To Paint in Tongues - Interactive, Artistic and Mobile Information Visualization for Social Media Texts

Creativity Enhancement by Painting with Tweets on a Smart Tablet

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Keywords: Text Visualization, Interface and Interaction Techniques for Visualization, Computer Assisted Creativity, Artistic Information Visualization, Computational Art, Social Media, Twitter, Painting with Data.

Abstract: A vast amount of thousands of Twitter messages are produced per second. As not only researchers and data professionals are interested in utilizing this data, other people could make use of specific insights. Without the skill to conduct queries with expert systems, tweets must tediously be read entirely in the traditional way. The creativity gets constrained and neglected in this tiring and cognitive demanding process. However these tweets could be a great source for conducting investigations as for example in sociocultural creative research, as writing for lyrics, scripts or even books. Writers could benefit from this huge amount of free accessible information about public opinions on recent topics. In this paper, we introduce a mobile visualization tool and its underlying visualization concept: Paint in Tongues. It can be used in different ways to visualize text-based social media content. Moreover it enables users that are unexperienced at information visualization to easily interact with the data and utilize it. Techniques that even enhance creativity, as doodling and combining different media, are utilized in an interactive visualization process to augment the data analysis for creative and visual oriented people.

1 INTRODUCTION

Getting insights in social media data sets, like online posts on Twitter, has become a very popular and common task in research activities within the last years. Though it is still far from being a simple one. This type of information is mostly text based, so that researchers ought to bring up a high cognitive workload for analysing and interpreting the plain text representation of the data set. Expert visualization tools help to simplify this analysis work that aims on finding patterns and relations within the data. Simply giving a general overview or specific insights on particular topics of interest is the core of those visualization tasks.

While experts and researchers are able to utilize these visualization tools, average people are excluded from this process. However social media content is already of pervasive nature within the daily life of people, so that insights in social media content could be utilized in almost every profession. Since the creative industry is as fast-paced as the research of

social media visualization, this seems a suitable point of contact. Thinking of creative writing, a vast amount of research is conducted for books, scripts and lyrics. Authors oftentimes start with a certain intention or topic that they will write about. To express and manifest their attitudes, broad investigations are of matter to get inspiration. This is a massive problem, because writing research often implies sociocultural research (MacArthur et al., 2008).

In this paper, we propose Paint in Tongues (PiT), a mobile interactive visualization tool for tablets. We target visually oriented users, whose jobs are in close relation to creativity and sociocultural research, like authors or even musicians. The visualization system therefore is motivated by two main purposes: (1) Creativity enhancement and (2) sociocultural research. It smoothly leads the users into creative processes and lets them overcome creative blockades by letting them doodle with text-brush. Simultaneously we enable them to explore contemporary textual media, like Twitter, to draw conclusions of sociocultural nature. In particular it

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combines visualizing a set of tweets relating to a specific topic on the one hand and creativity enhancing interaction aspects on the other hand. Users get insights in social media content in a very simple way and the cognitive effort for exploring such a data set is thereby lowered. We illustrate the usefulness and the benefit of the tool by giving an application example and utilizing a prototype of the proposed system. We also show that a high ease of use is provided and that the underlying semantic space of a limited set of tweets can be explored.

To find a start for such a creative process, it is common to use painting or rather doodling as an initialization approach to get into the creative workflow. We let users actually paint with the text data from tweets and therefore link creative techniques with semantic visualization of explicit information. This gives the users a quick and easy access to the content and relations of tweets. It finally provides insights or different views on particular topics. An overview is shown in figure 1.

Since users only have to state a certain topic that they are interested in, they do not know which words they will paint with until they actually appear on the digital canvas. Concerning this matter, the name of the concept, "Paint in Tongues", refers to a glossolalia (to speak in tongues), where people speak words of which they do not know that they will speak them until they come out. Together with the tweets information, our tool provides a template image that semantically relates to the topic of interest. The initial

thoughts of the user, the tweets content, linking techniques, semantic paintings and the template images create a tension that will result in unexpected conclusions and connections. These act as creative stimuli and broaden the view of the user.

