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„Sense & Sonority - The Influence of Sonority on Language Perception“

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Abstract

Sonority is per se a controversial topic, the definition of which poses methodological difficulties. However, there is a broad consensus in the scientific community that sonority is a non-binary phonological element that can be used to categorize all sounds into a hierarchical scale (Ladefoged, 2000: 227). Using an adapted form of Fought's sonority scale (Fought et al. 2004), this study will analyse and compare the mean sonority values of European languages. Additionally, it will contrast the mean values of the sonority with the subjective perception of the languages (Kogan & Reiterer 2021), to investigate whether a correlation can be determined. This novel approach to studying language is arguably what sets my research apart, given that the inclusion of language perception is part of the rather young discipline of phonaesthetics. Language perception is influenced by a myriad of factors and consequently, identifying the phonaesthetic component, which could be described as the emotional perception of a language, is not an easy feat. The results of the analysis will also serve as a foundation to re-analyse older theories, such as the correlation between climate and the sonority of a language.

Phonaesthetics is a young and promising field which, in time, will change the way we study and conceptualise language. In everyday conversations, non-linguists often focus on their perception of language(s), describing them as beautiful, sweet in sound, and harmonious. Among linguists, however, studying the subjective perception of languages has long been viewed as unscientific, which is why little research about it has been done. My thesis, by contrast, is part of an emerging academic current that strives to reverse this trend. Not only does my thesis address this lack of academic interest, but it emphasises that studying the beauty of language is, in fact, crucial to understanding language itself.

Kurze Zusammenfassung

Sonorität an sich ist ein umstrittenes Thema, dessen Definition methodische Schwierigkeiten mit sich bringt. Gundsätzlich besteht jedoch ein Konsens darüber, dass Sonorität ein nicht-binäres phonologisches Element ist, mit dem alle Laute in eine hierarchische Skala eingeordnet werden können (Ladefoged, 2000: 227). Unter Verwendung einer adaptierten Form der Sonoritätsskala von Fought (Fought et al. 2004) werden in dieser Studie die mittleren Sonoritätswerte von einer Auswahl an europäischen Sprachen analysiert. Zusätzlich werden diese Mittelwerte mit der subjektiven Wahrnehmung einer Sprache (Kogan & Reiterer 2021) verglichen, um zu untersuchen, ob eine Korrelation vorliegt. Diese (relativ) neue Herangehensweise an die Untersuchung von Sprache ist das Alleinstellungsmerkmal dieser Studie, da die Einbeziehung der Sprachwahrnehmung Teil der recht jungen Disziplin der Phonästhetik ist. Die Sprachwahrnehmung wird von einer Vielzahl von Faktoren beeinflusst, was die Identifizierung einer phonästhetischen Komponente, die man als die emotionale Wahrnehmung einer Sprache bezeichnen könnte, erschwert. Die Ergebnisse der Analyse werden auch als Grundlage dazu dienen weitere Theorien, wie die Korrelation zwischen dem Klima indem eine Sprache gesprochen wird und dem Klang einer Sprache, zu überprüfen.

Die Phonästhetik ist ein junges und vielversprechendes Gebiet, das mit der Zeit die Art und Weise, wie wir Sprachen betrachten, verändern wird. Wenn Laien über Sprachen sprechen, wird oft ihre subjektive Wahrnehmung als Vergleichsbasis herangezogen, das heißt eine Sprache wird, zum Beispiel, als schön, melodisch und attraktiv beschrieben. Unter Linguisten wurde die Untersuchung der subjektiven Wahrnehmung von Sprachen jedoch lange Zeit als unwissenschaftlich angesehen, weshalb nur wenig Forschung dazu betrieben wurde. Diese

Masterarbeit soll Teil eines neuen Ansatzes sein, der sich bemüht, diesen Trend umzukehren und der Phonästhetik einen fixen Platz innerhalb der Linguistik zu verschaffen. Die vorliegende Arbeit füllt nicht nur einen Teil dieser akademischen Lücke, sondern zeigt auch dass die Untersuchung der Schönheit einer Sprache das Potential hat neue Wege der Sprachanalyse zu erschließen.

Table of Contents

List of Illustrations

Acknowledgement

I want to thank my supervisor, Prof. Dr. Susanne Maria Reiterer, for her tremendous support. She did not only help me find my topic in the first place (which was not an easy endeavour), she also helped me enormously throughout the process of the thesis. Additionally, she encouraged me to present my thesis at various conferences and was always available for my questions, often even responding to my e-mails in the middle of the night.

On this note, I also want to thank the Phonaesthetic Research Group as a whole. The cooperation within the group enabled me to tackle my own thesis with ease. Within the group, I want to especially thank Anna Winkler, since she helped me understand and navigate the data of the research group. However, apart from the research group, I want to thank my dear colleagues Liisi Törmäkangas and Franz Schmid, for encouraging me and meeting up in our *Buddy-Meetings* to discuss our progress, or rather rant about the lack of it.

Special thanks go to Esther Zitterl, whose warm encouragement and constant support helped me to stay on track. I am especially thankful for her help with proofreading my work in such great detail, and for understanding and reformulating my scattered arguments. Last but not least, I want to thank my parents, Susanne and Andreas Nemestothy, for their continuous support, their trust in my abilities and for simply enabling me to study.

I. Introduction

The backbone of this study is the belief that there are linguistic correlates that influence the aesthetic perception of a language. Why does one perceive, for example, French as the language of love and German as sounding strict? In the words of the polyglot Holy Roman Emperor Charles V: “I speak Spanish to God, Italian to women, French to men, and German to my horse” (Brunner 2014). One approach would be to call this a collection of cultural clichés that are solely based on the cultural history of the speakers of the language. The other approach, which this study is based on, tries to determine the linguistic features that cause listeners to perceive a language as erotic or structured. While this approach acknowledges the cultural influences and stereotypes, it argues that they can not fully explain why certain languages are perceived as more aesthetic than others.

Aesthetic research, as conducted in the fields of psychology and cognitive science in general, focuses mostly on visual stimuli and the effects that these evoke on participants. In this case, acoustic stimuli are subject to discussion, which is why this investigation pertains to the realm of phonaesthetics, which is a relatively young and promising field for future research. The first part of the thesis will introduce phonaesthetics and the previous studies that were conducted on language perception.

As implied by the title of this thesis, the linguistic feature that this paper focuses on is sonority. Sonority is a somewhat controversial topic, given that it does not only have a multitude of different definitions, but also hundreds of hierarchies and scales, the purpose of which is to rank the sonority values of sounds. Consequently, to avoid confusion, this linguistic key feature, will be defined as it was used and understood in this thesis, and then incorporated into a scale that suits the purpose of this study. Subsequently, the mean

sonority value of 29 European languages will be established via transcriptions using the International Phonetic Alphabet (IPA 2020).

The analysis of this study consists of three parts. Firstly, the mean sonority values of the languages will be compared and used to rank said languages. In addition, this part will contain rankings of the corresponding language families and discussions regarding the implications (and possible correlations).

The second part of the analysis will focus on comparing the mean sonority values to the results of the linguistic perception of the study of the Phonaesthetic Research Group. The group is led by Prof. Dr. Susanne Reiterer and further consists of Max Sinnl, Anna Winkler, Žiga Bogataj, Vita Kogan and the author of the present thesis. The Phonaesthetic Research Group collaborates with the MediaLab of the Faculty of Philology and Cultural Studies at the University of Vienna, which is led by Dr. Jörg Mühlhans. The present study forms part of a larger project of the Phonaesthetic Research Group. Thus, the reference Phonaesthetic Research Group (2021) will be used to give credit for the data acquisition executed by my colleagues. The link that is embedded in this reference leads to a website that states the publications and all of the people involved in the study. The comparison with the data of the research project of the Phonaesthetic Research Group (2021) will address the question of whether sonority influences one of the four factors in which the participants could rate their aesthetic perception, namely: beauty, eros, status and order.

The third part of the analysis digs deeper into an assumption of an earlier study (Fought et al. 2004) that suggested that the sonority of a language depends on the climate in which a language is spoken. This idea will be taken up and investigated in the European context, in which the present study is set.

The discussion will pose questions along the lines of: “How erotic and chaotic is sonority?” Or: “Can we find a ‘Celtic lover effect’?” The principal focus lies on identifying the missing link between linguistic factors and language perception, which is an exceptionally challenging task, given that this study is moving into academically uncharted territory. Sonority seemed a fitting focus for this study since it is closely connected to the syllabic structure of a language, which in turn rendered it possible to find potential correlations in previous research. However, future research might find other linguistic features which influence the aesthetic perception of a language.

I.1. Aesthetics & Phonaesthetics

Traditionally, aesthetics is coined as a branch of philosophy that deals with the nature of taste, fine arts, and the appreciation of beauty. However, in rather recent scientific development the psychological research of aesthetics started to gain momentum (Zeki 1999; Leder et al. 2004; Leder & Nadal 2014). This is due to innovations of technical and theoretical nature. Technical progress allowed and improved the conditions under which art and the experience of it can be studied in the laboratory. In neuroscientific research, aesthetics were discovered as an area of interest. And the theoretical input, such as by Leder and colleagues (2004), offered descriptive information-processing models of the components that aesthetic appreciation consists of. The model can differentiate between two forms of aesthetic experience, affective and cognitive processing, which result in aesthetic emotion and aesthetic judgements as outputs. These two kinds of experiences are believed to be linked reciprocally (Scherer 2003; Leder et al. 2004), which means that the affective process influences the cognitive process and vice-versa. Hence, aesthetic judgements can not only be

seen as the product of purely cognitive influence, since the emotional processing will affect the outcome.

I.1.1. Phonaesthetics

The term phonaesthetics, meaning the pleasantness associated with certain sounds or even languages, was coined by none other than (linguist and author) J.R.R. Tolkien (Robbins 2013). Phonaesthetics, as viewed from a scientific perspective, is a fusion of aesthetics research and the linguistic subfield of phonetics and phonology. Research on aesthetics predominantly focuses on the visual sense and on the fine arts. One reason why aesthetics research did not focus on language is that in a historical context languages were described as "primitive" in order to ensure the hegemony of colonialist oppression (Mazzon 2021). This notion divided languages between the "good" language of the European colonisers and the "primitive" language of those that were oppressed. This also happened (and still happens) in the context of oppressing the languages of minorities within a country. One well-known example is the oppression of Catalan under the Franco regime until 1977 (Pujol Casademont 2020). However, the oppression of minority languages does not lie in the (recent) past, it is still very present up until today.

This socio-historical context casts any ranking of languages in a poor light. Therefore, it must be stressed that the endeavour of the present study is not to say that any language is superior. In contrast, the present study and the project of the Phonaesthetic Research Group (2021) try to elicit a general effect that a language has on a listener. Languages that are judged by listeners as, for example, sounding more erotic are in no way superior to languages with a lower rating of eroticism. The notion that some language is inherently better than others ("linguoracism"; Gounari 2006) is rejected by the present study.

One of the few researchers that investigated phonaesthetics is Crystal (1995). The subject of the study was the investigation of the beauty of English words. The study includes lists of words that were ranked as most beautiful by poets and the media, which include, just naming a few: tranquil, golden, melody, peace, twilight and velvet. Their observations indicate that it is impossible to completely separate the semantic component when judging the beauty of a word. As can be observed by the small sample of words, they are, for example, connected to abstract positive states (peace) to nature (twilight) or to luxurious objects (velvet). However, Crystal (1995) investigated why exactly these words were chosen of all possible candidates with a beneficial semantic association, and he did so by analysing phonological patterns.

Jacobs (2015) analysed the beauty of words in the German language. The highest rated German word was “Libelle” (dragonfly), followed by “Morgenröte” (aurora) and “Mittsommernacht” (midsummernight). Further analysis suggested that the most beautiful words describe natural phenomena and objects related to wellness. The ugliest words were almost all swear words or linked to genitalia. Building upon their earlier study, Jacobs (2017) investigated the subjective beauty of words by creating a novel metric for quantifying word beauty. This score is the “aesthetic potential” of a word and he calculated it by using an adapted version of the sonority score combined with phonotactic features. “[...] [I]f a German word features an optimal length [...], a specific combination of sonorous syllables, semantic associations with words like ANMUT (grace) or FREUDE (joy) and is rather surprising, it has an increased likelihood of being classified as beautiful.” (Jacobs 2017: 4-5). This method suggests that the interplay of phonology and semantics results in words being judged as more beautiful. Therefore a word with a beautiful meaning alone might not be considered as sounding beautiful. A quite viral example is found in a video by Copy Cat

Channel (2013) which investigates, in a rather exaggerated and comedic way, how German sounds stricter (or even aggressive) compared to English, French, Italian and Spanish. Included in this comparison are also the German words “Schmetterling” (butterfly) and “Überraschung” (surprise), both arguably with a positive semantic association and a rather unbeneficial phonetic realisation.

The beauty of spoken language, similar to the beauty of individual words, is hard to filter out since it is also heavily influenced not only by the meaning of the words spoken but by the individual speaker’s voices. In a poem, traditionally, content and form are inextricably intertwined to create a dense, creative piece of writing. In an ideal setup for phonaesthetic research, the focus could be solely put on the way language sounds, without considering the semantic meaning of the words uttered. Apart from the semantics, the voice of the speaker might also exert influence on the emotional response of the listener. This is best illustrated by comparing, for instance, an actor with a trained voice and a teenager facing puberty vocal change. If we manage to look at spoken language and subtract the cognitive processes triggered by the semantic meaning and the influence of the individual voice, we will be left with a pure phonaesthetic appreciation of a language.

As a matter of fact, it is virtually impossible to work with natural language and exclude the influence of the semantic components and the speaker’s voice. In addition, the sociocultural influence must be taken into consideration, given that it often manifests itself through stereotypes or even (linguistic) prejudice. “[...] [W]hen dealing with natural (and not artificial) languages it is almost impossible to identify the sociocultural influences on aesthetic judgments (e.g., enjoying the sounds of Italian because Italy is beautiful) and the language’s acoustic contributors (e.g., Italian is spoken rapidly with a high sonority index)”

(Kogan & Reiterer 2020). This thesis thus strives to actively filter out the effects of the semantics, the speaker's voice and the sociocultural influence whenever possible: For instance, comparing the judgements of foreign listeners is a feasible way of investigating the beauty of a language while minimising semantic interference. The sociocultural influence will be reduced by using lesser-known languages. To reduce the influence of the speaker's voice, only female voices presenting in a similar style will be used.

I.1.2. The Latin Lover Effect

Hot climate is believed to be responsible for an increased sexual drive (Demir, Uslu & Arslan 2016) and is also linked to the occurrance of specific linguistic features. The linguistic features showcased in previous studies were: a higher percentage of CV-syllables (Munroe et al. 1996) and a higher sonority value (Fought et al. 2004; Ember & Ember 2007; Maddieson 2018; the detailed discussion follows in section I.5.). This connection between climate and language will be subject to research in the current study and will play a role in the analysis of the "Latin lover effect" (Reiterer et al. 2020). The Latin lover effect builds upon the common stereotype of the passionate lover of Latin or Romance European origin. The Romance languages, much as their "lovers", enjoy great popularity. Especially the bigger Romance languages are often named as examples for languages that sound romantic and erotic. One can easily find articles stating the reasons why French is the language of love (Rogador 2021), that Italian is the true language of love (Kerr 2017) or why everything said with a Spanish accent sounds sexy (Big 7 Travel Team 2010). That said, the investigation of the Latin lover effect has the goal to shed light on whether these languages are believed to be erotic just due to the stereotype of their amorous speakers or if linguistic factors, such as the increased sonority, play a role (Reiterer et al. 2020).

I.1.3. Language Perception, Emotions and the Connection to Music

Reiterer and colleagues (2020) found that the socio-cultural factors, such as the second language experience and the voice of the speaker, explained about two-thirds of the variation in the aesthetic judgements of listeners. However, the phonetic properties of languages also played a significant role. Kogan and Reiterer (2021) expanded the investigation of how linguistic features influence the phonaesthetic perception of a language. The idea that some languages sound as beautiful as a piece of music stems from the parallels that can be observed between the two. According to the musical protolanguage hypothesis (Fitch 2010; Kirby 2011; Ma et al. 2019), both modern languages and music can be traced back to one reconstructable common origin. The hypothesis builds upon the idea that both developed from the imitation and modification of sounds of the natural environment (e.g., sounds of other animals). Both music and language can be used to express basic emotions and feature similar acoustic features. This is especially true when comparing the similarity in vocal tract constraints associated with speaking and singing. An example of this is the similarities between speech rate and tempo in music. Both are temporal aspects that signify how many units are played or uttered in a certain time frame (e.g., syllables per second). In situations of high arousal (emotions of anger, fear and happiness) the tempo increases in both speech and music. Consequently, in situations of low arousal (sadness), the opposite is true (Juslin & Laukka 2003; Ma & Thompson 2015).

When it comes to the definition of melody, music and language are nothing alike. In linguistics, melody refers to an organised pitch pattern in speech (Patel 2010). For instance, when analysing languages using the musical definition of melody, a paradox occurs: Those languages that are linguistically speaking melodious would be categorised as unmelodic in

musical terms (Kogan & Reiterer 2021). This paradox occurs due to pitch in speech having the purpose to convey structural information and language being, in comparison to music, generally relatively atonal (Chow and Brown 2018). Furtheron, Kogan and Reiterer (2021) noted that languages with a higher pitch modulation (linguistic melody) have generally a slower speech rate, and vice versa. On the one hand, the Romance languages were generally the flattest and fastest languages in their sample. However, these languages are commonly rated as beautiful and erotic (Latin lover effect; section I.1.2.). On the other hand, the Germanic and the Slavic languages showed greater variety in terms of pitch, and therefore are linguistically speaking more melodic. Put simply, the findings of Kogan and Reiterer (2021) suggest that the speech tempo and the flatness in linguistic melody make the language appear beautiful and erotic.

I.1.4. Aesthetic Judgements and Sonority

A very intriguing finding of Reiterer and colleagues (2020) is the connection between aesthetic judgements and the sonority of a language. The correlations between the factor eros and sonority (two-tailed, r = 0,5*, P = 0,04) and the factor orderliness and sonority (r = -0,63**, P = 0,01), were both significant. The scatterplots of the correlations are showcased in illustration 1. Considering these findings, it can be assumed that a sonorous language is sounding more erotic and, due to the negative correlation, less orderly or unstructured.

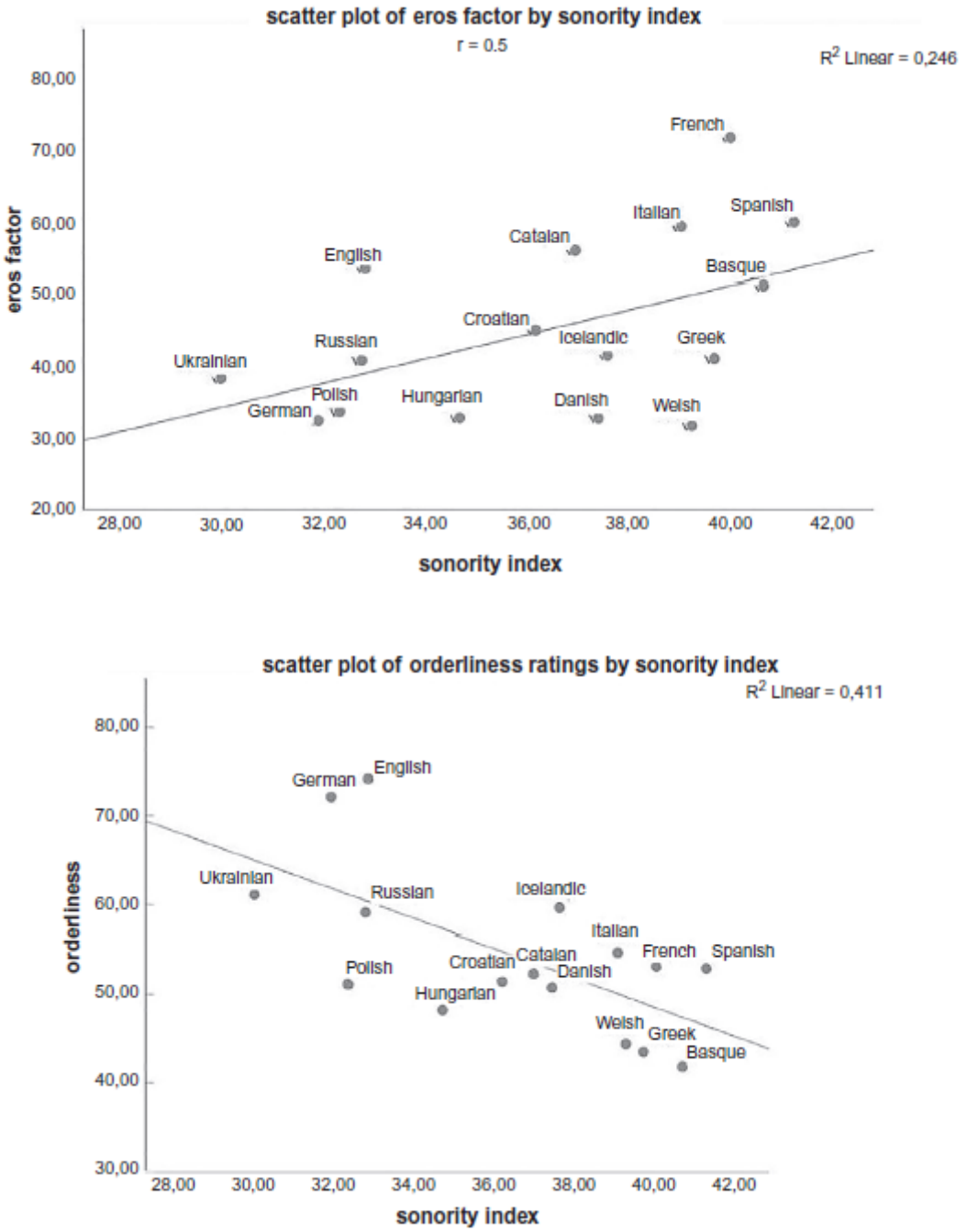

Illustration 1: Scatterplot of the correlations between the factors eros and orderliness and the sonority index of the languages (Reiterer et al. 2020).

The connection between sonorous sounds and audial pleasure has already been acknowledged for rankings of individual words. Feng (2017) analysed well-known brand names and emphasised the preferential use of more sonorous open vowels (e.g., /a/, / ɔ/) and more sonorous consonants, such as lateral approximants (/l/) and rhotic sounds (/r/). As

an example, they used the brand name “Rolex”, which has the goal to reflect the smooth design of the watches it represents. One could even go one step further and include the *kiki-bouba* effect. Put simply, the effect showcases that the novel word *kiki* would be instinctively associated with a sharp pointy object and *bouba* with an object with a rounded shape (Köhler 1929; Ramachandran & Hubbard 2001; Cuskley et al. 2015). Both words feature CV-syllables and high contrasts due to the usage of stops. However, *bouba* is definitely more sonorous, due to the voiced stops and open vowels. The rounded shape could be arguably associated with higher erotic properties, whereas the pointy shape could be seen as more structured and orderly. Even though it is, admittedly, a far stretch going from a shape to general aesthetic judgements, it reinforces the underlying idea.

The idea of the smooth versus the sharp shape in the *kiki-bouba* effect can be expanded to the sounds that animals produce in the wilderness. Rendall and Owren (2010) investigated the different associations between harsh and smooth sounds in the animal kingdom. For example, hissing sounds, which could be interpreted as parallel to voiceless fricatives (e.g., /s/ or /x/), would signal hostility and high arousal, whereas smooth sounds would be associated with relaxation. Rendall (2003) emphasises that the emotional reactions in the animal communication system are similar to those of humans. Once again, the smooth versus sharp sound argument could be well translated into the sonority hierarchy, with smooth sounds being relatively more sonorous.

Focusing on sonority, the present study aims to further investigate the influence of linguistic features on the perception of language. The data of Reiterer and colleagues (2020) was calculated with a sample of 16 languages and in accordance with the current study (Phonaesthetic Research Group 2021), the correlation will be investigated in a bigger sample.

I.2. Sonority and how to count it

One of the initial and principal steps in this thesis is to determine the mean sonority values of European languages. These values will then be used to detect any possible correlation between sonority and the phonaesthetic evaluation of the language. In addition, an older theory of the correlation between sonority and climate will be discussed which will also be based on the mean sonority values of a language. In this section, the different definitions of sonority will be analysed. The following section (I.3.) will offer insight into the discussion surrounding sonority. The third section (I.4.) will delve into the sonority hierarchy and the sonority scales.

Sonority is used and defined in a myriad of ways throughout the pertinent literature, all of which present different foci. However, basic ideas of sonority remain constant, such as the interconnection between syllable structure and sonority. The great variety of theories looks at sonority in different ways and offer more or less detailed sonority scales, which usually rank the sound classes from most sonorous to least.

The first example cannot even be considered a true sonority scale, since it is just a binary definition: In Halle and Clements (1983) the sonorant sound, with its counterpart, the obstruent sound is defined as one of 20 features that distinguish sounds. As one of these 20 binary features, it can also be broken down to the feature of "+sonorant" or "-sonorant", meaning that sounds can be categorized binarily into these two groups. "Sonorant sounds are produced with a vocal tract configuration sufficiently open that the air pressure inside and outside the mouth is approximately equal. Obstruent sounds are produced with a vocal tract constriction sufficient to increase air pressure inside the mouth significantly over that of the ambient air. (Vowels, glides, liquids, nasals vs. stops and fricatives)" (Halle & Clements

1983). In their definition of sonorant sounds, they already give us a rough distinction of which sounds are sonorous and which are not. Even in the more elaborate sonority scales, presented in this section, we will still find this basic distinction.

Sonorant	**¬ Sonorant**
Vowels	
Glides / Semiwovels	Stops
Liquids	Fricatives
Nasals	

Illustration 2: Distinguishing sonorant and non sonorant sounds, or obstruent sounds, according to Halle and Clements (1983).

