Annotator-Centered Design: Towards a Tool for Sentiment and Emotion Annotation

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Abstract: We present a first prototype of the tool *SentiAnno*, which is an annotation tool specifically designed for sentiment and emotion annotation in structured written texts. To design this tool, we employ the user-centered design (UCD) framework and adapt it by focusing on the annotator, thus phrasing our development approach *annotator-centered design*. In iterative steps, we gather requirements and feedback from annotators as soon as possible in the development process via various usability engineering methods. We propose that this design process is especially beneficial for challenging and subjective annotation tasks like sentiment and emotion annotation of literary texts. We describe our first iterations and present results of the current prototype. We show how we were able to create functionalities facilitating the annotation process by applying this annotator-centered design approach.

Keywords: Annotation, Annotation Tool, Sentiment Annotation, User-Centered Design

1   Introduction

Annotation is one of the most important tasks in various areas of *Digital Humanties* (DH) like computational linguistics (cf. [PX10]) and digital editions [BV07, Ba12]. While there are tools that can perform automatic annotations for different tasks like part-of-speech tagging, manual annotations are equally important and very common in DH research projects. When deciding upon the annotation tool to use in a project, researchers can select upon a plethora of general-purpose tools (cf. [DB04]) or tools that are rather focused on DH-specific tasks [KG12, Bö15, Yi13]. Especially in the realm of semantic annotation, tools that are designed for a specific task are not uncommon. Examples for this are coreference [Re18] or sentiment annotation [ÖK18]. However, when designing annotation tools, it is often done without a specific development framework that integrates the potential user. Furthermore, when developing annotation tools but also when performing annotation projects, one rarely finds that feedback and opinions by the annotators about the annotation process and tools are gathered. Most of the times, annotators are presented with an annotation scheme, manual or guidelines developed by one or multiple experts to perform the work. Nevertheless, the annotators rarely have influence on scheme design, tool selection or tool development. While there are studies evaluating the usability of annotation tools, they are most of the times done heuristically by an expert [Ga04, SP05, Bu12, BMB17]. Few studies perform usability tests with potential annotators and if done so it is oftentimes focused on more administrator-specific func-

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tionality [DGS04, HP15] and is mostly done for the purpose to select a tool before the start of the project. In contrast to this, we propose to integrate annotators' requirements and feedback into the tool development process in order to design more annotator-friendly annotation tools. We refer to this process as *annotator-centered design* following the concept of user-centered design. We suggest that by putting the focus on the annotator and by integrating usability engineering methods into an iterative design process, we can not only improve and design better annotation tools but also constantly correct and adjust the annotation scheme and overall process. Furthermore, we propose that this annotator-centered design process is especially fitting for the use case of challenging and subjective semantic annotations like coreference or sentiment annotation in literary texts. Annotation in these contexts has been shown to be very tedious and difficult and yields rather low agreement levels among annotators [SBD18, KK18], which is very problematic for the effective acquisition of annotated corpora. Annotator-centered design might improve upon those problems not only because usability problems with tools are addressed earlier and can be adjusted, but because the theoretical foundation and the annotation scheme are often not fully defined in advance and feedback by the annotators might improve the clarity of the scheme and annotation guidelines.

In the following, we present how we employed this annotator-centered design process for the implementation of an annotation tool for the specific task of sentiment and emotion annotation of structured literary texts. We describe the overall idea, the methods we employed so far, as well as how they influenced the design process. We present the current prototype of our tool *SentiAnno* and especially highlight some of the functionality and design solutions that were inspired by early feedback of potential annotators.

2   Approach

User-centered design describes a multistep iterative process to design more user-friendly products [Vr02]. Some of the main features of user-centered design that we want to integrate in our design approach, the annotator-centered design, are:

(1) The acquisition of requirements and feedback of potential user groups in early stages of development and throughout the process. Though annotation tools also have an administrative context, we regard potential annotators as the main user group.

