language

道可道，非常道。
名可名，非常名。
無名天地之始；
有名萬物之母

ㄥ . Δ . ∇ . | , ∅ . ㄣ . | .
∅ . Δ . ∇ . ∅ , ∅ . ㄣ . | .
ㄣ . ∅ . ∇ . ∅ , ㄣ ∅ ∅ . \ . ∅ . † .
ㄣ . ∇ . ∅ , ㄣ ∅ . † ∅ . ∅ . †

*The Path that can be trodden,
is not the eternal Path.*

*The Name that can be named,
is not the eternal Name.*

*Nameless, it is the Originator
of heaven and earth*

*Named, it is the Mother
of ten thousand things.*

...

-Dao De Jing, chapter 1

Foreword - by Ana Bosnić

It is my distinct pleasure to write the foreword to this work by Stijn, Niek, Jarno, Jep, Jonathan and Max, students of the Humanities Honors Program at Utrecht University. As this book shows, they have attempted to create a new language (one with the potential for universal adoption), thus embarking on a linguistic adventure packed with challenges, curiosity, and a dash of audacity.

Creating a new language is a complex, interdisciplinary task requiring skills, time, effort, dedication, motivation, endless creativity, and above all – (linguistic) knowledge. There also needs to be a deeper understanding of linguistic notions and theories, complexities that underpin human communication, the cultural diversity that influences our lexicon, and the paradox of simplicity and expressiveness.

The authors have embarked on this journey to create Atlan, trying to develop a universal, neutral, and simple language; a language that should be able connect people, transcend boundaries, and be embraced by diverse communities. Ambitiously, they have attempted to craft a linguistic framework that would not favor any specific culture or group, but rather provide a neutral platform

for human communication. Needless to say, that this was a titanic task, and the mere act of attempting it is praiseworthy.

As a constructed language, Atlan benefits from the kind of tools that an organically generated language cannot. Thus, for example, the creators of Atlan have tapped into vast reservoirs of linguistic data to inform their decisions, allowing them to create Atlan's phonetic inventory, script and vocabulary. This fusion of human creativity and computational insights laid the foundation for their linguistic invention, offering a boost in their pursuit of universality, unambiguity, and parsimony. It goes without saying that this innovative approach to language creation serves as a testament to the boundless possibilities that arise when human creativity converges with computational tools.

In conclusion, this book encapsulates the result of the arduous work carried out by Stijn, Niek, Jarno, Jep, Jonathan, and Max in their quest to create a universal and neutral auxiliary language. Throughout the pages of this book, readers will bear witness to their tireless pursuit to create a language that transcends borders and fosters effective global communication. It is my hope that

their journey inspires further research into the intricacies of language, serves as a reminder that the power of human ingenuity knows no bounds, and shows that linguistics can be fun!

And can Atlan become a new lingua franca? Well, only time will tell.

Ana Bosnić

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Chapter 1

Introduction

1.1 Opening Remarks

“The limits of my language mean the limits of my world.”

- Ludwig Wittgenstein

Language, the remarkable construct that binds humanity together, possesses an unparalleled power to shape our thoughts, connect individuals, and cultivate shared understanding. It is through language that we express our deepest emotions and convey ideas, as well as the preservation of the vastness of human knowledge. Yet, in this vast linguistic landscape barriers and borders rise,

resulting in imperfect communication and the impediment of the exchange of ideas across cultures and nations.

Philosophically, language can be perceived as more than a mere tool for communication. It shapes our understanding of the world, influences our perspectives, and defines our cultural identities. Language is not merely a means of conveying information, but a reflection of our collective history, aspirations, and values.

Natural languages that have emerged throughout human history presents both a marvel and a challenge. While they showcase the richness and diversity of human expression, they also lead to barriers and misunderstandings amongst speakers and cultures. In an attempt to solve these problems, several languages have been constructed; so-called constructed languages, or “conlangs”. As we will see, the language we develop here is an international auxiliary conlang. *International* meaning being as inclusive and as accessible to as much languages of the world as possible. *Auxiliary* meaning that we *don’t* want our language to replace natural language. Our language should be seen as a tool for communicating clearly and internationally.

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There is a diverse array of constructed languages. Some constructed languages are made for film, such as Klingon in Star Trek. Others are more personal. The group of ‘Conlangers’ is a flourishing community of people who create constructed languages. You might know one of these languages, such as Esperanto. The quest for a constructed international auxiliary language, however, is not new. It has its roots in the early 20th century, when linguists, philosophers, and idealists alike envisioned a language that could serve as a bridge between nations and foster understanding among diverse cultures. Their vision was grounded in the belief that a language constructed with careful consideration of phonology, grammar, and vocabulary could provide a common ground for intellectual discourse, transcending the boundaries imposed by native languages.

This book takes you on a captivating journey through the intricacies of constructing an international auxiliary language. It explores the fundamental principles underlying language construction, delves into the complexities of phonological categories, and examines the neurologic basis of language acquisition and comprehension. Additionally, it investigates the challenges and opportu-

nities presented by the creation of a culturally neutral and inclusive language.

As we embark on this exploration of language and its creation, we invite you to contemplate the immense potential that lies within a constructed language - a language that aspires to be a unifying force, bringing together individuals from diverse backgrounds, fostering global communication, and ultimately transcending the limitations imposed by our native tongues.

Join us on this intellectual odyssey as we delve into the realm of linguistic possibilities, guided by the belief that language, at its core, reflects our shared humanity. Through the creation of a constructed international auxiliary language, we may pave the way for a more inclusive and interconnected world.

About the project

This book is authored by Jep Antonisse (artificial intelligence), Niek Elsinga (language and culture studies – linguistics), Max Geraedts (artificial intelligence), Stijn Janssens (philosophy), Jonathan Roose (literature studies) and Jarno Smets (language and culture studies – logic). It was written for the Humanities Honours course ‘Research Seminar’ at Utrecht University, under supervi-

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sion of Dr. Ana Bosnić (linguistics). Our project was to create a constructed language ‘Atlan’, and write a book about it. From February until June of 2023, we met every week to work on constructing the language, writing literature review essays on the different aspects of the language, programming different tools, and finally putting together this book as the final project. We all enjoyed working on the project, and had many interesting discussions about language, philosophy, literature etc., as well as establishing informal friendships.

The language is based on sketches made by Stijn, who had made an earlier attempt at constructing a language that would fit the proposed constraints, but was dissatisfied with the final results. He collected notes and resources on different aspects that would have to be put into the language (the writing system and phonology had already been assembled), but after realising the sheer time and ambition required to attempt completing it, he put the project on ice for a few years.

When the project for the Research Seminar was first introduced, Ana gave a short introduction of herself and her work, mentioning the practical application of linguistics seen in constructed languages. Stijn was reminded

of the old project he was still intending on finishing someday, and realised that with the help of the two AI students, the project would be a lot more achievable, having the power of computation on our side. As though through serendipity, the rest of the group members happened to be standing in close proximity when Stijn pitched his idea to them, generating much enthusiasm from everyone, and thus the project was decided upon the very same day.

Our constructed language ‘Atlan’ is designed to be both an international auxiliary language (IAL) and a philosophical language (PhilIAL). It is built along three primary constraints:

1. Human universality / cultural-linguistic neutrality
2. Unambiguity
3. Elegance / form from function / parsimony

The first constraint covers the goal of the language to be an IAL: a truly unbiased auxiliary language does not show a disproportionate favour of one specific language over any other, as is now very much the case with English being the main IAL (the reason why this book

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is written in English). It cannot be a mix of a few European languages, like Esperanto for example. Nevertheless, absolute neutrality is impossible because there is no true ‘centre’ to different linguistic structures, and the number of different languages and their relative number of speakers will also shift the balance in the total world population (this will be accounted for with the aid of AI, see chapter 6.2).

The second constraint overlaps in political and philosophical relevance: a language that is to be learned and commonly spoken by speakers of any language on Earth is intended to unify and overcome language barriers, as if to ‘undo the confusion of tongues’, and to construct a ‘modern Adamic language’. Within the analytic tradition, philosophy is often regarded as the ‘perfecting of language’ through making statements logically consistent and definitions clearly defined (Stanford, 2022). These concerns together require Atlan to have an orthography that is phonologically consistent, a lack of homonyms and synonyms that do not add any meaningful nuance and a syntax that does not (easily) allow for grammatically confusing or logically ambiguous statements.

The third constraint is the most ideal and philosoph-

ical in nature. ‘Elegance’ here is meant in a similar way to how mathematicians and physicists praise simple and straightforward formulas that describe and predict a vast set of phenomena and data. The goal is thus to have as little unnecessary parts as possible; less is more. This goal we call *parsimony*. This means that any form of complexity, be it orthographic, semantic or syntactic, should arise as an emergent property of the combination of its basic parts.

1.2 The story of King Atlas – Stijn Janssens

We have chosen to name our constructed language ‘Atlan’, which consists of the words ‘AT’, meaning all / every / universal, and ‘LAN’, meaning speak / talk / language. Therefore, the name can be understood literally to mean ‘Universal Language’. Although the majority of Atlan’s lexicon was generated by an AI programmed on natural language data, the syllables ‘AT’ and ‘LAN’ were consciously assigned their meaning as a symbolic homage to the mythical figure titan Atlas.

In Greek mythology, Atlas was said to have been condemned to by the Gods to uphold the firmament for eter-

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nity, after having lost in the Titanomachy, an epic battle between the Titans and the Gods. The Greek poet Hesiod located him at the extreme West, at the edge of the known world (which back then mostly referred to the landmasses surrounding the Mediterranean¹ sea). This made him later be identified with the Atlas Mountains of Northern Morocco. This seems to coincide with a folk legend of the local Mauri people, also known as Berbers, of present-day Morocco, who to this day still tell of the legendary King Atlas of Mauritania. Because of this, a suggested etymology for the name is the local Tamazight word *‘ádrār’*, meaning mountain.

According to Greek mythology, he was encountered by the hero Perseus. Upon arrival in Atlas’s Kingdom, he asks for shelter, claiming to be the son of Zeus. Atlas refuses, because of a prophecy that once told him that a son of Zeus would come to steal golden apples from his orchard. Because of this, Perseus turned Atlas into a mountain range, with his head at the peak with forests for hair, and his shoulders as the ridges. Perseus, however was not the prophesised apple thief. The real thief was rather his grandson and half-brother (thanks

¹From Latin, meaning *middle earth*

1.2. THE STORY OF KING ATLAS – STIJN JANSSENS

to Zeus' incestuous practices), Heracles. When fulfilling his twelve labours, he was sent to steal some golden apples from Hera's orchard, which was tended by Atlas's daughters, the Hesperides. Atlas and Heracles tricked each other into carrying the firmament, until Heracles managed to escape with the apples.

King Atlas is said to have invented the celestial sphere, and perhaps even first having established the science of astronomy. He was supposedly skilled in philosophy, mathematics and astronomy. Perhaps this led to his connotation of carrying the firmament. King Atlas inspired cartographer Gerardus Mercator, famous for the Mercator projection of earth, to name his world-maps after him. The Atlantic Ocean was named after Atlas the titan, as well.

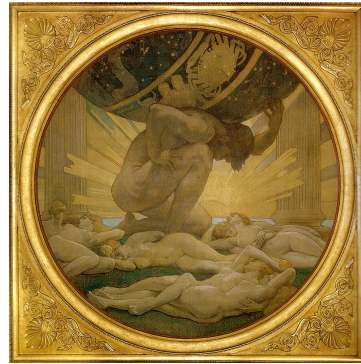


Figure 1: Titan Atlas and the Hesperides, by John Singer Sargent, ca. 1922-1925

In his late dialogue *Timaeus*, the philosopher Plato

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refers to King Atlas as being the first ruler of Atlantis, a city established by Poseidon. Perhaps this city might have referred to a place which is now known as the Richat Structure, a geological formation of concentric circles in northern Mauritania just below the Atlas Mountains, matching the description given by Plato. During the purported existence of this city, 12.000 years ago during the African humid period, this area was a lush and fertile land, until the sudden catastrophic global warming event known as the Younger Drias took place, turning the area into the Sahara Desert we know today. Neolithic artefacts from this era have been found around the Richat Structure, as well as fluvial and torrential deposits from the time the Younger Drias is believed to have taken place. Perhaps this was the origin of the myth of its sudden destruction, having been passed on through oral tradition of North African peoples, until it reached the Egyptian priest Sonchis, who Plato claims to be the source of the story.

