Textual Glyphs for Literary Visualisation: a Poetry Analysis Digital Tool for Students.

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This paper aims to show how a digital interactive interface in which students can view poetry in various forms can be used alongside the study of poetry to improve their learning experience for those who are at an introductory level of poetry analysis in a related field of study. At this time, the ways that students interact with poetry and learn how to analyse it is still mainly restricted to the non-digital world. However, this paper illustrates that the use of a digital interactive interface alongside more traditional forms of study can improve the mental state of the user, as in that they feel less overwhelmed by poetry that they have to analyse, and that this interface can improve, to a certain extent, the understanding that they have of the text. Moreover, unlike existing digital interfaces within the field of text and poetry analysis, this interface keeps the text as centrepiece so as to not deter the user from use of the application nor let the user feel overwhelmed or be obstructed by the technology, but rather that the technology is of help to the user. Therefore, the application has also been kept as simple as possible in its design and layout and the visualisation mainly happens to the text itself via glyphic elements that will differentiate according to the features that are chosen by the user. Moreover, these glyphic in-text visualisations can themselves be changed to perhaps accommodate a different view on the text for the user.

1 Introduction

Over the years, digital technology has seen a steady rise within education. In a lot of countries, it is being used in almost every level of education to a certain extent and research universities are no exception to this trend. Those studies that are intrinsically linked to digital, such as computer science, of course, see much use of this technology, but this use is not nearly as present in other studies. Many humanities studies traditionally rely on less digitally mediated means and as such the use and usefulness of digital technology might not be as apparent to this field. Nevertheless, even studies that are more grounded in traditional means cannot escape the digital trend. The use of digital media such as Microsoft PowerPoint in the classical lecturer setting is something that already feels natural and familiar to many students and lecturers. Moreover, technology is even used within these fields to conduct research. Within language studies, many scientists use programmes to compare various texts for e.g., authorship distribution, which was significantly more difficult before the introduction of digital technology. Still, some reluctance in adopting technology to the benefit of education and research is present within these more traditionally oriented fields of study. For example, students who just started their literature studies and have only had some introductory lectures about poetry need to, in many cases, then practice analysing these poems in their traditional format. This can be quite overwhelming for students and digital technology could assuage this feeling by offering an environment in which information is more readily available and the options of interacting with the text are more clearly defined and visualised. Therefore, the digital interactive interface that this project offers will venture to resolve these problems. The paper is structured as follows: first, a section that contains a short subject background and problem definition; second, a concrete approach how the problem will be approached and what solutions will be applied; third, a section with the user evaluations of various stages of the product and examination if the solutions this product offers are effective; fourth, a summary of the findings that come from the evaluations and a reflection on the project as a whole.

2 The difficulty of analysing poetry and the lack of digital tools for students

Students of literature have to learn to analyse literary texts in their studies. For many, this is a daunting task considering the extensive possibilities of features contained in a text. This can be especially true for poetry, where the author, in many cases, has used language in such a way that almost all textual features used in the text might be indicative of a certain meaning or feeling that is conveyed by the text. This is mainly due to poetry being often of a smaller scale than for example novels and therefore the author often taking the time to carefully consider each letter, word and sentence before eventual publication. Of course, there are poetic styles that deviate from this perhaps pedantic way of writing, but because this project is more concerned with the introductory level of text or rather poetry analysis, it seems more fitting to focus on the gross of poetry where the authors do seem to have added textual elements that can be discerned with the more standard and introductory manners of poetry analysis.

It can be overwhelming when the student only has the text in front of them and a vague recollection of some theory from lectures they attended. Technology could be of help in this situation. When it comes to text analysis, there are already lots of tools in use. However, these tools seem to focus on a broader perspective, because technology in that situation is used to do or enhance actions that would be far too time consuming or big in scope for one or a group of humans to undertake. For example, the field of stylometry compares different styles of genres or writers, which can be more easily done with a programme that compares various features in one text to various features in another. Those features might also be the plosives from the aforementioned example, but in this situation, it is not used to analyse a single work or text, but to compare on a far larger scale, which of course could be incredibly useful for certain research.