We address different distinct scenarios where the tool can be used to carry out particular tasks:

- **Overview:** A general overview of a specific interest is needed, which would traditionally be achieved by reading several tweets on Twitter. While we provide the same content, we are however interested in interactive exploration.
- **Comprehensive Content:** Abstract impressions are provided as well as detailed insights regarding one special interest.
- **Comparison:** The tool can be used to compare different sets of tweets by conducting multiple visualization iterations with separate interests.
- **Public Opinion** and **Meaning:** In sociocultural analysis, it is important to know other peoples' opinions. The sum of these subjective opinions is represented within the set of tweets. By interactively exploring the information a generalized and recent public meaning of a certain term can be derived.
- **Context:** By only stating one topic, we give insights on its surrounding environment, for example which words are used frequently together with another specific word.
- **Unexpected Connections** and **Relations:** A major interest in exploring the tweets is to get
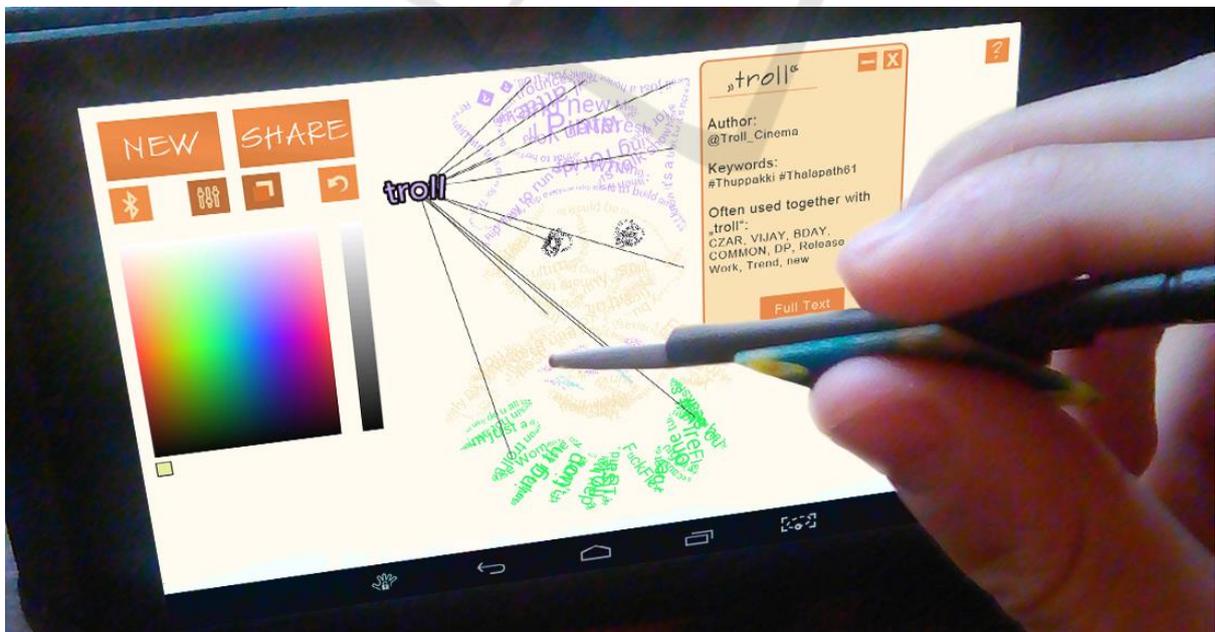

Figure 1: An overview of the interaction with the Paint in Tongues mobile application running on a smart tablet.

new perspectives on a topic. Visual connections give users a direct cue about relations of the content that the tweets refer to.

- **Combination:** To support the development of novel and personal ideas, different media from different sources are combined with individual artistic doodles. These different sources and some individual initiative ensure that users are not solely adapt others' opinions. Cognitive inertia is therefore prevented simultaneously.

- **Share:** The resulting information artworks can be shared after finishing data exploration. So even more external impressions can be gathered, for example in form of comments, messages or retweets. This feedback extends the scope of data analysis beyond the original set of tweets. It also gives the chance to record final or even intermediate results.

Besides the information visualization aspect, art creation or creativity enhancement, it is important to mention that it is not the final artistic doodle that is of major importance. Rather the process between starting to doodle and finishing an artwork is the core aspect of PiT. At this stage, we show a fundamental and novel way of creating text visualizations and how they can be used to explore data, communicate emotions and support ideation. We will however not go into further details about the last emphases in this paper and address the visualization, interactive exploration and analysis.