In Peter Ladefoged's *a course in phonetics* (2000: 227), sonority is defined within the chapter that explains the basics of syllables. Sonority can be used as a tool to measure syllable peaks, which underlines the connection between sonority and syllable structure. „The **sonority** of a sound is its loudness relative to that of other sounds with the same length, stress, and pitch." (Ladefoged, 2000: 227) This more technical definition looks at sonority from a phonetic viewpoint and it draws attention to the core property of sonority, namely that it describes the relative loudness of a sound. What this means is that when someone says the vowels [ɑ] and [u] at a greater distance to you, you should hear the sound [ɑ] easier. This is mostly due to the mouth being wider open when pronouncing the sound. For this reason, [ɑ] is more sonorous than [u]. Ladefoged (2000: 228) created the following chart of the relative sonority of some English sounds. As can be seen, the categories that were defined in illustration 2 are still intact, but illustration 3 gives a more nuanced view of the sonority levels of individual sounds.

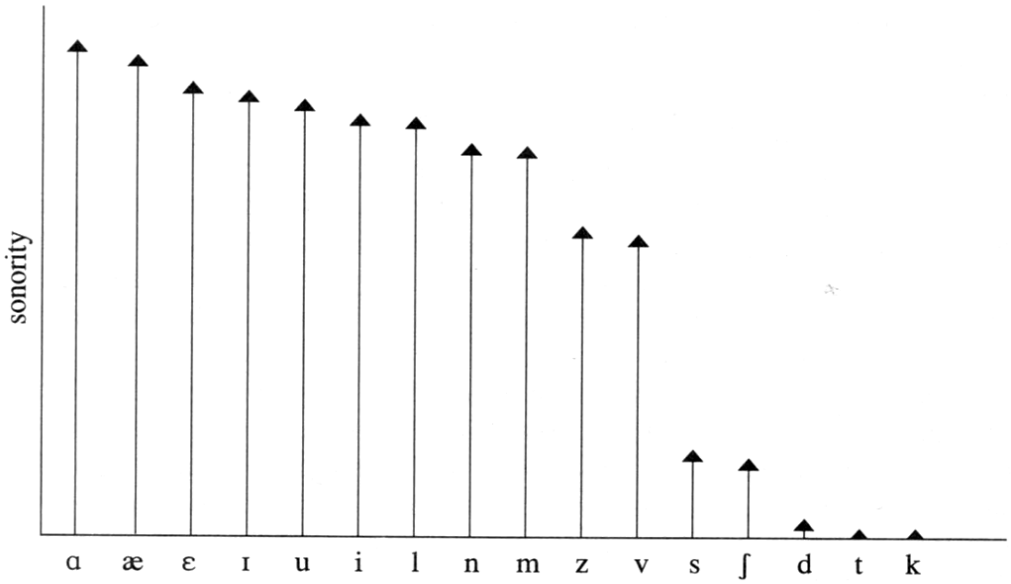

Illustration 3: The chart shows the relative sonority value of sounds used in the English language. (Ladefoged 2000: 228)

The chart in illustration 3 makes it clear that the vowels are more sonorous, with the low vowel [ɑ] being the most sonorous of the sounds depicted. Despite being consonants, the liquids and nasals are also characterised by relatively high levels of sonority, as depicted in the chart above (see the sounds [l, n, m]). The least sonorous sounds are the voiceless stops [t, k]. These rudimentary distinctions between the groups of phones seem to be consistent with later adaptations of sonority scales.

Moreover, illustration 3 manifests the distinctive feature of sonority as described by Parker: "As used in linguistics today, sonority can be defined as a unique type of relative, non-binary, feature-like phonological element that potentially categorizes all speech sounds into a hierarchical scale." (Parker 2012: xi). Put differently, expanding the chart above, potentially all speech sounds could be ranked from most sonorous to least sonorous. Interestingly, Parker (2012) explicitly states that sonority is used as a non-binary feature, as opposed to the definition in Halle and Clements (1983).

I.3. Debating Sonority

Sonority and the related concepts have received a fair share of criticism, which in turn can be divided into three principal lines of argumentation, each of which concerns different aspects. The first objection pertains to the field of phonetics and questions whether a consistent acoustic correlate exists. Secondly, the connection between sonority and the perceptibility of an utterance is put in question. The third point of criticism challenges the validity of the sonority sequencing principle. The following sections discuss the advantages and disadvantages of working with sonority on these three levels.

I.3.1. Searching for an Acoustic Correlate

There is an ongoing debate on whether sonority has a consistent acoustic correlate. The lack of such correlate would make sonority arguably redundant (Harris 2006). However, there are a lot of correlates that have been investigated and linked to sonority. According to Parker (2002), at least 98 different correlates of sonority have been posited. The most frequently used physical correlate is the openness of the vocal tract (Jespersen 1970). This measurement implies that sonorous sounds are produced with a more open vocal tract than their obstruent counterparts. However, due to the character of a physical feature, it is difficult to quantify this correlate. Ladefoged (2000: 227; as mentioned in section I.2.) defines sonority as the relative loudness of a sound when compared to sounds with the same length, stress and pitch. The phonetic counterpart to perceived loudness is the amplitude or intensity. Parker (2008b) states that intensity is the best way to characterize sonority. With their measurements of the mean intensity values, they construed a formula to calculate the mean sonority value and their sonority hierarchy (which will be discussed in detail in section I.4.)

Harris (2006) especially criticises the inconsistency of using intensity as a correlate, since not every local intensity maximum corresponds to a syllable nucleus. The problem in question frequently arises in fine-grained local differences in the sonority of consonant clusters. For example, in the German monosyllabic word <Spiel> we can see a fine-grained change in sonority and could assume a smaller second sonority peak (illustration 4).

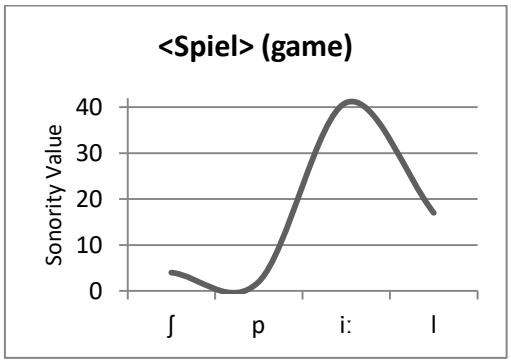

Illustration 4: Sketch of the sonority peak(s) in the german word <Spiel>. The sonority values were taken from the adapted sonority scale of Fought et al. (2004).

As seen in illustration 4, another rise in sonority and therefore intensity can be seen in the onset of the syllable. This phenomenon arises in consonant clusters, in which the second part consists of a stop as in /ʃp/. Seeing that there is no one-to-one correspondence between every local intensity maximum and the syllable nucleus, it could be argued that there is an ever so slight inconsistency in the correlate. However, in order to provide an even clearer picture, the idea of using intensity as a correlate has been adapted in recent studies (Albert et al. 2018; Albert & Nicenboim 2020; Schröer 2020). These new approaches feature periodic energy as a more consistent correlate to sonority than intensity.

I.3.2. The Intelligibility of Sonority

When working with sonority, one of the most frequently used arguments is that more sonorous languages are automatically more intelligible. This argument is, for example, employed in the research on the impact that climate has on sonority (Fought et al. 2004; Ember & Ember 2007; Maddieson 2018). The gist here is that more sonorous languages are used in a warmer climate, since, due to being more outdoors, the people need a language that conveys messages better over great distances (see section I.5.). However, it must be stressed that there is a crucial difference between being able to hear something from a greater distance and being able to understand the message. Sonority clearly, due to the perception of greater loudness, helps to convey sound over greater distances. For example, interjections that are used to focus attention on someone that is shocked or experiences pain (e.g., "ah!"), can illustrate this. These long vowel interjections are easily heard over greater distances, yet convey no clear message. The informational content is concentrated in the consonants and not the vowels. Harris (2006) states: "There is an inherent property of speech that seems at first sight paradoxical: most of the sound energy is concentrated in vowels, while most of the linguistically significant information is concentrated in consonants." This is why some languages, like Arabic, have a writing system that consists mainly of consonants. In addition, disemvoweled texts (i.e., texts in which the vowels have been artificially removed) remain relatively good intelligible. This can be seen in short forms used in text messages, which have the purpose to convey meaning easily without typing too much (Boyd 2010). For example "sry" for "sorry", "thnks" for "thanks" or even "bb" for "baby" (Urban Dictionary 2021). This even works with bigger segments, for example in "SMTH FR PRSDNT", where the omission of the vowels impairs the reading flow only slightly. However, if just the vowels of said segment "I O EIE" are presented, the intelligibility is

completely lost (Harris 2006). Nursery rhymes can be used as an example of how even disemvoweled speech is still intelligible, given that the vowels are exchanged in every verse (e.g., the English nursery rhyme “I like to eat apples and bananas” or the German nursery rhyme “Drei Chinesen mit dem Kontrabass”).

Therefore, the connection between sonority and intelligibility only works so far as to whether a sound sequence can be heard over a great distance. Stating that a language conveys messages better due to greater sonority, can not be supported, since sonority seems to be only a minor influence in a complex interplay of different linguistic features which facilitate intelligibility. Generally said, the perceptibility of speech is based on the principle that stability is less salient than change (Ohala 1992). More influential would be features such as syllable structure, consonant-vowel ratio and contrasts in intensity, just to name a few.

I.3.3. The Sonority Sequencing Principle and Cluster Reductions

As mentioned in section I.3.1., consonant clusters play a crucial role in the analysis of sonority peaks in syllables. The sonority sequencing principle (SSP) suggests that phonemes with high sonority values are located in and around the centre of the syllable, while phonemes with low sonority values are found at the margins of the syllable (Roca & Johnson 1999). As an ideal example, the German monosyllabic word <Trank> will be showcased in the following illustration.

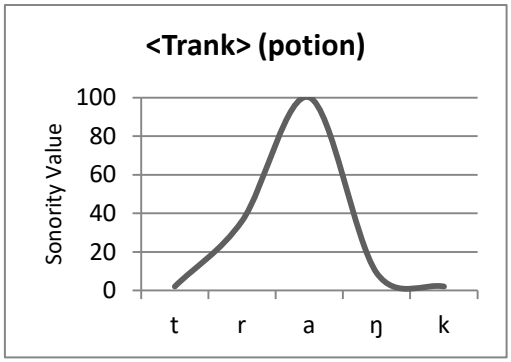

Illustration 5: Sketch of the sonority peak in the German word <Trank>. The sonority values were taken from the adapted sonority scale of Fought et al. (2004).

In the example of illustration 5, the nucleus of the syllable is /a/. The onset of the syllable /tr/ starts with a voiceless stop /t/ which has the least sonority and builds up to a rhotic sound /r/ which has a higher sonority level and is closer to the nucleus of the syllable. And in the case of the coda of the syllable /ŋk/, the more sonorous nasal is closer to the nucleus and the less sonorous voiceless stop is at the end of the syllable. In illustration 5 the change in sonority is depicted by a curve, which peaks at the nucleus of the syllable. This example shows a syllable that adheres to the sonority sequencing principle (SSP).

As already mentioned, the SSP is not always adhered to, as was described in illustration 4. This leads to criticism of the SSP and the whole connection between sonority and the syllable structure since its universality is in question (Harris 2006). However, an explanation might be found in the struggle of children learning to produce consonant clusters. One method to facilitate the pronunciation of consonant clusters is the reduction of them to just one consonant. In accordance with the SSP, Wyllie-Smith and colleagues (2006) have postulated that children reduce the onset consonant clusters in a manner that produces a maximal rise in sonority, and the coda consonant clusters are reduced to produce a minimal fall in sonority. This pattern of reduction is termed the sonority hypothesis (SH) (adapted from Ohala 1999; Wyllie-Smith et al 2006). The SH predicts that, for example, the voiceless

stop in the onset cluster will be retained (e.g., [**p**eːp̚t] for /**pf**eːp̚t/), whereas the voiceless stop in the coda cluster will be omitted (e.g., [fɪ**n**] for /fɪ**nt**/).

In the case of clusters with sonority reversal, as was demonstrated in the German example <Spiel> in illustration 4, the SSP is not adhered to in the original form of the syllable. The sonority hypothesis (SH) postulates that children will create a new syllable that adheres to the SSP when they perform a consonant cluster reduction. The following illustration shows another german monosyllabic word, that similar to <Spiel> (illustration 4) does not adhere to the SSP and has a second small sonority peak.

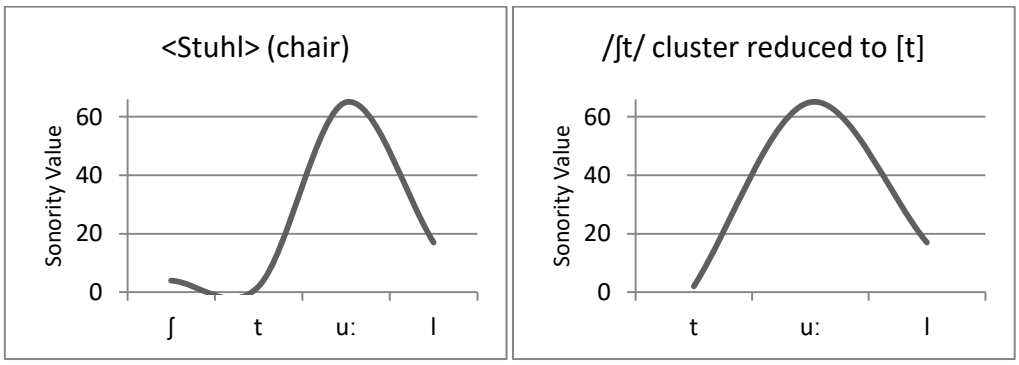

Illustration 6: Sketch of the sonority values of the phonemes in the German word <Stuhl>, both in its correct pronunciation and in the cluster reduced version that children commonly produce. The sonority values were taken from the adapted sonority scale of Fought et al. (2004).

The consonant cluster reduction of illustration 6 (i.e., [t] for /ʃt/) was uttered exactly in this way by a child during recordings made by Szagun (2004a / 2004b / 2011), which were uploaded to the CHILDES database (MacWhinney 2000). On the left-hand side, the correct pronunciation shows that the SSP is violated since there are two peaks in sonority in only one syllable. The cluster was reduced according to the SH and this leaves us with a syllable that, although it is incorrectly pronounced, adheres to the rules of the SSP. This example illustrates how the sonority hypothesis (SH) is linked to the sonority sequencing principle (SSP). If the child would have omitted the [t] and produced the [ʃ], the cluster reduction

would not adhere to the SH, since this would not result in the maximal rise in sonority in the onset.

Using the SH, cluster reductions produced by children have been extensively examined (Ohala 1999; Wyllie-Smith et al. 2006). Ohala (1999) reported in their study on cluster reductions in nonsense words of 16 children, aged between 1;9 and 3;2. Reductions of onset fricative + stop (e.g., /sp/) and fricative + nasal (e.g., /sn/) consonant clusters consistently involved the production of the least sonorous element, while coda fricative + stop consonant clusters were reduced to the most sonorous element. The Results of Ohala (1999) indicate that, in general, the children's consonant cluster reductions adhere to the sonority hypothesis (SH). Therefore it can be assumed that even though not all syllables adhere to the SSP, it seems that one clear syllable peak per syllable is favoured by speakers.

To conclude this section with the words of Parker (2008a: 1180): "Despite its problems, sonority makes sense". And hence: "If the notion of sonority had never been proposed until this day, it would certainly be invented soon." (Parker 2008b: 82) So to say, sonority might have problems and unclear definitions on many linguistic levels. However, dropping the notion of sonority altogether would do more harm than good. Sonority remains an interesting feature, which might help to explain a multitude of linguistic phenomena.

I.4. Sonority Hierarchy

The sonority scale or sonority hierarchy is a crucial aspect of sonority, which renders it possible to distinguish the sound categories in (more or less) small steps ranging from most to least sonorous. Parker (2008a: 1176) claims that the ideal sonority hierarchy would be the same for all languages and therefore arguably a part of Universal Grammar.

> "[...] Ideally we can establish a single, unique sonority hierarchy to analyze all known languages. This is not to say that any particular language actually exploits every one of the natural class rankings in the sonority scale. On the contrary, it would be quite amazing (although fortuoitous) to discover such a case. Nevertheless, the explanatory power of sonority is maximized if we ascribe it to UG, making it equally available to all humans." Parker (2008a: 1176)

The assumption of a universal sonority scale seems ideal, yet acoustic studies of sonority are commonly performed as case studies of individual languages (Price 1980; Keating 1983; Parker 2002). How universal a sonority scale can be is subject to discussion, since these hierarchies are mostly created to categorize one language. Additionally, most often the language in question is English or another Indo-European language.

Jany and colleagues (2007) investigated the ongoing dispute on the natural classes that need to be distinguished in order to create a comprehensively valid sonority scale. Moreover, they analysed how universal the ranking of the natural classes is by investigating four languages, namely Egyptian Arabic, Hindi, Mongolian and Malayalam. The results of Jany and colleagues (2007) indicate that the relative sonority values for the different consonant classes vary greatly cross-linguistically. For three of the four investigated languages, a similar broad sonority hierarchy could be established. This hierarchy ranks as follows from most to least sonorous: glides, liquids, nasals, obstruents. The acoustic measurements to sonority show

that even broad hierarchies are not maintained in all languages. Especially obstruent sounds differed in their sonority values cross-linguistically (Jany et al. 2007). It can be concluded that, as is the case with many linguistic tools, it must be taken into consideration that the sonority hierarchy is primarily based on English as a sample language. However, the broad consensus on a rather undetailed sonority scale shows that, to some degree, there might be a possibility to construe a scale that is true for a large sample of languages.

In order to further investigate the structure of sonority scales, some examples will be presented in the following sections. The illustration below shows a very detailed sonority scale by Parker (2008a: 1177).

Natural class	**Sonority Index**
low vowels	17
mid peripheral vowels (not [ə])	16
high peripheral vowels (not [ɨ])	15
mid interior vowels ([ə])	14
high interior vowels ([ɨ])	13
glides	12
rhotic approximants ([ɹ])	11
flaps	10
laterals	9
trills	8
nasals	7
voiced fricatives	6
voiced affricates	5
voiced stops	4
voiceless fricatives (including [h])	3
voiceless affricates	2
voiceless stops (including [ʔ])	1

Illustration 7: Parker's (2008a: 1177) final hierarchy of relative sonority.

The sonority hierarchy by Parker (2008a: 1177) suggests that the basics of the previously discussed scales are still valid. The detail of his scale shows the gradient steps within the vowels, where the interior vowels score lowest, and the low vowels are ranked first. The sonorous consonants, as seen between index numbers 12 - 7, are often altered in different sonority scales. Parker (2002) claims that his ranking is based on intensity intervals, and he goes further into the topic of the acoustic correlate of sonority: "The instrumental results presented in this chapter *strongly confirm the physical reality of the sonority hierarchy*. The five parameters studied are correlated with typical phonological sonority scales in the following order (from strongest to weakest): intensity, intraoral air pressure, F_1 frequency, total air flow, and duration." (Parker 2002: 197, emphasis added). Acoustic intensity is often mentioned as the correlate to sonority. However, the exact definition is the issue of an ongoing debate (as mentioned in section I.3.).

Parker (2002) went a step further and even created a formula to connect intensity values with sonority values. This is showcased in the following quote:

> "[N]ot only can we conclude that sonority and intensity are very highly correlated, but we can now go one step further and also specify the exact nature of the relationship between them: for every dB by which intensity is increased, the corresponding sonority rank or index increases by about .37 units (...). Another way of stating this same fact is that there is an average difference of about 2.7 dB's worth of intensity between successive ranks on the sonority scale (2.7 = 1 / .37). This of course assumes that the steps or intervals between natural classes on the sonority hierarchy are all of the same size." (Parker 2002: 215).

While Parker's formula seems to be a fruitful approach, it seems unlikely that the steps between the natural classes are always even, and even if this were the case, it would lack any justification. Furthermore, it goes without saying that even the sounds making up a

natural class will vary slightly in their sonority values. This is demonstrated in illustration 3, which showed the sonority calculation of Ladefoged (2000). This chart featured [ɑ] and [æ], which are part of the group of the low vowels, both in Parker's (illustration 7) and Fought's sonority scale (illustration 8). However, they differ slightly in their sonority value. The case for even steps can be weakened even further by looking at the grave differences between the sonority values of nasals and fricatives (illustration 3).

The approach of Fought and colleagues (2004) to the sonority scale argues for uneven steps between the natural classes, as indicated by the respective scale values. These associated values for each class of sounds suggest new possibilities of using sonority. This flexibility is also the principal reason why the sonority hierarchy of Fought and colleagues (2004) was used as a basis for the transcription in this research. The associated scale values facilitate an analysis of the mean sonority value of a word, a paragraph or even a language.

Sonority Scale

Class Label		*Scale Value*	*Examples*
A	(low vowels)	100	[a, ɔ, æ]
O	(mid back vowels)	80	[o]
E	(mid nonback vowels)	69	[e, ɛ, ə]
U	(high back vowels)	65	[u]
W	(high back semivowels)	43	[w]
I	(high nonback vowels)	41	[i, ɪ]
R	(rhotic consonants)	36	[ɹ]
Y	(high front semivowels)	27	[j]
L	(lateral sonorants)	17	[l]
N	(nasal sonorants)	9	[m, n, ŋ]
S	(voiceless fricatives)	4	[f, s, ⊖]
Z	(voiced fricatives)	3	[v, z, đ]
D	(voiced stops)	2	[b, d, g]
T	(voiceless stops)	2	[p, t, k]

Illustration 8: The Sonority Scale of Fought and colleagues (2004: 33) which introduces scale values.

The sonority scale of Fought and colleagues (2004: 33), as depicted in illustration 8, is slightly less detailed than the one of Parker (2008a: 1177), as shown in illustration 7. Parker has some more categories for natural classes and distinguishes between rhotic approximants, flaps, and trills, which are all summed up as rhotic consonants in Fought's sonority scale. However, Fought and colleagues separated semivowels into two categories, while Parkers Hierarchy only mentions glides as one category. Interestingly, the scale of Fought and colleagues counts the schwa as a regular part of the vowels group, whereas Parker ranks all interior vowels lower than the rest of the vowels. Ranking the schwa lower seems very intuitive since it is often described as a "neutral" vowel (McArthur et al. 2018). One other slight difference is that Faught and colleagues rank all fricatives higher than the (oral) stops, which Ladefoged also did (as shown in illustration 3). However, Parker (2008a: 1177) distinguished the fricatives and stops primarily by their voicedness and secondarily by the articulation type.

The introduction of scale values is a unique characteristic of the sonority scale of Fought and colleagues (2004: 33) and makes it a powerful tool. It is thus hardly surprising that the scale values represented the primary argument for using this particular scale as the basis for the analysis in this study. In addition, this scale impresses due to its attention to detail. Comparing the sonority hierarchies of Parker (2008a) and Fought and colleagues (2004), it became clear that every scale has its advantages and disadvantages. Creating a brand-new scale, however, would complicate any comparison of the findings of the present study with previous research. Moreover, there are (arguably) too many sonority scales out there already. Consequently, an adapted version of the scale of Fought and colleagues (2004) will be used to analyse the language samples in this study and the adaptations will be presented in the methods section (section II.1.).

I.5. Climate and Language

A series of pioneering studies (Munroe et al. 1996; Munroe & Silander 1999; Ember & Ember 2000; Munroe et al. 2000; Fought et al. 2004) investigated the connection between linguistic features and climate. The features in question are the proportion of CV-syllables (consonant-vowel syllables) and the sonority score of languages. For instance, Munroe and colleagues (1996) suggested that languages spoken in warmer climates have a higher percentage of CV-syllables. In addition, Fought and colleagues (2004) suggested that languages have a higher sonority score if spoken in a warmer climate. The assumption behind this is that people in warm climates generally spend more time outdoors and therefore need a language that facilitates communication over a greater distance. Consequently, the languages of warmer climates are said to have adapted to accommodate more CV-syllables and a higher mean sonority value, since sonorous sounds are easier to hear over greater distances and CV-syllables provide the highest contrast (Ember & Ember 2007). In the following sections, more recent findings and additional implications that are based on these pioneering research projects are presented.

I.5.1. Acoustic Adaptation Hypothesis

Birdsong lacks complexity in comparison to the human language. However, the findings on the Acoustic Adaptation Hypothesis that are mainly focusing on birdsong were adapted by Maddieson (2018) in order to investigate the connection between Climate and Language. The Idea behind this investigation is that like birds, human cultures adapted their languages in accordance with the climate in which they reside. The Acoustic Adaptation Hypothesis is supported by clear evidence for birdsong (Seddon 2005). The Hypothesis proposes that the acoustic communication of birds, as well as other species, is influenced by the environment.

The analysis of Boncoraglio and Saino (2007) indicates that the vegetation in the habitat of a bird species correlates with changes in properties of the song of said animal. The changes were found, for example, in modulations of the maximum frequency and the frequency range in the birdsong. The basic idea of the Acoustic Adaptation Hypothesis can be summed up as follows: The environment, and not only the acoustic aspects of it, has an influence on the acoustic communication of the species that live in it. The adaptation of the communication functions in order to ensure a faithful transmission in complex environments and to surpass these obstacles (Maddieson 2018).

In order to adapt the idea of the influence of the Acoustic Adaptation Hypothesis on human language, Maddieson (2018) investigated the effect of temperature on the sonority of language. In their study sonority was used in its binary definition (sonorant versus obstruent sounds; Halle & Clements 1983) and the acoustic material was scanned for sonorous time fractions. The sonority score represents the percentage of sonorous material in a recording of a speech of one language.