We have chosen to name our language after Atlas because of his legendary reputation as being the ruler of a Utopian civilisation, a symbol of knowledge, as well as his connotation with philosophy and organised knowl-

edge about the world. It seems appropriate to us to name our language Atlan, being somewhat of an encyclopaedic philosophical language, after this ancient cross-cultural figure representing wisdom and the bridge between heaven and earth.

1.3 Need for an IAL – Jonathan Roose

Historically the diversity of languages has been both a blessing and a curse. On the one hand has the variety of tongues been a database of ways to understand the world and human expression, on the other it has also led to barriers and in- and outgroups. This is why five of my co-students and I have taken up the ambitious task of creating a so-called International Auxiliary Language (IAL for short), a language that will allow its users to bridge language barriers and lead to mutual understanding between speakers with different mother tongues, a neutral ground on which all international communication can occur.

The lingua franca's of today's world that are used in international relations, like French, English or Swahili give hierarchical importance to the language of one par-

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ticular group and/or state, these languages are based on political power and historical conditions, they cannot be neutral, they have become international languages because of political interactions and thus are always a political matter. The aim of an IAL is to be a meeting ground of all people without it being dependent on power relations and historical animosities. This project has a lot in common with others IALs, Esperanto, for example, made by L.L Zamenhof with the hope that a collective language will lessen the violence between nations. However, why Esperanto succeeded is also why it is limited. It was made to bring speakers of European languages together and it did, for a small part, however, only speakers of European languages. Such languages are commonly referred to as 'Euroclones'. Our goal with this project is to create a unifying international language for the whole world, which can thus not be limited to only a small set of language groups.

The ambition we have with the language Atlan is to create a language that is based on nothing more than the human condition. Later in this book Stijn will explain more how we intend to do this however, for now I would like to introduce a term that might help to better un-

derstand what we hope to achieve with Atlan. A *tertium comparationis* is a wish of many translators to have some way to compare the meaning of the original text with their translation. Deriving from the Latin for ‘a third comparison’ this term describes the want for a ‘perfect language’ that could be used to completely translate a given text. Of course, the translation is meant to have the same meaning however, some meaning will always get lost, the comparison is to see whether the new meaning has not lost the essence of the original. Whether the very quiddity of the original meaning is captured in the translation. What translators want is a semiotic system that can show the essence of a message in a way that can be compared to all other languages. In Atlan we hope that we can create a linguistic code, the rules of grammar and use of a language, that can function as such a *tertium comparationis* by making it based on the essential human experiences. A language that can get to the essence of a thing by basing it on the basic human ontological being. This language will function as an IAL that is neutral and universal, it is a language based on the human condition that every human experiences.

1.4 Eco's words – Jonathan Roose

In this ambitious project we are indebted to the numerous projects that predate ours with the same or similar aims. Not only is there Zamenhof's Esperanto many more thinkers have dealt with the quest for an IAL. To name all would be too numerous however we can mention a book that has introduced many of the language projects to us. Umberto Eco's book *The Search for the Perfect Language* has been a great source of inspiration in this project. Like Esperanto the book is mostly concerned with Europe. Nonetheless to finish this introduction to Atlan we end with a passage from his book to summarise the project:

“Is it possible to reconcile the need for a common language and the need to defend linguistic heritages? Both of these needs reflect the same theoretical contradictions as well as the same practical possibilities. The limits of any international common language are the same as those of the natural languages on which these languages are modelled: all presuppose a principle of translatability. If a universal common language claims for itself the capacity to re-express a text written in any other

language, it necessarily presumes that, despite the individual genius of any language, and despite the fact that each language constitutes its own rigid and unique way of seeing, organizing and interpreting the world, it is still always possible to translate from one language to another. However, if this is a prerequisite inherent to any universal language, it is at the same time a prerequisite inherent to any natural language. It is possible to translate from a natural language into a universal and artificial one for the same reasons that justify and guarantee the translation from a natural language into another. The intuition that the problem of translation itself presupposed a perfect language is already present in Walter Benjamin: since it is impossible to reproduce all the linguistic meaning of the source language into a target language, one is forced to place one's faith in the convergence of all languages. In each language 'taken as a whole, there is a self-identical thing that is meant, a thing which, nevertheless, is accessible to none of these languages taken individually, but only to that totality of all of their intentions taken as reciprocal and complementary, a totality that we call Pure Language [reine Sprache]'" (Eco 1995:345)

1.5 Linguistic relativity – Max Geraerds

To start I would like to explore linguistic relativity. It is an important term within the study of linguistics, and I would like to explore the possible consequences it has for a universal language. For those of you who are unfamiliar with this term, it refers to the hypothesis that Sapir and Whorf – two linguists – developed about how the structure of a language can influence our thinking. Sapir and Whorf developed two hypotheses about this presumed phenomenon. A strong and weak hypothesis, the strong one argues that language determines thought and that linguistic categories limit and determine cognitive categories. Effectively stating that the language one speaks limits their cognitive abilities. This hypothesis is now disregarded by many modern linguists. The weak hypothesis, however, is still a main point of discussion among linguists. It argues that language influences thought but does not determine it. This weaker version is much easier to accept. A good example of this is the way in which different languages have different perceptions of colors, representations of time and other elements of cognition. So, while it is safe to say that the

1.5. LINGUISTIC RELATIVITY – MAX GERAERDTS

strong hypothesis is false it is difficult to deny that language does have an influence on our way of thinking. Language is our way of representing the world. A difference in language can lead to a difference in our representation of the world.

Ideas and views that would eventually go on to become to define linguistic relativity are first found in ancient philosophy. However, it only began to enter mainstream research in the eighteenth and nineteenth century, with German romantic philosophers on the forefront. (German) nationalism fuelled the discussion about language and its relationship with culture and unity at this time. Wilhelm von Humboldt – a Prussian philosopher, linguist and government functionary – stated in 1820:

The diversity of languages is not a diversity of signs and sounds but a diversity of views of the world (Traband, 2000).

After this movement in Europe, American scientists began discussing this same subject in the early twentieth century. At this time the idea that some languages were superior to others was commonly accepted. It was thought that lesser languages maintained their speakers

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in intellectual poverty (Migge, 2007). This caused some American linguists to seek to eradicate Native American languages, they thought that its speakers were savages and needed to speak English to become civilized. The first linguist that began refusing these beliefs was the American Franz Boas, during his studies he became fascinated with the Inuit. After learning their language and culture he began stressing the equal worth of all cultures and languages. There were no such thing as lesser languages according to Boas. Boas' student Edward Sapir went back to the Humboldtian idea that language is vital to understand the unique perception everyone has of our world (Leavitt, 2010). Sapir argued that no two languages could never be perfectly translated to each other. This dissonance in language continued in the world view of individuals according to Sapir:

No two languages are ever sufficiently similar to be considered as representing the same social reality. The worlds in which different societies live are distinct worlds, not merely the same world with different labels attached (Sapir, 1929).

This did not however mean that Sapir agreed with the

strong hypothesis, he did in fact disagree with it. Stating that:

It would be naïve to imagine that any analysis of experience is dependent on pattern expressed in language (Sapir, 1946).

So, it seems that in these middle stages of the development of linguistic relativism views on the subject changed dramatically over the years. As we continue through history, we arrive at the linguist Benjamin Lee Whorf. Whorf was one of Sapir's students and has been associated with linguistic relativity more than any other linguist. One of his best-known examples regards the different words the Inuit have for snow compared to the one word we have for it in English. This example showed that you could not perfectly translate even simple concepts such as snow between languages. This example was however later contested as a misinterpretation by Whorf (Pullum, 1991). Another example of Whorf's linguistic relativity was the time in Hopi. Whorf argued that the Hopi did not have countable units of time compared to the SEA – standard European languages – the Hopi instead regarded time as a single continuous concept. This notion was however also later contested by

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other linguists. In the 1980's Ekkehart Malotki claimed that he had not found any evidence for the claims Whorf had made about the Hopi. This refute was then in its turn contested by relativist scholars who criticized Malotki's study for forcing the Hopi language into a grammatical model that didn't fit the data (Lee, 1996). How Whorf approached the Hopi is an example of the structure-centered approach. This approach focuses on a structural difference between languages. It then examines the possible consequences and ramifications of this structural difference. The Hopi and the peculiar structure time has in their languages is a prime example of this approach (Lucy, 1997). Whorf died at 44 and left many unpublished papers, these were eventually published in a single volume titled *Language, Thought and Reality*. Since neither Sapir nor Whorf had officially formulated a hypothesis Brown and Lenneberg – two influential linguists from the twentieth century – formulated their own in 1954:

- (i) "The world is differently experienced and conceived in different linguistic communities"
- and (ii) "Language causes a particular cognitive structure" (Brown, 1954).

These were later reformulated by Brown into the *weak*

and *strong* formulations:

Structural differences between language systems will, in general, be paralleled by non-linguistic cognitive differences, of an unspecified sort, in the native speakers of the language. (Weak)

The structure of anyone's native language strongly influences or fully determines the worldview he will acquire as he learns the language. (Strong)

Thus, we have arrived at the creation of the Sapir-Whorf hypothesis. Which was not created by Sapir or Whorf. What we have also seen is the difficulty of quantifying linguistic relativity. We have seen many bold claims which have all in turn been contested by others. With this reflection we arrive at the last stretch of the development of linguistic relativity. In 1996 the anthology *Rethinking Linguistic Relativity* was published. It discussed linguistic relativity that focuses more on cognition and social aspects of language. For example, men speaking Guugu Yimithirr could give directions based on a compass-like system of north, south, west and east (Levinson, 1998). This shift of focus alongside the development of better means of conducting research ushered in much new re-

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search seeking to not only define but quantify linguistic relativity.

Brown and Lenneberg thought that languages described the same objective reality. They decided to research if the difference in describing this reality could be proven to have influence on behaviour. For their experiments they decided to focus on the different descriptions of colour in different languages. For one of their first experiments, they tested whether it was easier for English speakers to remember colour shades for which there existed a specific word opposed to shades which were more difficult to describe with words. Later they also compared results between English and Zuni speakers – Zuni classifies green and blue as the same – and it was found that Zuni speakers did have more difficulty making distinctions between shades in the green/blue category (D’An-
drade, 1995). These studies by Brown and Lenneberg began a tradition of investigating linguistic relativity through colour terminology. Real differences could be seen between the perception of colour by an individual and the language they speak. These studies however also received criticism because colour perception is hardwired into the brain. This causes it to be universally restricted by some

factors for all humans (Lucy, 1997). I however have some nuance to add to this argument. While it is true that colour perception is hardwired into our neural system, I believe linguistic relativity to be a *quale*. A relativity regarding our experiences, thoughts and inner dialogue. While it is undoubtedly true that colour perceptions are *biologically* the same for all of us, I believe the real difference lies in our *mental* representation of this biological phenomenon.

Colour research was continued by Berlin and Kay, an anthropologist and linguist respectively who are most well known for their research in colour. During their research they found clear universal conventions when it comes to colour naming. For example, they found that although different languages have different colour terminology, there are universal trends among them. Languages who only have three colour terms all have the same three colours, black, white and red (Berlin, 1969). Because colour naming was originally thought to be random, this new information was seen as a powerful argument against linguistic relativity (Grumperz, 1996). This criticism has since in turn been criticised by relativists such as Lucy who argued that the conclusions from Berlin

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and Kay were skewed because they insisted that colour terms only encoded colour. According to Lucy, this made them blind to instances where colour terms contained and provided other information that might be considered as linguistic relativity (Lucy, 1992). As we see and discuss more aspects of linguistic relativity it should become clear that it is a very broad and contested hypothesis.