2 RELATED WORK

The nature of novelty that our work arises from is about combining several existing approaches rather than about fundamental research. PiT builds upon text-based visualization approaches and refers to painting techniques. It also draws conclusions from concepts that we find in fields like Information Visualization, Human-Computer Interaction. Computer Assisted Creativity and Computational Art are related fields, too.

Since the importance of social media has grown in all areas of daily life, visualization, interaction and analysis techniques that relate to this online content became of high significance, too. As scientists, we are interested in underlying structures of social media content and networks, so that plenty of visual analytics tools were proposed. Riff, Lacy and Fico (2014) propose techniques to analyse media messages. Quantitative content analysis is here conducted to address typical problems in this area, as

measurement, sampling and general technological aspects. Sticking to content analysis, the work of Chew and Eysenbach (2009) describes an expert analysis of Twitter content which targets on a specific pandemic outbreak. Kennedy et al. (2007) use Flickr content to get insights on other specific topics of interest that relate to geographical problems.

None of the works mentioned above shifts the targeted audience to users who are novices at information visualization techniques. Projects like CityBeat (Xia et al., 2014) or Selfiecity (Tifentale and Manovich, 2015) are recent examples that at least try not to exclude non-professionals from analysing social media content. Yet these systems still need experience to analyse the content and demand high cognitive effort. With our work, we avoid this effort, but yet provide insights in a specific topic of interest.

By dealing with messages of tweets and visual representations, text visualization techniques like word clouds are closely related as well. Tools like Wordle (Feinberg, 2010) are commonly used by a broad range of users today to somehow analyse and represent a set of text data. Other examples of word clouds make use of their layout to encode a semantic feature (Wu et al., 2011) (Paulovich et al., 2012). The trade-off in using word clouds is surely that the sentence structure, which is made from the word sequences, is lost in favour to the visualization layout. We incorporated such a feature in PiT in a way that gives users 100% freedom of decision about the layout, while preserving the word sequences.

In the field of creative textual work, early approaches as proposed by Davis (1985), Amabile (1985), Messaris (1994) and Sinatra (1986) state the benefit of combining visual with literal aspects within a creative writing workflow. Heye (2006) states that doodling in general is a core feature to unlock mental blocks and draw innovative ideas out of the unconscious. West (1991) goes even further and proposes doodling to start a creative process, since some people are "visual thinkers" and actually have to see anything in order to be creative. This technique can also be utilized as a visual stimulus to avoid cognitive inertia, where ideas go only in one direction, without looking at a topic in different ways (McFadzean, 2001).

Other computer applied creativity assisting tools can be found in papers of Shneiderman (2006) et al. (2002), where creativity support tools were stated as enabling and innovative for all kinds of users, like engineers, scientists and even artists. Regarding the artistic relation of our visualization tool, it is commonly accepted and approved, that visualization can surely benefit from artistic concepts. Abstract

painting styles for example can be used to portray data in several dimensions (Tufte, 2001) (Wolfe, 1994). Therefore painting styles could also visualize and express unique features in text data like tweet texts, and furthermore allow users to easily recognize these features.

To close this section, it must be said, that no published work could be found where text data was explicitly used to paint and perform analyses on these painting-like results.

3 VISUALIZATION TECHNIQUE

Regarding the visualization technique, a brief overview of the data handling, transformation and flow is given first. Then we outline the algorithmic concepts and interaction techniques that we use.

Since textual Twitter data is visualized, the general scope of our visualization is clear. We focus on message texts, authors and hashtags, which make up the simple but multivariate dataset we. The overall flow of our proposed visualization tool is divided into **three distinct tasks** (figure 2). **(1)** State the interest, **(2)** paint with the text data and **(3)** interact with the information and layout. In painting the characters and words of the tweets dynamically and continuously, it is assured that users may stop if they found something of particular interest, and continue if they are ready to get further insights. A background image is provided as a template, too. This side feature is intended to quicken and simplify the start of the process and is therefore able to overcome initial thinking barriers.
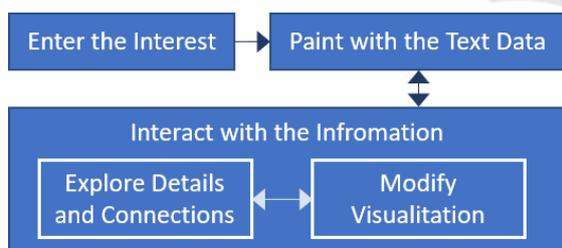

Figure 2: The workflow of Paint in Tongues.