The speech material is taken from a Christian organisation, which offers recordings of religious texts in a multitude of languages. Maddieson (2018) mentions drawbacks from using religious material of the Christian faith and for using recordings that were not produced in a controlled environment. However, the drawbacks they acknowledge, the occurrence of non-indigenous biblical names (such as Noah and Jesus) and the fluctuation in sound quality, are far from conclusive. Even though, it is clear that the convenience of such a premade databank is very advantageous, the usage of Christian texts poses a grave problem. Especially in the context of researching languages of the world, this practice is highly problematic due to the oppression of different cultures and the missionary work in the

historical context of colonisation. The usage of Christian material in non-European cultures as a sample text is not providing a representative impression of the language.

To further underline this argument, even in a highly Catholic-dominated context as in Austria, the usage of the church language will not give a good overview of the language variety that is used in this country. For this reason, sacral words are used only separated from the rest of the language in dialect research (Pfalz 1925; Fanta-Jende 2020). For instance, the diphthong <ei> varies greatly in the Bavarian dialects of German. Conversely, in sacral words, these variations do usually not occur. For example, common words like “Stein” (stone) and “Bein” (leg) would feature the version of the diphthong <ei> which is typical for the dialectal region (Kranzmayer 1956). In contrast, sacral terms, like in “Heiliger Geist” (holy ghost), would not feature the same version of <ei>. This distinctness of the specific jargon that is used in relation to the Christian church will highly influence the outcome of the study of Maddieson (2018). Hence, this must be considered as a major limitation when looking at the results of this study.

The results of Maddieson (2018) show a highly significant correlation between the sonority score and the climate of the environment in which a language is spoken. In this study 100 languages from all over the world have been included. Their findings suggest that languages that are spoken in parts of the world with a hotter climate are generally more sonorous.

I.5.2. Climate, Family and *Sprachbund*

In order to clarify the influences on the correlation between sonority and climate, the language family and the *Sprachbund* must be incorporated into the analysis. Maddieson (2018) investigated the effects of the 49 different family classifications they found for their sample and states as follows:

> "A standard objection to claims of any external influence on language structure is that the differences said to be associated with the external influence are simply inherited differences from ancestor states. That is, they can be explained by membership in different language families. In the present case, this is difficult to refute." (Maddieson 2018: 5)

The objections that are mentioned were statistically analysed by Maddieson (2018), and it showed that the overwhelming majority of the variance in the sonority score can be explained by the language family. In this study only the impact of the language family was taken into account, the *Sprachbünde* (geographically associated languages that do not have to be in the same family) which explain effects of neighbouring languages adapting to each other, were not included in Maddieson's study (2018). The argument that language family and *Sprachbünde* can explain the correlation between sonority and climate will be referred to as the *Sprachbund* Hypothesis. Interestingly, *Sprachbünde*, in contrast to language families, are often construed around geographical features, for example, the Alps (Gaeta & Seiler 2021) or are confined to distinct regions, such as the Balkan Peninsula (Sawicka 1997). This triggers a sort of hen-egg problem since it is not clarified if the creation of *Sprachbünde* is prior to the adaption to the climate or vice versa. The question of whether the environment, in which a language is spoken, per-se has an influence on the sonority will be investigated in this study.

I.6. Rationale & Hypothesis

The motivation in focusing on phonaesthetic research lies in uncovering the emotional responses that languages trigger, which is sort of voyaging in uncharted waters. There are only a few earlier studies on phonaesthetics and they mostly focused on individual words. For example, Crystal (1995) analysed the aesthetics of English words and Jacobs (2015) of German words. However, the notion, introduced by Reiterer and colleagues (2020), to analyse the perception of languages revolutionised the approach to phonaesthetics.

It is well established that, for example, the fine arts trigger emotional responses, and the scientific research on this topic has gained great momentum in the last 20 years (e.g., Zeki 1999; Leder et al. 2004; Leder & Nadal 2014). This rather young development in researching aesthetics with psychological tools can be adapted to the research of phonaesthetics. Are languages able to trigger emotional responses like fine art? A forum entry under the question of why it is enjoyable to hear spoken French, states the follows:

> "The French language reminds me of the ***color palette of a Claude Monet impressionist painting*** - filled with bright light; and a mix of baby and sky blue, canary yellow, lime/tea to yellowish-green, or rose/pink red, I feel transformed to a beautiful French Sunday picnic. It feels like much craft and care was put into how the painting is made, yet the painting is done, simply, in plein-air. *The French language is a mix of refined beauty hidden with complex logic and depth.*" (Chen 2017)

This forum entry shows, with a very colourful description, that indeed language can trigger emotional responses just like a painting of Claude Monet. In popular media and travel journals, it is often stated that a language sounds erotic and romantic (e.g., Big 7 Travel

Team 2010; Kerr 2017; Rogador 2021) or strict and harsh (e.g., Copy Cat Channel 2013). However, these emotional categorisations are relatively untouched on a scientific level.

Building upon the research of the Phonaesthetic Research Group (2021) the present study wants to shed light upon the influence of sonority on phonaesthetic language perception. Sonority was chosen since on a smaller scale the pilot study by Reiterer et al. (2020) showed promising results. Furthermore, sonority is also subject to an ongoing debate of the connection between languages and the environment in which they are spoken (Fought et al. 2004; Ember & Ember 2007; Maddieson 2018; section I.5.). This makes sonority a very interesting feature, where alone the definition and the scale of it could be subject to an extensive research project.

I.6.1. Hypothesis

This section focuses on the hypothesis that this study is based on and which will be tested after calculating the mean sonority score of a language using the sonority scale and the theoretical background described in the previous sections. The underlying research questions can be separated into two separate hypotheses that use different methodological approaches.

The first part of the hypothesis compares the sonority data to the results of the research project of the Phonaesthetic Research Group (2021). The phonaesthetic research project elicited the aesthetic judgements of 144 participants on a broad sample of European languages. The participants had to listen to a recording of a female speaker of “The North Wind and the Sun” in the respective language. The aesthetic judgement is separated into four factors which were derived from the pilot project of the Phonaesthetic Research Group

(Reiterer et al. 2020; Kogan & Reiterer 2021; Phonaesthetic Research Group 2021), namely Eros, Beauty, Orderliness, and Status. Expanding said pilot project, the assumption was made that sonority is one of the linguistic features that have an influence on the perception of language. The influences were present especially in the judgements of eroticism and orderliness of the languages.

The study from Jacobs (2017), which uses individual words instead of a mean value per language, suggests that the sonority of a word influences the perceived beauty (see section I.1.1.). While the design set-up of Jacobs (2017) differs from the approach used in this thesis, the connection of sonority and beauty is still relevant in this context, seeing that it was formulated in a broad sense. Hence this hypothesis will also be tested.

The hypothesis of this block is formulated as one main hypothesis and three sub-hypotheses:

1. **The mean sonority of a language influences the aesthetic judgement of it.**

1.1. More sonorous languages are perceived as sounding more erotic.

1.2. More sonorous languages are perceived as sounding less orderly (i.e., more chaotic).

1.3. More sonorous languages are perceived as sounding more beautiful.

The second part of the hypothesis focuses on the study of Fought and colleagues (2004), whose sonority hierarchy is also the basis for the scale used in this study. In their research, they state to have found a correlation between sonority and climate. A sample of 60 languages from around the world was used and organised according to their mean sonority value and the climate zone they are natively spoken in. The argumentation for the causes of it seems somewhat far-fetched, yet their findings of more sonorous languages being spoken in warm and hot climates seem intriguing (see section I.5.) Since the present paper focuses only on Europe and not the world, this theory will be slightly adapted to fit the purposes of

the investigation. Reiterer and colleagues (2020) have found that the Romance languages have a relatively high sonority value and argued for the Latin lover effect (see section I.1.2.). Additionally, a smaller pilot project conducted for the purposes of the present study has identified a general tendency, namely that the language areas in Europe's South and West are dominated by more sonorous languages, while the Northern and Eastern language areas comprised less sonorous languages. Hence the following hypothesis:

2. **The mean sonority value of a language correlates with the geographical area in which the language is spoken.**

II. Methods

As aforementioned, the phonaesthetics of language perception is a fairly new field of linguistic research. To begin with, the dimensions in which (the beauty of) a language can be described must be defined. Reiterer and colleagues (2020) introduced a set of 22 descriptors that can be used to describe the aesthetics of a language. These were, sorted alphabetically: Beauty, Coolness, Culture, Elegance, Eroticism, Fashion, Fun, Generosity, Importance, Intelligence, Melody, Memorability, Orderliness, Pleasantness, Romanticism, Seductiveness, Sexiness, Softness, Status, Sweetness, Wealth and Welcomingness. The length of this list already suggests that some of these dimensions can be combined into bigger features (or categories), which in turn were created by an exploratory factor analysis. Additionally, familiarity with a language and a separated judgement of the voice of the speaker in the recording were elicited. The results of the exploratory factor analysis slimmed the dimensions down to five, namely Beauty, Status (and Culture), Eros, Orderliness, and Sweetness (and Softness). For the present research of the Phonaesthetic Research Group (2021), the factors were further limited to four, by incorporating Sweetness into the Beauty dimension. The factors in the new experiment were named as follows: “Erotic / Sexy”, “Beautiful / Sweet”, “Status” and “Orderly / Structured”.

II.1. Adapted Sonority Scale

Class Label	Scale Value	All Phonemes of the N=29
low vowels	100	a, ɔ, æ, ɑ, ɐ, ʌ, ɒ,
mid back vowels	80	o, ɤ,
mid nonback vowels	69	e, ɛ, ə, ø, œ, ɵ, ɜ,
high back vowels	65	u, ɯ, ʊ,
high back semivowels	43	w,
high nonback vowels	41	i, ɪ, y, ʉ, ɨ, ʏ,
rhotic consonants	36	ɹ, ɾ, r, ʁ, ɽ, ʀ,
high front semivowels	27	j, ʊ,
lateral sonorants	17	l, ʎ, ɬ, ɭ,
nasal sonorants	9	m, n, ɳ, ŋ, ɱ, ɲ, ˜,
voiceless fricatives	4	f, s, θ, h, ç, x, ʃ, ɧ, ɕ, ʂ, ɬ, χ,
voiced fricatives	3	v, z, ð, ʝ, ɣ, β, ɦ, ʒ, ɮ, ʑ,
voiced stops	2	b, d, g, ɟ, ɖ,
voiceless stops	2	p, t, k, c, ʈ, ʔ,

Illustration 9: The adapted sonority scale, using the values of Fought and colleagues (2004). All of the Phonemes that were used in this study in the sample of 29 languages are shown in the third column. ([˜] Nasalization is counted separately with the scale value of the nasal sonorants)

The table above illustrates the final version of the sonority scale as it was used to calculate the mean sonority values of the languages used in this study. As mentioned above, both the basic structure of the scale and the scale values derive from the sonority scale used by Fought and colleagues (2004), as shown in illustration 9. The biggest advantage of this scale is that it features scale values that enable the analysis of the mean sonority value. The list of phonemes, in the third column of the table above, shows all representatives that were used in the transcriptions of the 29 European languages that constitute the sample of this study. The phones were added and classified individually after occurring in the sample text of "The

North Wind and the Sun" of each language. This adapted table with all mentioned phones was used to calculate the sonority values via a python program.

II.2. Procedure

II.2.1. Language Sample

A total of 29 European languages are featured in this study. The language choice was streamlined with the sample of the main experiment in the Phonaesthetic Research Group (2021) to ensure comparability. Of the ones used in the principal experiment, two languages had to be dropped since no adequate sources for IPA transcriptions were available, namely Maltese and Corsican. Additionally, seven languages have been added to the sample, since the higher recognition rates of these do not interfere with the mean sonority value, which is the primary feature investigated in this study. The languages that were added are Spanish, French, Italian, Croatian, German, Russian and English. To compare the results of the additional languages, data of the study of Kogan and Reiterer (2021) is used, where the phonaesthetic judgements were elicited with the same method as the follow-up study (Phonaesthetic Research Group 2021), which is currently under progress.

The sample texts used for this study are mainly based on phonological illustrations in the *Journal of the International Phonetic Association*. These transcribed texts are based on the translation of Aesop's fable called "The North Wind and the Sun". The reason why this specific textual basis was chosen is primarily a practical one: it is a standard in cross-linguistic research and the text is translated in almost all languages. Using a semantically parallel corpus ensures greater comparability across languages since the genre and the length of the texts are fairly constant. While opting for "The North Wind and the Sun" is often (rightfully) criticised for having a cultural bias towards Europe, this is not necessarily a disadvantage in

the context of this research seeing that it might have facilitated finding adequate translations of the fable in all European languages analysed in this study.

Some of the transcripts were in an older IPA style or had an adapted version of the translated “The North Wind and the Sun” as a basis for the transcription. For the analysis, the older symbols were interchanged with the new ones so as to render the texts comparable. If the sample text differed from the transcript and the acoustic stimuli of the Phonaesthetic Research Group (2021), it was determined if the text was still suitable for the purpose. The differences were then coded in four categories, ranging from no divergence to major divergences. For example, the French version was coded as containing a minor divergence since the sample text used the French noun “bise” for the “North Wind”, while it was literally translated as “vent du nord” in the voice recordings. Since only one nominal phrase changed in this particular case and the rest of the text was identical, it was coded as having minor divergences.

II.2.2. Transcription and Analysis

After reviewing the IPA transcriptions of “The North Wind and the Sun”, the phonetic transcriptions were restructured and adapted in order to render them suitable for the sonority analysis. The transcriptions provided in the illustrative articles of the *Journal of the International Phonetic Association* ranged in complexity. To ensure comparability, all of the transcriptions were thus simplified and supplementary information such as stress, secondary articulation, and quantitative marks, were excluded. Some transcripts even offered optional phones. However, prioritising practicality, the transcriptions were kept as simple as possible, meaning that every optional phone was omitted.

The simplified transcription was then analysed via a sonority calculating program created with python specifically for this thesis. Said program used the adapted sonority scale (illustration 9) as a basis and calculated the mean value of sonority as well as the sum of the phonemes in the text. This mean value of sonority will be used to compare the sonority of the languages analysed.

II.2.3. Aesthetic Judgements

This section will briefly describe the methodology of the study that was used to elicit the aesthetic judgements of languages. This study is based on the project of Reiterer and colleagues (2020) and expanded the sample of languages. The present analysis uses data of the previous studies (Reiterer et al. 2020, Kogan & Reiterer 2021) to compare the languages that are not part of the sample of the ongoing research project of the Phonaesthetic Research Group (2021) since it focuses on languages that are generally less familiar. The studies mentioned before were all conducted online, which means that the participants were in an uncontrolled environment. The stimuli of this study are recordings of female voices of "The North Wind and the Sun" in 23 European languages, namely: Albanian, Breton, Catalan, Corsican, Czech, Danish, Estonian, Finnish, Greek, Hungarian, Icelandic, Irish, Latvian, Maltese, Norwegian, Polish, Portuguese, Romanian, Slovene, Swedish, Turkish, Ukrainian, and Welsh. Corsican was later excluded since the recordings were generally rated worst, which was due to the recording per se lacking in quality and not due to the language being generally disliked. For each language, at least two different female voices were recorded to identify differences in the ratings of the voice alone. The recordings are part of the research database of the Phonaesthetic Research Group (2021).

The evaluations of the phonaesthetic perception of the languages were elicited by using four freely movable scales for each phonaesthetic dimension (Beauty, Eros, Status and Orderliness). The opposing ends of the scale were marked with corresponding smileys. Familiarity of a participant with the language was also elicited and accompanied by a gamified task that lets the participants guess which language they just heard. They could either guess the language itself or the language family. A demographic questionnaire, which was designed to obtain information regarding age, gender, nationality, educational background as well as the languages that the participants use, was also part of the research.

II.2.4. Statistical Analysis

The statistical analysis of this study will be performed in two separate parts. The first part focuses on the correlation between the mean sonority value and the results of the Phonaesthetic Research Group's study on language perception and the preceding pilot study (Reiterer et al. 2020, Kogan & Reiterer 2021, Phonaesthetic Research Group 2021). The mean sonority value of an individual language will be compared with the aesthetic judgements divided into four categories, namely: Eros, Beauty, Status and Order. The phonaesthetics study has a total of 144 participants, their data was adapted so that the judgements on the languages they speak were excluded. The bivariate correlations are measured with one-tailed Pearson correlations in SPSS. A one-tailed correlation was deemed fit for this type of research since it studies the influence of sonority on aesthetic judgements and not vice versa. Any influence of the aesthetic judgements on sonority, which is regarded as a feature of the language, can be discarded, given that judgements about a language cannot interfere with the structure of a language.

The second part of the statistical analysis focuses on determining whether there is a correlation between the mean sonority value of a language and the area in which a language is spoken. Said language area will be represented by a language hub (i.e., a linguistic centre). The purpose of these language hubs is to serve as a reference point for the longitudinal and latitudinal data. Bigger cities in the area where the language is spoken were used as language hubs, for example, the capital of a nation where the language is primarily spoken (for pluricentric languages the biggest capital was chosen) or a larger city in the area where a minority language is spoken. The data of the geographical location is derived from the Latitude and Longitude Finder (2021). Using this data, two one-tailed Pearson correlations were calculated: the first one between the mean sonority value and the latitudinal data and the second one between the mean sonority value and the longitudinal data. The correlations were calculated in SPSS.

III. Results of the Sonority Analysis

The results will be discussed for each language individually and grouped in their respective language family. In addition, language and language family specific information will be provided and discussed so as to explain the linguistic, geographic, and cultural background. The sample is grouped into three big language families consisting each of 6 languages, i.e., the Romance, Germanic and Slavic language family; two small groups of 3 languages, the Celtic and the Finno-Ugric language family; and the remaining 5 languages which are the sole representatives in this sample of their language family, namely Greek, Basque, Albanian, Turkish, and Latvian.

III.1 Celtic Language Family

The Celtic language family has a mean sonority level of 39,3 and is therefore first in line of the five families analysed in this study. Analysing the Celtic languages turned out to be rather difficult due to issues with standardisation, given that there were stark contrasts between the voice recordings and the phonetic illustrations in the *Journal of the International Phonetic Association*. We will now look in detail at the three Celtic languages that are included in the sample, namely Breton, Irish, and Welsh, in the order of their mean sonority level. All three languages are part of the Insular Celtic subgroup of the Celtic language family. According to Bell and colleagues (2021: 1), all Celtic languages have a verb-initial word order and a system of initial consonant mutation. However, the historically present phonological triggers for the alternations are absent or opaque in modern Celtic languages.

III.1.1. Breton

Breton is part of the Brittonic family subgroup of the insular Celtic language family, which makes it a close relative of Welsh. In the *Journal of the International Phonetic Association,* two articles contained transcriptions of Breton using different dialects. The Breton of the Isle of Groix (Ternes, 1975) used a translation of "The North Wind and the Sun" which bore only little resemblance to the text of the recordings of the Phonaesthetic Research Group (2021). The Breton transcription of the Treger dialect (Hewitt 1978) was closer to the recordings, yet there were still major deviations in sections of the transcription. Said deviations have to be accounted for when comparing the data to the findings of the Phonaesthetic Research Group (2021). Arguably, these difficulties arise due to the lack of a standard version of Breton, which in turn may be caused by sociolinguistic neglect and oppressive language policies, considering that Breton was banned in France until the late 1960s. Even today, the language is ranked as "severely endangered" by the Atlas of the World's Languages in Danger (UNESCO 2021).

The Treger dialect of Breton is spoken in the north of lower Brittany and is not a homogeneous idiom. However, it is spoken (more or less) uniformly throughout the Treger area, with certain phonological, morphological, and lexical features that differ from other Breton dialects. In the following section, the simplified transcription that was created for the analysis will be presented and discussed. This transcription is based on the illustration of the Breton Treger dialect of Hewitt (1978).

1. Transcription of Breton

awel n anternoz ag n ɛwəl wa tabytal pini wa ahrẽã pa wa
død ɵ beaʒur o fon paked nɵ vantel dom nom glɛwed e
wan n ini kentã a lakefe a beaʒur da denã i vantel hẽz
nœhe viʒe gweled krẽɔh wid igile a sety awel n anternoz da
hwezã gwasã ma hale mɛt wasɔh a ze hweze startɔh a ze
pake a beaʒur i vantel indro deð ag aben a fin da po wezed
awel n anternoz da glask ober a nœhe n ɛwəl tom da bara
warnð ag a beaʒur dysty da denã i vantel a vise wa ret
mat da awel n anternoz ðzav wa krẽɔh n ɛwəl witð

First and foremost, it has to be noted that the stress is not marked in the transcription, since it does not influence the mean sonority level. Gemination, which occurs for example in [fonn] (2nd line) has been eliminated in all texts in order to keep them comparable, therefore the geminated [n] is only represented by one phoneme. If there was an optional phoneme as in [aʳhrẽã] (1st line) the optional [r] was also discarded, since only a few transcriptions even gave optional phonemes in the first place. In addition, some vowels in the original transcription were marked as centralised as in [awël] (1st line), yet centralising an [e] creates a sound that is very close to schwa [ə] sound. Therefore, the centralization was also replaced by a schwa, as illustrated by [ɛwəl] (1st line), so as to keep the transcription as simple and comparable as possible.

According to the present study, Breton has a mean sonority score of 41,5 and the transcription consists of 397 phones in total (the nasalisation, as in [denã] is counted as a separate phone).

III.1.2. Irish

Irish, also referred to as Irish Gaelic, is part of the Insular Celtic languages and therefore a more distant relative of Breton and Welsh. As an official language in the Republic of Ireland

and a recognised minority language in the United Kingdom, Irish is still spoken as first language in areas on the western coast of Ireland, especially in the counties of Cork, Donegal, Galway, and Kerry. The lowest rate of Irish speakers on the island of Ireland is in Northern Ireland, which belongs to the United Kingdom. The regions in Ireland in which Irish is the dominant language are referred to as the Gaeltacht regions (Chasaide 1995).

Since there is a poor correspondence of letter to sound, a transcription in IPA is crucial to the understanding of spoken Irish. The transcript that is used in this study is based on the speech of a native of Derrybeg (Doirí Beaga) in the County of Donegal in the northwest of the Republic of Ireland (Chasaide 1995). In the following section, the transcription will be analysed. It was adapted from the illustration provided by Chasaide (1995). This transcription has major divergences from the sound files of the Phonaesthetic Research Group (2021), yet it was still the most adequate rendition available.

2. Transcription Irish

vi ən ɣi əduaj ɪs ən jrian əɟ arəgal lə çɛlə lə fal əmah caku dən
vɛrt əbə çrɛçə nərə hanɪɟ taçtali ən balah əgəs klɔkə teh
a xaçu ɛɟə denti çəd gər ən dɪnə bə çrɛçə ən dɪnə bə luaçə
ə horhu ər ən taçtali ə xlɔkə wɪnt dɔ ɪnçɪn hed ən ɣi əduaj
xɤh tren ɪs ə hɤku leçə ah a ved is ə hed çi ça bə luçə ə han
an taçtali ə xlɔkə hart fa du dʌ əgəs sə dɛru diri ən ɣi
əduaj əs ən iararт ənçɪn lɤnri ən jrian gə teh əgəs wɪn ən
taçtali dɔ ə xlɔkə læhrah bɤn əgəs ər ə dɔj çɪn bɛɟən dən
ɣi əduaj ə adwal gɤrəb i n jrian ə bə lædrə dən vɛrt

The adapted transcription leaves out the indications of stress and the secondary articulations. Since the place of articulation only distinguishes the sonority levels of the vowels, the secondary articulation of the consonants does not contribute to the sonority level. For example, in the Irish transcription, palatalization and velarization appear frequently: in [$w^{ɤ}ɪn^{j}t^{j}$] (4th line), both secondary articulations appear in one word, which was

simplified as [wɪnt] in the adapted transcription. Leaving out the indications for the secondary articulation was necessary to keep the transcript as simple as possible without losing any valuable sonority-related information.

The mean sonority value for Irish is 38,7 which makes it the 2nd most sonorous language of the Celtic language family, yet only the 8th most sonorous in comparison to the total sample. The sum of phones in this transcript is 406.

III.1.3. Welsh

Welsh is part of the Brittonic Celtic languages and therefore more closely related to Breton than to Irish. The phonetic description of Welsh has a long history, dating back to 1882 (Sweet 1882), when the transcription that was used as a basis for the analysis is of the Northern Welsh dialect family was created. Efforts of revitalizing the Welsh language that started in the 1960s succeeded in maintaining Wales as a nation bilingual: both de facto and de jure (Morgan 2001). Two key pieces of legislature in this context are the Welsh language acts of 1967 and 1993. The western parts of Wales show, in agreement with the Irish data (III.1.2.), a greater percentage of Welsh speakers. According to Stats Wales (2020), around 30% of Welsh residents report that they are able to speak Welsh.

The transcription of the illustration is based on the speech of a Northern Welsh native woman, born and raised on the Llŷn Peninsula in the county of Gwynedd (Bell et al. 2021: 3). In contrast to the samples of Breton and Irish, in this case, the voice recording of the Phonaesthetic Research Group (2021) matches the adapted transcription perfectly. The illustration of Bell and colleagues (2021: 21) offered both a broad phonemic and a narrow phonetic transcription. For the purposes of this study, the latter was chosen, since it offers greater detail.