Advances in cognitive psychology and cognitive linguistics again brought a new wave of studies that focused on linguistic relativity. George Lakoff, for example argued that language is often used metaphorically and that this metaphorical use can give us insight in the cognitive effect of language. He gave the example that in the English language time is often likened with money, a lot of metaphors including time talk about it like it can be invested, saved and spent. This cognitive relationship submerging through language can be a sign of linguistic relativity. Especially considering that other languages do not talk about time this way. Other metaphors like this that are based on human experience are languages where up is associated with good and down with bad. This association can be seen in many myths and folklore, such as heaven being high up in the skies and hell

being down. Lakoff also argued that metaphors play an important role in political debates such as the “right to life” or “right to choose” (Lakoff, 1980). Lakoff revitalized linguistic relativity not only because of his newly found results, but also because he reappraised linguistic relativity thus rendering past criticisms moot. He did this by concluding that the debate regarding linguistic relativity had been confused. To clear up this confusion Lakoff described four parameters on which researchers differed in their opinions on what constitutes as linguistic relativity. These were his four parameters:

1. The degree and depth of linguistic relativity. Perhaps a few examples of superficial differences in language and associated behavior are enough to demonstrate the existence of linguistic relativity. Alternatively, perhaps only deep differences that permeate the linguistic and cultural system suffice.
2. Whether conceptual systems are absolute or whether they can evolve
3. Whether the similarity criterion is translatability or the use of linguistic expressions
4. Whether the focus of linguistic relativity is on language or in the brain (Lakoff, 1987)

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Lakoff concluded based on these definitions that past critics of linguistic relativity had based their criticism on novel definitions of linguistic relativity. According to him this rendered their criticism superficial.

Up to this point we have mostly seen the broad general way linguistic relativity has developed through history. In this last part I want to focus more on some specific cases and thoughts I have about linguistic relativity. Beginning with its influence on constructed languages and literature. Because there are many instances where authors have used language – natural or constructed – in their stories. One of the best examples of this is how George Orwell showed how linguistic relativity might be exploited for political purposes. The authoritarian state in his novel 1984 created a language Newspeak which made it impossible for people to criticize them (just like Atlan, Newspeak also has some Olig synthetic features: see chapter 5.1.1). Another example is Rand's *Anthem*, a story about a dystopian communist society who erased the word "I" from their language to erase individuality. Ideas like this illustrate not only the possibility of language on us but also the fact that we can think about language in this way. The fact that we can imagine it

having such an influence on ourselves speaks volumes.

Looking back in history we can see the influence language has had on us and our actions. Book burning illustrates this perfectly. The earliest occurrence dates back to 600 BC. Maybe most famous example coming from the 1930's and 40's when the Nazi's burned countless Jewish books. The Nazi's sought to erase Jewish culture and saw burning their books which were written in their language about their culture to be necessary. While terrible, it does illustrate that language is inseparable from culture. Seeking to eradicate one demands eradicating the other. Which in turn means that creating one requires creating the other. Linguist and author J.R.R. Tolkien did exactly this when writing stories set in Arda, the most famous of those being *The Lord Of The Rings* and *The Hobbit*.

Others sought to create a language to enable a higher level of cognition. They believe that by speaking a new – better – language humans can reach higher levels of thought. One of these languages is Loglan and its evolution Lojban. This conlang is extremely logic based. They seek to be as logical as possible. The creators wanted to use it to test whether linguistic relativity exists. Because

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the language is entirely based on logic, they thought that it would make its speakers think more logically. Speakers of Lojban reported that they did feel like they thought more logically when speaking Lojban (Nicholas, 2003). Another example of how language can influence our thoughts in a specifically directed way. Another linguist who sought to do this using her Conlang is Suzette Haden Elgin. She has invented the language Láadan which according to its creator makes it easier to express a female world view. Elgin argued that SEA languages have a male centered world view. Using linguistic relativity, she sought to counter this using language. The Toki Pona language was created with the same intent. Its creator – Sonja Lang – wanted to create a simple universal language which focused on happy thoughts. It quite literally aims to make its speakers happier (Lang, Sonja). Because of its simple nature (having only 123 words total), however, it cannot be used to express more detailed or complex meaning: its word for ‘complicated’ is even the same as the word for ‘bad’, *ike*. We once again see that language can have a directed influence on our thoughts. It is not a stretch to pose that we are all confined by our language. It is our way of expressing our thoughts, desires and feel-

ings. The following quote by Von Humboldt illustrates this beautifully:

“...there resides in every language a characteristic worldview . . . By the same act whereby [man] spins language out of himself, he spins himself into it, and every language draws about the people that possesses it a circle whence it is possible to exit only by stepping over at once into the circle of another one (Von Humboldt, 1988).”

Throughout this chapter we have seen the evolution and creation of linguistic relativity. We have seen that it is a difficult topic to pin down and reach consensus on. We have, however, also seen that it does have a remarkable effect on our thinking and understanding of the world. All the way from colours to how we feel. We have seen that we can create languages to infuse its speakers with a certain world view. The power of language is evidently not to be underestimated and we can only guess at the future. Will there be one universal language one hundred years from now? Is one universal language desirable? One way or another, language has and always will be an integral part of our being. For without it we are left soulless.

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Language & culture

Language and culture have long been inseparable. They influence each other and evolve alongside each other. Culture needs language and language needs culture. Learning a new language has made this painfully obvious to me. At one point you figure out that it is not sufficient to just learn the meaning of a word according to the dictionary. To then use grammar to construct sentences. Language is more intricate; words can mean one thing in each context only for another context to change its meaning to the complete opposite. Some words are not even in the dictionary. Some words have an entirely different meaning than the one stated in the dictionary. The meaning of some words changes dramatically over time. Some might even say that depending on which language we speak our view of the world can change. Not only this but language grows over time, it is never in a stable state. As is our world and culture.

We can see clearly that culture influences our language. When culture changes our language changes with it. A good example of this is Dutch ‘straattaal’- literal translation; street language – an unofficial dialect spoken by the youth subculture in the Netherlands. ‘Straat-

taal’ consists of mostly normal Dutch words and sentence structure, it has however a few exceptions. It introduces new words and ignores grammar in certain situations. Hereby marking itself different from standard Dutch and dominant Dutch society. This diversion is not an accident. These youths don’t want to be a part of mainstream or ‘adult’ society. They seek to define themselves, creating their own language plays a big role in this. It creates a very strong in-group – people who speak the language and can communicate with each other – and a very distinct out-group – people who do not speak the language – this helps in creating subcultures. The fact that a lot of subcultures have their own variations of the language of the dominant culture marks the importance of language in society and the bilateral relation between language and culture.

This makes it difficult to imagine a language without any culture attached to it. This is, however, one of the goals we have with Atlan. We want to create a language that is as universal as possible. We cannot have one dominant culture associated with Atlan as this would result in a bias for people from that culture. In this chapter I want to explore by what we really mean when we say

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universal language and what our vision is of the culture that could be attached to Atlan in the future. Because a language without any culture is impossible.

Culture

As you have read in the introduction our goal with Atlan is to create a universal auxiliary language. Not based on one country, culture or region but based on human experiences. I however believe – as implied in the introduction – that a language is impossible to exist without an attached culture. I view language as I do the chicken and egg dilemma. It is impossible for one to exist without the other also existing. This conclusion seems like a problem for Atlan. Our goal is to create a universal language but at the same time it is impossible for a language to be without culture. And therefore, it is also impossible for a language to be without biases. I, however, believe to have found two possible solutions to this problem. The first option is to accept that Atlan has no culture and therefore is not a proper language. This might seem like a shocking conclusion, and I will elaborate on it later. The second option is to attempt to create a new culture attached to Atlan. A culture based on human experiences.

Language without culture

The first option I want to discuss is the language without culture option. Seeing how I have stated earlier that I believe a language without culture is impossible you might be confused by this option. Let me explain what it precisely is I mean when I say language without culture. This option originates from the dilemma of making a universal language. For this to be true it cannot depend on a culture. If it did it would not be universal anymore. But it is also true that without a culture Atlan cannot be a language. I will not go into detail on the precise conditions something has to satisfy to be a language, but I will conclude that having an associated culture is one of them. A result then of the decision to not have any culture associated with Atlan is that Atlan is not a language. Now of course it will still satisfy a lot of the conditions of being a language. It can be spoken and written, and its main purpose is to communicate with other people. But it will not be a language like we know them. It will not have a culture. It will not have a country where it is the official language of. It will not have a history. It will in some sense be more like a computer language. It will not naturally evolve over time it will instead receive

updates when deemed necessary.

This might feel like it makes Atlan a very cold and empty thing. Which it does. I think, however, that for the purpose we devised for this language this is a necessary sacrifice. Atlan will be a universal language, used for communication between people who speak different languages. Atlan does not need to be a language as we know it today because it will fulfill a different purpose. It is okay for Atlan to not have its own culture, history, country and people because we already have enough language who have those things. Atlan will be used as a worldwide communication language; it is allowed to be cold and lifeless. For those languages with identity already exist and will continue to exist in the future. The purpose of Atlan will be to bridge the gap between these cultures. It will be cold and cultureless for everyone; this will make it an even playing field for all those who speak it. This would be the main future I see for Atlan without culture.

Language with many cultures

If you strongly disagree with the idea of language without culture you are lucky because I have a second option, language with many cultures. It is impossible for Atlan

to have one culture because it would be biased towards that culture. It would create an ‘in’ and ‘out’ group, a fatal flaw for a supposed universal language. To avoid this problem, we could have many cultures associated with Atlan. This would create many groups who all have their own variation on Atlan. They can understand each other but they will also each have their own identity. This way Atlan can be used to communicate internationally but it will also have an identity, culture and history. In fact, it will have many different ones. This would create the option for different countries/cultures to develop their own version of Atlan with which they will build their own history with. Of course, these variations cannot be too big otherwise these different groups will not be able to understand each other anymore. But apart from this restriction this solution offers a much more alive version of Atlan than the previous one.

An obvious argument against this option would be one that argues for one universal culture that is associated with Atlan. This seems like the perfect solution. Atlan will have an associated culture and it will be a universal one. Thus, not excluding anyone and maintaining its purpose as a universal language. I don’t think this

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is possible unfortunately. Creating one universal culture is a worthy ideal but I am afraid it is not yet possible. As I have said before a culture creates 'in' and 'out' groups. I believe that culture not only creates these groups it needs them. It originates from them. We can see throughout history that a common enemy brings people closer together. This is also the case for culture. The effect of trying to create a universal group with everyone is impossible. There needs to be some sort of 'out' group. The effect of this choice would be very similar to the language with many cultures' choice. There would be many variations in Atlan, all of them associated with their own culture. It is best to have this view from the very beginning of Atlas' journey, giving the speakers this freedom rather than having them take it.

I see these as the two possible solutions for the problem I stated in the introduction. It remains a fact that a universal language cannot have a culture. It would not be universal anymore. Having a language without a culture would mean it will not be a language anymore. This poses a problem. I offer two possible solutions for this problem. The first one is to create a language without a culture. The second solution is to create a language with

many cultures. These solutions are extremes on the same spectrum. I don't know which of these solutions is the best solution. I do think that they both solve the problem albeit in their own way. They would have massively different consequences for Atlan in the future. I look forward to seeing how Atlan will develop in our society in the future.