In step **(1)** of the flow, the user enters a topic of interest. This topic is used for fetching tweets that are closely related and of high importance regarding this topic. Preferences allow more professional users to filter and adjust the search. In general, we apply a certain pre-processing that cannot be disabled. Unknown characters, URLs and unreadable sequences of special punctuation characters (e.g. "!!=[!&") are filtered out. Thereby we focus on exploring the semantic meanings of the text data.

Step **(2)** is the part where the text data is painted dynamically on the digital canvas of the smart tablet. This feature enables to choose the scope of the visual analysis. It can range from a simple dimension of a few words up to a more complex size of 14000 words.

Step **(3)** is the interaction mode. It is possible to interact directly with single words to get specific detail information about it here. In addition, these selected words can be moved within the created painting to build up abstract and individual constructs. Individually important aspects can be emphasized here. It can be switched between the interaction and the painting mode, so that the iterative interplay creates alternative views on the data set. This is valuable for deriving dynamic visual patterns of the data set and can be combined with a linked graph view. These links are used as cues for the user, to easily draw their attention to other areas where a similar word is used (figure 5).

3.1 Algorithmic Concepts

Since the set of data we are dealing with in this paper has a manageable scope there is less focus on complex algorithms. However simple algorithmic concepts are still needed to provide a clear visualization concept for the multivariate data set. The simplicity gets even more important because we are addressing beginners at data visualization. These algorithmic concepts are likewise of notable significance for the interaction techniques that are supported by our visualization tool.

Most of these concepts are carried out prior to the actual visualization, so that they are not intended to be changed during the visualization process. The most important concepts are filtering, sorting/ordering, node linking, iteration and painting with text data. The text painting algorithm is based on the work of Bohnacker et al. (2012). Furthermore we use a microcontroller setup to control the brush/font size of the visualization dynamically.

The iterative aspect is reflected in several abstract facets. Switching between the painting mode and the interaction mode, for example, iteratively extends the scope of the analysis and builds up the data interpretation.

3.2 Interaction Techniques

Our visualization application supports several basic techniques that enable users to interact with the data. Both breadth-like and depth-like procedures are supported, so that overall content-related aspects between tweets can be discovered as well as detailed

information on particular tweets. These interactions are mostly regarded as proposed by Yi et al. (2007) and Heer and Shneiderman (2012). In particular we support these techniques: stop word elimination, word selection/highlighting, exploration, encoding, reconfiguration, abstraction/elaboration, filtering, connecting, undoing/redoing and sharing.

Furthermore we add a semantic layout feature. By interactively painting the words on a digital canvas, users have a high degree of self-determination concerning the visual representation of the text data. Colour and arrangement are assigned very freely and dynamically. Thus a semantic relation between content and appearance can be expressed by the user.

4 APLLICATION EXAMPLE

In this section, we describe a step-by-step illustration of our proposed PiT tool by utilizing a prototype. We show a simple example for visualizing tweets, with a focus on interactively exploring the textual data by doodling and adjusting the visualization layout. The **three distinct steps** again are: **(1)** Enter a topic interest (figure 3), **(2)** paint with the text data on an initially blank canvas (figure 4) and **(3)** interactively explore and modify the previously painted layout of the data (figure 5). As described earlier, steps two and three can alternately be repeated.

Figure 3: Step **(1)**: Preferences are set at the initial screen.

Independent from the intention of using PiT, we start at the initial screen where a certain topic of interest has to be entered (figure 3). In this case we choose to fetch English tweets about the topic "tweety" with stop word filtering applied. After all queries are processed, we find ourselves at the blank canvas screen in the painting mode. Then we could for example trace an outline of the provided image template. In figure 4 a) we can see this step visualized with a blank canvas and the template image displayed. In 4 b), we show the drawn outline and decided to turn off the template option for the sake of clarity. If we are solely focused on creating abstract

contemporary doodles with a text brush, we could finish our visualization artwork (figure 4 c)) by utilizing the template image and brush adjustments like size and colour and then share it.