(2) The iterative aspect of user-centered design: We want to evaluate our solutions as early as possible with potential annotators, adjust the tool and reevaluate it, thus creating a constant development cycle.

(3) Methods from usability engineering to gather feedback and to evaluate the tool: prototype mock-ups, questionnaires, interviews, contextual inquiries and focus groups. Finally, we want to add another feature to the user-centered design approach that is more specific to the research task in annotation projects in DH, thus renaming the process annotator-centered design.

(4) We want to use results of the iterative process like feedback and evaluation results not only on tool improvement but also for possible improvements of annotation schemes, manuals, guidelines and the overall theoretical foundation of the annotation concept.

We have employed the annotator-centered design process for the development of the annotation tool *SentiAnno*. Our goal is to acquire a corpus for sentiment and emotion analysis in dramatic texts, a research area that has gained a lot of attention in the DH in recent years [Mo11, NB13, SB18, SBW19], for evaluation and machine learning purposes. We are focused on sentiment and emotion annotation for German dramatic plays by *Gotthold Ephraim Lessing*. In the following, we will describe our first studies integrating methods of the annotator-centered design approach.

For the start of our project, we conducted a small-scale sentiment and emotion annotation study with six annotators of differing expertise (cf. [SBD18] for more information about this study). Annotators had to annotate the speeches (single utterances of a character) of plays by Lessing. For our pilot studies, we used *Microsoft Word* as annotation tool. We presented the speeches and annotators had to mark the annotation in cells of tables following each speech.

To gather first feedback by annotators, they had to complete a questionnaire about the challenges and difficulties of the annotation and reported about the time needed for the annotation. While reports about major problems with the tool were rare, we gathered a lot of feedback about problems with the annotation scheme and manual, which we had derived from similar annotation projects in the context of product and movie reviews. Based on the feedback we adjusted the annotation scheme, simplified it and allowed annotators to mark what the reference of a specific sentiment is. Furthermore, annotators reported that they were oftentimes very unsure about annotations what also hindered their annotation flow. Therefore, in our future scheme we also integrated the possibility to mark the certainty of an annotation.

We conducted another annotation study (this time with students of German literary studies) with the adjusted annotation scheme and a more precise manual (for more information about this study cf. [Sc19]). Once again, annotators had to complete a questionnaire. Furthermore, we also conducted a focus group with the annotators after the annotation process, a method well known in usability engineering, allowing us to get into more personal interaction with annotators. Results of this study showed that the annotation of certainty facilitated the process a lot since now annotators did not feel frustrated if they were unsure about an annotation but could simply mark their uncertainty. However, while agreement levels were higher than in the first study (mostly due to the more precise manual and simplified annotation) the reported difficulty with various aspects like language remained. Furthermore, critique concerning *Microsoft Word* was expressed since it does not look motivating and oftentimes annotators simply forgot to annotate speeches. It was at this point that we shifted our focus more towards tool development.

To start the development process, we first conducted two contextual inquiries with pre-

vious annotators. A contextual inquiry is also an established method in usability engineering. The idea is to observe the users during their everyday practice with a tool, in our case while performing regular annotations. We also instructed the annotator to "think aloud" to gather more information about what they are doing and why. We were able to acquire enough feedback and ideas to develop a first prototype. Before starting the real implementation, we first developed mock-ups via the mock-up-tool *Pencil*[2] and discussed these mock ups with the previous mentioned annotators of the contextual inquiry. Based on this feedback, we adjusted our mock-ups and developed our first prototype of *SentiAnno*, a tool specifically designed for structured sentiment and emotion annotation of text. We will refer to the feedback and data we gathered from annotators in section 3 to illustrate design decisions concerning the prototype.

3   Prototype

In the following section, we describe the current state of the prototype, focusing especially on features that were designed based on feedback and results employing the annotator centered-design process. Therefore, there is a lot of additional functionality we do not outline in detail like import/export-functions and other administrator-specific functions. *SentiAnno* is currently a web-based annotation tool working with TEI-annotated XML files.