Chapter 2

Phonology – Niek Elsinga

2.0 Introduction

A language is a system through which an individual can communicate with others, which is structured in grammar and vocabulary. Languages are usually spoken, but can also be conveyed by signs as with sign language, or with script. The definition of language is quite a contested topic. Multiple theories about the purpose of language have been proposed. One of the first definitions of languages was put forward by Ferdinand De Saussure. De Saussure saw language as self-contained, self-regulating system, in which the elements are characterised by their

relationship with other elements in the system. De Saussure named his vision on linguistics ‘semiology’, but this was posthumously named structuralism by other linguists (Matthews, 2014).

Nowadays, linguistic scholars deem the structuralist approach outdated, and favour more recent explanations. While some linguistic scholars such as Noam Chomsky and Steven Pinker see language as a biological, formal, or ‘mathematical’ system of signs that are dictated by grammatical rules to convey an utterance (Chomsky, 2002; Pinker, 1994), other scholars such as Nicholas Evans pursue the more ‘functional’ approach and see language as a system of communication that allows for the exchange of utterances (Evans & Levinson, 2009). One other view sees language primarily and purely as a ‘tool’ that can be used for humans to undertake linguistic behaviour, in that language is solely a means of producing and understanding utterances that evolved over the course of human history (Fitch et al., 2005).

Note that these definitions more or less convey the same meaning: “a system through which an individual can communicate”. The difference between these views is not so much what language is for, but what it em-

phasises. They are not mutually exclusive to a certain degree. Nonetheless, contemporary scholars predominantly adopt Chomsky's biological approach. However, even this view has been contested, on the grounds that neuroscientific studies have found neither biological nor neurologic evidence for the existence of Chomsky's theory on the application of WH-questions, i.e., what, where, when, who(m/se), why, which, and how (Kluender & Kutas, 1993).

English is still the most spoken language of academia worldwide, and the *lingua franca* of the western world (Mauranen, 2003). It has not, however, gained this position because it is easy to speak or learn. Pronunciation of English vowels, for example, is unlike its graphemic notation, due to phonological shifts of vowels after the standardisation of English spelling in the 15th and 16th centuries (Denham & Lobeck, 2007). English did not gain its position because of the purported absence of cultural influence of English, as stated by Knapp and Meierkord (2002). English fulfils the need of a global *lingua franca*, as it has spread to large areas of the world due to various factors. These include the adoption of the Latin script worldwide, the invention of the internet and its

first widespread use in the United States of America.

The development of the American research university and subsequent adoption of English as *the* academic language have also been of tremendous importance its widespread use. However, there exist more sinister factors as well, such as widespread colonization brought about by the British, American cultural hegemony, and the spread of Christianity through western missionaries (Ariza & Navarro, 2006). The use of English in academic language has long been postulated by some to be ‘neutral’, i.e., free of cultural influences (House, 2003). However, as of late this claim has been challenged. Scholars such as Pölzl and Seidlhofer (2006) and Knapp and Meierkord (2002) have claimed that English is ‘imperialistic’ by definition due to the use of English by colonists. These colonists subsequently decreed that English would be the sole language to be spoken in countries which do not have English as its endogenous language, and as such was seen as a form of oppression (Macedo & Bartolomé, 2014). Other scholars have presumed that English can be ‘neutral’ to a certain degree, and that it is up to the speaker of a language to give partiality to one’s words and actions (Norton, 1997). If this view is mirrored

against the notion of the impartiality of language and that language and culture are interwoven to their very core as famously articulated by Kramsch (2014), it is possible to surmise that any language that has evolved naturally in humans through use and repetition without conscious planning or premeditation is intrinsically biased, due to the fact that culture and language are inherently linked (Lyons, 1991).

Atlan is designed to be an auxiliary constructed language, a language that is created with the purpose of facilitating communication between people who have different native languages. This decision has been made because we are of the opinion that a language that is used in academic context should be neutral. This does not imply that the language shall solely be used for academic purposes, nor does it mean that it should replace other languages.

With the creation of the language, multiple goals have been kept in mind. The primary purpose in the creation of a language is to be as culturally neutral as possible, so that no group of people will be especially favoured or disfavoured when learning the language with regards to the similarity to their own. Creating a language from

scratch can procure this cornerstone.

Another main goal is that the language should both be easy to speak and understand. The notion of unambiguity is another tenet, with the goal of reducing confusion or misinterpretation within communication as much as possible. This means being as sparse as possible, with different elements of the language, where simplicity is key, and complexity should arise from the combination of the basic elements. This is, of course, of utmost importance in phonology and morphology. If a differing consonant is used, it would change the entirety of the word. The same applies to morphology, where the distinction needs to be made between who the actor and who the recipient is.

This paper will serve as an overview regarding the phonological and morphological considerations that have been made for the language. In the first section of this paper, I will elaborate on the neurology concerning speech and language. The second section will cover the choices that have been made regarding the phonology for consonants, vowels, and prosody. Finally, I will close this paper by summarising what has been stated, and giving some concluding remarks.

2.1 The Neurologic Basis of Language

Neurolinguistics is the study of how the brain produces, comprehends, and acquires language. It combines both the framework of humanities, namely the language aspect, with a neuroscience approach. The two traditional brain areas that are correlated with the production and comprehension of language and speech with respectively Broca's area in the frontal lobe, and Wernicke's area in the temporal lobe (Geschwind, 1972), which are connected through the *fasciculus arcuatus* (Bernal & Altman, 2010). These areas are not bilaterally localized, and solely exist in the left cerebral hemisphere.

The production of speech occurs according to three main principles: conceptualization, formulation, and articulation. In the first stage, conceptualization, an individual with the intention to create speech links the desired concept to the particular spoken words. This preverbal message contains the desired to-be conveyed thoughts to be expressed. The second stage is formulation, in which the linguistic form for the desired message is formulated. Here, knowledge of grammar, phonology, and phonetics is applied to the preverbal message. The third stage

is the articulation of the message, in which motor functions are activated to produce the utterance.

The perception of language or speech begins at the level of the sound signal and the process of audition. Subsequently, speech sounds are further processed in order to gain information regarding acoustic cues and phonetics. This information can then be used for processes that are considered to be 'higher-level' language processes, such as word recognition (Levelt, 1999). These produced sounds are then further processed in the auditory cortex of the brain.

Research has indicated that the auditory cortex processes voiceless and voiced phonemes differently in ferrets, which have similar structures in the processing of auditive information when compared to humans (Mesgarani et al., 2008). Phonemes are, put very simply, sounds, or the smallest units of speech. Phonemes are usually divided into consonants and vowels (Yallop & Fletcher, 2007). Consonants are created by constricting the air-flow in the vocal tract when air is forced out of the lungs, and is mostly done by the tongue.

Some consonants can also be created by, among others, the nose and vocal tract. Voiced consonants are con-

sonants that incorporate the vibration of the vocal cords when the articulation of the letter occurs. Some examples of voiced consonants are the /b/, /d/, and /g/. Voiceless consonants on the other hand do not make use of the vocal cords. Examples of voiceless include /p/, /t/, and /k/. Some languages, such as Arabic, do not have the voiceless bilabial plosive /p/ in their phonological inventory (Al-Ani, 1970). When a speaker of Arabic wants to say the word ‘pizza’, they would pronounce it as ‘bizza’, for the voiced bilabial plosive /b/ is used instead of the /p/. If an Italian on holiday in an Arabic-speaking country would order a pizza, pronouncing the word with the voiceless bilabial plosive /p/, a monolingual speaker of Arabic would not have any hindrances whatsoever with the comprehension of the utterance (Versteegh, 2014).

This can be linked to another research by Liégeois-Chauvel et al. (1999) on the inquiry of the perception of voiced and voiceless phonemes. In this research, a speaker produced voiceless and voiced phonemes, with the following vowel being /a/ (/pa/, /ta/, /ka/ for voiceless, and /ba/, /da/, /ga/ for voiced) in a random order. Neurologic tests were carried out using a tool called ‘electroencephalography’ (EEG). An EEG maps where in the

brain electrical pulses occur, i.e., where and which areas of the brain are activated when an individual is exposed to stimuli. The EEG has shown that the auditory cortex is able to process syllables with voiced consonants from syllables with voiceless consonants in the left hemisphere, however, the right hemisphere was not able to make this distinction and solely processed acoustic stimuli. Furthermore, the auditory cortex was not able to differentiate syllables with voiced consonants and voiceless consonants. The results from the EEG showed no discernible differences between syllables with voiced and voiceless consonants. However, a differential coding of voiced and voiceless syllables is preserved. This would still mean that an individual is able to distinguish these phonemes (Liégeois-Chauvel et al., 1999).

2.2 Consonants in Atlan

As previously stated, the word ‘pizza’ would be pronounced as ‘bizza’ by according to Arabic phonology (Al-Ani, 1970). The example also states that ‘pizza’ and ‘bizza’ would both be understood as the same word. This is because in Arabic, the ‘b’ and ‘p’ are variants of the same phoneme.

This is called allophony.

Furthermore, certain languages (or language families) use scripts that do not implicate the voicing of a consonant, such as Tamil. Tamil uses both voiced and unvoiced consonants, however, it is decided by context (e.g., a -linguistic- register), and not by its script. A consonant being voiced or unvoiced does not imply that a word gets a whole new meaning, but gives meaning to the context of the word. Consonant voicing thus is not contrastive in Tamil (Keane, 2004; Schiffman & Arokianathan, 1986). Regarding the phonology of our language, the decision has been made that both voiceless and voiced consonants are allophones. For example, a speaker of our language would perceive both the voiced bilabial plosive /b/ and voiceless bilabial plosive /p/ as the same phoneme.

The script is meant to reflect this, as is the case with Tamil. Furthermore, because not every language has the same set of phonemes nor the same number of phonemes, we have decided that nine distinctive categories should be made. The phonemes that belong to each respective category are allophones in our language. The categories in this were chosen according to mutual intelligibility, proximity according to the consonantal chart of the In-

ternational Phonetic Alphabet, and manner of articulation (Ladefoged, 1999). Furthermore, consideration has been given to the frequency of each phoneme and its subsequent category. Every category contains a phoneme that has a high rate of frequency in languages worldwide. In order to retrieve the information regarding salience of the phonemes, the UCLA Phonological Segment Inventory Database (UPSID) and the Phonetics Information Base and Lexicon (PHOIBLE) were used (Maddieson, 1984, 1986; Moran & McCloy, 2019). These databases document the frequency of every existing phoneme.

The categories are as follows: The first category contains the (bi-)labial plosives [b, p]. The bilabial plosives are found in 98.89% of all languages worldwide according to UPSID. The second category consists of the coronal plosives, i.e., the dental, dento-alveolar, alveolar, and retroflex plosives, [t, d, ʈ, ɖ]. The coronal plosives are found in almost every language according to Liberman *et al.* (1967), however, no exact percentage is given regarding its frequency. The third category contains the dorsal plosives and dorsal fricatives [k, g, q, ɢ] and [x, ɣ, χ, ʁ]. The dorsal plosives and fricatives are found in 99.30% of all languages worldwide according to PHOIBLE and

UPSID. The fourth category consists solely of the bilabial and labiodental nasal [m, ɱ]. According to UPSID, PHOIBLE, and Maddieson(2013a), the bilabial nasal is the phoneme with the highest degree of frequency worldwide, with over 96% of all languages containing it. The fifth category consists of the coronal and dorsal nasals [n, ɲ, ɳ, ŋ, ɴ]. No exact percentage is known of the frequency of the non-bilabial nasals, however PHOIBLE states that over 80% of all languages contain a phoneme of this category.

The sixth category is what is called the ‘liquid’ consonants. All trills, laterals, and lateral approximants, as well as the coronal and dorsal flaps and taps [ɾ, ʀ, ɽ, ɺ, ɿ, ʙ, ɮ, ɭ, l, ɭ̥, λ, ʟ, w, ɹ] belong to this category. This class is considerable in size, but carefully chosen. Many languages contain one of these consonants, and differing phonemes are usually considered allophones if a differing phoneme is used, as is the case with /r/ and /l/ in Japanese and Korean (Ladefoged & Maddieson, 1996; Maddieson, 2013b; Takgi & Mann, 1995). No exact percentage is given for the frequency of these liquids.