When we want to explore the data within the visualization in more detail and draw conclusions about the content and relations, we could now iteratively switch between visualizing tweets texts in the painting mode and interacting with the data in the interaction mode. In figure 5 we are further interested in the word "tweety" and select the word by tapping on it while we are in the interaction mode. The word is highlighted and links are drawn towards all other similar words that are represented on the canvas. Tapping on the word furthermore opens a window which provides detailed information about the tweet that our selected word is contained in (figure 5).
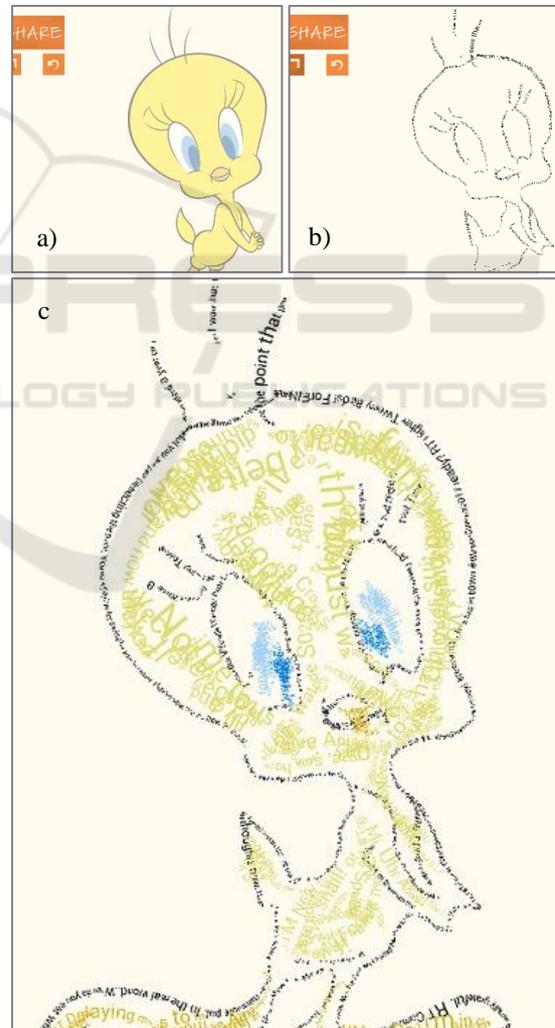

Figure 4: Step **(2)**: a) Initial blank canvas with a template image is displayed. b) First contours are drawn, template is turned off. c) An artwork-like visualization is crafted.

Besides author and keywords (hashtags) of this tweet, generalized information concerning the distinct word is displayed, which is a set of words. These words are used most frequently within other tweets that contain the word "tweety". Therefore, the message texts of the whole set of 100 tweets are used, to make a more valid statement. If this detailed information about "tweety" and its relations showed us interesting aspects or inspiration that we were looking for, we might want to be able to treat this selected word apart from others. Therefore we rearrange the visual layout by tapping, dragging and dropping the word to another position (figure 5).

After this positive result of the exploration, we switch back to the painting mode to extend the scope of our visualization in order to find more interesting aspects and conclusions. Node-link graphs for example can produce patterns that are worth further investigating. Regarding the enhancement of creativity, the interplay between the template image and the meanings of the written message texts can lead to stimulating aspects as well. Totally different or even dissonant meanings can be reflected here, so that the topic of interest can be viewed from different angles. Alternative views, opinions and ways of
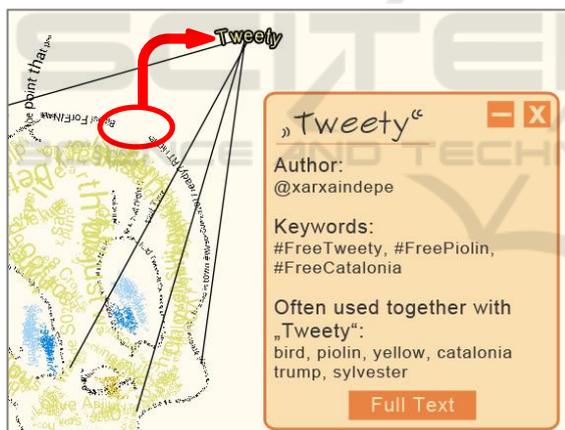

Figure 5: Step **(3)**: Details are provided on demand in the interaction mode by selecting a word on the digital canvas. Here the word "Tweety" is selected, rotated and moved from its originally painted position. The interaction was used to rearrange the layout of the words and to separate personally important words from others.

looking at the content that might not be considered before are the result of this interactive data set exploration.