One of the first design decisions we made was concerned with the annotation scheme: As seen in section 2, this scheme is still under development and constantly changing. Therefore, the administrator is capable to design various types of annotation schemes with various scales (figure 1). Furthermore, annotators informed us that they had difficulties assigning sentiment and emotion classes as nominal selections. Thus, we integrated the possibility to define sliders on which annotators can make more vague selections. Sliders are rather uncommon in regular annotation tools but have been proven helpful for our annotators in making very uncertain vague annotations. Additionally, we also implemented the possibility to make annotations via open text fields, which allows the annotator to give more precise feedback or report problems when necessary.

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[2] https://pencil.evolus.vn/ (note: all URLs mentioned in this article were last visited June 20, 2019)
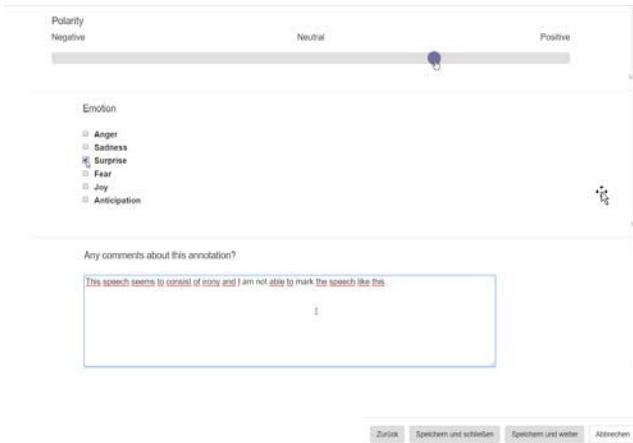
Fig. 1: Different styles for annotation schemes.

Figure 2 shows the overall view during the annotation process.

Fig. 2: Annotation view.

Annotators can click on a speech to annotate this speech. On the left side as well as on the upper screen annotators are informed about their progression. On the left side the structural units of the play are filled out with green color the further an annotator progresses. Being informed about the progression is one of the main requirements reported by annotators during our pilot studies. Speeches that are already annotated are marked in a brighter background than speeches that still must be annotated. The currently selected speech is illustrated in bold font. All these features help the annotator to know where they are and what is left to do. On the left side, annotators can also use the structural progress information to jump from unit to unit e.g. jumping to the last act or a specific

scene. On the right side, annotators can use functions to zoom into the text or filter the speeches e.g. filtering speeches that have already been annotated. Annotators recommended this feature, so they do not accidently miss out annotations. Annotators can also skip speeches for later time via this function. Summing up, annotators have now the freedom to do the annotations in the order they prefer.

When starting the annotation of a speech a new window appears where annotators can perform the annotation according to the previously defined scheme (figure 3).

Fig. 3: Selecting an annotation.

One feedback we also address is that annotators wanted to always see the speech when choosing the annotations. This was not always possible using Microsoft Word. Therefore, if annotators move the mouse away from the annotation scheme, the scheme becomes transparent displaying the speech again. Furthermore, annotators do not have to leave the annotation screen to select the next speech but can simply jump to the next speech with a button press thus the annotation flow is only interrupted if wanted and annotators can work much faster.

One of the major issues reported especially when dealing with non-experts (i.e., annotators with no background in German literary studies) were problems concerning the understanding of the language. Therefore, we implemented a function to right click on a word to receive information about the meaning of the word and possible synonyms. This function is implemented by including a thesaurus. For example, in figure 4 you see what annotators receive when right clicking on the word "Putz" (an old German word for appearance, "Aufmachung"):
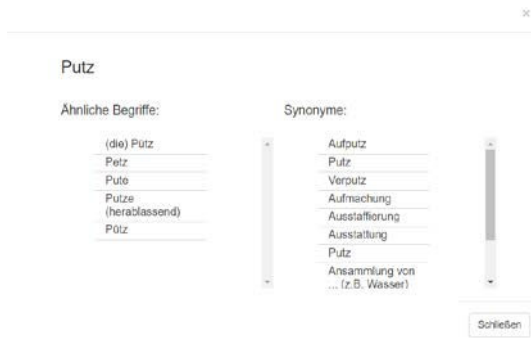
Fig. 4: Similar terms for the word "Putz".