However, this project is not so much interested in results to be used for research, but rather to aid or enhance the learning process of individuals; this project is focussed on education rather than on research. Nevertheless, the same manner at which those stylometric programmes look at texts can be used for this project – the difference is the output. Instead of having a large scale and abstract representation of features outside of the text itself, this project would have that the text remains visible as a centrepiece and the features spotted by the programme to be visually represented within that text. In this way, the student can engage with one feature at the time and consider if that feature has any meaning or value for a certain interpretation of the text. The application will not enforce any conclusions upon the student, but rather will help the student to more easily spot and visualise features that the student can then further engage with on their own.

The value of this project then lies in the ease and speed at which the student can learn to engage with poetry and perhaps other texts. This can create more room for the student to engage more deeply with subject matter, instead of being overwhelmed by texts and having to remember different features that might be important.

Remembering those features will rather come second by the act of exploring those features in the application, instead of first having to remember which ones there were and then exploring these.

3 Creating an easy-to-use digital tool for students that does not overwhelm

There are four different stages that make up the solution. These consist of the digitally enhanced mental model for poetry analysis, guiding poetry reading through the interface, shaping views on a text, accommodating the interpretation process of the poetry.

3.1 Digitally enhanced mental model for poetry analysis

There are some distinct differences when it comes to what humans are capable of and what computers are capable of. When it comes to text and poetry and its analysis, the computer can be regarded as good at memorisation, text attribute finding and visualisation. On the other hand, humans can potentially be better at understanding the text and reading the implicit meaning between the lines. Bradley et al. state that "often within technological disciplines the pursuit of speed and efficiency are paramount. But, with domain experts like literary critics, slow and methodical interaction with texts is part of the workflow and sense-making process. By challenging the paradigm of efficiency, we can design visualizations and interactions that are much more human and aid in our interactions with technology" [1]. This illustrates that there is a possibility here to design a tool that enhances and supports the valued human centric way of interactions within the field, opposed to focussing digital tools on that which is typically the standard with technology. In practice, this can mean a reduced short-term memory load for users by for example reducing the need to remember which characteristics are associated with which words or by splitting up the task of analysis through feature selection. Moreover, visualisations are often more prominent and easily remembered, so if the user is able to change the visualisation of the text and also again return it to its previous state, then this is an easy manner to enhance memorisation without the boundary of having to do the visualisation by hand and not being able to revert it without considerable effort.

3.2 Guiding poetry reading through the interface

This focuses on guiding the user's attention flow. When orienting, the users look at the annotations and sidebar. When it comes to expecting, the users get an understanding of what the annotations mean, so they create a mental model. When searching, the users look for specific annotations, which relates to the visual query. Finally, with filtering the users find useful annotations for later analysis (fig. 1.C).

When it comes to affect in the sense of response to stimuli in a positive or negative way, the decision was made to make an aesthetically pleasing interface that induces feelings of relaxedness into the users. Practically, this means that the filters/annotations have to be perceived as nice looking and not unnecessarily

distracting. Moreover, round shapes can be used and a calm background that does not distract the user. A dark mode can also be an option here to reduce eyestrain.

The interface should consist of simple interaction design. This means a simple structure that in one part consists of affordances and the other is for viewing only (fig 1.A). Moreover, colours will be there to guide the users' interactions (fig. 1.D). The interactions will be in a key-modal style with a menu driven or form fill in structure, which will not exceed two levels of depth. This design will be similar to common web interfaces, as to reduce the amount of learning needed by the users. This taking into account the learning process is further extended when it comes to symbols and images (fig 2.C). Other focusses consist of grouping by sequence of use and importance for the user. The mental model for the layout will be kept as simple and familiar as possible with only a sidebar for options and a main view to look at the selected poetry.

3.3 Shaping views on a text

The colours of the text visualisations (fig. 3.A, 3.B, 2.B, 2.D) are considered when it comes to their meaning. Some similarities of colours will occur and therefore the shape of these elements is also varied. Moreover, there will be a text label that indicates what the visualisations mean. The visualisations or glyphs combine multiple attributes such as meaning, category, scale, divergence, and position.

3.4 Accommodating the interpretation process

This relates to the structural consistency of the tool. Despite there being a lot of different glyphs and options to choose from, the overall layout never changes. Moreover, the user never loses sight of the original text, which is important as Jänicke, et al. confirm that "when similar close and distant views were provided, 'users stressed that it is preferable to see the actual words' rather than abstract overviews [JRS*09]" [2]. Also, the text itself is somewhat tabular in that the rows are verses, and the cells are words.