By looking at the tweets visualization artwork, we can get an **overview** about the frequencies of specific words using the link function. These links and the detail information about other commonly used words

give both detailed insights and abstract impressions to what we refer as a **comprehensive content** of the set of tweets. These links and frequencies also **compare** the contents visually. We get further information about a certain **public opinion**, **context** and **meaning** of words. If we choose our topic to be "tweety" for example, we are able to see that other people use words like "bird", "yellow" and "sylvester" together with "tweety", which is very obvious (figure 5). But more **unexpected connections and relations** are also shown, so that words like "piolin", "catalonia" and "trump" were often used in tweets about tweety. The **combination** of different media, like text, images, semantic layout and graphs amplifies this broadening of thoughts and helps to avoid cognitive inertia. At the end, these elaborated information visualizations can be **shared** with other people on social media platforms to extend the scope of data analysis and get feedback from different sources.

5 USER STUDY

Since we target an audience that consists of novices at information visualization, we conducted a small and simplified user study to get qualitative feedback about the overall usability. Nine Students from creative study programmes were asked to test the tool. They were advised to perform some tasks and to fill a post-study questionnaire on aspects concerning the visualization, interaction and user experience. A combined set of questions from the QUIS (Chin, Diehl and Norman, 1988) and the USE questionnaire (Lund, 2001) were used. In free text questions and comments, the participants were asked to state qualitative negative and positive aspects concerning the application and the usefulness within their creativity workflow.

The study did not aim to be a comprehensive usability study because it was placed within the prototype development process. It could still be utilized to find crucial problems that must be solved before planning a more advanced and costly user survey, based on the results of this pilot study.

5.1 Participants and Tasks

Since all participants were students from the majors of film studies, media studies, music studies or online journalism, they had no experience in the field of Information Visualization. However all of them had experience in creative writing, like script or lyric writing. The tool was given to them for five minutes of unguided exploration without prior tutorial.

Afterwards, six tasks were carried out by the users. The first four tasks were simple and straightforward and aimed at observations on interactions with the interface. The last two tasks were more freely to inform about a certain topic of interest and using the tool until the participants would say they could get some inspiration regarding this topic. After these tasks, the questionnaire was conducted. Besides the survey-like part, it should be stated what they found particular helpful, if there occurred any errors and if they could imagine to use it within their particular field of work. Altogether about 25 minutes at maximum were used for each participant, depending on their individual set end of the last two tasks. These 25 minutes were composed of five minutes free exploration, five minutes for the first four tasks, ten minutes for the last two tasks and five minutes for answering the questionnaire.

5.2 Results

As a result, we could point out some minor flaws in our tool. Participants were irritated about choosing brush colours for the painted text and thought that they would have any meanings. The transition between the states of the tool were not understood as clearly as expected. It did not impair the usability after completing five minutes of free exploration.

Especially the comments on the conclusions about their interest were very enlightening. Eight of nine participants stated that they could come up with different and novel perspectives about their topic based on the visualization and interaction techniques that we support. It could also be pointed out that these participants would use the tool for getting started to explore and investigate on a certain topic, but not further. More comprehensive content acquisition would need the possibility to write down personal ideas and thoughts that the users come up with while doodling and interacting with the visualization.

Overall each participant described that he or she could get into a creative process easily and that basic inspiration for further work could be acquired with the help of the Paint in Tongues tool.

6 DISCUSSION AND LIMITATIONS

As we do not have to handle huge data scalability problems that are common in other areas of social media visualization, there still are other limitations and types of scalability issues to be considered carefully.

We propose our tool as a mobile application for smart tablets. This is a technical limitation, so that our testing environment was an HP Slate 7 Extreme, which is a tablet of average technical measurements. The biggest problem was the screen resolution of 800x1280 pixels on a 7" display. Since this space is sufficient for small paintings and doodles of up to about one hundred words, visual clutter (Rosenholtz et al., 2005) starts to appear if more words are used.