To the seventh category belong the labial fricatives and labial approximants [v, ɸ, β, f, ʋ, θ, ð, ʌ, w]. These

phonemes are found in 84.49% of languages worldwide according to PHOIBLE and UPSID. The eight category are the coronal sibilant fricatives [s, z, ʃ, ʒ, ɬ, ɮ, ɕ, ʑ, ɸ]. According to UPSID, these phonemes are found in 88.03% of languages worldwide. The ninth category consists of the palatal consonants [ç, j, ɟ], which according to UPSID and PHOIBLE are found in 90% of all languages. A tenth quasi-category was made for glottal and pharyngeal consonants; however, we have decided to give these phonemes no meaning.

Atlan also employs a glottal stop [ʔ], however this sound is not notated in its orthography. Rather, it functions to differentiate two of the same vowels when placed next to one another. For example, ‘KA.AK’ could be confused with ‘KAK’ if there is no pronounced distinction between the two syllables, therefore the former should be pronounced as ‘KAʔAK’.

2.3 Vowels in Atlan

Categorising the vowels was considerably more difficult, considering that vowels cannot be placed on an axis of ‘place of articulation’ and ‘manner of articulation, as is

the case with consonants (Ladefoged, 1999). Vowels can be placed on a spectrum, with one axis from ‘close’ to ‘open’, and another from ‘front’ to ‘back’. The close-to-open axis refers the position of the tongue placed against the roof of the mouth. ‘Close’ in this context means that the tongue is positioned as close as possible to the roof of the mouth as it can be without creating a constriction, whereas ‘open’ means that the tongue is positioned as far as possible from the roof of the mouth. The front-to-back axis refers to the position of the tongue in the mouth. ‘Front’ in this context means that the tongue is positioned as far forward as possible in the mouth, ‘back’ means that the tongue is positioned as far backwards as possible in the mouth (Yallop & Fletcher, 2007).

Vowels considered to be close-front include [i] as in the English word ‘free’ and the Dutch ‘vieren’, and close-back include [u] as in the Dutch ‘voet’ and the English ‘boot’. Open-front vowels include [a] as in the British English ‘hat’, and open-back include [ɑ] as in the Dutch ‘bad’ (Gussenhoven, 1992; Roach, 2004).

Because the quality of vowels is a spectrum and not every vowel exists in every language, a certain degree of allophony exists in vowels as with consonants. In In-

donesian, [ɪ] and [ʊ] are allophones of /i/ and /u/, while in Dutch they are contrastive (Gussenhoven, 1992; Soderberg & Olson, 2008).

For our language, five categories of vowels were made. As with the consonants, these are based on the salience of the vowels and its frequency in languages worldwide. The data regarding this is based on the same tools as for consonants; UPSID and PHOIBLE. Three of these categories were easily made because most languages contain this respective vowel. These are, from high to low frequency, [i, u, a], with respectively 92, 88, and 86% occurrence in languages worldwide. For the two remaining categories, a substantial lower frequency is noted for [e, o], with respectively 61 and 60% of the languages worldwide containing the vowel according to UPSID and PHOIBLE.

These five categories were chosen because these five vowels are found in every language, and the frequency of the vowels [e, o] were found in roughly the same percentages in language families worldwide, with the exception of (some) Australian languages (Butcher, 2018; Moran & McCloy, 2019).

Another extra vowel is used in our constructed lan-

guage, namely the schwa [ə], but this vowel is not notated. Its function is to differentiate two of the same consonants that occur next to one another, similar to the use of the glottal stop. For example, in spoken Atlan, the difference between ‘AK.KA’ would be barely distinguishable from ‘A.KA’, therefore the former would be pronounced ‘AKəKA’ to retain the distinction.

2.4 Decisions regarding the phonetics: tone and prosody

In some languages, tone (i.e., the use of pitch), is a meaning distinguishing feature. For example, Mandarin is a tonal language and depending on the pitch or variation in pitch, the word ‘ma’ can have five different meanings, such as horse, mother, scold, or as a marker for a question (Lee et al., 1996). Pitch can be as important as vowels themselves for comprehension of words and grammatical functions. Following on from the previous section, we decided that phonetic properties, such as tone, have no semantic nor pragmatic value. Prosody has no intrinsic value either. Prosody consists of intonation and rhythm. Intonation are the changes in pitch

used for, e.g., conveying the speaker's attitudes and emotions, or to highlight or focus an expression. The concept of rhythm in language is dubious at best, and is perhaps better explained by the notion that the perception of rhythm is based on the language that an individual already speaks, and is thus irrelevant to precisely define (Arvaniti, 2012). Likewise, lexico-semantic characteristics are solely conveyed through phonemes, not the intonation or pitch of said phonemes. This is due to the fact that only a select few languages make use of pitch differences for semantic meanings, such as Mandarin, Cantonese, Vietnamese, Yoruba, and Navajo (Bauer & Benedict, 1997; Yip, 2002).

2.5 Morphology in Atlan

What is the difference between 'walking' and 'walked'? Both words convey the meaning that something or someone is moving at a regular pace by lifting and setting down each foot in turn, never having both feet off the ground at once. However, while they convey the same meaning in movement, saying: "Stijn walking there yesterday," would be incorrect, as is "Jep is walked there".

The difference here is the suffix: a morpheme added at the end of a word to form a derivative (e.g. -ation, -fy, -ing). A morpheme, and its subject of study called morphology, examine the smallest meaningful units of language, which can be individual words or parts of words (Matthews, 1991). The main goal of morphology is to understand how words are constructed and how they convey meaning. It analyzes the various types of morphological processes, such as affixation, where morphemes are added in, around, before, or after a word, or compounding, where two or more words are combined to form a new one, and inflection, in which the form of a word is altered to indicate grammatical information like tense, number, or gender (Booij, 2007).

Some languages make heavy use of these morphemes for these context-related factors, other languages do not. Languages exist on a continuum in regard to morphology, but can be more or less categorised. On one end of the spectrum exist isolating or analytic languages, in which words are composed primarily of individual morphemes that are each distinct and carry a specific meaning, such as Vietnamese (Comrie, 1989). In isolating languages, each morpheme generally corresponds to a spe-

cific concept or grammatical function.

On the other end of the spectrum, there are polysynthetic languages, in which words are composed of multiple morphemes that are fused together to express complex ideas and convey a wealth of information within a single word. In polysynthetic languages, a single word can contain a combination of roots, affixes, and grammatical markers, allowing for the expression of entire sentences' worth of information (Baker, 1998). In polysynthetic languages, the process of word formation involves extensive morphological affixation, compounding, and incorporation. An example of a polysynthetic language is Nahuatl, spoken in Mesoamerica before the colonization by Spanish conquistadores (Rolstad, 2001; Suarez, 1983). Somewhere in this continuum, agglutinative languages exist.

In agglutinative languages, morphemes are typically added to the root or stem of a word to express various grammatical features such as tense, aspect, mood, number, case, and person. Unlike other synthetic languages like Nahuatl, agglutinative languages maintain a one-to-one correspondence between morphemes and specific grammatical functions. Generally, agglutinative languages

have a great degree of transparency in their morphological systems. The term “transparent” means that the relationship between the morphemes and their meanings is relatively straightforward and predictable. The affixes are typically added in a consistent and regular manner, allowing for clear distinctions between different grammatical features (Durrant, 2013). A wonderful example of an agglutinative language is Turkish (Lewis, 2001).

Atlan, like Turkish, makes use of an agglutinative system for morphemes. One of the core elements of Atlan is that unambiguity is a prerequisite. In choosing an agglutinative system for morphemes, we are of the opinion that this keystone has been achieved.

2.6 Concluding remarks

In this paper, we explored the neurologic basis of language and discussed the phonological considerations for the creation of an international auxiliary constructed language. We highlighted the interconnectedness between language and the brain, and the subsequent choices regarding the phonetic, phonological, and morphological system.

2.6. CONCLUDING REMARKS

Language is a complex system that is not merely a tool for communication but a reflection of our culture and identity. While constructing a language that is completely devoid of bias may be challenging, striving for neutrality and inclusivity is a worthy endeavour. The creation of a neutral and accessible language has the potential to enhance global communication, foster cultural exchange, and promote inclusivity. While language will always carry cultural influences, our efforts to create a more neutral language reflect our commitment to open dialogue and mutual understanding in an increasingly interconnected world.

Chapter 3

Writing Atlan

3.1 Typography and direction of reading

Jarno Smets

ATLAN'S writing system is a natural application of our philosophy: start with elementary parts, and every complexity will be a mere combination of those parts. Our glyphs (as we shall call them) each denote one syllable. They always do so; they always will stand for the *same* syllable. Unlike English: in the words “tone” and “to”, the “to” is pronounced respectively [tu] and [tə].

That is the rationale behind our writing system; let us dive into the details. As told, Atlan has a set of basic lines. They are:

3.1. TYPOGRAPHY AND DIRECTION OF READING

Consonants		Vowels	
Line	In I.P.A.	Line	In I.P.A.
	/t/	⊂	/u/
—	/k/	⊃	/i/
⌋	/j/	⌒	/a/
⌋	/s/	⊂	/o/
⌒	/f/	○	/e/
⌒	/l̃r/		
•	/p/		
○	<nil ¹ >		

Figure 1: The basic lines of Atlan's writing system.

These lines all represent a single vowel (V), or a single consonant (C). We can combine them to make syllables. By combining two consonant lines, you get a CVC-syllable, such as *loj*, *pas* or *mup*. You can also make a VC-syllable, such as *mu*, *po*, or *ji*. The vowels don't have sep-

¹When you see this hollow circle, the other line is combined with nothing. Don't panic if you don't yet understand this; it will be explained shortly.

arate lines in a CVC or VC-syllable; instead, the vowel is determined by the position of the two consonant-lines. We will go deeper into that below. First, we give the rules for the order of the consonants and vowels: what determines whether two lines make e.g. *poj* or *jop*, *mu* or *um*?

This order is determined by the manner in which the lines combine. There is always a “bigger” line, and a smaller one. These lines fit inside an imaginary box. The position of the smaller line relative to the bigger line, determines the order of consonants. A general rule of thumb is best given with the help of a box:

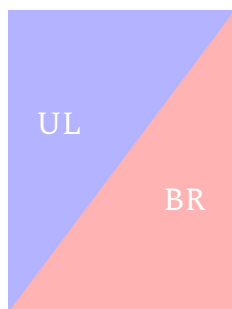


Figure 2: Box for determining consonant order.

If the smaller line is in the upper-left triangle (UL), it the consonant it designates comes first. If it is in the bottom-right one, it comes second. For the rest of the

3.1. TYPOGRAPHY AND DIRECTION OF READING

explanation, it is advised to keep this box in the back of your head. An example:



As you see here, the smaller line is found on top. Hence, it is placed inside the upper-left triangle. The consonant for which the smaller horizontal line stands (the *k*), comes before the other consonant, the *s*.

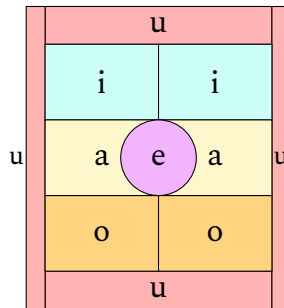


Figure 3: Location of the smaller line in relation to the vowel.

The vowel is...

- *u* if the smaller line is found at the edges. The smaller line is in its whole above, under, left or right of the main line.

- *i* if the smaller line is found on the upper-left or upper-right side of the main line. It is usually smaller than the line made for *u*, to avoid confusion.
- *a* if the smaller line is found left or right to the middle of the line.
- *o* if the smaller line is found on the bottom-left or bottom-right hand of the main line. Again, this line is smaller than the line for *u*.
- *e* if the smaller line is placed in the middle. Or, if the small line intersects with the main line at the middle. In some instances, the small line is then split up by the main line.