Next to this, there will be a reasonable focus on personalisation. Each option has a default, but some parameters will be able to change according to the user's wishes. This gives them more control over the glyphs. Moreover, in this manner they themselves can decide to what extent they use the tool and can make it as complex as they themselves feel like.

For usability, there will be a focus on learnability, memorability and throughput. There will be an ease to select data and have options to get more info. Moreover, the tool is error forgiving as no option is definite.

For interpretation, the user is made aware that a word has a specific attribute. These can be interpreted wrongly or can be due to uncommon language structure or stylistic choice by the author.

4 Results and Evaluation

User evaluation 1

For our first user evaluation, the focus lay at comparing different forms of visualisations of poetry and its analysis to see how overwhelming they were and to

see if they were deemed to be useful for textual analysis. The goal of this evaluation was to assess the needs of the users and their experience with existing visualisations and the prototype version developed for this project.

The results for the statements “the representation of the text made/helped me understand the text” illustrate that the project’s application could potentially be a more effective means to help students understand poetry. However, due to the shown image still being an early and not usable prototype, this conclusion should not be considered as final, but rather an indication that the already existing visual representations are lacking to some extent when it comes to understanding the poetry.

The results for the statements “this representation of the text made me feel overwhelmed” illustrate that the project’s application could be a less overwhelming means to visualise poetry and its features. At least, the results show that there is room for improvement when it comes to the way that poetry is displayed with the purpose of analysing it, because users found the shown existing ways to be overwhelming. This can in turn hamper the ability for a student to improve and learn poetry analysis skills and moreover decrease the motivation to do so, which would negatively impact the educational environment that this project tries to improve.

User evaluation 2

With this evaluation, the usability requirements were tested. These specifications included being able to open a text in under a minute, the texts being comfortable to read, the annotations/filters being clear and the visual query being easy, the annotations’/filters’ colours and symbols being easy to interpret, users being able to filter for specific annotations, the level of detail being flexible.

The results illustrated that in general the users experienced these different parameters as either average or above. However, it was clear that to optimise the experience and adhere more closely to the set specifications a lot could still be changed. These changes have to do with some of the terminology, the visual representation of certain elements and the general use of some of the features. The state of the application during the second evaluation was still perceived as relatively too unnecessarily complex. However, the users did report that the functions of the tool were well integrated already and that the tool felt overall consistent. Moreover, the users did not feel as if they needed a lot of extra knowledge to make use of the application. All in all, these results show that there is definitely a lot of room for improvement with tweaking individual elements, but that the experience as a whole is usable and not too hard to understand.

5 Conclusion and Discussion

This project started with the assumption that students at an introductory level of poetry would find poetry as a text alone daunting. The first evaluation tested this assumption on a group of students who are most likely beyond that introductory level as they were at the end of their bachelor's degree or at the beginning of their master's degree. Although these students are most likely more familiar with poetry, the results of the evaluations still show that the original textual form of poetry was overwhelming. Therefore, it can be said that logically speaking introductory students would feel a similar way, though further research could be done on this. Nevertheless, there is clearly a gap that exists that could be filled with a tool to make poetry less overwhelming. When shown the early prototype of this tool, the users indicated that they felt less overwhelmed by the text itself. Although, at first, the visual representation of the tool itself could induce this very feeling, this could well be due to the unexpectedness of the prototype itself as the users did not know what they were going to see. They report that after a while they understood more what they saw and that made the feeling of being overwhelmed fade. However, the same was not said about the original textual form and so the tool's visual representation might already serve its purpose. Some users state that this is due to the options already shown along the text and its visual effects on the text. This is in contrast with the original text, which is fully reliant on the user to be interacted with, instead this project's tool already offers options for the user to discover. All in all, these results gave confidence that the tool's design and development were on the right track to solve the initial problem.

The second evaluation focussed more on direct usability of the tool's interface. According to the previous evaluation an interface was made that focussed on being as less overwhelming as possible, because that was one of the biggest takeaways from that evaluation. The specific textual aspects as a feature to look at texts were seen as useful, but to look at the text in general it was also preferred to have the option to see the text without any visual changes. Therefore, that option was added as well. All in all, the focus of this evaluation was to improve the ease of use of the application. There should not be anything overly distracting or cumbersome as to not obstruct the purpose of analysing the poems. The topics covered were the navigation of textual filters and their customisation. There were quite some minor remarks and suggestions for changes. These were related to the clarity and understandability of certain features, used terms and visual elements. This has been taken into account as far as possible for the time that this project had to be developed.