3. Transcription Welsh

roið gwɪnt ə gɔklɛð ɐr hɐɨl ən dɐtla pɐ ɨn ohonɐint ɔɪθ grəvɐv pɐn dɐɪθ
teiθijɔr heipijɔ wɛti ei lɐpjɔ mɔ̃ klɔkɪn kənɛs kətinɐsɛ̃nts mɐɪr ɨn ə lwiðei
iju neit ɪr teiθjɔr dəni jeɪ glɔgin gntsɐ vəðɐr ɨn krəvɐ ənɐ vɛ xəθɔð gwint
ə gɔklɛð kɨn gɐlɛtɛð ɐgə gɐɬɐɨ ɔ̃n pɔ vuijɐ xəθɐɨ ə mijɐv tɨn tənɐir teiθiɔr
ei glɔkɪn ɐmdɐnɔ ɐk ən ə diwɛð peitiɔð gwint ə gɔklɛð ɐr i əmdrɛx ənɐ
skleĩnioð ər ɦɐɨl ə̃n dɐmpɐit ak ən sɨθ pɪn tənɔð ə teiθijɔr ei glɔgɪn ak vəɬi rɔð
ə ɾhɐit i wint ə gɔklɛθ gətnɐpɔt mɐir hɐil ɔjð ə krəvɐv ohonints

The illustration of northern Welsh came without stress indication and therefore none is found in the adapted form either. Since voiceless stops already construe the least sonorous group, aspiration was not additionally indicated in the adapted transcription. As with the other two Celtic languages, secondary articulation, in this case labialization and palatalization, were discarded to simplify the transcript. These phenomena can be found, for example, in [$p^hɐ^j$] (1st line), which was transcribed as [pɐ] in the adapted version.

Welsh seems to be the least sonorous of the representatives of the Celtic language family, yet it lies in the middle ground, at place 14, in the total sample of 29 languages. The mean sonority value of Welsh is 37,7 and the transcription consists of 419 phones.

III.2. Romance Language Family

The Romance language family is widely spread around the world and has a total of over 900 million native speakers worldwide. The major Romance languages are also used as a lingua franca, which is especially true for French and Spanish. The sample that is used for this study consists of six languages which can be further grouped into sub-families: Spanish and Portuguese of the Ibero-Romance Family, Catalan of the Occitano-Romance family, French of the Gallo-Romance family, Italian of the Italo-Dalmatian family, and Romanian of the Eastern Romance family. In the following sections, the languages will be discussed individually,

appearing in order of their mean sonority value. The Romance language family scored in sum a mean sonority value of 38,9 and is, therefore, the 2nd most sonorous language family of this sample. Therefore, it was the most sonorous of the language families with 6 languages in the sample.

III.2.1. Spanish

Spanish is the most widely spoken Romance language. It is used by about 350 million people primarily on the Iberian Peninsula and in Latin America (Martínez-Celdrán et al. 2003). Since this study focuses on European languages, a sample of Castilian Spanish was chosen. What is interesting about the phonology of Spanish is that the phoneme inventory is rather limited, given that it consists of only five vowels. The illustration used for this study offers a semi-narrow and a broad transcription. The former was chosen due to the greater level of detail provided. As was the case with Welsh, the Spanish IPA transcription matched the recordings of the Phonaesthetic Research Group (2021) perfectly.

4. Transcription Spanish

el βjento norte ˌj el sol porfjaβan soβre kwal deʎos era el mas fwerte kwando aθerto a pasar um bjaxero embwelto en ãntʃa kapa kombinjeron ẽŋ ke kje n ãntez loɣrara oβliɣar al βjaxero a kitarse la kapa seria konsiðeraðo mas poðeroso el βjento norte soplo koŋ graɱ furja pero kwanto ma soplaβa ma se areβuxaβa en su kapa el βjaxero por fin el βjento norte aβandono la empresa ẽntonθez βriʎo el sol kon arðor e imeðjatamẽnte se ðespoχo ðe su kapa el βjaxero por lo ke l βjento norte uβo ðe rekonoθer la superjoriða ðel sol

In the adapted version that was used in this study, the indications for stress were discarded. In addition, the provided diacritics for non-syllabic and advanced vowels and for dental consonants were removed, as were optional phones and secondary articulations, in order to render the transcript comparable and as simple as possible. Special attention has been paid

to the use of the bilabial fricative, as in [βjento] (1st line) since it has a slightly greater sonority level than the similar plosive [b] which was used in the broad transcription of the illustration.

Spanish has a mean sonority level of 40,8 and is, therefore, the 2nd most sonorous language of this sample. Since the transcription of the Breton translation of "The North Wind and the Sun" deviates greatly from the recordings of the Phonaesthetic Research Group (2021), this is the highest scorer with a perfect match of transcription and recording. The Spanish transcript consists of a total of 428 phones.

III.2.2. French

French evolved from the Latin spoken in Gaul and is, therefore, part of the Gallo-Romance language family. French is an official language in 29 countries and one of the six official languages in the United Nations. Given that the focus of the study lies on European languages, a variety of Parisian French was chosen. The transcription deviates slightly from the recordings. As has been mentioned in (II.2.1), the only difference is that the nominal phrase <la bise> is used instead of the literal translation <le vent du nord>. In the following section the transcription, which is based on the Principles of the International Phonetic Association (1949/2010), will be presented and analysed.

5. Transcription French

la biz e lə sɔlɛj sə dispytɛ ʃakœ̃ asyrɑ̃ k il etɛ lə ply fɔr kɑ̃t iz
ɔ̃ vy œ̃ vwajaʒœr ki s avɑ̃sɛ ɑ̃vlɔpe dɑ̃ sɔ̃ mɑ̃to i sɔ̃ tɔ̃be dakɔr
kə səlyi ki arivrɛ lə prəmje a fɛr ote sɔ̃ mɑ̃to o vwajaʒœr sərɛ rgarde
kɔm lə ply fɔr alɔr la biz s ɛ miz a sufle d tut sa fɔrs mɛ ply ɛl
sulflɛ ply lə vwajaʒœr sɛrɛ sɔ̃ mɑ̃to otur də lyi e a la fɛ̃ la biz a
rnɔ̃se a lə lyi fɛr ote alɔr lə sɔlɛj a kɔmɑ̃se a brije e o bu d œ̃
mɔmɑ̃ lə vwajaʒœr reʃofe a ote sɔ̃ mɑ̃to ɛ̃si la biz a dy rkɔnɛtrə
kə lə sɔlɛj etɛ lə ply fɔr de dø

Some minor changes have been implemented in accordance with the phonetic illustration of Fougeron and Smith (1993), for example, the article <le> was adapted in this transcription to feature the schwa [ə] resulting in [lə] (e.g., 1st line). In addition, the indications for the quantity of the vowels have been discarded, as for example in [biːz] (1st line).

French is the 3rd most sonorous language in this sample and has a mean sonority value of 40,7 and is therefore almost as sonorous as Spanish. The transcription has a total of 393 phones, with the nasalization as in [ʃakœ̃] (1st line) counting as a separate phone.

III.2.3. Portuguese

Portuguese is part of the Ibero-Romance family. It originally evolved from Vulgar Latin spoken on the Iberian Peninsula and has retained some Celtic phonology. Portuguese is the most widely spoken language in South America. However, given that this study has a rather Eurocentric focus, a European version of Portuguese will be analysed. The basis for the transcription is a Lisbon native (Cruz-Ferreira 1995). European Portuguese is characterized by a velarized resonance superimposed on both vowels and consonants. An overall rather lax articulation, even in careful speech, constitutes the most striking characteristics of this language variety (Cruz-Ferreira 1995). The transcription provided in the illustration by Cruz-Ferreira (1995) matches the recorded speech by the Phonaesthetic Research Group (2021) perfectly.

6. Transcription Portuguese

u vẽtu nɔrt i u sɔl dʃkutiẽu kual duʒ doiz ɛrɔ maiʃ fɔrtɯ kuẽdu
susɯdeu pɐsar ũ viɐʒẽtɯ ɯ̃volt numɐ kapɐ au velu põiẽis
diɐkordu ẽi komu ɐkel kɯ primɐiru kõsgis ɔbrigar u viɐʒẽtɯ ɐ tirar
ɐ kapɐ sriɐ kõsidɯradu u maiʃ fɔrt u vẽtu nɔrtɯ kumɯso ɐ
suprar kõ mũitɐ furiɐ meʃ kuẽtu maiʃ supravɐ maiz u viɐʒẽtɯ si
ɐkõʃgava suɐ kapɐ ɐtɛ kiu vẽtu nɔrtɯ dzʃtiu u sɔl briʌo ẽtẽu kõ
todu ʃplẽdor i imɯdiatɐmẽt u viɐʒẽtɯ tiro ɐ kapɐ u vẽtu nɔrtɯ
tɐv ɐsĩ dɯ ʁkuɲɯsɐr ɐ supɯriuridad du sɔl

The transcription by Cruz-Ferreira (1995) provided contour tones, which were discarded so as to keep all of the transcriptions comparable since most of the other transcripts did not include tones. In addition, the markings for stress were not included in the adapted transcription, given that stress does not influence the sonority level.

Portuguese has a mean sonority level of 40,3 and is, therefore, the 4th most sonorous language of this sample. In sum, the adapted transcription has 408 phones.

III.2.4. Italian

Italian is, arguably, the closest modern language to Latin, from which it descended via Vulgar Latin. In the European Union, Italian is the second most widely spoken native language with 67 million native speakers. Almost all native Italian words end with vowels (this phenomenon is called *open syllable* since the coda position is left empty), which makes the language easy to use in rhymes. The speaker of the illustration by Rogers and d'Arcangei (2004) speaks a sort of "mainstream Italian", which can be defined as a national variety that is widely used in the media. Furthermore, the speaker is a native of Rome and she cultivated an accent with no strong regional features. This Italian acrolect, or standard variety, is also referred to as the "RAI" accent, in reference to the name of the national broadcaster (Rogers & d'Arcangeli 2004). The version that is used as the basis of the transcription does not

deviate from the recordings of the Phonaesthetic Research Group (2021). Rogers and d'Arcangeli (2004) provide both a phonemic and a phonetic transcription in their Illustration of the IPA, and the latter was chosen due to greater detail provided.

7. Transcription Italian

il vɛnto del nɔrd ed il sole stavə̃ɾo diskutɛndo su ki tre i duwe fos
ɪl pju fɔrte kwand arivɔ umŋ vjədʒətore avɔlt in um mãntɛlo i duwe
detʃizeɾo ke il primo di loɹo ke fose ɾjuʃito a fat tɔʌər il mantɛlo av
viədʒətore sarebe stato il pju fɔrte tre i duwe kwindi il vɛnto del
nɔrdə sofjɔ pju fɔrte ke mai ma pju luj sofjava pjuw il vjadʒatore
sj avoldʒeva ɾẽ so mantɛlo fin a kwando il vɛnto rinunʃɔ aloɹra il
sole lo ɾiskaldɔ kon i sɬj radʒi e imediatamẽnte il vjɐdʒɐtore si
tɔls im mantɛlo fu kozi kejl vɛnto del nɔrdə amize ke il sole ɛrajl
pju fɔrte tre i duwe

The transcription is a simplified version of the illustration of Rogers and d'Arcangeli (2004). Given that quantitative features will not be further analysed in this study, both long vowels and geminated consonants are represented by just a single phone. This is best illustrated by [ffɔːrte], where both the gemination and the long vowel are discarded, resulting in [fɔrte] (2nd line). Additionally, diacritics for changes in the tongue position in the pronunciation of vowels have been dropped to maintain the transcript simple, yet functional. Furthermore, creaky voicedness, as well as pharyngalization, have also been discarded.

Italian scored a mean sonority value of 38,2 and is, therefore, the 10th most sonorous language of the sample of 29. In total 455 phones are in the adapted version of the transcription, counting nasalization as a separate phone.

III.2.5. Catalan

Catalan is part of the Occitano-Romance language family. It is most prominently spoken in the autonomous Spanish community of Catalonia. Furthermore, it is also an official language

in the Region of Valencia, the Balearic Islands, and in Andorra. Being a minority language, Catalan has endured socio-political hardships in the past and was banned under the Francoist dictatorship. Since the Spanish transition to democracy, after 1975, Catalan has been institutionalized as an official language. Today Catalan has more than 4 million native speakers. The illustration by Carbonell and Llisterri (1992) uses the speech of a native of Barcelona as a source for their transcription. The transcription matches the recordings of the Phonaesthetic Research Group (2021).

8. Transcription Catalan

lə trəmuntanə j əl sɔl əz ðisputaβan sustəniŋ kað u k eʌ erə l mes fɔr
kwan də soptə bɛwən um biədʒe kə s əkɔstə mbulikat ən unə yraŋ kapə
baŋ kumbəni kə l ki prime fəriə kə l βiədʒe s trəɣes lə kapə səriə tiŋgup
pəl mes fɔr lə trəmuntanə s pɔz ə βufa m totə lə seβə furiə pərɔ kɔm
mez βufaβə mez əl βiədʒe s aβriɣaβə m lə kapə ə lə fi ba dəʃa korə
ferli trɛwrə ələzɔrəz əl sɔl kumənsa ðə βriʌa j əl kab d um mumen əl
βiədʒe ben əskəlfat əs trɛw lə kapə əʃi lə trəmuntanə βa βe ðə
kuŋfəsa kə l sɔl erə l mes fɔr

The transcription has been altered only slightly. For instance, the stress indications of the basis from Carbonell and Llisterri (1992) have been discarded. As was the case with the Spanish transcript, special attention was paid to the usage of the bilabial fricative [β]. Catalan scored a mean sonority value of 37 and the transcription consists of 394 phones.

III.2.6. Romanian

Romanian is part of the Eastern-Romance sub-branch and therefore only distantly related to the other Romance languages described in this section since the Vulgar Latin dialects separated between Western and Eastern Romance already in the period from the 5th to the 8th century. It is the official language in Romania, Moldova and the autonomous province Vojvodina of Serbia. The transcription that is used as the basis for this study is from the

Principles of the International Phonetic Association (1949/2010: 331). The source for this transcription is the speech of a native of Bucharest. The illustrative transcription does not deviate from the recordings of the Phonaesthetic Research Group (2021).

9. Transcription Romanian

vɨntul ʃi soarele se tʃertaw fiekare pretinzɨnd kə jel jera tʃel maj tare kɨnd jej vəzurə un kələtor tʃe sosea ɨmbrəkat ku paltonul jej se ɨntseleserə kə atʃela sintre jej kare va izbuti sə dezbratʃe pe kələtor de palton va fi rekunoskut katʃel maj tare detʃ vɨntul ɨntʃepu sə sufle din toatə puterea dar ku kɨt sufla maj tare ku atɨt kələtorul ɨʃ strɨndʒa maj tare paltonul jar pɨnə la urmə vɨntul renuntsə de a i l skoate atuntʃ soarele ɨntʃepu sə strəlutʃaskə ʃi ɨn kurɨnd kələtorul ɨnkəlzit ɨʃ skoase singur paltonul ʃi astfel vɨntul a trebuit sə rekunoaskə kə soarele jera tʃel maj tare dintre jej doj

Removing the stress indication and the marking of non-syllabicness of the first part of the diphthongs were the only changes made to this transcript. These alterations have no influence on the sonority level and were made to streamline the transcript.

Romanian scored a mean sonority level of 36,3 and is the least sonorous language of the Romance language family that were analysed in this study. However, within the sample, it ranks 19th (of a total of 29 languages) and is thus far from being the least sonorous. The transcription used in the analysis consists of 499 phones.

III.3. Finno-Ugric Language Family

For the purposes of this study, the three Finno-Ugric languages with the most speakers were chosen, namely Hungarian, Finnish, and Estonian. They are part of the Uralic language family and not related to the Indo-European language family. However, the languages of the Finno-

Ugric family are not very closely related, Hungarian is part of the Ugric family and Estonian and Finnish are part of the Baltic Finnic language family.

The Finno-Ugric family together has a mean sonority level of 37,5 and is, therefore, the 3rd most sonorous of the 5 language families that were analysed in the present study. In the following section, the languages and their transcriptions will be presented starting with the most sonorous one.

III.3.1. Finnish

Finnish is part of the Baltic Finnic language group and is an official language in Finland and Sweden. A distinctive property of Finnish is that it is typologically agglutinative. In addition, the orthography of Finnish is structured in a way that most graphemes correspond directly to a single phoneme (1:1 correspondence). Finnish distinguishes between both vowel and consonant length, and it uses vowel harmony. The basis for the transcript is taken from the Principles of the International Phonetic Association (1949/2010: 331). The translation of "The North Wind and the Sun", used for the IPA transcription, deviates from the translation used in the recordings of the Phonaesthetic Research Group (2021).

10. Transcription Finnish

pohjatuli ja auriŋko vaitelivat kumala olisi eneman
voima kun samala nakivat kulkijan jola oli ylan lamin
vaipa siloin sovitin etta se on vakevampi joka pikemin
sa kulkijalta palysvaten pois nytkøs pohjatuli puhaltaman
nin eta viuhui muta mita kovempa se puhalsi sita tar
kemmin kari vain mies vaippa ymparillen ja vimein tuli
heitikin koko homan siksen siloin alkoi auriŋko lampimasti
loista eika aikakan nin kulkija risiu vaipansa nin oli tulen
pako myønta eta auriŋko oli kun olikin vakevampi

As mentioned before, Finnish distinguishes between vowel and consonant length (gemination). These quantitative marks have been discarded in the adapted transcript, in order to keep the transcripts of the individual languages comparable. This can be illustrated by [sovitti:n], showcasing both germination and a long vowel, which was reduced to [sovitin] (3rd line). Other than that, only a few small adaptations were made to the original transcript (The Principles of the International Phonetic Association 1949/2010: 331).

Finnish scored a mean sonority value of 38,1 and is the most sonorous language of the Finno-Ugric family and the 11th sonorous language in the sample of the 29 European languages. The transcript consists of 419 phones.

III.3.2. Hungarian

Hungarian is part of the Finno-Ugric language family, but it is only distantly related to Finnish and Estonian, since it is part of the Ugric family. It is spoken in Hungary and is a recognised minority language in Romania, Serbia, Croatia, Slovakia, Slovenia, Ukraine, and Austria. The illustration of Szende (1994) is based on a speech with a somewhat advanced style, meaning a variant close to the acrolect, as spoken in Budapest. The transcript is a perfect match to the version that is used in the recordings of the Phonaesthetic Research Group (2021).

11. Transcription Hungarian

ɛtsɛr ɑz esɑki sel eʃ ɑ nɑp vɛtɛlkɛtɛk hoɬʲ mɛjikyk ɑz ɛrøʃɛb ep
ɑrɑ jøt ɛɬʲ vãdor vɑʃtɑk køpøɲɛgbɛ burkolodzvɑ ɑz esɑki sel eʃ ɑ
nɑp ɲombã mɛgɛɬʲɛstɛk hoɬʲ ɑz lɛs ɑ ɬʲøstɛʃ ɑki ɦɑmɑrɑb rɑbirjɑ ɑ
vãdort hoɬʲ lɛvɛɬʲɛ ɑ køpøɲɛget ɑkɔr ɑz esɑki sel ɛkɛzdɛt ʃyvøltɛni
ɑɦotʃɑk birt dɛ ɑ vãdor ɑnɑl soroʃɑbɑŋ võtɑ mɑgɑ køre ɑ køpɛɲt
minel ɛrøʃɛbɛŋ fujt iɬʲ ɑstɑn ɑz esɑki sel ɛl iʃ vɛsitɛtɛ ɑ vɛrʃeɲt
ɑ nɑp mɛg ɛkɛstɛ õtɑni tyzø ʃugɑrɑit mirɛ ɑ vãdɔr ɛtsɛribɛ̃ kibujt ɑ
køpøɲɛgebøl ɑz esɑki sel keɲtɛlɛ̃ vot mɛgɑdni hoɬʲ bizoɲ ɑ nɑp ɑz
ɛrøʃɛb

Hungarian distinguishes length in both vowels and consonants (long vowels and geminated consonants) and both have been transcribed in the original transcript (Szende 1994: 4) with the addition of a length marker. By contrast, in many other transcriptions, such as the Finnish one (as seen in the previous section), long consonants were represented by a duplication of the phone. Nevertheless, the quantitative marks were discarded, which can be illustrated by [ɛrø:ʃɛb:] which is [ɛrøʃɛb] (1st line) in the adapted transcript. This ensures that the transcriptions, and therefore the languages, are comparable with each other. Markings of stress, which are fixed on the first syllable in Hungarian, were also dropped. Special attention was paid to the distinctive vowel qualities.

Hungarian has a mean sonority value of 37,4 and lies exactly in the middle of the ranking of this sample. The adapted transcription, including the nasalization, has a total of 439 phones.

III.3.3. Estonian

Estonian is part of the Finnic branch of the Finno-Ugric language family and is closely related to Finnish. Estonian is spoken by slightly more than a million people and is the official language of Estonia. A distinctive feature of the language is its three degrees of contrastive quantity, which allow to distinguish between a half-long [e·], a long [e:] and an extra-long [e::] vowel. The transcription provided by Asu and Teras (2009) is based on the speech of a native of Central Estonia who uses Standard Estonian. The translations used in the illustration and for the recordings are identical.

12. Transcription Estonian

ykskort vaitlesit pɤhjatul ja pæike sele yle kump
neist on tukevam jus sis tuli møta tet ræntaea seljas soe mantel
pɤhjatul ja pæike lepisit koku et se kelel esimesena ɤnestup
suntita ræntaeat mantlit seljast vɤtma on teisest tukevam pɤhjatul
puhuski kɤikest jɤust aka mita rohkem ta puhus seta enam komale
tɤmpas ræntaea oma mantli hɤlmat lɤpuks lopus pɤhjatul katsest sis
hakas aka pæike ni sojalt paistma et ræntaea kohe oma mantli seljast
vɤtis ja nɤnta pitiki pɤhjatul tunistama et pæike on tast tukevam

Estonian features, as mentioned before, have half-long, long and extra-long vowels as well as geminated consonants. All these quantitative markings have been discarded in the adapted transcript. Interestingly, Asu and Teras (2009) used both length marks and duplicates of the phone to mark long consonants, as for example in [hɑkːkɑs] which was reduced to [hɑkɑs] (7th line). The many different ways in which the authors in the illustrations of the International Phonetic Alphabet mark quantity show that it is crucial to revise the transcription if languages are compared. In addition, stress indications, markings for special tongue positions on vowels, and palatalization have been dropped, for the sake of simplicity and inter-comparability.

The mean sonority level of Estonian is 37,0 and it is, therefore, the least sonorous language of the three Finno-Ugric languages that were analysed. The adapted transcript has a total of 426 phones.

III.4. Germanic Language Family

The Germanic languages are spoken natively by a population of more than 500 million people, whereas the largest part is contributed by the more than 360 million English native speakers. English is the world's most widely spoken language with estimates of 2 billion speakers, native and learned, worldwide. The sample of the Germanic family that is used for

this study can be further separated into the West Germanic sub-family, English and German, and the North Germanic languages, Swedish, Danish, Norwegian and Icelandic. Swedish, Danish, and Norwegian are in part mutually intelligible, whereas Icelandic is a more conservative language. The mean sonority level of the Germanic language family is 36,2 and it is, therefore, the 4th of the five language families that are analysed by this study. Interestingly, the North Germanic languages scored better than the West Germanic ones. The languages will be presented in the following sections, ranked from most sonorous to least sonorous.

III.4.1. Icelandic

Icelandic is a part of the North Germanic family and is spoken by a bit more than 300.000 people, which are located almost completely in Iceland. As a West Scandinavian language, it is closer related to Faroese than to Norwegian, Swedish, and Danish. Icelandic is a very conservative language, which has changed relatively little since the Old Norse of the 10th to 13th century. Icelandic has, similarly to German, retained a four-case synthetic grammar. The basis for the transcript is a rather narrow transcription from the Principles of the International Phonetic Association (1949/2010: 328). The translation used in the illustration has minor deviations from the one used for the recordings of the Phonaesthetic Research Group (2021).

13. Transcription Icelandic

einøsɪnɪ deildø norðanvɪndørɪn o soulɪn øm kvort θeira vairɪ
sdergara θœi sauø θau man i ɬirɪ kaubø au ferð au vejɪnøm θeim
kom θau saman øm að θað θera sɟɪldɪ teljas sdergara er ɟaidɪ
neiht ferðamanɪn tɪl θes a fara ur kaubønɪ norðanvɪndørɪn touk
θau tɪl a blausa av œdløm maihdɪ en θvi meira sem han bljes θvi
θjehdara vavði ferðamaðørɪn kaubønɪ að sjɪr oɣ a logøm gafst
norðanvɪndørɪn œhp svo for soulɪn að sɟina o θað var ɬiht θau
for ferðamaðørɪn øndɪr eins ur kaubøni norðanvɪndørɪn var
θau a kanasd vɪð a soulɪn vairɪ sdergara en han

The transcription in the Principles of the International Phonetic Association (1949/2010: 328) used phonetic symbols that are not part of the revised version of the International Phonetic Alphabet (2020). In the original version, the outdated symbol [ɪ] was used, which was replaced by [ɪ] in the adapted version. After crosschecking it with the recordings it was unambiguous that a close front vowel with retracted tongue root is the optimal representation. The quantitative marks, depicted by the length mark after vowels and by duplication of consonants, were again discarded to keep the transcriptions comparable.

The mean sonority value for Icelandic is 38,3 and it is, therefore, the 9th most sonorous language of the sample and the most sonorous of the Germanic languages. The adapted transcript has in total 443 phones.

III.4.2. Danish

Danish is part of the North Germanic language family and is closely related to Swedish and Norwegian. In written form, those three languages are mutually intelligible. However, spoken Danish is hard to understand for Norwegian and Swedish speakers. Danish has undergone many phonological changes which makes the speech so unique. The illustration by Grønnum (2009) is based on the variety of Danish spoken in the greater Copenhagen

area, which serves as the standard language. The translation of “The North Wind and the Sun” used by the illustration and the one used for the recordings (2021) are identical.