Then we have three exceptions to these rules. The first: you can combine two equivalent lines, to make syllables such as *pop*, *mum*, or *lol*. The order of these lines doesn't matter; hence we choose place the smaller line to the upper-left of the main line in such cases. For the vowel *u*, there are two small lines, split at the center. For *e*, there are either two or three small lines. At least one of those lines crosses through the center of the imaginary box.

3.1. TYPOGRAPHY AND DIRECTION OF READING

The second exception has to do with the k (/k/). That letter had the base line –, right? It’s a horizontal line. Because of that, we have to think of a different box from figure 2 to figure out the consonant-order. The solution is simple: we flip the box. It then looks like this:

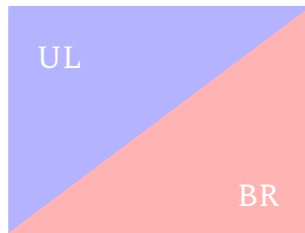


Figure 4: the imaginary consonant-order-box for /k/.

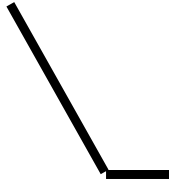
The third exception: Remember that the p is represented by the dot •. For clarity, we couldn’t combine simply two dots to make a full syllable. Hence, two p -dots combine a bit different from the rest of the lines. The p also can’t combine well with the circle (which designated “nothing”). They combine in the following way:

Basic line	u	i	a	o	e
	•	◊	⊙	◊◊	⊙◊
•	•	◊	⊙	◊◊	⊙◊
•		◊	⊙	◊◊	⊙◊

CHAPTER 3. WRITING ATLAN

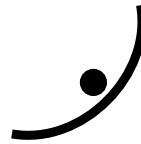
These were the rules for the script of Atlan. It might sound a bit cryptic, so let's discuss some examples. If you still feel uncertain whether you understand the rules, read through them again. Personal experience tells that, after some time, recognizing letters gets more intuitive.

3.1. TYPOGRAPHY AND DIRECTION OF READING



Let's dissect this letter. This is the letter "mok", or (*/mok/*) phonetically. First step is to discover the main line, which is the long diagonal here. This is the consonant *m* (*/m/*). Then there is a smaller line, found in the bottom-right corner. This is the *k* (*/k/*). The horizontal line is in the bottom-right of our imaginary square. Hence, the *m* comes before the *k* (see also figure one). We got the two consonants, now rests the vowel. Feel free to look back at figure two. The smaller line is found in the bottom-right corner, hence the vowel here is an *o* (*/o/*). The full syllable is *mok* (*/mok/*).

Now let's look at another one. See if you can determine the syllable yourself first. The main line is obvious: it's the big curve. This big curve is a *j*² (*/j/*). The smaller dot is a *p* (*/p/*). The dot is found inside the quadrant



"UL" of figure one. Hence, the dot comes first. The dot is found a bit left from the centre of our imaginary box.

Hence, the vowel here, is the *a* ($\langle /a/ \rangle$). The full syllable is *jap* ($\langle /jap/ \rangle$).

Do you feel if you got the hang of it? Let's do a few more.

To spice things up a bit, we'll have a syllable with the vowel *e*. Remember that this vowel had smaller lines be placed in the centre. Alternatively, the



smaller line could intersect the centre, or be split up by it. In this example, the smaller line is split up by the bigger line. The bigger line, the *l* ($\langle /l/ \rangle$) splits up the line for *j* ($\langle /j/ \rangle$). Because it does, the vowel is *e* ($\langle /e/ \rangle$), and the syllable is *lej* ($\langle /lej/ \rangle$).



Now the last example. This, we think, is the best-looking glyph in our catalogue. What does it stand for? There aren't two, three, or four separate lines here, as should be. Instead, there is a triangle with a circle

²Quick tip: the curve for *j* looks alot like the *j* itself, doesn't it? Look for more of these similarities in our writing system; they help!

3.1. TYPOGRAPHY AND DIRECTION OF READING

inside. What do we do? Well, remember the *p* ($\langle p \rangle$), which was a dot. And remember that “nothing” also has its line: the circle. There was an exception for when two p-dots combined, or a p-dot and a circle. The exception was explained a few pages back. If you go there, you encounter the same glyph. This syllable is the *pe* ($\langle pe \rangle$). A tip for remembering these glyphs: if you see a glyph with a triangle and a circle, think of the *p*.

We hope the examples have made clear how our writing system works. This concludes the explanation of our writing system for syllables. Upcoming is our writing system for numbers, and for names. Before we get to the next part, a few words of advice for learning the writing system:

- On the next pages, a full list of our glyphs is added. They are 490 in number; as many glyphs as we have syllables. Don’t be intimidated by the list; instead, use it wisely. Look through the list, and try to grasp the pattern of formation. Read the explanation above, and try to get a feel of how our glyphs are formed. Again: after some while, you’ll have a stronger intuition.

CHAPTER 3. WRITING ATLAN

- Try drawing some of the glyphs. It helps for getting used to the glyphs. You don't need a ruler to draw them; just make sure they can be distinguished from each other.
- Any blank space is the “nothing ”we talked about above. You can see the circles appear at the rows of those blank spaces. If the half of an entire row is empty, it means that a combination's reverse is unnecessary. Think of syllables like *lol*, *nun* or *juj*. They are symmetric, so we don't need a full row for them.

Again, on the next page is a table containing all our glyphs. The left two columns contain the base lines, placed in order of combination. If you've forgot which base line stands for which consonant, return to the table at the begin of the chapter. It's a great tool for using as a reference. So come back when you need it.











































3.1. TYPOGRAPHY AND DIRECTION OF READING

i	o	a	i	u
o	o	a	i	u
a	i	u		
i	o	a	i	u
u				
Base lines				
i	o	a	i	u
o	o	a	i	u
a	i	u		
i	o	a	i	u
u				
Base lines				

CHAPTER 3. WRITING ATLAN

[illegible]

3.1. TYPOGRAPHY AND DIRECTION OF READING

	i	o	a	i	u	Base lines
i						
o						
a						
i						
u						
Base lines						
						

3.2 Numerals and Mathematics

3.3 Punctuation

Atlan has minimal punctuation, only having dedicated symbols for a comma and a full stop, and spaces are the same as in any other orthography. A comma is notated as a small half circle which is open at the top: \circ symbolizing an ‘open’ continuation of the sentence, and the full stop is notated as a half circle which is open at the bottom: \cap , symbolizing a closed sentence.

Other punctuation will be marked by Atlan’s semantic atoms: question sentences start with the interrogative particle E, and so this eliminates the need for a question mark. Exclamative sentences start with the particle O, eliminating the need for an exclamation mark. Other examples would be ‘&’ being ‘AN’ (‘and’), ‘%’ being ‘EP.NO’ (‘per hundred’), ‘:’ being ‘I’ (‘relative clause’) etc.

3.4 Transliteration

Atlan words will be transliterated into the Roman alphabet using the archetype letters U, I, A, O, E, P, T, K, M, N, S, F, L, J. Dots are used in between each syllable, in order to prevent confusion about where syllables are broken up, since this could create ambiguity in meaning. Dots in between two of the same consonants (eg. AK.KA) or vowels (e.g. KA.AK) are pronounced as a glottal stop or shwa, respectively (see chapter 2.2 and 2.3).

Atlan's syllables are all (C)V(C). Some loanwords or names, however, might have two or more consonants in a row within the same syllable. In such cases, the individual letter lines that exceed the CVC limit, will stand on their own next to the syllable glyph. The name 'Stijn', for example, will then become 'S.TEJ.N'.

3.5 Numerals

Atlan also has a numeric system distinct from the familiar arabic-numerals. They look like this:

CHAPTER 3. WRITING ATLAN

1 —┐	10 ┐—	100 —┑	1000 ┑—
2 —┑	20 ┑—	200 —┒	2000 ┒—
3 —┒	30 ┒—	300 —┓	3000 ┓—
4 —┓	40 ┓—	400 —└	4000 └—
5 —└	50 └—	500 —┕	5000 ┕—
6 —┕	60 ┕—	600 —┖	6000 ┖—
7 —┖	70 ┖—	700 —┗	7000 ┗—
8 —┗	80 ┗—	800 —┘	8000 ┘—
9 —┘	90 ┘—	900 —┙	9000 ┙—

The bottom right corner will be the first order of magnitude (below 10), the upper-right corner the second order (tens), the bottom-left corner the third (hundreds) and the top left the fourth (thousands). This way, when reading a single numeral, one would read from left to right and top to bottom, first the thousands, then the hundreds, then the tens and then the below tens, like for example the number 2023 (┑┒┓). An empty line is equal to zero (—), and having one of the corners empty but others with a number attached means that that order of magnitude is zero (such as the third order of magnitude in 2023). Decimals can be made by using a comma and

adding a numeral behind it: in this case the orders of magnitude are flipped: one behind the comma is a tenth, two is a hundredth, three a thousandth and four a ten thousandth. For example, 2023,2023 would be $\text{+} \text{7} \text{ } \boxed{\text{+} \text{7}}$.

An added benefit of this numeral system, besides taking less space, is that addition could be more visually intuitive for some numbers: $\text{—} \text{1}$ plus $\text{—} \text{7}$ equals $\text{—} \text{v}$, $\text{—} \text{1}$ plus $\text{—} \text{7}$ equals $\text{—} \text{7}$, $\text{—} \text{1}$ plus $\text{—} \text{—}$ equals $\text{—} \text{J}$.

Atlan's numeral system also allows for a duodecimal base notation, with the addition of unique numerals for 10 and 11:

$$10 = \text{1} \text{—} , 120 = (\text{1} \text{—}^{\perp}), 1440 = (\text{7} \text{—}^{\text{<}}), 17280 = (\text{J} \text{—}^{\perp})$$

$$11 = \text{1} \text{—} \text{1} , 132 = (\text{v} \text{—}^{\perp}), 1584 = (\text{J} \text{—}^{\text{<}}), 19008 = (\text{—} \text{—}^{\perp})$$

The added benefit of a duodecimal system is that certain fractions divisible by 2, 3, 4 and 6 are more straightforward to calculate by heart, whereas 10 can only be divided easily by 2 and 5. Another benefit is that it is more suited for many numerical systems, such as time divided into 60 seconds per 60 minutes per 24 hours, the twelve months and zodiac signs, as well as rotation being divided into 360 degrees.

The duodecimal system can also be easily counted on a single hand, by using the thumb of the same hand as a pointer to count off the 3 finger segments in the 4 remaining fingers (see figure). Atlans number syllables fit this system as well:



Image taken from West (2015).

1, 2 and 3 are 'IP' \triangle 'OP' \triangleright 'UP' ∇ , since these all end in P they are grouped together on the first finger. 4, 5 and 6 are 'IK' \ominus , 'OK' \ominus , 'UK' \circ — , following again the same vowel pattern, but with K, grouping them on the second finger. Similarly, 6, 7, and 8 are 'UK' \circ — 'IM' \searrow 'OM' \searrow , and 9, 10, 11 are 'JI' \circ — 'JO' \circ — 'JU' \circ — .

Currently, Atlan does not have a standardised system to clarify beforehand whether decimal or duodecimal numerals are used, other than to spot the usage of the numerals \top and $\top\top$. Frankly, current duodecimal systems in Arabic notation don't have this either, but it could be easily stated verbally beforehand.

3.6 Mathematics – Stijn Janssens

Just as with punctuation, mathematical symbols can be approximated by semantic atoms. For example, plus + could be ‘AN’ \mathcal{A} (‘and’), minus - could be ‘NE’ \neq (‘negative’), divided by : could be ‘EP’ \triangle (‘per’), equals = could be ‘ME’ \backslash (‘equal’). This way, speakers will not be required to learn many new mathematical symbols, but rather the glyphs could function as these, as well as carrying their own pronunciation and meaning. More complicated mathematical symbols or notations might need to be formalized and standardized by mathematicians, which might require more than one syllable.