A final evaluation to test if the final product can indeed improve the learning experience for those who are at an introductory level of poetry analysis in a related field of study has not been conducted. However, the first evaluation already suggests that the early product representation already served to alleviate some of the initially assumed problem. Moreover, the second evaluation ensured that a lot of the usability of the tool was optimised.

6 Future Work

The foundation of the project's tool has already been firmly established. However, the way that the tool is expanded upon both in features and visual representation of both the tool itself and the in-text feature options can be researched and tested to perfect the experience.

6.1 More filters

- Theme extraction using topic modelling (epic, tragic, lyric, romance, etc.).
- Syntax style figure detection using machine learning or rules (e.g.: hyperbole if exaggerating adjectives are used).
- Phonetic filter, rhyme and auditive styles figure detection.
- Use a model trained on literature, such as the new BookNLP.

6.2 Interface

- Offering multilingual support.
- Interface could be adapted for longer texts such as novels, which could require more navigation tools, separation chapters, mini annotations in scroll bar.
- An expert mode that could offer more customisation.

6. 3 As groupware

- This project has focussed on an individual perspective, but we can also look at how this tool can be useful for groups of students when working together on analysing a text. It could offer visual support to communicate perceived patterns and stylistic gut feelings.
- It could also be shaped to be used as a tool used in class by teachers.

6.4 Beyond

- Create a module or templates to make these annotations easy to implement in other interfaces (always same entity annotation style problem).
- Create a visual language framework for text annotations that could be used in a consistent manner across different products, user does not need to learn a different colour code again (such as colour palette for part of speech or persons / number).

References

1. Bradley, A. J., Collins, C., Hancock, M., Mehta, H. (2014). *Visualization, Digital Humanities, and the Problem of Instrumentalism*. IEEE VIS Workshop on Visualization for the Digital Humanities (VIS4DH). http://hdl.handle.net/10155/1313

2. Jänicke, S., Franzini, G., Cheema, M. F., & Scheuermann, G. (2017). *Visual Text Analysis in Digital Humanities.* Computer Graphics Forum, 36(6), 226–250. https://doi.org/10.1111/cgf.12873 https://catalogue.leidenuniv.nl/permalink/f/1e3kn0k/TN_cdi_gale_infotracacademiconefile_A502202284 https://onlinelibrary-wiley-com.ezproxy.leidenuniv.nl/doi/full/10.1

Appendix

Section 1) Structure of the interface

Fig. 1: Interface

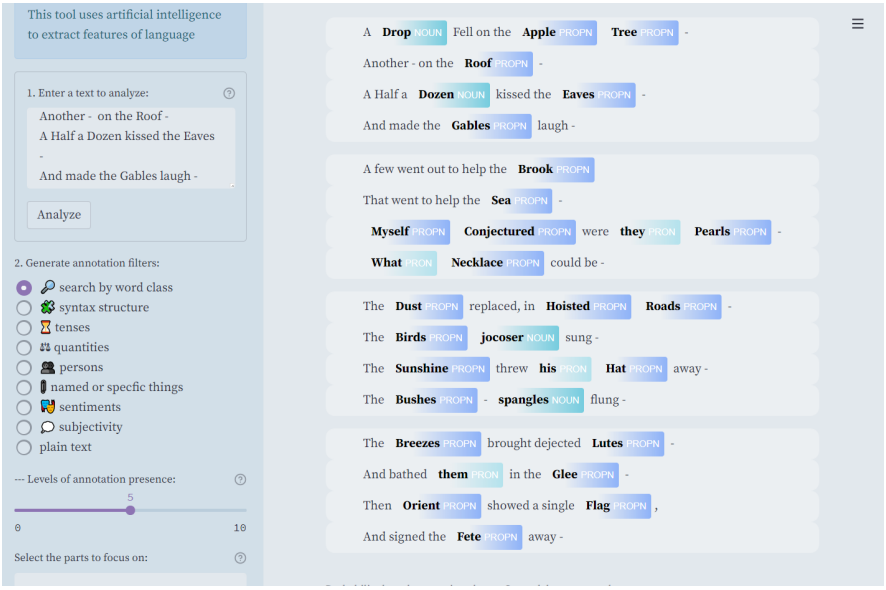


Fig. 1.A: Interface annotated with its structural composition

Fig. 1.B: Interface annotated with the poetry structure visualizer through negative space