Since *SentiAnno* is designed as a web-based tool, annotators certainly can also look for such information on the web. However, we think it is better for the annotation workflow to stay in the annotation tool. The prototype is available online.[3]

4 Future Work

We are currently planning to continue the annotator-centered design approach. We started first evaluations of our tool via usability studies comparing the performance, usability and user experience systematically to other standard annotation tools. Based on this feedback, we want to continue to improve our tool according to the requirements of annotators. We also plan more large-scale annotation studies implementing methods like diary studies to gather feedback about the annotation process and tool when used for longer phases. We were able to prove the benefit of the annotator-centered design approach concerning the tool design but also the annotation scheme and the theoretical foundations, which are still developing. Overall, these improvements will facilitate the gathering of well-annotated corpora enabling advancements in the research area of sentiment analysis in literary texts much faster. We hope that our work motivates other developers to integrate similar ideas to improve the usability and user experience of tools in DH.

Bibliography

[Ba12]   Barbera, Michele; Meschini, Federico; Morbidoni, Christian; Tomasi, Francesca: Annotating digital libraries and electronic editions in a collaborative and semantic per-

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[3] A first prototype is available online: https://mjakob93.alkaid.uberspace.de/SentiAnno/ . Enter *test* as username and *passwort* as password. Then select *Emilia* as project and the document *Emilia Galotti* to enter the annotation screen for sentiment annotation in *Emilia Galotti*. Please note that this prototype is still work-in-progress.

spective. In: Italian Research Conference on Digital Libraries. Springer, S. 45–56, 2012.

[BMB17]   Breitenfeld, Andre; Müller-Birn, Claudia: A State-of-the-Art Review of Semantic Annotation Tools. 2017.

[Bö15]   Bögel, Thomas; Gertz, Michael; Gius, Evelyn; Jacke, Janina; Meister, Jan Christoph; Petris, Marco; Strötgen, Jannik; Cordell, Ryan; Baillot, Anne: Collaborative Text Annotation Meets Machine Learning: heureCLÉA, a Digital Heuristic of Narrative. DHCommons journal, 1, 2015.

[Bu12]   Burghardt, Manuel: Usability recommendations for annotation tools. In: Proceedings of the Sixth Linguistic Annotation Workshop. Association for Computational Linguistics, S. 104–112, 2012.

[BV07]   Bradley, John; Vetch, Paul: Supporting annotation as a scholarly tool—Experiences from the online Chopin Variorum edition. Literary and Linguistic Computing, 22(2):225–241, 2007.

[DB04]   Dybkjær, Laila; Bernsen, Niels Ole: Towards General-Purpose Annotation Tools-How far are we today? In: LREC. 2004.

[DGS04]   Dipper, Stefanie; Götze, Michael; Stede, Manfred: Simple annotation tools for complex annotation tasks: an evaluation. In: Proceedings of the LREC Workshop on XML-based richly annotated corpora. S. 54–62, 2004.

[Ga04]   Garg, Saurabh; Martinovski, Bilyana; Robinson, Susan; Stephan, Jens; Tetreault, Joel; Traum, David R: Evaluation of transcription and annotation tools for a multi-modal, multi-party dialogue corpus. Bericht, UNIVERSITY OF SOUTHERN CALIFORNIA MARINA DEL REY CA INST FOR CREATIVE . . . , 2004.

[HP15]   Hoff, Karoline; Preminger, Michael: Usability testing of an annotation tool in a cultural heritage context. In: Research Conference on Metadata and Semantics Research. Springer, S. 237–248, 2015.