14. Transcription Danish

noʌʌnvenn ʌ soln kʌm eŋgɑŋ i sdʁið ʌm vɛm a bm dɑ vɑ dn sdæʌgəsdə
da sɔ di n vɑndʁæŋsman dɑ kʌm gɔɔnə svøbd i n vɑm kɑbə ʌ di enððəs
ʌm a dɛn dɑ fœʌsd ku fɔ kɑbm a hɑm sgu anses fʌ dn sdæʌgəsdə
fœʌsd to noʌʌnvenn fad ʌ han blɛsdə ʌ blɛsdə mɛn jo me:ʌ han blɛsdə dɛs
tɛdʌʌ hʌld mann kɑbm sɑmm ʌm sɑ te sisd mʌdə noʌʌnvenn gi
fʌtabd sʌ to soln fad ʌ han sgenððə ʌ sgenððə ʌ te sisd feg mann de fʌ
vɑmd ʌ mʌdə ta kɑbm æ da mʌdə noʌʌnvenn enʁœmə a soln vɑ dn
sdæʌgəsdə a di to

The transcription of Danish shows to some degree an exception to the rules of the previous examples. The duplications of the consonants were not classified as a change in quantity: rather, it seems to be the utterance of the two phones one after the other. This phenomenon can be further underlined by the usage of duplicated vowels: With the use of the example of [noˌ̃ʌʌnvenˀn̩] which is [noʌʌnvenn] (1st line) in the adapted transcript. What might (wrongly) be perceived at first sight as a long consonant can only be two consecutive [n] sounds since there is a syllable border between them. The first [nˀ] carries the *stød* marking from the short vowel before it, which is a special Danish feature of a kind of creaky voice, also known as vocal fry. The second [n̩] is syllabic which means that it functions as the nucleus of a syllable, and in this case, it is a syllable on its own. The cluster of vowels can be broken down into the diphthong [oˌ̃] with a non-syllabic second part and the beginning of the next syllable with the second [ʌ]. Unfortunately, the illustration of Grønnum (2009) indicated no syllable breaks, which complicated the analysis. After crosschecking with several recordings of the Phonaesthetic Research Group (2021), the transcript was adapted accordingly.

Furthermore, the diacritics for the *stød*, changes in voicedness and stress have been discarded. Optional sounds were also dropped given that they did not feature in the recordings.

Danish has a mean sonority value of 37,7 and is therefore ranked approximately in the middle of the total sample. The transcript consists of only 364 phones which makes it the 3rd shortest of the sample.

III.4.3. Norwegian

The Norwegian language is part of the North Germanic family and forms a dialect continuum with Swedish and Danish. Norwegian has two written standard forms, *Bokmål* and *Nynorsk*. The former was used for the translation of both the illustration and the speech recordings. *Bokmål* replaced Middle Norwegian as the language of the elite after the union of Denmark and Norway in the 16th - 17th century. The Principles of the International Phonetic Association (1949/2010: 327f) uses an eastern variety of Norwegian *Bokmål* as the basis for their transcription. The translations that were used as sources for the illustration and the recordings (2021) vary slightly.

15. Transcription Norwegian

noɽavinn ɔ soɭa çeklət ɔm vem a dəm va ɖən stɛrkəstə da
kɔm də en man gɔənə me en varm kappə ɔm sej dible eni ɔm
at dən sɔm fœʂʈ fik mann til ɔ kastə kappən skʉlə jelə fɔr
stɛerkərə en dən andrə sɔ blɔstə noɽavinn a al sin makt men
jo mer han blɔstə dəs tettərə trak mann kappən ɔm sɛj ɔ til
sist ga noɽavinn ɔp da ʃen soɭa fram sɔ gɔt ɔ vaɳʈ ɔ straks
tok mann a sej kappən ɔ sɔ mɔtə noɽavinn inrœmə at
soɭa va ɖen stɛrkəstə a dəm

Like Danish, the Norwegian transcription includes duplicated consonants which cannot be interpreted as just a variety of the quantity of one phone. A cross-examination of the

transcription and the recordings showed that the pronunciation of the end of [noɽavinn] (1st line) is indeed two separate consecutive [n] sounds. However, the illustration (The Principles of the International Phonetic Association 1949/2010: 327f) does not indicate any syllable breaks or a syllabic second nasal, which would be the correct form to indicate this phenomenon in a transcription. Unfortunately, the transcription breaks its own rules by suddenly using duplicated consonants to indicate true germination. Therefore, two consecutive consonants could mean either that there is a change in quantity (gemination) or that indeed two consonants were uttered (with a syllable border between them). As an example for gemination, the form of [mɔttə] (7th line) has been reduced to [mɔtə] since the recordings show no evidence for two articulated [t] phones. In this case, the duplication was a quantitative mark and is therefore dropped. Similarly, the length marks on the vowels, which are indeed of quantitative nature, have been discarded in the adapted transcript. Stress and linking indications have also been removed to ensure a high degree of comparability and functionality of the transcription.

Norwegian has a mean sonority level of 37,2 and thus ranks approximately in the middle of the complete sample. With 336 phones, the adapted transcript is the 2nd shortest of all samples analysed and is only 4 phones longer than the Latvian transcript.

III.4.4. Swedish

Swedish is closely related to Danish and Norwegian and part of the North Germanic language family. Swedish has the most speakers in the Nordic countries with about 10 million native and more than 3 million second-language speakers. The style of speech used in the illustration of Engstrand (1990) uses the speech of a Stockholm area speaker as a basis. The

translations of “The North Wind and the Sun” used in the illustration and the recordings have no notable deviations.

16. Transcription Swedish

nudɑanvindən ɔ sulən tvistadə əŋ gɔŋ ɔm vɛm ɑv dɔm sɔm vɑ
staɹkast ˌjøst do kɔm ən vandɹaɹə vɛgən fɹam insvept i ən vaɹm
kapa dɔm kɔm do øvəɹɛns ɔm at dɛn sɔm fœsʈ kəndə fo vandɹaɹən at tɑ
ɑv sɛˌj kapan han skølə anses vɑɹa starkarə ɛn dɛn andɹa do blostə
nudɑanvɪndən so hoʈ han nɔnsɪn kəndə mɛn ˌjʉ hoɖaɹə han blostə
dɛstʊ tɛtarə sveptə vandrarən kapan ɔm sɛˌj ɔ tɪ sɪst gɑv nudɑan vindən
əp fœsøkət do lɛt sulən sina stɹolaɹ ɦina helt varmt ɔ ˌjenast tug
vandɹaɹən ɑv sɛˌj kapan ɔ so vɑ nudɑanvɪndən tvəŋən at erçɛna at
sulən vɑ dɛn starkastə ɑv dɔm tvo

The transcription provided by Engstrand (1990: 3) used only standard markings of the IPA, which facilitated the adaptation. Markings for stress and intonation were discarded given that they are irrelevant for the purposes of this present study. For the sake of comparability, indications for vowel length have also been dropped.

Swedish has a mean sonority level of 36,0 and is the 9th least sonorous language in the sample. The transcription consists of 439 phones.

III.4.5. German

German is a West Germanic language and therefore more closely related to English than to the North Germanic languages. It has almost 100 million native speakers and about 85 million second-language speakers. Hence it is the most spoken native language within the European Union. It is mainly spoken in Central Europe and is an official language of Austria, Belgium, Germany, Liechtenstein, Luxembourg, Switzerland, and the Region of South Tyrol in Italy. German is a pluricentric language with three standardized variants, namely the German, Austrian and Swiss Standard High German. Given that the standard variant of

Germany has the most speakers and is most commonly taught as second language, it will be used in this analysis. The basis for the transcription is an illustration of the Principles of the International Phonetic Association (1949/2010: 325) since it came closest to the standard variant. However, two other transcriptions were taken into account to adapt the transcript (Moosmüller et al. 2015, Kohler 1990). The illustrations featured no deviations and were therefore comparable with the version of “The North Wind and the Sun” used for the recordings of the Phonaesthetic Research Group (2021).

17. Transcription German

ʔaɪnst ʃtʀɪtən zɪç nɔʁtvint ʔʊnt zɔnə veɐ fɔn ʔinən baɪdən
vol dɛɐ ʃtɛʁkeʀə vɛʀə ʔɑls ʔaɪn vɑndeʀɐ deɐ ʔɪn ʔaɪnən
vɑʁmən mɑntəl gəhʏlt vaɐ dəs vegəs daheɐ kam zi vʊʁdən
ʔaɪnɪç dɑs deɐjenɪgə fyɐ dən ʃteʁkeʀən gɛltən zɔltə deɐ
dən vɑndeʀɐ tsvɪŋən vʏʁdə zaɪnən mɑntəl ʔaptsunemən
dɛɐ nɔʁtvɪnt blis mɪt ʔalɐ maxt ʔabɐ je meɐ ʔɛɐ blis
dɛsto fɛstɐ hʏltə ziç dɛɐ vɑndeʀɐ ʔɪn zaɪnən mɑntəl ʔaɪn
ʔɛntlɪç gap dɛɐ nɔʁtvɪnt dən kɑmpf ʔɑʊf nun ɛrvɛrmtə di
zɔnə di lʊft mɪt ʔirən fʀɔʏntliçən ʃtʀalən ʔʊnt ʃon nax
venɪgən ʔɑʊgənblɪkən tsok dɛɐ vɑndeʀɐ zaɪnən mɑntəl
ʔɑʊs da mʊstə dɛɐ nɔʁtvɪnt tsugebən dɑs di zɔnə fɔn ʔinən
baɪdən dɛɐ ʃtɛʁkeʀə vaɐ

The basis for the adapted transcription (The Principles of the International Phonetic Association 1949/2010: 325) has been adapted so as to modernize the symbols that were used. Both [ɩ] and [ɷ] are not listed in the current version of the International Phonetic Alphabet (2020). The vowel [ɩ] was replaced by [ɪ] and [ɷ] was replaced by [ʊ]. Furthermore, some transcriptions of articles and interrogatives have been changed completely, since the use of a rhotic sound was suggested. After crosschecking the recordings, words ending with a rhotic consonant were replaced with an [ɐ], which is the standard for German transcription. The article <der> posed a special case, given that it was originally transcribed

as [dɐʁ], which is basically unpronounceable by German-speaking natives. The rhotic sound was dropped, and an [ɛ] was added before the [ɐ] since the <e> is intelligible in careful speech. Consequently, the adapted transcript now features [dɛɐ] (2nd line). Special attention was paid to the usage of the glottal stop [ʔ] in front of words that start with vowels since it is a distinctive phonetic feature of German. The indications for stress and vowel length have been discarded, for the sake of simplicity and comparability.

German has a mean sonority value of 35,0 and is, therefore, the 7th least sonorous language of the sample. With 524 phones the transcription is the 2nd longest and only 3 phones short of being the longest.

III.4.6. English

English is a West Germanic language and has 400 million native speakers. However, in total English have an estimated number of over 2 billion speakers, since there are more people who have learned English than there are native speakers. English is the most spoken language in the world and is arguably the most widely used lingua franca, especially in scientific discourse. Since this study focuses on European languages, a southern British variety was chosen for the analysis. The adapted transcript is based on the narrowest transcription of the Principles of the International Phonetic Association (1949/2010: 320). The translations of “The North Wind and the Sun” used in the illustration and for the recordings (Phonaesthetic Research Group 2021) are identical.

18. Transcription English

ðə nɔθ wɪnd ənd ðə sʌn wə dɪspjutɪŋ wɪtʃ wəz ðə strɒŋgɐ
wɛn ə trævlɐ keɪm əlɒŋ ræpt ɪn ə wɔm kloʊk ðeɪ əgrid ðət
ðə wʌn hu fɜst səksidɪd ɪn meɪkɪŋ ðə trævlɐ teɪk hɪz kloʊk ɒf
ʃʊd bɪ kənsɪdəd strɒŋgə ðən ði ʌðə ðɛn ðə nɔθ wɪnd blu əz
hɑd əz i kʊd bət ðə mɔ hi blu ðə mɔ kloʊslɪ dɪd ðə trævlɐ
foʊɬd hɪz kloʊk əraʊnd hɪm ənd ət lɑst ðə nɔθ wɪnd geɪv ʌp
ðɪ ətɛmpt ðɛn ðə sʌn ʃɒn aut wɔmlɪ ənd ɪmidjətlɪ ðə
trævlɐ tʊk ɒf hiz kloʊk ənd soʊ ðə nɔθ wɪnd wəz əblaɪdʒd tə
kənfɛs ðət ðə sʌn wəz ðə strɒŋgər əv ðə tu

The transcription was adapted only slightly. Stress indication and vowel length were discarded. Other than that, the symbols [ɻ] and [ɷ] were replaced by the updated version's [ɹ] and [ʊ] respectively, after controlling it with the speech of the recordings.

English has a mean sonority level of 32,8 which makes it the 3rd least sonorous language of the sample. The adapted transcript consists of 392 phones.

III.5. Slavic Language Family

The Slavic languages are part of the Indo-European language family. The Slavic language family includes more than 20 languages, 10 of which are spoken by at least a million people and have official status as national languages. The family can be subdivided into the South-, East- and West Slavic languages. The current study analyses a sample of 6 Slavic languages, two of each sub-family: Slovene and Croatian (South Slavic group), Russian and Ukrainian (East Slavic group), Czech and Polish (West Slavic group). The order in which the languages were presented is already the correct order from highest mean sonority level to lowest. Interestingly, this also orders them correctly in pairs of their respective sub-family.

The Slavic family has the lowest mean sonority score, which is 34, of the language families that were analysed in this study. The languages of the group will be presented in the following sections.

III.5.1. Slovene

Slovene, or Slovenian, is part of the South Slavic language family. It is spoken by about two and a half million speakers, mainly in the Republic of Slovenia, of which it is the official language. However, it is also spoken in the Region of Friuli Venezia Giulia of Italy and in the Regions Carinthia and Styria of Austria. The illustration of Šuštaršič and colleagues (1995) is taken as the basis for the adapted transcription. It is based on the speeches of two speakers from Ljubljana. The translation of "The North Wind and the Sun" used for the illustration matches the one used in the recordings (Phonaesthetic Research Group 2021).

19. Transcription Slovene

seʊərni ʊetər in sontsɛ sta sɛ prɛpirala kateri ɔd njiju jɛ mɔtʃneiʃi
kɔ jɛ mimɔ priʃɛu pɔpotnik zaʊit u tɔpəu plaʃtʃ dɔgɔʊɔrila sta sɛ
da bo ʊɛljau za mɔtʃneiʃɛga tisti ki mu bo pərʊɛmu uspelɔ da bo
pɔpotnik slekəu sʊoi plaʃtʃ seʊərni ʊetər jɛ zapixau z usɔ mɔtʃjo
toda bol kɔ jɛ pixau bol təsno jɛ pɔpotnik ɔʊijau sʊoi plaʃtʃ
ɔkoli sɛbɛ kɔntʃnɔ jɛ seʊərni ʊetər pɔpustiu nato jɛ sontsɛ
tɔplo pɔsijalɔ in pɔpotnik jɛ takoi slekəu sʊoi plaʃtʃ in tako jɛ
seʊərni ʊetər morau priznati da jɛ sontsɛ mɔtʃneiʃɛ ɔd njɛga

Only minor changes were made to the source transcript of Šuštaršič and colleagues (1995). The length indications on the vowels were removed since they are of no particular importance in the context of this study. Additionally, the indications of stress were discarded in order to keep the transcription simple.

Slovene has a mean sonority level of 38,1 which makes it (by far) the most sonorous language of the Slavic language family and the 12th most sonorous of the complete sample. The adapted transcription has 423 phones in total.

III.5.2. Croatian

Croatian is, linguistically seen, a standard variety of the pluricentric language Bosnian-Croatian-Montenegrin-Serbian (BCMS), which was formerly called Serbo-Croatian. The Serbo-Croatian language was linguistically standardized in the mid 19th century by the initiation of the Vienna Literary Agreement. After the breakup of Yugoslavia, the social conceptions of the language got separated along the new political borders and ethnic lines. Croatian is an official language in Croatia, Bosnia and Herzegovina, Serbia, and the Burgenland region of Austria. The illustration of Landau and colleagues (1995) is based on the speech of an announcer of the Croatian television network. The translation that is used for the illustration is different from the one used in the recordings of the Phonaesthetic Research Group (2021).

20. Transcription Croatian

sjeʊerni ledeni ʊjetar i suntse su se prepirali o sʊojoj snazi stoga
odlutʃe da onome od ɲix pripadne pobjeda koji sʊutʃe tʃoʊjeka
putnika ʊjetar zapotʃe snaʒno puxati a budutɕi da je tʃoʊjek
tʃʊrsto diʒao odjetɕu naʊali on joʃ jatʃe tʃoʊjek pak joʃ jatʃe
ot studeni pritisnut naʊutʃe nasebe joʃ ʊiʃe odjetɕe dok se ʊjetar
ne umori i prepusti ga tada suntsu ono u potʃetku zasija umjereno
kad je tʃoʊjek skinuo sʊʊiʃak odjetɕe poʊisi ono joʃ jatʃe ʒegu
dok se tʃoʊjek u nemogutɕnosti da odoli suntʃeʊoj toplini ne sʊutʃe
i ne podʑe na kupaɲe u rijeku tekutɕitsu pritʃa pokazuje
da je tʃesto uspjeʃnije uʊjeraʊaɲe negoli nasiʌe

The source transcription of Landau and colleagues (1995) was altered only minimally. The linkings between words were retracted and the markings for stress and accent were

dropped. The length markings of the vowels were also discarded to render the transcript as basic and inter-comparable as possible.

Croatian scored a mean sonority value of 36,5 and therefore ranks somewhere in the middle of the complete sample. The adapted transcript has a total of 522 phones and is, therefore, the 3rd longest, just 2 phones shorter than German.

III.5.3. Russian

Russian is an East Slavic language and has approximately 162 million native speakers and about another 110 million second-language speakers (Lewis, Simons & Fennig 2013). The speakers are based mainly in the Russian Federation and in the other former republics of the USSR. Russian has two pronunciation standards, those of Moscow and St. Petersburg. However, in modern-day Russia a general pronunciation standard, which merges features of both, is emerging. The illustration of Yanushevskaya and Bunčić (2015) is based on the speech of a St. Petersburg native, whose pronunciation is (it comes as no surprise) in accordance with the St. Petersburg standard variety as used by the younger generation. The translation used for the illustration deviates slightly from the one used in the recordings (Phonaesthetic Research Group 2021).

21. Transcription Russian

adnaʒdʲ sevirnʲj vetir i sɔntsʲ pasporili kto iz nix silneji kak ras veta
vrema ani zametili zakutanava fplaʃ putnika katorʲj ʃol pa darogi i riʃʲli
ʃto tot ʲz nix budit ʃitatsa samʲm silnʲm kamu ranʃʲ udastsa zastavit putnika
snat plaʃ tut sevirnʲj vetir prinilsa dut iza fsex sil no tʃem silneji
on dul tem silneji kutalsa putnik fsvoj plaʃ tak ʃto fkantse kantsof
sevirnʲj vetir dolʒʲn bʲl atkazatsa at svajej zateji tagda zasijala solnʲʃka
putnik panimnogu atagrelsa i fskori snal svoj plaʃ takim obrazam
sevirnʲj vetir vʲnuʒdin bʲl priznat ʃto sontsʲ silneji jivo

The broader transcription provided by Yanushevskaya and Bunčić (2015) was chosen as a basis since it fitted the speech of the recordings of the Phonaesthetic Research Group (2021) best. In Russian, palatalization is a distinctive phonological feature that occurs very frequently. However, in the adapted version palatalization is not accounted for since the change in the place of articulation does not influence the sonority level. Geminates were marked, as is advised by modern transcription standards, with a length indication. These indications were discarded in the adapted transcript given that the quantitative features are not subject to this research. To further simplify the adapted transcript, the markings for stress were also dropped.

Russian has a mean sonority level of 33 and is, therefore, the 5th least sonorous language of the complete sample. The number of phones of the adapted transcript is 472, making it the 6th longest of the 29 languages.

III.5.4. Ukrainian

Ukrainian is an East Slavic language and has about 35 million speakers (Lewis, Simons & Fenning 2016). Ukrainian emerged as a literary language in the 18th century. The language was banned under Tsar Alexander II until 1918, when it became the official language, alongside Russian, of the newly founded Ukrainian People's Republic. After the fall of the Soviet Union, Ukrainian became the only official language of the state (Pompino-Marschall et al. 2017). The illustration by Pompino-Marschall and colleagues (2017) is based on the speech of a Bukovina area native, who studied in Kyiv. The translation of "The North Wind and the Sun" used for the transcription does not differ from the one used in the recordings (Phonaesthetic Research Group 2021). In the illustration (Pompino-Marschall et al. 2017)

both a narrow and a broad transcription were provided. The latter was chosen as the basis for the adapted transcription due to the fact that it fitted the version of the recordings best.

22. Transcription Ukrainian

pɔspɛrɛtʃaɬɪsa sɔntsɛ i piʊnitʃnɪi ʊitɛr s prɪʊɔdu tɔɦɔ xtɔ
z nɪx dʊɔx sɪlniʃɪi aʒ raptɔm ʊɔnɪ pɔmitɪlɪ mandriʊnɪka jakɪi samɛ
prɔxɔdɪʊ pɔʊz nɪx kutajutʃɪs u paltɔ ɔbɪdʊa diiʃlɪ spilnɔji dumkɪ
ʃtʃɔ tɔi budɛ ʊɪznanɪi sɪlniʃɪm xtɔ ʊɪmusɪt mandriʊnɪka znatɪ sʊɔjɛ
paltɔ piʊnitʃnɪi ʊitɛr dʊʊ z usijɛji sɪlɪ alɛ tʃɪm dʊʒtʃɛ ʊin dʊʊ
tɪm ʃtʃɪlniʃɛ kutaʊsa mandriʊnɪk u sʊɔjɛ paltɔ ʊrɛʃti rɛʃt piʊnitʃnɪi
ʊitɛr pɛrɛstaʊ bɔrɔtɪsa i tut sɔntsɛ ziɦrilɔ pɔʊitra sʊɔjimɪ prɪʊitnɪmɪ
prɔmɛnamɪ i ʊʒɛ tʃɛrɛz dɛkilka xʊɪlɪn mandriʊnɪk znaʊ sʊɔjɛ paltɔ
ɔtɔʒ piʊnitʃnlɪi ʊitɛr ʊɪmuʃɛnɪi bʊʊ ʊɪznatɪ ʃtʃɔ sɔntsɛ s pɔmiʒ nɪx
dʊɔx bulɔ sɪlniʃɪm

The adapted transcription does not contain any markings of secondary articulation, which in this case concerns mostly palatalization, which is, similar to Russian, very frequent in Ukrainian. In addition, indications used for diphthongs and stress have been discarded, since they do not affect the sonority level.

Ukrainian scored a mean sonority value of 32,9 making it the 4th least sonorous language, just behind Russian. The adapted transcription is with 527 phones the longest one of all sample texts.

III.5.5. Czech

Czech is a western Slavic language and therefore closest related to Slovak and Polish. It is spoken by nearly 10 million people in the Czech Republic and by another two million people in the neighbouring countries and abroad (Šimáčková et al. 2017). The Czech language can be divided into two varieties, namely Bohemian and Moravian, which correspond to the two historical regions. For the analysis in this study, the Bohemian variety was chosen since it has more speakers and is commonly used in Prague. The transcription is based on the

corresponding illustration of Šimáčková and colleagues (2017). The translation that was used in the illustration is the same as used for the recordings of the Phonaesthetic Research Group (2021).

23. Transcription Czech

sɛvɛrak a sluntsɛ sɛ ɦadalɪ gdo zɲɪx jɛ sɪlɲɛjʃi f tom spatrɪlɪ potsəst nɛɦo
ktɛri kratʃəl zaɦalɛn plaʃcɛm ʔujɛdnalɪ tɛdɪ ʒɛ tɛn sɛ ma povaʒovad za
sɪlɲɛjʃiɦo gədo prvɲi dokaʒɛ ʔabɪ sɪ potsɛstni sʊlɛkl plaʃc tu zatʃal sɛvɛrak
foukad zɛ fʃi silɪ ʔalɛ tʃim vits foukal cim vits sɛ potsɛstni zaɦaloʊal do
svɛɦo plaʃcɛ konɛtʃɲɛ sɛ sɛvɛrag vzdal marnɛɦo ʔusɪli pag zatʃalo sluntsɛ
svicit ʔa ɦrat ʔa za ɲɛjaki ʔokamʒɪk potsəstni ktɛrɛmu bɪlo ɦorko sxoɟɪl
plaʃc tak musəl sɛvɛrak ʔuznad ʒɛ sluntsɛ jɛ sɪlɲɛjʃi

The transcription was adapted to keep all transcriptions of the sample inter-comparable. Markings for vowel length were discarded, as were indications for stress and secondary articulation. Czech makes use of the glottal stop if a word starts with a vowel, as is the case for the German language. An example of this is [ʔujɛdnalɪ] (2nd line).

The mean sonority level of Czech is 32,6 making it the penultimate language of the sample. The adapted transcript consists of a total of 419 phones.

III.5.6. Polish

Polish is part of the West Slavic language family and has about 41 million speakers in Poland and another 10 million living abroad. Polish is a very consonant heavy language: not only does it have a rich system of consonants, but it also allows for extremely long consonant clusters. The clusters can get up to 5 consonants long, and 4 consonants long clusters occur rather frequently. Even geminated affricates may appear in word-initial position, as in [dʒdʒɨstɨ] “rainy” (Jassem 2003). It goes without saying that this directly affects (i.e., lowers) the overall sonority score. The translation is based on the illustration of Jassem (2003). The

translation of “The North Wind and the Sun” used in the illustration deviates slightly from the one used for the recordings (Phonaesthetic Research Group 2021).