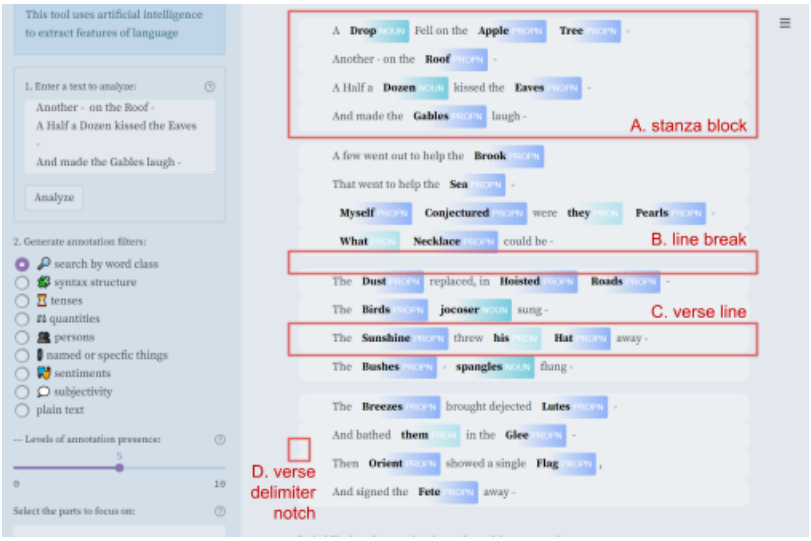


Fig. 1.C: Interface annotated with the linear interaction flow

Fig. 1.D: Interface annotated with a usage-oriented colour scheme

Section 2) Visual vocabularies of the annotation filters

Fig. 2.A: Table presenting the different filters and their annotation styles

filter name	annotation	textual coding	usage
search by word class	A DET Drop NOUN	colour, frame, boldness, label	
syntax structure	DET NOUN VERB	colour, frame, label	
tenses	tinkling bottom had	colour, direction, (reverse) italics	
quantities	milk SG cans PL	colour, number of underlines, label	

persons	his 3 SG	colour, label	
named or specific things	in Hoisted Roads - GPE	colour, frame, label	
sentiments	les laugh 0.3	colour, opacity, label, direction	
subjectivity	It wasn't fair 0.9	colour, opacity, label	

Fig. 2.B: Typology tree diagram of the visual annotation styles

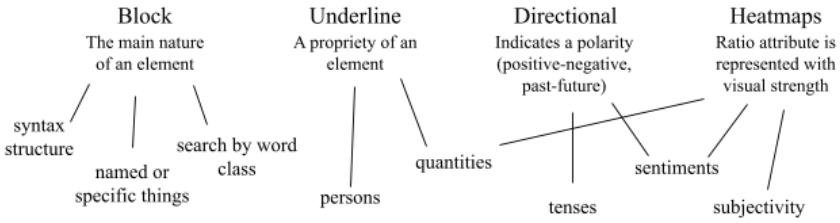


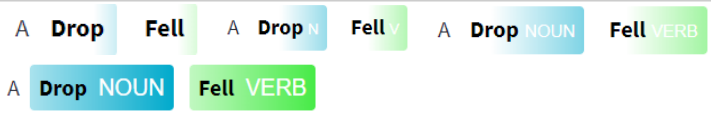
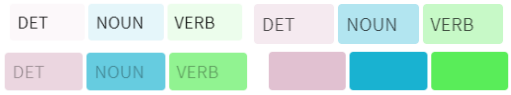
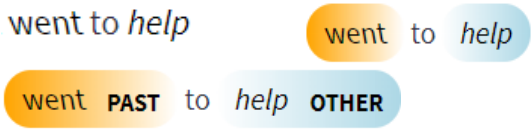
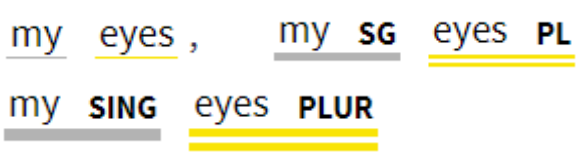
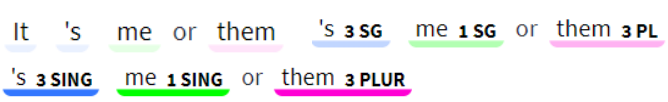
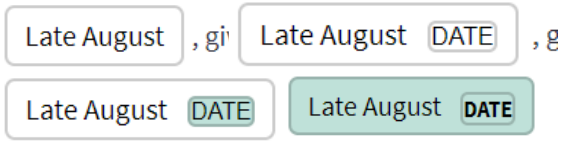
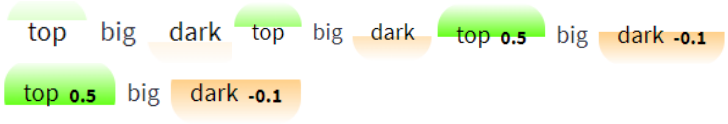
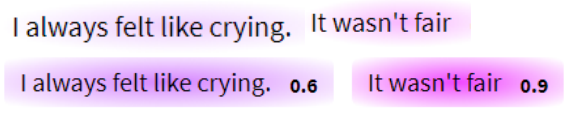
Fig. 2.C: Table presenting the menu icons of the filters and the metaphors they embody