3.7 Typography









Since Atlán’s writing system is comprised of a set of basic lines, a great degree of artistic freedom is possible in creating different fonts and calligraphy styles to write the language. Atlán typography should make sure to re-

main faithful to the specific orientations of the different lines as to not cause confusion between them. Since any glyph contains a minimal amount of lines, usually two, typographic ornamentation can be added to glyphs without causing much confusion. Here we provide four examples of typographic variations on the word ‘Atlan’: a Times New Roman font, a *Comic Sans*-style font, Asian-style calligraphy and Arabic-style calligraphy.

3.8 Names, loanwords, and cartouches

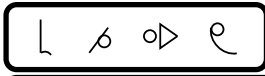
Words that denote certain names, such as personal names, placenames, names for institutions, as well as loanwords denoting certain culture-specific objects or concepts, like certain meals, for example, are incorporated into Atlan as phonetic approximations of these words in their source language. Because every possible syllable in Atlan already has its own designated semantic value, this could cause confusion, if the syllables are interpreted as Atlan words instead of loanwords. For this reason, names and loanwords always follow the following structure:

denoting category (e.g.: **person**  (EJ), **place**  (LU), **town**  (TOS), **food**   (MAJ.KOS)) + **NA**  (**name**)

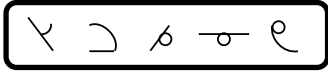
3.8. NAMES, LOANWORDS, AND CARTOUCHES

+ **phonetic approximation**

Using this formula, ‘Paris’ would become: ‘TOS.NA.PA.LI’



, and ‘curry’ would become ‘MAJ.KOS.NA.KA.L



. If the conversational context makes it explicit enough that the subject matter concerns a loanword, and not a literal Atlan word, the markers denoting category + NA may be omitted for the sake of fluent speech.

In (formal) typography, a cartouche may be employed to encircle the phonetic approximation in order to enhance intelligibility. Cartouches originate from Ancient Egyptian hieroglyphic orthography, where they were used to encircle the names of pharaohs (see Fig. 1) (Chrisholm, 1911).



3.8. NAMES, LOANWORDS, AND CARTOUCHES

Fig.1 Cartouche of Hapshepsut, one of the few female pharaohs in Egyptian history. She was often referred to androgynously because of a lack of feminine royal nomenclature (Graves-Brown, 2010).

The cartouche originates from the hieroglyphic ‘shen’, a stylised loop of a rope, which literally means ‘to encircle’, but had come to symbolise eternal protection. Therefore, it was also believed to have apotropaic powers (warding off evil). The word ‘cartouche’ comes from the French word for ‘paper bullet cartridge’, first applied when Napoleon’s soldiers encountered the frequently occurring glyph and noticed its resemblance to such cartridges (White, 2002). Interestingly, cartouches played an important role in deciphering Egyptian hieroglyphics. The early Egyptologist Thomas Young, following a suggestion from the decipherment scholar Jean-Jacques Barthélemy, compared the cartouches that appeared on the Rosetta Stone to the proper names that appeared in the Greek text (Robinson, 2009). This way, he was able to decipher the name ‘Ptolomy’ (Young, 1823). If Atlan were ever to become widely used, and inscriptions were made employing cartouches, perhaps the archaeologists of some distant future might employ them to decipher the script in the

same manner that Young did.

The 2001 conlang Toki Pona by the Canadian linguist Sonja Lang also employs cartouches in these contexts, for the same reason that Atlan does so (Lang, 2016). Just like in Toki Pona, Atlan’s cartouche shall be a simple oval circumscribing the name or loanword, without the additional straight line as used in Egyptian cartouches. One could object that employing a typographic element that derives from a specific cultural tradition, namely that of ancient Egypt, is in conflict with Atlan’s constraint of cultural neutrality. To this we object with the following justifications: the cartouche serves a practical function in preventing orthographic ambiguity; the Ancient Egyptian culture is currently extinct and thus does not advantage current day Egyptians over any other culture; the historical origin adds an extra layer of symbolism and cultural depth which in no way interferes with practical use; and frankly, we are of the opinion that it looks quite cool.

As we will see in the next part, the glyphs can be made on the computer using T_EX. This also is true of cartouches. A cartouche can be made by simply saying name. For example, the T_EXcode Utrecht produces:

[SAMPLE CODE: Utrecht]

Utrecht = UT-LEK-T

We will talk more of TeX in the next subchapter.

3.9 On Dyslexia

Stijn Janssens and Jonathan Roose

3.10 T_EX and Atlan – Jarno Smets

Atlan is precise when needed, but not forcingly rigid. Being all nitty-gritty is possible, but not demanded. Hence, the typesetting language T_EX³ is a great fit for this book, and for Atlan's writing system. Here I will quickly guide the reader through the uses of T_EX in this book.

First, there are our glyphs. They are hand-programmed in T_EX using Tikz. It was a strenuous effort, but worthwhile. The glyphs are high-resolution, scaleable, and they also look the part. The usage is straightforward as well.

To print any of the Atlan glyphs in T_EX you load in the package `Atlan.sty`. Most glyphs are simply transliterations of syllables, with a backslash in front. E.g. `\mum` prints `\`. Some commands were already occupied, hence

³Or its modern forms L^AT_EX and LuaL^AT_EX, as used here.

some of the commands are named differently, e.g. `\Atlanpi`, since simply `\pi` would print π . Next up, I plan to make a font that is available on other typesetting platforms.

Then, our numeral glyphs rely on Lua^ATeX a more potent version of TeX. The command, again, is straightforward. You simply state `numbr{<number>4}`. An example of the command: `\numbr{321}` produces $\overline{321}$.

Then, of course, this book is typeset in TeX. We could have made it easier for ourselves. But, typesetting with TeX was worth the effort. We are proud of what we have made; both content- and appearance-wise.

⁴Due to the nature of our numeric system, the biggest number you can fill in, is 9999.

Chapter 4

Morphosyntax

4.1 Unambiguous Syntax

Jarno Smets

AMBIGUITY is of all times and places, and natural language is rife with it. *Goal, purple people eater, John trades with Mary*; these words and expressions can all be interpreted in multiple ways. Some despise ambiguity, while others wallow in it. Whatever one thinks of ambiguity, it is a part of natural languages.

For our constructed language, we want to minimize ambiguity. This for the sake of clarity and communicability. Hence this essay.

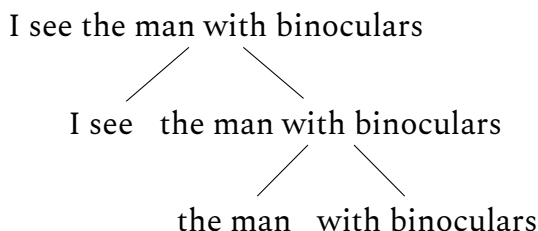
In this essay, I will cover a specific type of ambiguity,

namely *syntactic ambiguity*, also known as *structural ambiguity*. A sentence that can be interpreted in multiple ways due to its syntax, is structurally ambiguous.

My aim in this essay is twofold. First, I want to show why syntactic ambiguity is a problem, especially for the goals of our project. Then, I will propose a strategy to minimize this form of ambiguity, and argue for that strategy choice.

What is syntactic ambiguity?

Syntactic ambiguity occurs when word-order gives rise to multiple interpretations (Oaks,2012, p.16) . The sentence “I see the man with binoculars” could be parsed (split into grammatical parts) in two ways:



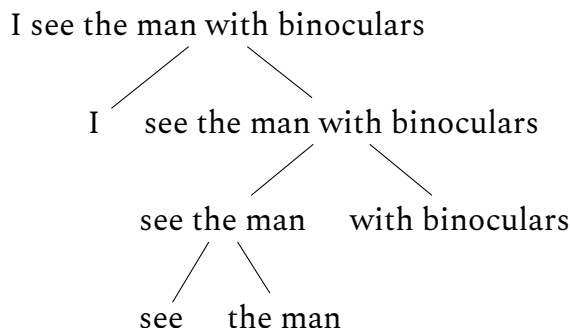


Figure 1: different syntax trees for “I see the man with binoculars”

As we see in the above syntax trees, the difference in interpretation hinges on the (de)coupling of the words *man* and *with binoculars*. You could make *with binoculars* modify *man*. One could also modify *see* via *with binoculars*. The structure of the sentence doesn’t give preference to one over the other.

For further illustration: one common type of syntactic ambiguity, is *scope ambiguity*. Scope ambiguity co-occurs mostly with logical operators such as quantifiers (for all, there exists), negation, and coordinators (and, or, but)¹. *Scope* is the part of a sentence over which such quantifier, negation, or coordinator ranges. Other in-

¹These are all operators in propositional logic. Quantifiers: \forall = for all, \exists there exists, \neg = negation, “not”. \wedge = and/but, \vee = or.

stances of scope ambiguity are seen with modifiers, which I will briefly discuss below. Scope and scope ambiguity can best be explained by example:

(1) *My cat is not grey or black*

Two readings for (1): my cat is neither grey nor black, he is red, for example. Alternatively, my cat is not grey, but is black of colour. The scope for negation is ambiguous here. The *not* either or it has scope over *grey or black*, or it only has scope over *grey*, .

Where lies the origin of such structurally ambiguous sentences? Yang (2014) discerns five major causes of structural ambiguity in English:

- A Negation scope
- B Words with special syntactic functions
- C Improper abbreviation
- D Unclear word-characteristics
- E Unclear modifier-relations

We discussed an instance of A above already. With B, Yang refers to words that generate *subordinate clauses*; subsentences. These sentences could either be the object of the bigger sentence, or be a truly subordinate clause. E.g.: *The girls reported to me when they came*. Did the girls report to me after they arrived? Or did they report their time of arrival? it is unclear, due to the meaning of the word *when* .

Now on to cause C Yang mentioned. *Improper abbreviation* is the improper shortening of a sentence. Again, think of the sentence *Mary trades cards with Joe*. I could have said *Mary trades cards together with Joe* if I wanted to convey that message. But I didn't; I left out the word *together*, making it ambiguous.

Then, an example will elucidate cause D: *drinking water is unsafe*. Is *drinking* a verb in itself, or part of the larger phrase *drinking water*? The word characteristics for *drinking* are unclear. *Drinking* can either be seen as a verb, or as a noun together with *water*.

Finally, cause E refers to a modifier. A *modifier* is a linguistic element that changes the meaning of another linguistic element. For example, *grey* modifies *dog*. With unclear modifier relations, it is not apparent which mod-

ifier modifies what. In the phrase *purple people eater*, it is unclear whether *purple* modifies *people*, or *eater*.

I propose we bring these causes down to two. Firstly, structural ambiguity is caused by unclear semantic roles. A *semantic role* of a word or sentence-part is the role it plays in the meaning of the sentence. For example, the semantic role of *the grey dog* is the same in both sentences underneath:

- (2) *The cat attacked the grey dog*
The grey dog was attacked

In the example given above, *I see the man with binoculars*, the semantic role of *with binoculars* is indeterminate. Is *with binoculars* how I see the man? Or does the man have binoculars? it is precisely this indeterminacy that seems to generate the ambiguity.

The second cause I propose, is unclear word-grouping and unclear scope. To get rid of the ambiguity in phrases as *purple people eater*, or *lesbian vampire killer*, it needs to be specified which words modify which.

The issue for Atlan

In the previous part, I examined syntactic ambiguity. Now, why is this a problem for Atlan?. I will here propose three reasons for that goal. First, I will argue that structural ambiguity inhibits the parsing of language by computers. Computer-parsing could boost the spread of Atlan. Secondly, I will show that some forms of syntactic ambiguity would endanger the communicative function of our constructed language. Atlan should be a bridge between two languages. Syntactic ambiguity can make it more difficult for two speakers from different languages to communicate. Lastly, I will argue that, in some high-stakes circumstances, syntactic ambiguity could be a great danger.