24. Transcription Polish

pevnego razu puwnotsnʲ vjatr iswoɲtse spʃetʃaliɕe ktozɲix
jest ɕilɲejʃʲ vwaɕɲe pʃexodʑiw drogoɰ̃ jaciɕ tʃwovjek oviɲentʲ
ftɕepwʲ pwaʃtʃ umu viliɕe vjents ʒetenzɲix kturʲ pjerʃʲ zmuɕi
pʃexodzon tsego abʲzdjow okrʲtɕe beɲdʑe uvaʒanʲ zaɕilɲejʃego
puwnotsnʲ vjatr zatʃow odrazu doɲtɕ stsawej ɕiwʲ aleim motsɲej
dow tʲmɕilɲej podruʒnʲ otulawɕe fpwaʃtʃ vreʃtɕe puwnotsnʲ
vjatr daw spokuj ftedʲ swoɲtse zatʃewo pʃʲgʒevaɕ afxfile
puʑɲej podruʒnʲ zdjow pwaʃtʃ ften sposup puwnotsnʲ vjatr muɕaw
pʃʲznatɕ ʒe swoɲtse jestɕilɲejʃe of ɲego

In an attempt to streamline all adapted transcripts, all indications for tone and other prosody-related markings were discarded from this transcription. Other than that, the transcript was already formated in a straightforward and easily comparable fashion.

Polish has a mean sonority value of 31,1 and is, therefore, the least sonorous language of the sample analysed by this study. The adapted transcript has a total of 456 phones, including nasalization.

III.6. Sole Representatives, Independent Branches and Isolates

III.6.1. Greek

Modern Greek is a descendant of Classical Greek. It has more than 13 million native speakers. The history of the Greek language is one of diglossia, with a high-status variety *Katharevousa* and a low-status variety *Dhimotiki* existing parallel. In the 1970s, the use of the purist variety of *Katharevousa* was officially abolished and a new standard based on the *Dhimotiki* spoken in Athens has emerged. The illustration of Arvaniti (2009) is based on the speech of an Athenian speaking Standard Modern Greek. The translation used in the

illustration deviates slightly from the one used by the Phonaesthetic Research Group (2021) for the recordings.

25. Transcription Greek

o vorʝes coiʌoz melonen ʝe ro pços eptuz ðʝo in o ðinetotɛros
ote nɛtiçɛ ne pɛresi epo broste tus ɛnes teksiðʝotis pu foruse kepe
oten to niðen o vorʝes coiʌo simɲfonisen
otiopço sɛkenɛ to deksiðʝoti ne vɣeli ti gepe tu
θe θɛoruden o pço ðinetos
o vorʝes erçise totɛ ne fisei mɛ menie eleoso pɛrisotɛro fisusɛ
toso pɛrisotɛro tiliɣoten mɛ ti gepe tuo teksiðjotis
ospu o vorʝes kurestice cɛ stemetisɛ ne fisei
totɛ oiʌo serçisɛ mɛ ti sire tu ne lebi ðinete
cɛ ɣriɣoreo teksiðʝotis zɛsteθicɛ c ɛvɣelɛ ti gepe tu
ɛtsi o vorʝes enegestice ne pereðɛxti
oti oiʌos inɛ pço ðinetos ep efton

A distinctive feature of Greek phonology is the five-vowel-system, which is similar to Spanish. The adapted transcript does not include any stress marks. In addition, indications for non-syllabicness of a vowel in a diphthong, as in [co̯iʌoz] have been removed. For the sake of simplicity, optional sounds have been discarded since they were not intelligible in the recordings.

Greek has a mean sonority level of 39,3 and is the 5th most sonorous language of the sample. With a length of 478 phones, the transcript is the 5th longest of the sample.

III.6.2. Basque

Basque is a language isolate, which means that it is unrelated to any other existing language. It is the only surviving Pre-Indo-European language in Western Europe. The Basque region is in the westernmost parts of the Pyrenees and includes parts of Spain and France. The Francoist Regime banned Basque (and Catalan), which critically endangered the language.

However, the trend reversed in the 1960s and publishing and education in Basque flourished. The long-lasting language contact to the Romance languages influenced the vocabulary and the Phonology of Basque. For instance, Basque features the same five vowels as Spanish. The transcript of the illustration from Hualde and colleagues (2010) is based on the Goizueta dialect, spoken in north-western Navarre, Spain. The translations of "The North Wind and the Sun" used for the illustration and for the recordings (Phonaesthetic Research Group 2021) featured no noticeable differences. The narrow phonetic transcription provided by Hualde (Hualde et al. 2010: 126) was chosen as the basis for the analysis.

26. Transcription Basque

ipar aisea ta euskia indartsuna sein tsen ʔespan ai siala iβiltari βa pasatu sen
kapa loði βatem bildua ʔeraβak suten indartsuna isain tsela iβiltariri
kapa ʔaurena kenusitsen tsina ʔordun ipar aisek bere iɲal ɣusikin ɟo
sun biɲo sembat eta fuerteo ʝo ibiltarik orðun eta estuo ʔeusten tsin bere
kapari ʔaskenen ipar aisek etsita utsi in tsun beraleiɲa gero euskia
fuerte βerotsen asi sen ta iβiltarik beleʃe kenu sum bere kapa ta ola
ipar aisek ai cortu βar isan tsun euskia sela bietan indartsuna

Like German and Czech, some of the words that would start with a vowel feature a glottal stop [ʔ]. This can be seen, for example in [ʔespan] (1st line). Optional phones were discarded given that they were not intelligible in the recordings. In addition, indications for diphthongs, apical and laminal release, and marks for changes in the tongue position have been removed, in order to keep the transcript simple and functional. Furthermore, creaky-voicedness and secondary articulations, in this case palatalization were dropped. Special attention was paid to the usage of the bilabial fricative [β], as was the case in Spanish and Catalan.

Basque has a mean sonority value of 39,2 and is, therefore, the 6th most sonorous language of the sample. The adapted transcript features a total of 416 phones.

III.6.3. Albanian

Albanian forms an independent branch of the Indo-European language family. Albanian is spoken by more than 6 million people, the majority of whom lives in Albania and the Kosovo. Albanian can be subdivided into two main varieties, namely, *Gheg*, spoken mainly in Northern Albania and the Kosovo, and *Tosk*, spoken mainly in Southern Albania (Coretta et al. 2021). The recordings used as the basis for the illustration by Coretta and colleagues (2021) are of speakers of the northern *Tosk* region. The first of the two transcriptions (Coretta et al. 2021: 23) was chosen because it matched the recordings better. However, the translations of "The North Wind and the Sun" used in the recordings (Phonaesthetic Research Group 2021) deviates from the one used for the illustration.

27. Transcription Albanian

eɾa e veɾiut ðe dieli pɔ ziheʃin se kuʃ iʃte mɜ i fɔɾtɜ kuɾ aty kalɔi ɲɜ
uðɜtaɾ tʃɜ kiʃte veʃuɾ ɲɜ paltɔ tɜ ngɾɔhtɛ ata ɾanɜ dakɔɾd tʃɜ kuʃ do ta
bɜnte uðɜtaɾin tɜ hitʃte paltɔn mɜ pɜɾpaɾa do tɜ tʃuhej mɜ i fɔɾti fil pas
kɜsaj eɾa e veɾiut filɔi tɜ fɣynte me dʒiθɜ futʃinɜ e saj pɔɾ sa mɜ ʃumɜ tʃɜ
fɣynte atʃmɜ ʃumɜ kapej uðɜtaɾi pas paltɔs sɜ tij deɾisa mɜ nɜ fund eɾa
e veɾiut u doɾɜzua pastaj dieli lɜʃɔi rezet e tij tɜ ngɾɔhta ðe meɲɜheɾɜ
uðɜtaɾi e hɔtʃi paltɔn e kɜʃtu eɾa e veɾiut u detyɣua tɜ pɾanɔnte tʃɜ
dieli iʃte mɜ i fɔɾtɜ se ajɔ

To adapt the transcription, secondary places of articulation were discarded. In this case, some lateral approximants were velarized, as in [dielˠi] (1st line). Furthermore, indications for laminal consonants were removed so as to keep the adapted transcript as simple and comparable as possible.

Albanian has a mean sonority value of 38,8 and is the 7th most sonorous language of the sample. The adapted transcription has 427 phones in total.

III.6.4. Turkish

Turkish is a member of the Turkic language family and has over 80 million native speakers. It is the national language of Turkey and is also spoken in smaller groups abroad. Since 1928, as a reform of Atatürk, Turkey has implemented the use of the Latin alphabet. One key characteristic of Turkish phonology is that it features vowel harmony. The illustration by Zimmer and Orgun (1992) is based on the accent of an Istanbul native, given that the Turkish variety spoken in Istanbul is considered the linguistic standard. The translations of "The North Wind and the Sun" used by the authors of the illustration and for the recordings of the Phonaesthetic Research Group (2021) are completely different. This has to be taken into consideration when comparing the results that use the recordings as the basis for their observations.

28. Transcription Turkish

pojrazɬa ɟyneʃ birbirlerinden daha kuvvetli oɬdukɬarɯnɯ ileri syrerec iddiaɬaʃɯjorɬardɯ dercen kaɬɯn bir paɬto ɟijmiʃ bir joʗdʒu ɟœrdyler bu joldʒuja paɬtosunu tʃɯkarttɯrabilenin daha kuvvetli oɬduɣunu kabul etmije karar verdiler pojraz var ɟydʒyle esmije baʃɬadɯ andʒak joɬdʒu paɬtosuna ɟitɟide daha sɯkɯ sarɯnɯjordu sonunda pojraz uɣraʃmaktan vazɟetʃti bu sefer ɟyneʃ atʃtɯ ortaɬɯk ɯiɯnɯndʒa joɬdʒu paɬtosunu hemen tʃɯkardɯ bœjledʒe pojraz ɟyneʃin kendisinden daha kuvvetli olduɣunu kabul etmije medʒbur kaɬdɯ

All indications of stress were removed to simplify the transcript. The markings for long vowels were also discarded so as to keep the transcripts inter-comparable. Other than that, it was only possible to perform minor adaptions since the recording did not match the transcription.

Turkish has a mean sonority level of 35,6 and is, therefore, the 8th least sonorous language of the sample. The adapted transcript has in total 447 phones.

III.6.5. Latvian

Latvian, also referred to as Lettish, is a Baltic Language and has about 1.3 million native speakers. Latvian is most closely related to the neighbouring Lithuanian. Since the Baltic languages are part of the Balto-Slavic Family, it is also distantly related to the members of the Slavic language group. The illustration of Brenzinger (1973) is based on standard Latvian as spoken in Riga. The translation, which was used for the transcription, deviates from the one used in the recordings of the Phonaesthetic Research Group (2021). The illustration provides both the transcription of careful and rapid speech, the latter was chosen as the basis since it fitted the recording better.

29. Transcription Latvian

reiz ziəməɬs ən saʊɬ sak stridetiəs kʊrʃ nə vɪɲiəm ɑbiəm æsuɐt
stɪprɑkais tiəʃ tai bridi vɪɲ pɑmɐnɪi kɑd biəzuɐs svɑrkuɐs
sɑtʊntʊʌuɐiʊʃuɐs vir nɑkɐm pə tsɛʌ saʊɬ n ziəməɬs tɐ nʊ nuɐrnɑi
kə stɪprɑkaɪs bus tɑs kʊrʃ pɪrmais piədəbus tseʌ vir svɑrks
nuɐvɪɬkt ziəməɬs nʊ put kuɐ spei bɛt jə stɪprɑk vɪɲʃ put
jə tsiəʃɑk tsɛʌ virs sɑvɪɬk svɑrks beig beigas ziəmələm
nɑtsɑs ɑdzit k saʊɬ tuɐmær ɪr tɑ stɪprɑkɑ

The transcription of Latvian contained some outdated phones, namely [ɪ] and [ɷ] which were replaced by the new phones according to the International Phonetic Alphabet (2020). As in the German transcription (see III.4.5), the vowel [ɪ] was replaced by [ɪ] as in [vɪɲ] (2nd line). The vowel [ɷ] was replaced by [ʊ] as in [saʊɬ] (1st line). Replacing the outdated vowels helps to make the transcripts as comparable as possible. Markings for tones were discarded because tone does not directly influence sonority. Indications for long vowels and secondary places of articulation, in this case labialization, were dropped.

Latvian has a mean sonority value of 34,2 and is, therefore, the 6th least sonorous language. The adapted transcript is the shortest of the whole sample with only 332 phones.

IV. General Results

This section provides a comparative description of the results by juxtaposing the individual mean sonority value results of the languages of this sample. These values were calculated using an adapted version of Faught's sonority scale (Fought et al. 2004) and adapted versions of the transcriptions provided by the respective illustrations in the *Journal of the International Phonetic Association* (see the previous section). The data of the mean sonority value serve as a starting point of the analysis and will later be compared to the geographical location and the correlation with the aesthetic Judgements (Phonaesthetic Research Group 2021).

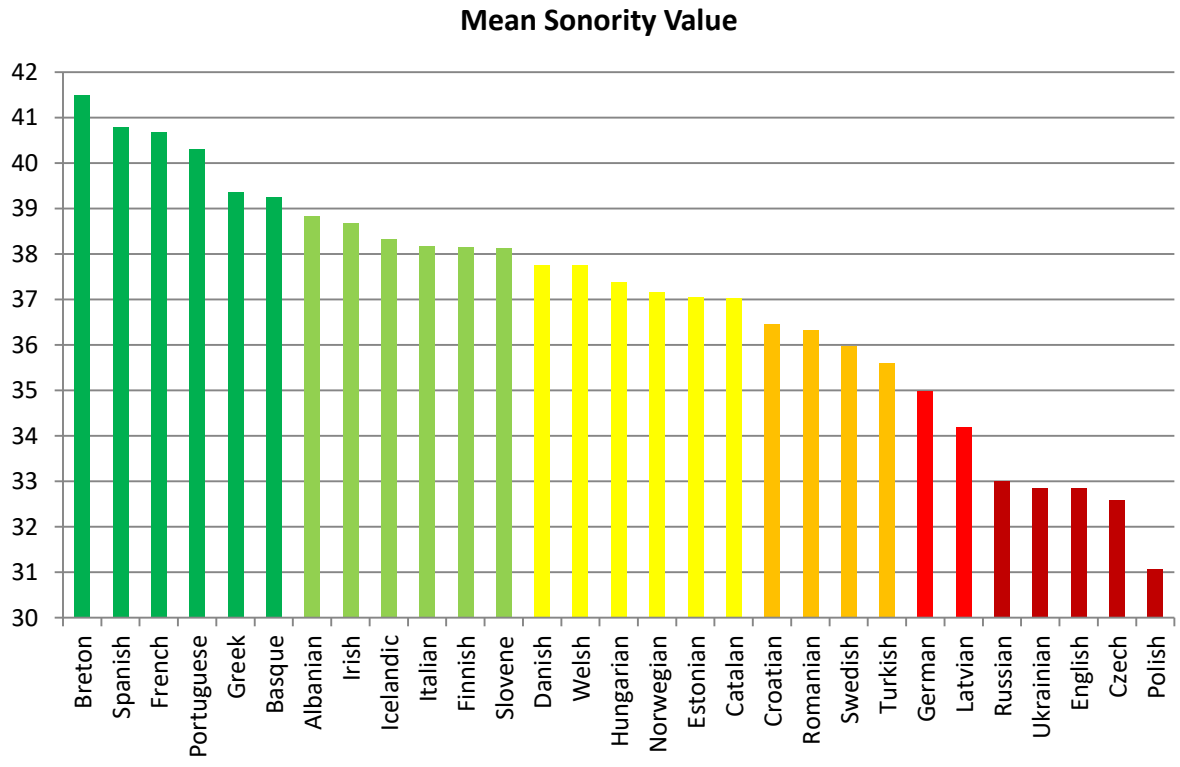

Illustration 10: Mean sonority value of the adapted transcripts. The languages are sorted from most sonorous to least sonorous. The traffic light colour-coding is based on the following thresholds: dark green ≥39, light green ≥38, yellow ≥37, orange ≥35, light red ≥34, and dark red ≤33.

Illustration 10 shows the chart of the mean sonority level, ranked from most to least sonorous. The languages are traffic light colour coded, ranging from dark green to dark red. The most sonorous languages, depicted in dark green, all have a mean sonority value of over 39, with Breton leading the group with the highest sonority level. Notably, three of the six languages in the highest tier pertain to the Romance language family. The second tier, in light green, contains languages with a mean sonority level between 39 and 38. The third tier contains languages whose mean sonority levels lie between 38 and 37 and is coloured in yellow. The next sections consist of the less sonorous languages, starting with the orange tier, ranging from mean sonority levels between 37 and 35. This is followed by a small group of light red languages ranging from 35 to 34. The languages with a mean sonority level below 33 are colour coded as dark red and are the least sonorous languages of the sample. Interestingly, in this group, four out of the five languages are members of the Slavic family.

On a macro level we can distinguish between the more sonorous languages (the 12 languages in green shades, >38), the middle-ground (the six yellow-coded languages, 38-37), and the less sonorous languages (the 11 languages ranging from orange to dark red, <37).

In the following chart (illustration 11), the languages are sorted by language families. The families and their members are ranged from most sonorous to least sonorous. The languages that either are isolates, independent branches or just the sole representant of their family in this sample are colour coded in grey and shifted to the end of the list.

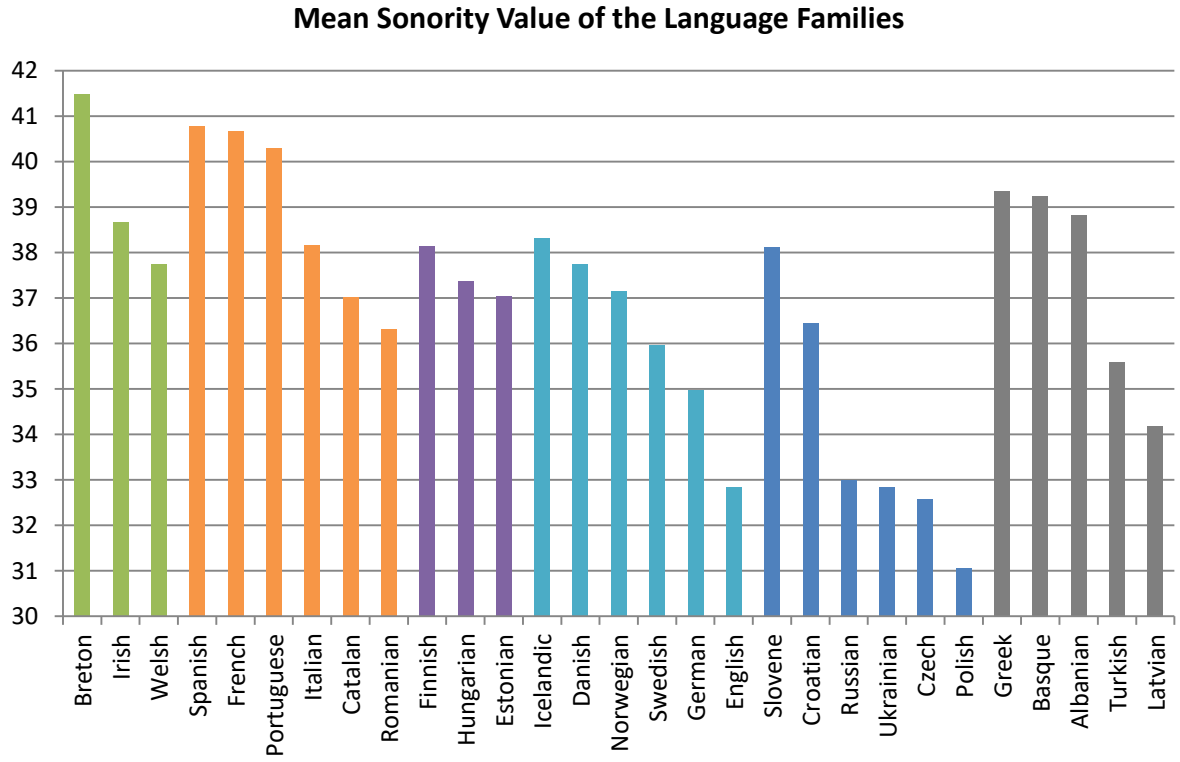

Illustration 11: Mean sonority values of the languages sorted by family. The green bars represent members of the Celtic language family. The Romance language family is shown in orange. The Finno-Ugric family is shown in purple. The Germanic family is shown in light blue. The Slavic language family is shown in dark blue. The languages that are not grouped in families are shown at the end in grey.

Illustration 11 shows that every language family contains a range of mean sonority values in their members. However, only languages pertaining to the Celtic and Romance family reach a mean sonority value of over 40, namely Breton, Spanish, French, and Portuguese. Taking their geographic location in Europe into consideration, all of these languages are centred in the Iberian Peninsula and France. In addition, it seems reasonable to assume that due to its intense language contact with French, the Breton language has arguably adopted some of the Romance characteristics in their Phonology.

On the other end of the chart, we only have members of the Slavic language family and English below a mean sonority value of 34. Interestingly, the South Slavic languages, represented by Slovene and Croatian, performed far better – in terms of mean sonority – than their Western and Eastern linguistic relatives. Such a trend can also be seen in the

Germanic language family, where the North Germanic languages score higher than the West Germanic languages, namely German and English.

The following chart (Illustration 12) depicts the length of the adapted transcription of the languages of the sample.

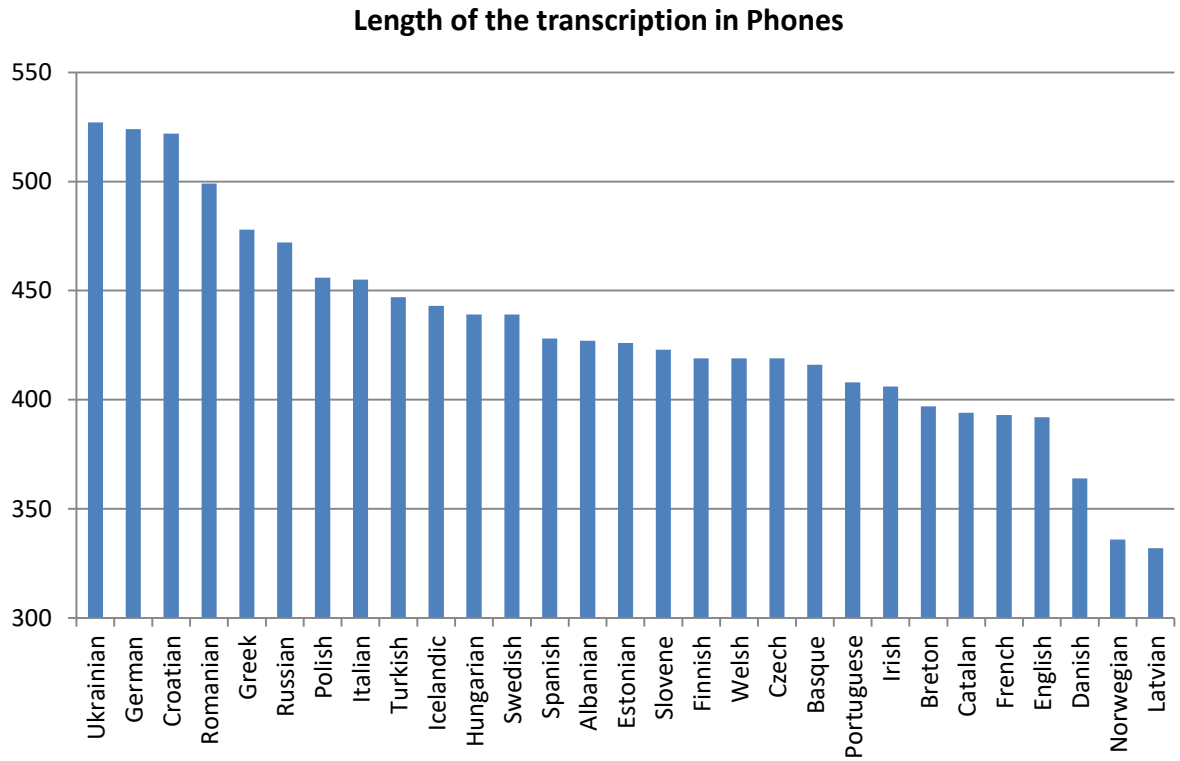

Illustration 12: The Length of the adapted transcription that was used to analyze the mean sonority value, ranged from most Phones (= 527) to least Phones (=332).

The length of the transcription ranges from 527 phones, Ukrainian, to 332 phones, Latvian. Only three languages had a transcript of over 500 Phones, namely Ukrainian, German, and Croatian. On the other end, only two languages had a transcript of fewer than 250 phones, namely Norwegian and Latvian.

V. Results of the Statistical Analysis

V.1. Aesthetic Judgements and Sonority

This section will focus on the correlations between the mean sonority value (as presented in the previous section) and the aesthetic judgements of the main experiment of the Phonaesthetic Research Group (2021). To determine the correlation, the mean values of the N = 144 participants judgements were calculated for each factor. As aforementioned (see II.2.4) the correlations were calculated with a 1-tailed Pearson Correlation in SPSS.

Correlations

		Mean Sonority Value	Eros (Mean)	Beauty (Mean)	Status (Mean)	Order (Mean)
Mean Sonority Value	Pearson Correlation	1	,341*	,253	,025	-,433**
	Significance (1-tailed)		,035	,092	,449	,009
	N	29	29	29	29	29

*. The correlation is significant at the 0,05 (1-tailed) level.

**. The correlation is significant at the 0,01 (1-tailed) level.

Illustration 13: Results of the Pearson Correlation Analysis. The aesthetic judgements are devided into the four factors as used by the Phonaesthetic Research Group (2021).

As shown in Illustration 13, there is a significant correlation (under 0,05) between the mean sonority level of a language and its perceived eroticism. Additionally, there is a highly significant negative correlation (under 0,01) between the mean sonority value and the perceived orderliness of a language, which means that more sonorous languages are perceived as less orderly. The scatterplots for the significant correlations are depicted in illustration 14. No significant correlations were found between the mean sonority value and the judgements in the factors of beauty and status of a language. However, we can still see a trend to a positive correlation between the mean sonority value and beauty, this is not significant but it might be proven significant in a bigger sample (illustration 15).