icon	description	filter	metaphor
	magnifying glass	search by word class	This object is used for looking for something specific and focussing on it, this filter serves for the same purpose, thus this icon is a good analogy
	jigsaw puzzle piece	syntax structure	Puzzle elements form a bigger whole together, such as these part-of-speech elements that make sentences.
	hourglass	tenses	The passing of time
	balance	quantities	To measure quantities, such as the difference between one more

			multiple in this filter (would have been better unbalanced to make the difference between singular and plural)
	silhouettes	persons	Words have grammatical inflections that reflect the person they represent, in a similar way silhouettes represent people without fully being them
📎	paperclip	named or specific things	The named entity recognition technique adds labels to what they consider as informative, paper clips are used to attach extra information to a document
🎭	happy and sad masks	sentiments	Is less direct than using an emoticon face, this suits the sentiment filter as these depict indirect associations with words. They can be negative or positive, and the sad plus happy mask reflect this polarity
	thought balloon	subjectivity	The thought balloon represents what someone is thinking, it is more opinionated and personal. This represents well the subjectivity score that is given to phrases that are not written like facts or in a neutral manner.

Fig. 2.D: Table presenting the adaptive levels of annotation to make them subtle or to focus on them

filter name	minimal		maximal

search by word class	
syntax structure	
tenses	
quantities	
persons	
named or specific things	
sentiments	
subjectivity	

Section 3) Colour vocabulary for universal part-of-speech tags

Fig. 3.A: Table presenting the different tags and their colours

official label	name	example	motivation behind the colour choice
ADJ	adjective	big, old, green, incomprehensible, first	are ‘accessories’ for words, so pink (is stereotype, open to suggestions)
ADP	preposition	in, to, during	same logic as adjectives and conjunctions
ADV	adverb	very, tomorrow, down, where, there	similar to adjective but are less diversified, somewhat paler
AUX	auxiliary	is, has (done), will (do), should (do)	green like verbs but paler
CONJ	conjunction	and, or, but	redder than particles because they can change drastically the meaning of a phrase
CCONJ	coordinating conjunction	and, or, but	same as above
DET	determiner	a, an, the	light colour as they are frequent
INTJ	interjection	psst, ouch, bravo, hello	yellow because they add something to a sentence in the same manner as emojis
NOUN	noun	girl, cat, tree, air, beauty	dictionaries are often used to look up nouns, the covers of those are often blue
NUM	numeral	1, 2017, one, seventy-seven, IV, MMXIV	grey because they can be symbols or are not really words
PART	particle	’s, not,	somewhat redder than determiner as these are more meaningful
PRON	pronoun	I, you, he, she, myself, themselves, somebody	same colour as noun but more vivid (because are subjects)
PROPN	proper noun	Mary, John, London, NATO, HBO	same colour as noun but deeper (because are proper)

PUNCT	punctuation	., (,), ?	greyish orange because they are delimitations
SCONJ	subordinating conjunction	if, while, that	same as conjunction
SYM	symbol	$, %, §, ©, +, −, ×, ÷, =, :), 🐱	greyish like punctuation but more greenish because weird, not normal punctuation
VERB	verb	run, runs, running, eat, ate, eating	more vivid because it is an action
X	other	sfpksdpsxmsa	white because uncategorized, error?
SPACE	space	s	dark grey to make stand out

Fig. 3.B: Taxonomy tree diagram of part of-speech elements grouped by their use in poetry analysis