[KG12]   Kehoe, Andrew; Gee, Matt: eMargin: A collaborative text annotation tool. In: Proceedings 33rd Conference on International Computer Archive of Modern and Medieval English (ICAME 33). 2012.

[KK18]   Kim, Evgeny; Klinger, Roman: Who feels what and why? annotation of a literature corpus with semantic roles of emotions. In: Proceedings of the 27th International Conference on Computational Linguistics. S. 1345–1359, 2018.

[Mo11]   Mohammad, Saif: From once upon a time to happily ever after: Tracking emotions in novels and fairy tales. In: Proceedings of the 5th ACL-HLT Workshop on Language Technology for Cultural Heritage, Social Sciences, and Humanities. Association for Computational Linguistics, S. 105–114, 2011.

[NB13]   Nalisnick, Eric T; Baird, Henry S: Character-to-character sentiment analysis in Shakespeare's plays. In: Proceedings of the 51st Annual Meeting of the Association for Computational Linguistics (Volume 2: Short Papers). Jgg. 2, S. 479–483, 2013.

[ÖK18]   Öhman, Emily; Kajava, Kaisla: Sentimentator: Gamifying Fine-Grained Sentiment Annotation. In: DHN. S. 98–110, 2018.

[PX10]   Palmer, Martha; Xue, Nianwen: 10 Linguistic Annotation. The handbook of computational linguistics and natural language processing, 57, 2010.

[Re18]   Reiter, Nils: CorefAnnotator: a new annotation tool for entity references. In: Abstracts of EADH: Data in the Digital Humanities. Galway, Ireland. 2018.

[SB18]   Schmidt, Thomas; Burghardt, Manuel: An Evaluation of Lexicon-based Sentiment Analysis Techniques for the Plays of Gotthold Ephraim Lessing. In: Proceedings of the Second Joint SIGHUM Workshop on Computational Linguistics for Cultural Heritage, Social Sciences, Humanities and Literature. Association for Computational Linguistics, S. 139–149, 2018.

[SBD18] Schmidt, Thomas; Burghardt, Manuel; Dennerlein, Katrin: Sentiment Annotation of Historic German Plays: An Empirical Study on Annotation Behavior. In (Kübler, Sandra; Zinsmeister, Heike, Hrsg.): Proceedings of the Workshop for Annotation in Digital Humantities (annDH). Sofia, Bulgaria, S. 47–52, August 2018.

[SBW19] Schmidt, Thomas; Burghardt, Manuel; Wolff, Christian: Toward Multimodal Sentiment Analysis of Historic Plays: A Case Study with Text and Audio for Lessing's Emilia Galotti. In: 4th Conference of the Association of Digital Humanities in the Nordic Countries (DHN 2019). 2019.

[Sc19]   Schmidt, Thomas; Burghardt, Manuel; Dennerlein, Katrin; Wolff, Christian: Sentiment Annotation in Lessing's Plays: Towards a Language Resource for Sentiment Analysis on German Literary Texts. In: Language, Data & Knowledge 2019. 2019.

[SP05]   Sazedj, Peyman; Pinto, H Sofia: Time to evaluate: Targeting annotation tools. Proc. Of Knowledge Markup and Semantic Annotation at ISWC, 2005, 2005.

[Vr02]   Vredenburg, Karel; Mao, Ji-Ye; Smith, Paul W; Carey, Tom: A survey of user-centered design practice. In: Proceedings of the SIGCHI conference on Human factors in computing systems. ACM, S. 471–478, 2002.

[Yi13]   Yimam, Seid Muhie; Gurevych, Iryna; de Castilho, Richard Eckart; Biemann, Chris: Web-Anno: A flexible, web-based and visually supported system for distributed annotations. In: Proceedings of the 51st Annual Meeting of the Association for Computational Linguistics: System Demonstrations. S. 1–6, 2013.