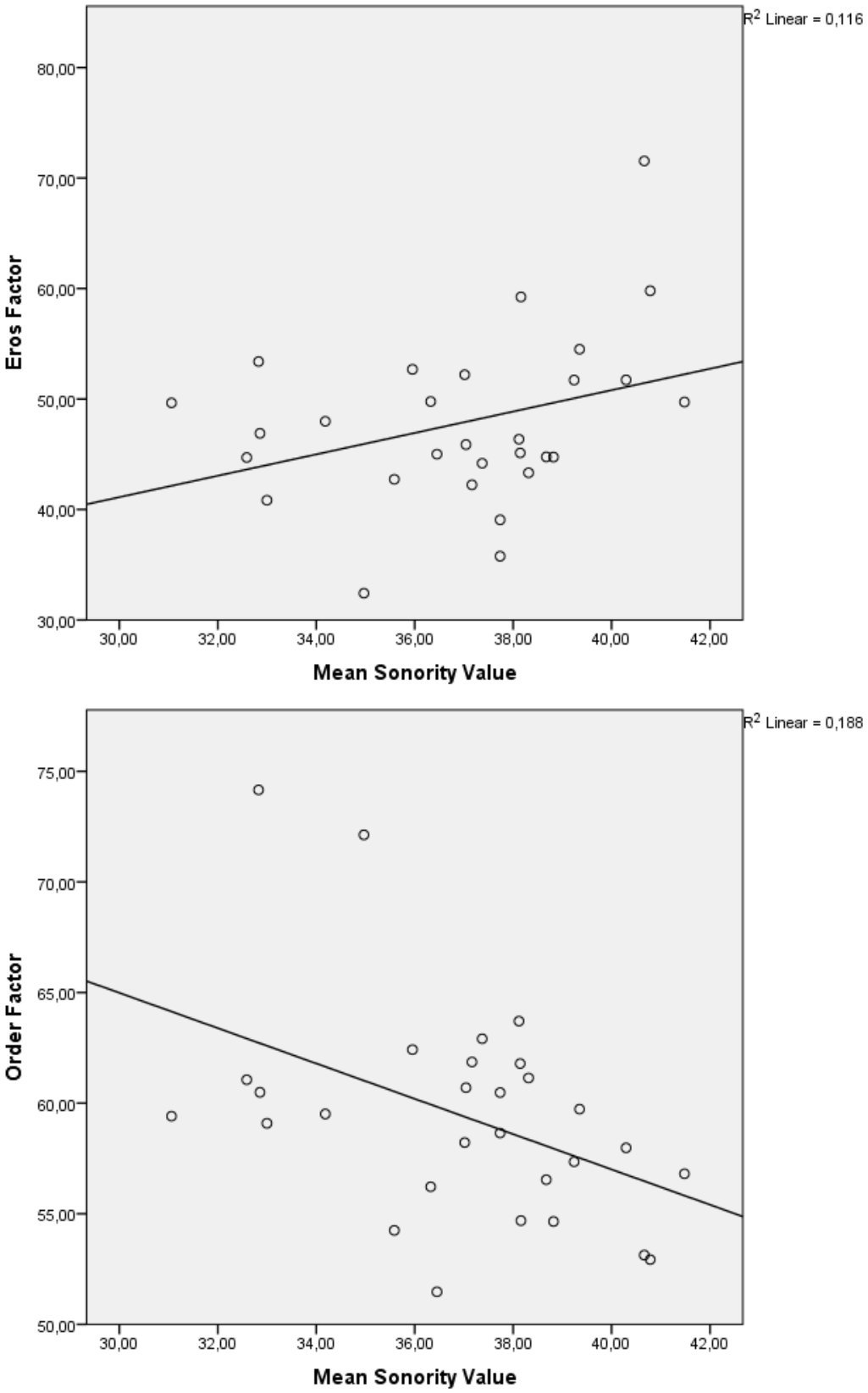

Illustration 14: Scatterplot of the correlations between the factors eros and order and the mean sonority value of the languages.

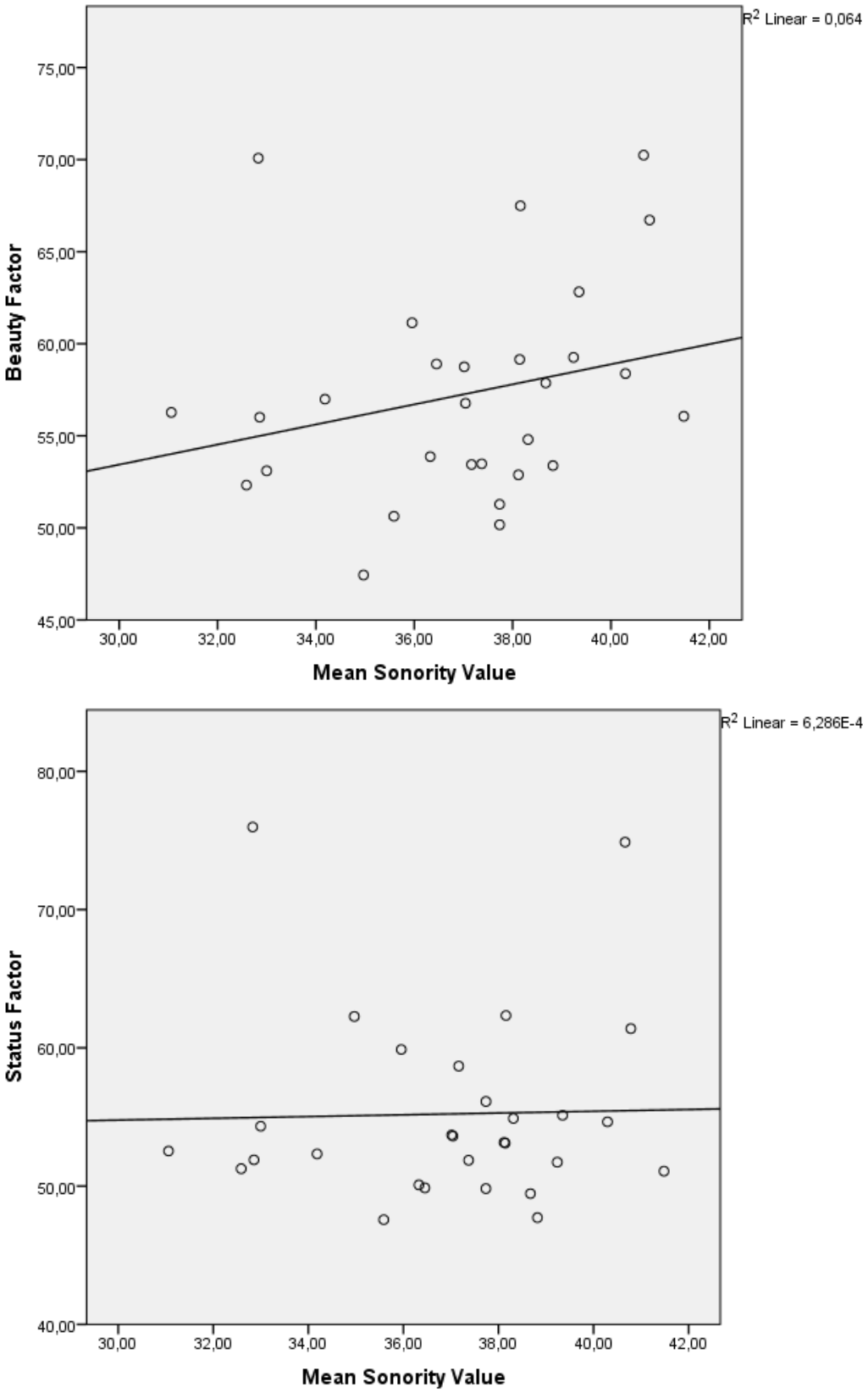

Illustration 15: Scatterplot of the correlations between the factors beauty and status and the mean sonority value of the languages.

V.2. Geographical Location and Sonority

This section focuses on the correlations between the region in which a language is spoken in Europe and the mean sonority value of the language. Illustration 16 shows a simplified map of Europe with the areas of the languages coded in colours according to their mean sonority values. The colour coding spans from most sonorous (dark green) to least sonorous (dark red) and the detailed assignment of the colours can be seen in the illustration below.

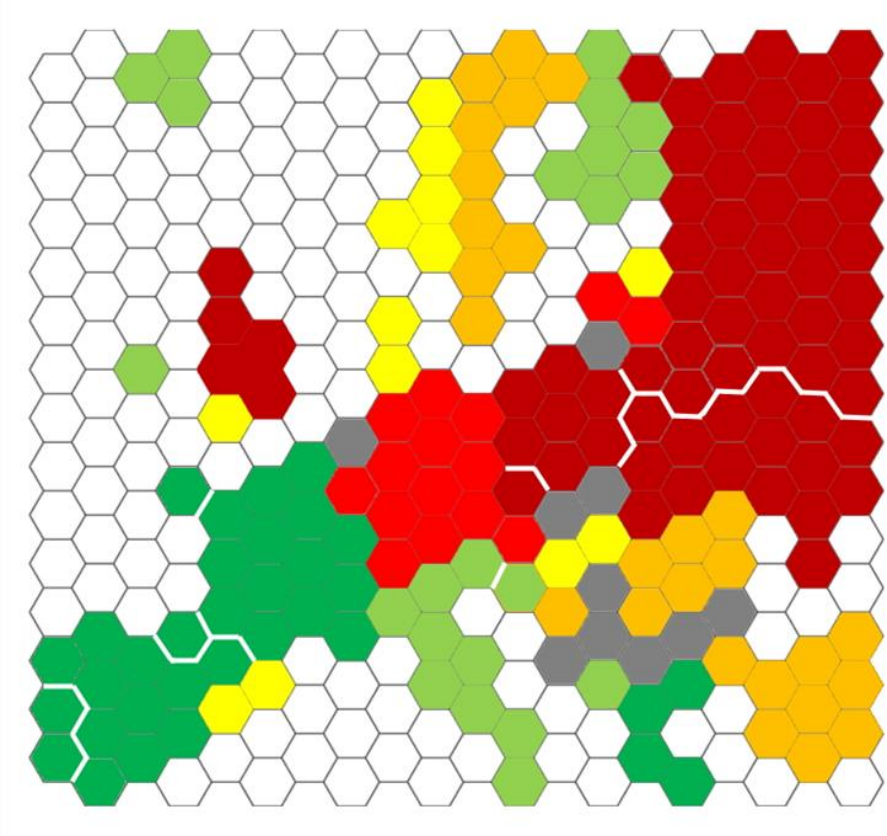

Illustration 16: Simplified Map of Europe with the language areas coloured according to their mean sonority value. The languages are coded as follows (see Illustration 6 for comparison): Breton, Spanish, French, Portuguese and Basque (dark green); Albanian, Irish, Icelandic, Italian, Finnish and Slovene (light green); Danish, Welsh, Hungarian, Norwegian, Estonian and Catalan (yellow); Croatan, Romanian, Swedish, Turkish (orange); German and Latvian (light red); Russian, Ukrainian, English, Czech and Polish (dark red). The categories range from most sonorous, dark green, to least sonorous, dark red. The areas shaded in grey represent language areas that were not part of this study. This map should only be a visual aid for the analysis and is in no sense complete nor does it represent the actual geographical locations.

This map shows that the dark green areas are located in Western and Southern Europe, whereas the dark red areas are mostly located in Eastern and Northern Europe. To investigate this phenomenon in greater detail, language hubs for the language areas were chosen and analysed via their latitudinal and longitudinal data. The language hubs were chosen as follows: for pluricentric languages, the biggest capital was chosen (e.g., Berlin was chosen for German); for languages spoken primarily in one European country, the respective capital was chosen (e.g., Kyiv was chosen for Ukrainian); for minority languages, a big city in the region where it is spoken was chosen (e.g., Bilbao was chosen for Basque).

With the data of these language hubs, a 1-tailed Pearson Correlation was calculated between the mean sonority value of the language and the geographical location data (longitude and latitude). The data for the geographical location is derived from the Latitude and Longitude Finder (2021).

Correlations

		Mean Sonority Value	Latitude	Longitude
Mean Sonority Value	Pearson Correlation	1	-,321*	-,531**
	Significance (1-tailed)		,045	,002
	N	29	29	29

*. The correlation is significant at the 0,05 (1-tailed) level.

**. The correlation is significant at the 0,01 (1-tailed) level.

Illustration 17: Results of the Pearson Correlation Analysis between the mean sonority value of a language and the Latitude and Longitude of the respective language hub / capital.

The calculation of the correlations in illustration 17 shows that the mean sonority value has a negative correlation with the latitude and with the longitude of the respective language hub. The negative correlation between the mean sonority value and the latitude is significant at the 0,05 level in a one-tailed test. Athens (as the language hub for Greece) was southernmost with a latitude of 37,98 and Reykjaviv (as the language hub for Icelandic) was the northernmost with a latitude of 64,13. The significant negative correlation between

latitude and the mean sonority value can be interpreted as follows: generally, the more southern the position of the language area in Europe, the more sonorous the language. The scatterplot for the correlation between latitudinal data of the language hub and mean sonority value is depicted in illustration 18.

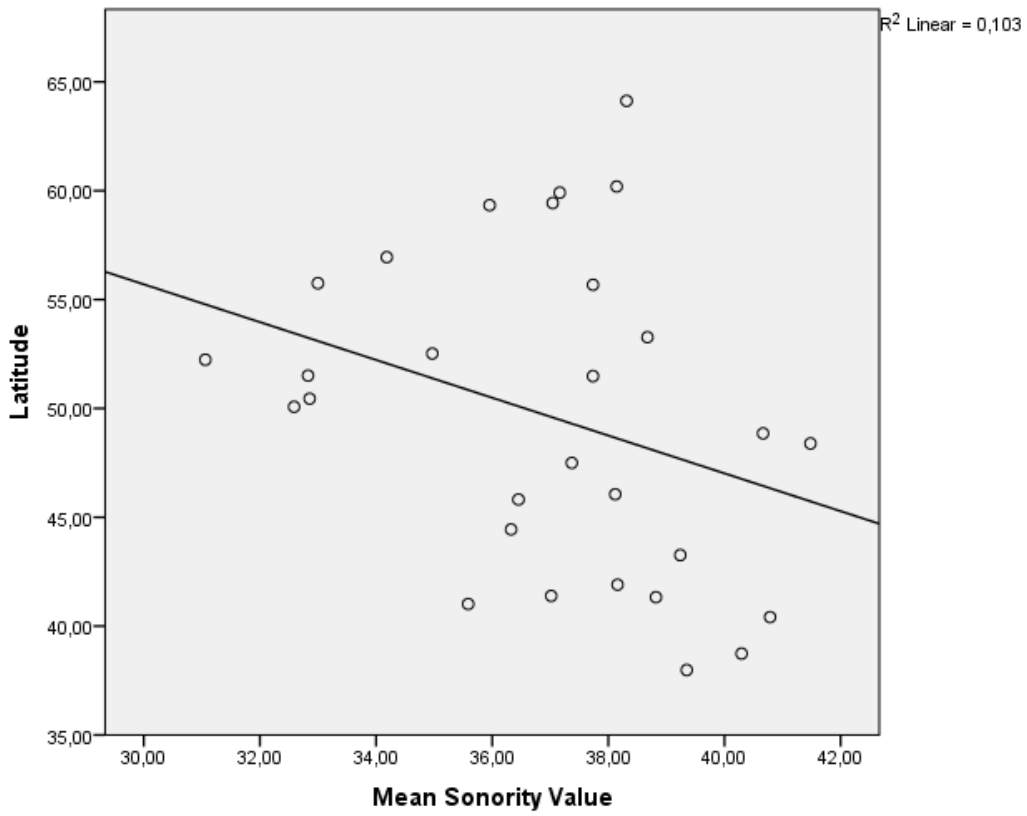

Illustration 18: Scatterplot of the correlation between the latitudinal data of the language hubs and the mean sonority value of the languages.

The negative correlation between the mean sonority value and the longitude is highly significant 0,01 in a one-tailed test. The westernmost language hub was Reykjavik with a longitude of -21,83 and Moscow (as the language hub for Russian) was the easternmost with a longitude of 37,62. The highly significant negative correlation between longitude and the mean sonority value suggests that the more western a language area in Europe, the more sonorous the language. The scatterplot for the correlation between longitudinal data and mean sonority value is depicted in illustration 19.

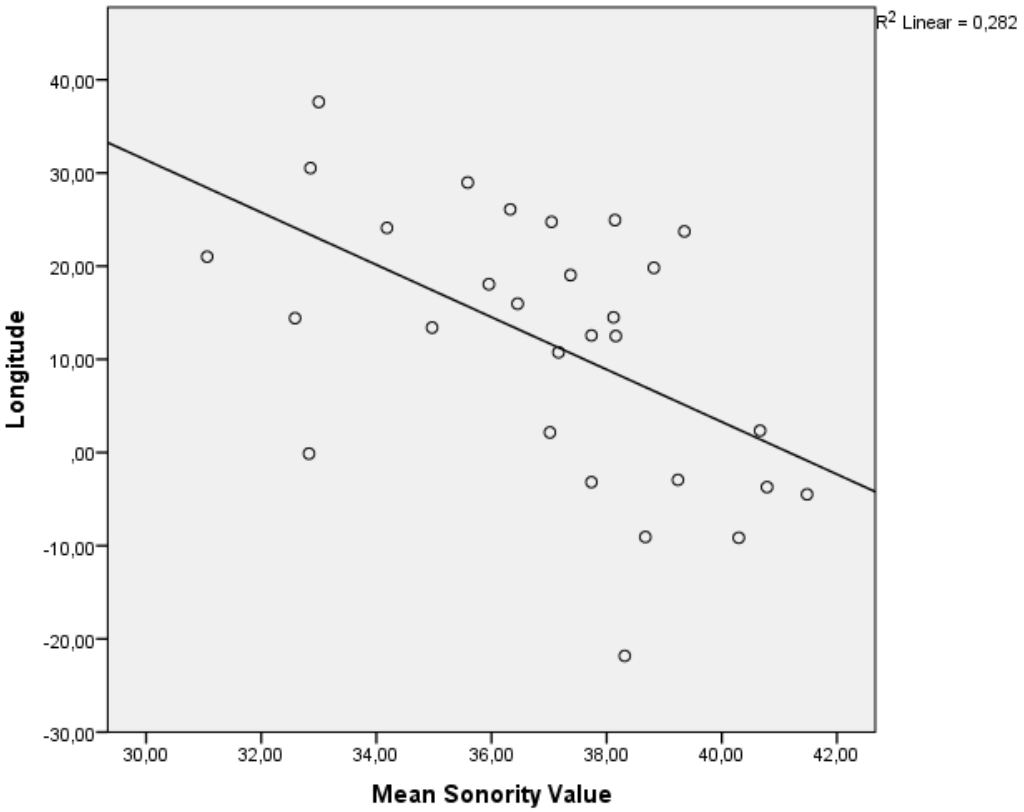

Illustration 19: Scatterplot of the correlation between the longitudinal data of the language hubs and the mean sonority value of the languages.

VI. Discussion

The purpose of this study was to determine if the sonority of a language has an influence on the perception of the language spoken. In the first part, the adapted sonority hierarchy was used so as to analyse a sample of 29 European languages and rank them from most sonorous to least sonorous according to one linguistic feature, namely their mean sonority values. Then, the languages analysed were grouped into their respective language family. Interestingly (and somewhat surprisingly), the language with the highest mean sonority value was Breton, which also enabled the Celtic language family to have the highest mean value. The Romance language family came second, with the West half of this family, i.e., Spanish, French, and Portuguese, scoring particularly high sonority values. The Germanic languages featured a divide, with the North performing relatively good, and the West Germanic languages having low mean sonority values. A similar phenomenon could be observed in the Slavic languages, seeing that their respective subgroups differed greatly in terms of sonority. The East- and West Slavic languages had especially low mean sonority values, with Polish being at the very bottom of the sample. Of the languages that were not grouped into families, Greek and Basque had uncommonly high sonority values.

In the second part, the established mean sonority values of the languages were compared to the results of the Phonaesthetic Research Group study (2021), which evaluated the aesthetic appeal of languages by letting participants listen to audio samples of “The North Wind and the Sun” performed by female speakers. These evaluations distinguish between four factors: Eros (the eroticism of a language), Beauty (and sweetness), Status (or culture) and Order (or structure). The hypothesis builds upon a pilot study by Reiterer and colleagues (2020) and assumes that the sonority of a language, as well as other linguistic parameters, influences

the perception of it (Kogan & Reiterer 2021). The results confirmed this assumption by showing that more sonorous languages were indeed perceived as being more erotic and less orderly.

In the third part, the mean sonority values were used to investigate the hypothesis of a possible link between climate and sonority. The comparability to the world climate zones that were used in Fought and colleagues (2004) is not given, since they especially focused on the tropical climate. However, Europe only features regions that are considered sub-tropical, and therefore the latitudinal and longitudinal data of language hubs were considered. This investigation was fruitful and showed that the languages spoken in Southern and Western Europe are more sonorous than those spoken in Northern and Eastern Europe.

The following sections will further discuss the effects of sonority on the aesthetics of language and the correlation between sonority and geographical location.

VI.1. Sonority - Erotic and Chaotic

We have established that the languages that are more sonorous are perceived as more erotic and less orderly (i.e., chaotic). But why is that so? A possible explanation is that the sonorous languages are in general the more vowel-heavy languages accompanied with more sonorous consonants. This peaks in strictly CVCV structured languages, which means that (almost) every consonant must be followed by a vowel. For example, Italian is considered a mostly CVCV structured language. On the other side of the spectrum, there are consonant-cluster heavy languages, such as German. The consonant clusters as well as the grave contrast that less sonorous consonants create might be perceived as more orderly and structured. However, when a vowel is followed by a sonorous consonant, there is no great

contrast to recognise. That would be a possible explanation for the negative correlation between sonority and orderliness.

With regards to the hypothesis, it can be concluded that the first hypothesis, stating that the mean sonority of a language influences the aesthetic judgement, can indeed be confirmed. The statistical data clearly suggests that this influence is given.

In this context, it has to be mentioned that the judgements of those who spoke the language were excluded in the project of the Phonaesthetic Research Group (2021). This seems reasonable since the familiarity of a language and the possible emotional connection with it may have a great impact on the rating of it. It is a scientifically recognised psychological concept that familiarity and liking show a positive correlation (Birch & Marlin 1982; Bornstein 1989; Kogan & Reiterer 2021). This effect can be summarized as follows: familiar objects are perceived as favourable because they have been proven harmless after initial exposure. Excluding the judgements of those who speak the language, which in other words means that they are highly familiar with it, helps to circumvent the familiarity effect. Interestingly, this effect was perceived strongest for the second or foreign languages that the participants learned. The L1 was sometimes even rated worse by native speakers than by those who did not know it (Kogan & Reiterer 2021). Nevertheless, this negative effect of the ratings is then also excluded by limiting the sample to the judgements of those who do not speak said language.

VI.1.1. The Eros Factor

This section focuses on the first sub-hypothesis, which investigates the correlation between sonority and the perceived eroticism of a language. The principal issue in the argumentation concerns the possible cultural influence on the judgements. Put differently: Do we perceive, say, Spanish as erotic simply because what we hear, in this case the recording of "The North Wind and the Sun" in Spanish, sounds erotic or because we associate the sound of the language with our own cultural experience, which might include stereotypes such as the Latin lover effect (Reiterer et al. 2020). This study tries to address this problem by including lesser-known languages and investigating their effect on the listeners. After all, the language with the highest mean sonority value of the present investigation is Breton and in this case, it seems reasonable to argue that there is (next to) no cultural influence as to whether it is perceived as erotic. Furthermore, the inclusion of lesser-known languages of the language families might further reduce the effect of cultural influences, since the familiarity-effect can be circumvented. Regarding the Romance language family, Romanian and Catalan were included as, so to say, lesser-known languages.

A possible explanation as to why sonority influences the eroticism of a language might be found in the speech rate and the syllable structure of sonorous languages. Dellwo and Wagner (2003) found in their study that a positive correlation between sonority and speech rate is tightly connected to vocalic share. A high vocalic share is found in languages with a predominant CVCV structure, as opposed to languages with a high share of consonant clusters. With vowels being generally more sonorous than consonants, a language with a stricter CVCV pattern is also more sonorous. To showcase the connection between syllabic

structure, sonority and eros, the data of Italian and German are compared. The syllable-structure data is reported in Rebanus (2003).

	German	**Italian**
open syllables	41% (N=220)	85% (N=229)
CV	31% (N=220)	58% (N=229)
consonant clusters	16% (N=220)	11% (N=229)
vocalic share	38% (N=220)	47% (N=229)
mean sonority value	34,97 (23rd of N=29)	38,16 (10th of N=29)
mean eros score	32,42 (29th of N=29)	59,24 (3rd of N=29)

Illustration 20: Comparison of German and Italian. The syllabic features are derived from Rebanus (2003) and the mean sonority value and the mean eros score are from the present study.

Italian is a good example of a language that is mostly CVCV syllable structured, at 58% according to Rebanus (2003). Italian also has a lower share of consonant clusters than German, which is quite (in)famous for it, and a higher vocalic share, seeing that vowels are in general more sonorous than consonants. Italian is known for having words ending in a vowel, hence the 85% of open syllables (on a side note: that is why Super Mario famously says in his stereotypical accent: “It’s-*a* me Mario” - he does not want to end a word on a consonant). Italian scored third in the mean eros ranking of the whole sample, while German came in last place.

The comparison of these two languages shows how the syllable structure, which influences the mean sonority value, might explain the perceived eroticism of a language. Additionally, the higher speech rate, which is connected to the syllabic features (Dellwo & Wagner 2003), might have an aesthetic value to it. The higher speech rate is often reported as “having a flow” (Kogan & Reiterer 2021), which might explain that the language is perceived as more erotic and also as more chaotic.