First of all, syntactic ambiguity is a problem for computers. Computers need a so-called *parser* to understand our language: The machines pick apart a sentence, in order to fully understand it (Schubert,2020). Syntactic ambiguity is a true roadblock for such parsing. Because syntactic ambiguity gives rise to multiple parsing options, a computer can't give a definite parsing of a syntactically ambiguous sentence. To circumvent, or to (par-

tially) overcome it, multiple algorithms have been created. Yet it remains a difficult problem (Chowdhary, 2020, p.645).

For our constructed language, computer parsing and processing could be of help to the language learner. Translations would be more accurate, and practice materials can be generated more quickly. The presence of syntactic ambiguity is troubling for computers to analyze natural language.

Besides, structural ambiguity endangers universality. Since our language is intended as an auxiliary constructed language, people learn our constructed language as a *second language*. Hence, learners all approach our language from the perspective of their mother tongues. Now here lies the problem: different languages have interpret scope in different ways.

This has been shown, for example, in Scontras et al. (2017). This team of researchers found out that Mandarin lacks *inverse scope*. Inverse scope can best be explained by an example: “A badger dug every hole”. In English, two readings are available for such sentence:

Surface scope - *There was one badger such that it dug every hole.*

Inverse scope - *For every hole, there was a (different) badger that dug it.*

Scontras et al. found out that the inverse scope reading is simply not available in Mandarin Chinese. Furthermore, they found out this lack of inverse scope is found in the English of native Mandarin speakers. Another study showed similar results: Korean learners of English habitually preferred the surface-scope reading, and left the inverse-scope reading out (Seon & Shin, 2022).

So, when learning new languages, speakers have the tendency to bring their native scope-reading preferences with them. This endangers the communicative function of our conlang. If our constructed language has certain scope ambiguities in it, miscommunication can occur. Say you have speaker X, in whose language both scope-readings are available. She communicates such a scope-ambiguous sentence to speaker Y. X wants to bring across the inverse scope-reading. To speaker Y, *inverse* scope-readings are *not* available. Then X fails to bring across *her* wished interpretation of the sentence; a communicative error has occurred. Hence, structural ambiguity endangers the communicative clarity of our constructed language.

Expanding further on communicative clarity: some contexts strictly demand that there be no ambiguity. Hazardous environments, such as nuclear power plants, weapon factories and the like, should communicate in a clear, unambiguous manner. Also law practice should be ridden of ambiguity. These are high-stake-environments. Any communication mistake could have far-stretching consequences.

Say an English nuclear-power plant has the following instructions etched into an important control panel:

(3) In case of emergency: pull the horizontal striped lever

Now, there are two levers in the control room. One is a lever you pull from north to south, and it is marked with horizontal stripes. The other lever is horizontal, but has vertical stripes instead. Which lever do you pull? I hope this example makes it clear how dangerous syntactic ambiguity can be.

Of course, this was a fabricated example. A real-life example, can be found in (Layman,1962):

(4) Serbian subjects in the United States, shall enjoy the rights which the ... laws grant ... to the subjects of the most favoured nation.

Example (4) elicits two interpretations: Serbian subjects who reside already in the United States enjoy the rights, or Serbian subjects, independent of where they remain, enjoy the rights when they are in the United States. This is syntactic ambiguity in law. Here it can have grave consequences for a large number of citizens.

With these few examples, I have shown why syntactic ambiguity is best left out in our constructed language. Firstly, it would make it hard for computers to parse our language. That while computers generally help to spread a language faster. Secondly, structural ambiguity in a language can cause miscommunication within a language. Not every language allows multiple scope readings, for example. Scope ambiguity can then lead to miscommunication in a language. Thirdly, syntactic ambiguity can be of real danger. It could cause communicative issues in high-stakes environments, such as infrastructure and law.

It must be noted, however, that syntactic ambiguity is not only a *bad* phenomenon. It can also serve poetic and humorist endeavours. For example, the structurally

ambiguous sentence

(5) *Time flies like an arrow; fruit flies like a banana*
is undeniably witty². Does the fruit fly similar to a banana, or do fruit flies love a banana? The first part of (5) seems to prime the reader for the first reading.

Minimizing syntactic ambiguity

Now I will look at the efforts of other constructed language to minimize syntactic ambiguities. I will examine the benefits and downfalls of their approaches. From that examination, I will aim to distill the strategy for *our* constructed language to bring structural ambiguity to a minimum.

One of the main origins of structural ambiguity is the distance between sentence-parts. In a structurally ambiguous sentence, it becomes unclear how the words are fit into phrases, and then how phrases fit in a sentence. For example, in the noun-phrase *purple people eater*, does *purple* belong to *people*, or to *eater*? Solving structural ambiguity is then making clear which words modify what, to only give one interpretation of a phrase or sentence.

²Found in (Cornish-Bowden, 2015).

The constructed language Lojban³ indeed does this. It has two ways of specifying which words belong together. The first manner comes in the form of the structure word *bo*. *Bo* enforces scope (The Lojban Reference Grammar, 2023). To see how, let’s take the English sentence “That is a big bug catcher”. In English, you could interpret this either as a big catcher of bugs, or a catcher of big bugs. In Lojban, the word *bo* makes this difference explicit:

(6) That is a bug-catcher that is big.

*Ta barda miptera bo kavbu*⁴.

(7) That is a catcher of big bugs.

Ta barda bo miptera kavbu.

As you might have guessed from the above examples, the structure word *bo* “pulls” two words together, to combine

³Lojban [loʒban] is a constructed language, created by a group of people wanting to improve another constructed language, *Loglan*. One of its spear points is having an ambiguous syntactic structure. Found on: <https://mw.lojban.org/papri/Lojban>, may 23rd, 2023.

⁴*Ta* = “That is”, *barda* = “big”, *miptera* = “bug”, *kavbu* = “catcher”, and *bo* is the structure word. English translation found in (Jbovlaste: a lojban dictionary, 2023)

them. Since the combination of words is made explicit by *bo*, ambiguity is resolved.

There is a second way of coupling words in Lojban. The makers of Lojban decided to make rules for grouping, the so-called *brivla*. *Brivla* is an umbrella term for nouns, verbs, adjectives and adverbs (The Lojban Reference Grammar, 2023). The *left-grouping-rule* states that the two leftmost *brivla* are grouped together. So, the sentence *Ta barda miptera kavbu*, is automatically parsed equivalent to the second reading above (The Lojban Reference Grammar, 2023).

It seems Lojban got structural ambiguity under control with these two restrains. What are the advantages and disadvantages of this approach?

As already mentioned above, the word-groupings are made explicit, effectively removing structural ambiguity from the language. This increases the clarity of Lojban, and thereby makes the language more universal. There are some downsides however. As we saw above, some scope readings are not even available in the mother-tongue of some speakers. The left-grouping rule described above could enforce a reading upon the language learner, which the language learner is far from familiar with. Lojban

then might sometimes give rise to miscommunications.

Another constructed language with the intent of minimizing (syntactic) ambiguity, is *Ithkuil*. Ithkuil marks semantic roles explicitly in noun cases (Ithkuil, Case Morphology, 2023). This is relatively similar to German, where the case *der* usually marks the (male) subject of the sentence, or *des* marks the possessor. Ithkuil has more cases, including the ones we all know (subject, object, possessor, dative). Examples are *instrument*, *force*, *agent*, and much more⁵.

Ithkuil specifies the exact case of every noun. Due to that, it is clear which word plays what role in a sentence. In *purple people eater*, for example, *eater* could be nominative, while *purple people* would be marked as accusative. In that way, ambiguity is brought down to a minimum. However, there is one big downside to this approach: it is too complex. Ithkuil is very complex, and hard to learn. Even the creator, John Quijada, can't speak it fluently (Foer, 2023). Thus, the ubiquitous presence of cases seems to do more harm than good; it eliminates ambiguity, but at the cost of learning-ease and fluency.

⁵Readers interested in more should visit Ithkuil's website: http://www.ithkuil.net/newwithkuil_04_case.htm.

We have seen how Ithkuil and Lojban deal with syntactic ambiguity. Taking this in account, how will Atlan deal with it?

A feature of Lojban was the explicit word-coupling with the structure word *bo* . The word directly made clear what words formed a separate noun-phrase. However, it is an extra word to remember. We believe it is a better idea to couple words in the most direct sense of the word: literally connect them to each other. This is a familiar feature of, for example, Dutch: *grijze hondentemmer* (grey hound-tamer) versus *grijze-honden temmer*. Both in English and Dutch, the words “dog ”and “tamer ”are joined to indicate that they belong together. In speech, words that should be separated, are separated by a pause.

Now, what about scope ambiguity? For negation, for example, we will include two types: sentential and predicate negation. Sentential negation is a form of negation that spans over a whole sentence. For this we put NE in front of the sentence. E.g. *I have **not** been to school today*. Predicate negation on the other hand, only spans over a predicate. For this we put NE in front of the predicate (or noun). For example, *I’m very **un**happy at the mo-*

ment. This would fix negation scope ambiguity. Take the aforementioned example *my cat is not grey or black*. The two readings can be separated using the distinction between types of negation:

(8) *My cat is ungrey or black*
it is not the case that my cat is grey or black

The sentential negation will take the form of a distinct particle, whereas the predicate negation will be an affix. This has the following reasons. Sentential negation spans over a whole sentence. To make it immediately apparent that a sentence is negated, it would be convenient to have a loose particle to place at the beginning of a sentence. Predicate-negation occurs within a sentence, and binds to predicates. Hence, it will be an prefix, connected to the predicate it negates.

This approach to negation doesn't make it more difficult to learn. Most languages are familiar with it: the most common types of negation are negative particles, and affixes (Martin et al., 2005, p. 454) Even if, for a learner's mother-tongue, there is a mismatch between negation type (sentential and negation) and form (particle and affix), the forms are very likely familiar. This

will very likely make our approach to negation somewhat more intuitive for a language learner. Moreover, predicate negation is present in a majority of languages (Martin et al., 2005, p.467).

But what about scope ambiguity outside of negation? E.g. *The dog or the cat and the bird made a mess*. Here, we appeal to operator strength from Classical Logic. Negation comes first. Then comes conjunction (“and”). Last comes disjunction (“or”) (O’Donnell et al., 2007, p.120)⁶. In the above example, the sentence is read as: (the dog or the cat) and (the bird) made a mess. That the bird made a mess, is certain. Whether the dog or the cat made a mess is uncertain.

Now it is worth noting a few *caveats* about my approach. Firstly, I reasoned mostly from syntactic ambiguities in English and Dutch. This could leave room in my solutions for syntactic ambiguities not thought of by me. Hence, I talked primarily of *minimizing* syntactic ambiguity. Besides, it is worth noting that context will disambiguate as well. I have mostly examined structurally

⁶After that comes the conditional (“if...then”, \rightarrow) and the biconditional (“if and only if”, \leftrightarrow). As far as I can tell, they don’t seem to generate syntactic ambiguity, hence I leave them unmentioned here.

ambiguous phrases and sentences in isolation. Some of those phrases or sentences would not be as ambiguous in context.

In this essay, I have shown two things. First, I argued that syntactic ambiguity should be avoided when constructing a language. This because syntactic ambiguity troubles computers, endangers communicative function, and can be potentially harmful.

Secondly, I have proposed several general recommendations for battling syntactic ambiguity. This I distilled from previous attempts at constructing structurally unambiguous languages, such as Lojban and Ithkuil . Lojban made its structure clear, but had a redundant syntax rule. Ithkuil explicitly specified the semantic role of each word, but became extremely hard to learn and speak as a consequence.

Atlan won't be as specific as Ithkuil or Lojban. It is a balance we need to find between preciseness and learnability. Both Ithkuil and Lojban are extremely precise, but sacrifice learnability. I am confident that Atlan will find a good balance, and that the learner will profit from that.

Chapter 5

Our Ontology

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Bibliography

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