VI.1.2. Searching for a *Celtic* Lover Effect

This section will primarily discuss the results of the calculations of the mean sonority value. Surprisingly Breton scored highest regarding the mean sonority value and consequently, the mean value of the Celtic language family is the highest of the language families present in this study. In the beginning of this study, a Latin lover effect (Reiterer et al. 2020) was assumed, which would predict that the Romance languages score highest. Yet the Romance languages were placed "only" 2nd as a language family despite the fact that many Romance languages had a high mean sonority value, with Spanish (ranked 2nd), French (3rd), and Portuguese (4th).

In Reiterer and colleagues (2020), the Latin lover effect was used as an explanation for why Romance languages receive favourable treatment in foreign language learning and as an explanation for an increased appeal of the Romance languages among listeners. However, since the Celtic languages are the most sonorous group, the case for a potential Celtic lover effect must be investigated. The following chart shows the mean sonority values and the mean eros factor ratings of the Celtic and Romance languages of this sample.

	Mean Eros	*Mean Sonority*		*Mean Eros*	*Mean Sonority*
Celtic Languages	**43,42**	**39,30**	**Romance Languages**	**57,38**	**38,87**
Breton	49,72	41,48	French	71,54	40,66
Irish	44,76	38,67	Spanish	59,79	40,79
Welsh	35,77	37,74	Italian	59,24	38,16
			Catalan	52,20	37,02
			Portuguese	51,73	40,29
			Romanian	49,77	36,32

Illustration 21: This tables sums up the mean Eros and sonority values of the Caltic and Romance Languages, both individually and as a family.

The table above illustrates that even though Breton has the highest mean sonority level (41,5) it has a slightly lower mean eros value than Romanian (49,7 < 49,8). Romanian is, however, the Romance language with the lowest eros value, while Breton is the Celtic language with both the highest eros and sonority value of its family. On one hand, when looking at the mean values of the language family in total it becomes clear that although the Celtic languages have a higher mean sonority value (39,3) than the Romance languages (38,9), the mean eros value of the Romance language family (57,4) is much higher than the one of the Celtic languages (43,42).

Despite the fact that a solid correlation between sonority and the eros value of a language was established, it seems that in this case the Latin lover effect remains true. Put differently, the Romance languages are clearly associated with sounding erotic. Generally, more sonorous languages tend to score higher on the eros factor, yet it seems that other influences need to be considered to account for the exceptionally high scores of the Romance language (i.e., for the Latin lover effect). Cultural associations could play an important role here since Romance languages are often portrayed as the languages of love in popular media. The Celtic languages, however, with far fewer speakers, are less familiar and might therefore evoke no specific cultural associations.

Another possible explanation lies in the biasing variable of voice, which could distort the results of individual languages. Reiterer and colleagues (2020) found that higher voice likability ratings go hand in hand with higher ratings for Beauty, Status, Eros and Orderliness. This could mean that, for example, Breton was ranked higher in the Eros ratings due to the likeability of the voices of the recordings. However, the sonority score, since it stems from transcriptions featured in official phonologies is not influenced by the voice.

VI.1.3. The Romanisation Effect

Even though the idea of a Celtic lover effect will not be pursued further, another phenomenon could explain why Breton leads the ranking. Many participants believed after hearing the Breton speech that they heard a Romance language. After finishing the aesthetic judgements they were asked, inter alia, to guess which language they heard and if they could name a close relative of this language. Investigations of the supplementary data of the Phonaesthetic Research Group (2021) showed that both Breton and Basque were often thought to be Romance languages.

The data of the study (Phonaesthetic Research Group 2021) shows that Breton was correctly recognised by only 11% of the participants. 9% thought they heard French and an additional 46% thought they heard a Romance language. This means over half of the participants (55%) thought that Breton is a Romance language. The answers to the search of a close relative show an even clearer picture: 52% indicated French and another 14% wrote another Romance language. This means that two-thirds of the participants (66%) think that Breton is closely related to the Romance languages.

After listening to the recording of Basque, the data of the Phonaesthetic Research Group (2021) indicates that 19% recognised the language correctly. In this case, again over half of the participants (57%) thought they heard a Romance language, 9% of them thought they heard Spanish. Spanish was named as a close relative by 32% and another 30% indicated another Romance language. Therefore, as was the case with Breton, almost two thirds (62%) thought that Basque is closely related to the Romance languages.

Thinking that both Breton and Basque are (related to) Romance languages is not without reason. In the Basque Country and in Brittany almost all inhabitants speak the official

language of their nation, French and Spanish respectively. For example, in the small town of Goizueta in the Basque Country, where a vast majority (95%) speak Basque, all inhabitants also speak Spanish (Hualde et al. 2010). The same is true for Breton: Kennard (2021) states that all speakers of Breton are also fluent in French. This lack of monolingual speakers in both languages and the centuries of contact with Romance languages have led to an influence in phonology, the lexicon and morphosyntax. For example, the phonology of Basque is very similar to Castilian Spanish (Hualde et al. 2010), they both share the same five vowel system and even the realisation of the vowels is almost identical.

Even though both Breton and Basque are not part of the Romance language family, both of them were confused for a Romance language. This confusion stems from phonological similarities that arise from centuries of language contact. These similarities, and the effect they have on listeners, will be referred to as the Romanisation Effect. This poses the question: Did listeners alter their emotional reaction because they thought they heard a Romance language? Some evidence for this can be found in the relatively high ratings that they received in the sample of 29 languages: Basque was ranked the 9th most erotic language (with a mean Eros rating of 51,71), and Breton ranked as the 11th most erotic (Mean Eros rating of 49,72), whereas the other languages of the Celtic language family were on place 19 and 28. Is it possible that Breton and Basque are experiencing the Latin lover effect, due to their similarities to Romance languages? Future research will be necessary to further investigate the influences that the Romanisation effect exerts.

VI.1.4. Arguing for Chaos

Perceiving more sonorous languages as more chaotic seems to be associated with having less harsh contrasts in the speech production. Sonority, as a feature, is linked to syllable

structure, and the explanation as to why sonorous languages are perceived as less orderly might lie in the structure of the syllables. First of all, why would a language sound more structured? Structure might be given due to contrasts in the sonority values of the sounds constituting a syllable. In the following example we will look at three syllables and their structure:

1) <Stab> (german: rod) *Mean Sonority Value = 27*			2) <cat> (english) *Mean Sonority Value =34,66*			3) <balena> (Italian: whale) *Mean Sonority Value = 51*		
O	**N**	**C**	**O**	**N**	**C**	**O**	**N**	**C**
ʃt	a:	p	k	æ	t	b	a	Ø

Illustration 22: Three examples of syllables with the mean sonority value calculated for just the syllable. The syllable is then analysed in the structure Onset (O), Nucleus (N) and Coda (C). The examples are chosen from German, English and Italian. The examples were chosen in order to depict the influence of specific syllable constructions on the mean sonority value, namely a consonant cluster, a high sonority peak with a great contrast to the Onset and Nucleus and an open Syllable. The Italian example <balena> is also a prime example for a CVCV-structure.

The illustration above showcases a small sample of syllables of three languages that were used in the current study (German, English and Italian). To demonstrate how the syllables are rated sonority-wise, the mean sonority value of these syllables was calculated. The syllable structure was then divided into the onset (O), the nucleus (N) and the coda (C). Example two shows a syllable where a low vowel [æ] is framed by two voiceless plosives. This illustrates the optimal condition of a sonority peak in the nucleus. In example one a consonant cluster can be seen in the onset [ʃt] of the German word *Stab* (rod) and example three shows an open syllable (as discussed in section VI.1.1.).

Arguably, clear contrasts in sonority are perceived as being more structured which in turn render a syllable easily distinguishable and thus facilitates its comprehension and interpretation. This would go in line with the argumentation of Ohala (1992) that for the intelligibility of speech, change is more salient than stability. Additionally, the consonants are of primordial importance for carrying the meaning of an utterance. The vowels, on the

other side, carry the melody of a language. This can be showcased by disemvoweled texts (i.e., texts that were artificially rid of vowels), which still are readable with relative ease (Harris 2006; see section I.3.2.). For example, the (almost completely) disemvoweled sentence “f u cn rd ths, u knw wt dsmvlng mns” (Maxwell 2007) is readable with relative ease. This phenomenon is also found in short text messages (Boyd 2010), as displayed by “sry” (Urban Dictionary 2021). Although being showcased in written language, this argument can be expanded to speech. Therefore, having a consonant cluster might help to comprehend an utterance, yet it has a negative impact on the mean sonority value. The open syllable in example three, however, is less distinguishable, yet it has a very high mean sonority value.

It seems that there is a trade-off between sonority and orderliness that the syllable structure conveys: Having more consonant clusters (example 1) or just both the onset and the nucleus filled with obstruents (example 2) may help to convey the message on a semantic level and contrast the sonorous vowel, yet results in a syllable with a lower mean sonority value. In contrast, having more syllables linked together in a CVCV structure, as in <balena> (whale) of example three, and more open syllables will result in a more sonorous language, which might be perceived as being more chaotic.

VI.1.5. Sonority and Beauty

In contrast to the results of the study by Jacobs (2017), this study did not find a significant correlation between the mean sonority value of a language and the perceived beauty of it. However, this does in no way refute Jacobs (2017) findings since their research was focused on individual words and poetic beauty. This study, even though finding a positive trend between beauty and sonority, did not find a significant correlation. To put this into

perspective, it has to be discussed how one might define *linguistic beauty*, especially in the case of searching for a general effect. Since, as the well-known proverb goes, “beauty lies in the eye of the beholder”, every individual might have a different interpretation of what a beautiful sounding language is.

As has been stated at the beginning of this paper, aesthetic research focuses predominantly on visual stimuli (Zeki 1999; Leder et al. 2004; Leder & Nadal 2014). A major influence in this sub-field of psychological studies is the research on the beauty of human faces and their features. In these studies, the so-called “beauty in averageness” effect has been described (Halberstadt et al. 2013). This effect demonstrates that morphed faces, i.e., artificially created faces by superimposing multiple individual images, were generally rated more beautiful than individual natural faces. This effect is somewhat counterintuitive because these morphed faces are sort of bland artificial faces that lack any distinctive features and characteristics. Individual judgements, in contrast to the general mean effects, might vary to a point that certain distinctive features are preferred. This general effect of rating these smooth and bland morphed faces as more beautiful seems to be relatively stable.

This effect is not easily adapted for the means of discussing languages, since it is harder to pinpoint the distinctiveness of features of a language. Yet, the gist is that less distinctive languages with features that are used by a greater number of other languages might possibly be perceived as more beautiful in the general opinion. This can be discussed within the framework of the markedness theory (Gaeta 2017). However, distinguishing between the “normal” linguistic features versus the “irregular” form is a somewhat troublesome approach: In the markedness theory, the “irregular” form of a phoneme is called the marked phoneme. However, if we take for example /p/ and /b/ we have a pair of phonemes that can only be distinguished by their voicedness. Yet, which is the marked one of the two, is being

voiceless or voiced the regular form of the phoneme? The problem of defining which form is marked leads to a greater discussion. Blevins (1995) stated for Italian, for example, that the relatively high share of CV-syllables can be perceived as beautiful since this structure is universal in the languages of the world. According to Oller (2000), it is also the first syllabic structure that children produce. This could be an explanation for the perceived beauty of languages with a higher share of CV-syllables since it might be a less distinctive feature. For the purposes of the present study, the markedness of linguistic features and the connection with beauty need further investigation.

Additionally, the familiarity effect might also play a role in the aesthetic judgements and therefore have an influence on what is perceived as beautiful. The "beauty in averageness effect" (Halberstadt et al. 2013) can also be interpreted as follows: the morphed faces might seem more familiar or closer to familiar faces of friends and family since they lack distinctive features, therefore it might be that we just rate the seemingly familiar faces as more beautiful. To some degree, this argument can be supported for languages, since the study of the Phonaesthetic Research Group (2021) found significant correlations between beauty and familiarity as well as eros and familiarity. Therefore, it seems that the more familiar languages (and maybe even the features that are better known) are perceived as more beautiful.

VI.2. Geographical Data & Climate

This study has found a significant effect of the languages spoken mainly in Southern and Western Europe being more sonorous than those spoken in Northern and Eastern Europe. The initial research of Fought and colleagues (2004) used climate zones in their analysis, however, in the context of looking at Europe alone, the climate zones were not deemed fitting. Therefore, the longitudinal and latitudinal positions of the language hubs of each language served as a basis for comparison.

While the effect is present, the cause for the languages in the Southwest being more sonorous is not entirely clear. The first approach seems to be linked to the exchange of language neighbours and languages families, meaning that the geographical location is only of secondary importance. For example, the Romance languages all had relatively high mean sonority values, and they are spoken in vast areas of Western and Southern Europe. Basque, which is a language isolate and therefore not related to the Indo-European languages, still adapted a lot of its phonological features from the Romance language neighbours (Hualde et al. 2010; see section VI.1.3). This approach thus argues that the mean sonority value is linked to language families and the *Sprachbünde* and is also influenced by the language neighbours. Consequently, this could possibly account for the fact that the languages in Western and Southern Europe are more sonorous, and it would similarly imply that the geographical implications are interesting yet only secondary.

The *Sprachbund* Hypothesis, which summarizes the aforementioned points, was rejected by Fought and colleagues (2004). They structured their argument within a population biology framework and argued as follows: Speakers in a warm or hot climate are more often outdoors and have to communicate over greater distances than if they were indoors. To

communicate intelligibly and effectively, the languages were adapted to be more sonorous, since sonority is linked to acoustic intensity. While the arguments of Fought and colleagues (2004) are intriguing, they also seem rather far-fetched. It seems logical that every language's principal purpose is to transmit information intelligible and effectively, and languages can be used in different contexts. In addition, both extreme cold and extreme heat arguably forces humans to stay indoors (in the shade or near the hearth). Therefore, this approach seems rather unlikely, especially in a European context, given that Europe is generally characterised by a temperate climate. Also, considering the fast pace of linguistic change it seems quite a stretch to compare it to evolutionary changes since they take disproportionately longer. Anthropological causative arguments are thus arguably not particularly useful in this context.

In conclusion, the *Sprachbund* Hypothesis, which sees the exchange of language neighbours and the similarities in language families as the explanation for similar phonological features, seems more sustainable. Languages are in constant contact with each other, and the phonology of a language experiences great change. This was shown in the cases for Breton (Kennard 2021) and Basque (Hualde et al. 2010), which adapted features of their everpresent Romance neighbours (see section VI.1.3.) Therefore the *Sprachbund* Hypothesis might offer a possible explanation as to why the languages in Western and Southern Europe are more sonorous than those of the Northeast.

VI.3. Limitations

This study adopted a relatively novel approach to evaluating sonority and the perception of languages, which in turn means that there are many limitations. This research project had the aim to cover two hypotheses as well as to establish the means for an evaluation of the mean sonority values of a language. A rare example of a study performing cross-linguistic research on a large corpus of languages was performed by Coupé and colleagues (2019). Therefore, the primary focus of the present study is to open up new research paths and it is therefore moving in uncharted linguistic waters. One of the main goals of the Phonaesthetic Research Group (2021) is to break the taboo regarding aesthetic judgements of languages and to establish phonaesthetics as a field of research. Therefore, the limitations section can (hopefully) serve as an inspiration for new approaches of looking into the correlation of sonority and the aesthetic judgements of a language. In this section, three big limitations will be presented and discussed.

VI.3.1. The North Wind and the Sun

This section focuses on the question: "How much material is enough to represent a language fully?" (Baird et al. 2021: 1). Since both transcriptions in the International Phonetic Alphabet and the recordings of the study use "The North Wind and the Sun" as the basis, it must be discussed what the limitations of representing a whole language with translations of Aesop's fable are. "The North Wind and the Sun" became the standard text for showcasing a language's phonology in the *Journal of the International Phonetic Association* (The Principles of the IPA 1949/2010), and therefore, the text is frequently used in cross-cultural language comparisons. In many regards, it seems useful and practical to use a semantically parallel text the features of which, such as genre and length, remain relatively constant.

Furthermore, the versions of the *Journal of the International Phonetic Association* include a broad phonetic transcription (sometimes an additional narrow transcription) and an orthographical version of "The North Wind and the Sun", which simplifies the interpretation (Baird et al. 2021). The original reason why Aesop's fable became a standard in phonological research was the assumption that it is panphonic for English, meaning that every English phoneme is present. However, the research of Baird, Evans and Greenhill (2021) suggests that it is only near-panphonic.

Discussing how much material is enough to completely represent a language is, at least when talking to other linguists, the equivalent of opening Pandora's Box. A substantially larger corpus than "The North Wind and the Sun" would have to be used to assure a full attestation of all allophones of all phonemes. Furthermore, in order to observe all phonological contrasts, a full attestation of all minimal pairs of a language is needed. Baird and colleagues (2021) suggest that auditory material and a corresponding text corpus of at least three and a half hours are required to assure that the phonology of a language is fully and correctly represented. Since the material of this length is often unavailable, little to no cross-linguistical research uses a sample corpus of that size. It goes without saying that the recordings and transcriptions of "The North Wind and the Sun" are thus not ideal to represent the phonology of a language fully. This has to be one of the most obvious limitations of this study and therefore the results, especially the mean sonority values, must be taken with a grain of salt.

VI.3.2. Sonority Scales

As discussed in section I.4. there is a multitude of sonority scales that, although sharing the same concept, vary ever so slightly in detail and in the ranking of the phonemes. Choosing

the sonority scale of Fought and colleagues (2004) was primarily a practical decision given that their sonority scale contained scale values. However, there are many more sonority scales and it would certainly be interesting to compare the results of sonority calculations performed on the basis of different sonority scales. However, the results will in all likelihood not vary greatly since the main distinctions of the natural classes are present in almost all scales. It might still slightly alter the ranking.

In addition, future research might include sonority calculations that are not based on the transcriptions themselves but directly on the acoustic material. This would lose the benefit of having two ratings that are independent of each other since then they both are based merely on the recording itself. Since in the current study, the aesthetic judgements are based only on the voice recordings of the Phonaesthetic Research Group (2021) and the calculations of the mean sonority value are based mainly on standard transcripts. Therefore, this might make it even harder to argue for the effects of a language, since then both the aesthetic judgement and the sonority value are merely based on one recording.

To sum it up, future research might investigate different mean sonority value calculations, either by using another scale, by calculating it via acoustic material or by doing both. Every new approach to the evaluation of the sonority might contribute to establishing a more straightforward way of defining the correct mean sonority value of a language.

VI.3.3. Working with Standard Languages

One of the most pressing issues in cross-linguistic research is that in order to compare one language with another, a standard version of each language is required. The present study, for instance, compared solely standardised versions of languages. However, these "standards" are often a far cry from the real-world usage of a language. Using "The North

Wind and the Sun" already limits the language to a formal register and only illustrates a part of its phonology. Future research might investigate spontaneous speech and compare lower linguistic registers of different languages with each other.

Arguing for a standard version is especially difficult when it comes to languages that are not as centralized as national languages. For instance, in the case of Breton, this study focused on the variants spoken on the Isle de Groix (Ternes 1975) and in the Treger region (Hewitt 1978), since they were deemed of a native speaker contact as a relatively "pure" and traditional form of Breton. However, the (relatively) newly established school Breton or "Neo-Breton" is a more frenchified (or romanised) version of the language that embraces, for example, French loanwords and sounds different from traditional Breton (Kennard 2021). This illustrates the (great many) problems that using just one "standard" version of a language pose in a comparison.

The choice to use one version of a language was, in reality, an economic one since analysing a multitude of regional and social variants per language would not be feasible for a study of this scope. However, it must be acknowledged that when another variety of language is used as the basis for the research, the results might differ.

In future research projects, one could possibly alter the scope of the study and delve into the varieties of one language. A project where the different regional varieties of German, for example, are analysed might lead to new insights into questions such as: Which regional variety of German is perceived as most erotic? Are the most sonorous dialects in the South and West of the German-speaking area, and therefore support the correlation described in the present thesis? In short, investigating the sonority of regional variants of a language might offer new insights.

VII. Conclusion

This thesis argues that the sonority of a language correlates with how its aesthetics are perceived, given that languages with a higher mean sonority value were significantly rated as more erotic and chaotic (i.e., less orderly). Since sonority is linked to the syllable structure of a language, it can be argued that the syllabic structure might cause this correlation, at least to some degree. On one side, high sonority contrasts within a syllable and more consonant clusters both make a language less sonorous, however, these intelligible contrasts might render the language more orderly. On the other side, a mostly CVCV structured language, which features open syllables, generally obtains a higher mean sonority value, and the lack of contrast between a vowel and a sonorous consonant might explain the perception of no structure. This lack of structure and the higher focus on vowels, which carry the melody of a language, might influence the perception of sounding more erotic.

However, cultural associations also play a significant part in this analysis. The Romance languages are often referred to as the languages of love in popular culture, which is known as the Latin lover effect. This effect might help to explain the popularity of Romance languages for second language learners. The Latin lover effect seems to remain constant, even if the Celtic language family had a higher mean sonority value than the Romance family. For instance, Breton, the language with the highest mean sonority value of the complete sample, still was rated as less erotic than every Romance language of this sample.

Earlier studies on aesthetics, focusing on visual stimuli, attested that most people perceive familiar stimuli as more beautiful. Familiarity of a language also correlated with the perception in the feature of Beauty and Eros in this study. Therefore, it can be argued that the positive effect of familiar objects holds true for languages.

In Europe, we can find the more sonorous languages in the South and West, as opposed to the North and East. This correlation was highly significant, yet its cause is open to discussion. Earlier assumptions of hotter climate influencing language on an evolutionary level seem to be rather far-fetched in the context of modern European languages. The *Sprachbund* hypothesis, which primarily argues for the effects of neighbourhood of languages and language families, sees the geographic location as a secondary effect. As discussed in this thesis, it seems plausible that the connectedness of language families and the *Sprachbünde* are the reason why the languages in the West and South of Europe are more sonorous.

This thesis adopted a broad approach by discussing sonority as a linguistic feature and correlating it to phonaesthetic language perception as well as to the environment in which a language is spoken. Opening up new fields of research is always accompanied by great limitations, most of which go beyond the scope of the present paper. Additional studies in the field of phonaesthetics are required to gain new insights. Generally, investigating phonaesthetics might open up interdisciplinary dialogue and allow linguists to see the beauty in language.

VIII. References

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IX. Appendix

Language	Mean Sonority Value	Phones (Sum)	Mean Eros	Mean Beauty	Mean Statuts	Mean Order
Breton	41,48	397,00	49,72	56,06	51,08	56,81
Spanish	40,79	428,00	59,79	66,72	61,39	52,93
French	40,66	393,00	71,54	70,24	74,88	53,13
Portuguese	40,29	408,00	51,73	58,38	54,65	57,98
Greek	39,35	478,00	54,50	62,82	55,12	59,73
Basque	39,24	416,00	51,71	59,26	51,73	57,35
Albanian	38,82	427,00	44,74	53,38	47,72	54,65
Irish	38,67	406,00	44,76	57,87	49,46	56,54
Icelandic	38,31	443,00	43,32	54,80	54,90	61,14
Italian	38,16	455,00	59,24	67,49	62,34	54,69
Finnish	38,14	419,00	45,12	59,15	53,11	61,79
Slovene	38,12	423,00	46,36	52,88	53,16	63,71
Danish	37,74	364,00	39,06	50,17	56,12	60,48
Welsh	37,74	419,00	35,77	51,28	49,82	58,65
Hungarian	37,37	439,00	44,18	53,48	51,87	62,91
Norwegian	37,16	336,00	42,23	53,44	58,68	61,86
Estonian	37,04	426,00	45,87	56,77	53,62	60,70
Catalan	37,02	394,00	52,20	58,75	53,70	58,22
Croatian	36,45	522,00	45,01	58,90	49,87	51,47
Romanian	36,32	499,00	49,77	53,87	50,09	56,22
Swedish	35,95	439,00	52,68	61,14	59,88	62,42
Turkish	35,59	447,00	42,73	50,63	47,57	54,25
German	34,97	524,00	32,42	47,44	62,27	72,13
Latvian	34,18	332,00	47,98	56,99	52,33	59,51
Russian	33,00	472,00	40,83	53,10	54,33	59,09
Ukrainian	32,86	527,00	46,89	56,01	51,90	60,49
English	32,83	392,00	53,39	70,08	75,97	74,16
Czech	32,59	419,00	44,70	52,32	51,26	61,06
Polish	31,06	456,00	49,65	56,27	52,54	59,41

Language	Mean Sonority Value	Language Hub	Latitude	Longitude
Breton	41,48	Brest	48,39	-4,49
Spanish	40,79	Madrid	40,42	-3,71
French	40,66	Paris	48,85	2,35
Portuguese	40,29	Lisbon	38,74	-9,14
Greek	39,35	Athens	37,98	23,73
Basque	39,24	Bilbao	43,26	-2,94
Albanian	38,82	Tirana	41,33	19,82
Irish	38,67	Galway	53,27	-9,06
Icelandic	38,31	Reykjavik	64,13	-21,83
Italian	38,16	Rome	41,90	12,50
Finnish	38,14	Helsinki	60,19	24,95
Slovene	38,12	Ljubljana	46,06	14,51
Danish	37,74	Copenhagen	55,68	12,57
Welsh	37,74	Cardiff	51,48	-3,18
Hungarian	37,37	Budapest	47,50	19,04
Norwegian	37,16	Oslo	59,91	10,76
Estonian	37,04	Tallinn	59,44	24,75
Catalan	37,02	Barcelona	41,39	2,15
Croatian	36,45	Zagreb	45,82	15,97
Romanian	36,32	Bucharest	44,44	26,10
Swedish	35,95	Stockholm	59,33	18,06
Turkish	35,59	Istanbul	41,02	28,98
German	34,97	Berlin	52,52	13,40
Latvian	34,18	Riga	56,95	24,11
Russian	33,00	Moscow	55,75	37,62
Ukrainian	32,86	Kyiv	50,45	30,52
English	32,83	London	51,51	-0,12
Czech	32,59	Prague	50,07	14,42
Polish	31,06	Warsaw	52,24	21,02