This problem is also very dependent on the user-driven layout of the visualization, as users paint it. Even a comparably small data set can be challenging when lain out in an inefficient way. Therefore we encourage to use a moderate amount of words and increase the brush size rather than to fill areas with many small characters. If it is taken advantage of the whole screen size, artistic visualizations could be elaborated that were still explorable with more than 150 words.

7 CONCLUSIONS

In this paper we proposed a mobile tool for visualizing textual data from tweets. It is addressed at users who are unexperienced to information visualization techniques, but interested in meanings and relations regarding a specific topic. Opinions and different views of the public Twitter community have to be revealed here. Therefore the visualization is focused on the extraction of essential content within a set of tweets. To support people in exploring this data, we combined several visualization and interaction techniques. Our approach is of particular benefit for several scenarios when creativity shall be enhanced in terms of textual context, for example where song lyrics are written.

We stated the necessary data handling and algorithmic concepts that these visualization and interaction techniques are based on. An application example was presented together with a small user study. Limitations and challenges of the visual concept and design were described briefly, as well as issues of technical nature. These gave insights into what could be done to improve the visualization tool.

After all we were able to prove that the general approach supports people to get into a creative process while simultaneously investigating on a specific topic. As intended it is especially useful for creative writing purposes. While the usefulness of our tool is constrained on initializing ideation only, now

it is the turn for improving and elaborating the concept reasoned by the results of this paper.

8 FUTURE WORK

Based on the discussion and a first pilot study, some aspects of future work were already mentioned indirectly. In following work, we will focus on a more advanced user study to evaluate the visualization tool. Since this paper targeted on the visualization aspect and the prototype application of the PiT concept, experiments with a focus on the actual creativity enhancing process will be conducted. Further issues in future development will therefore enable users to take personal notes while interacting with the data. This provides additional help especially for creative writing, but will also help to extend the visualization and the interaction by a "Record" technique, as proposed by Heer and Shneiderman (2012).
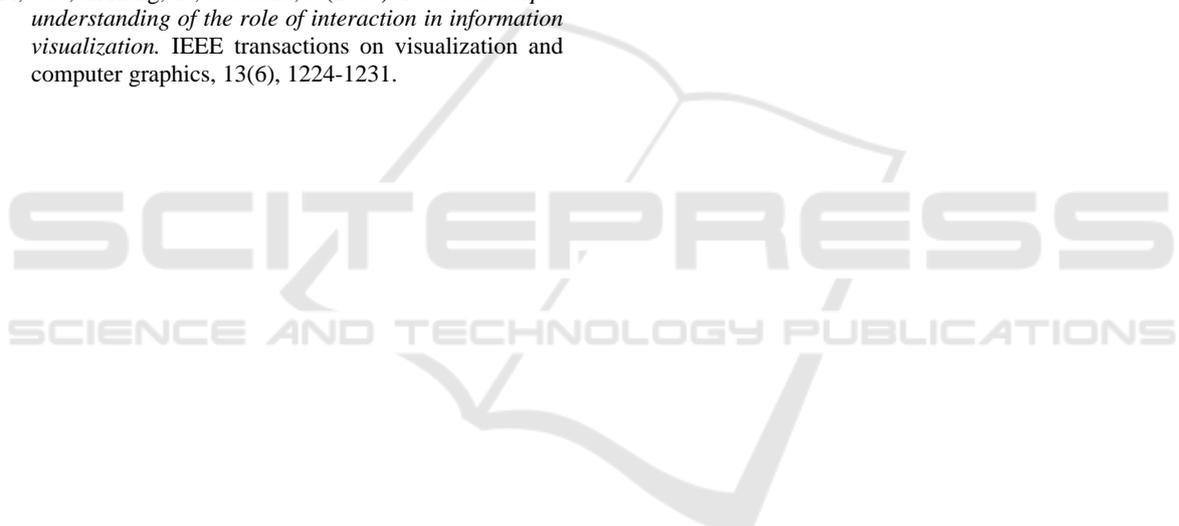
While we only address Twitter as the underlying data set of our work visualization tool, the concept can easily be transferred to other social media platforms that work with text/messages and tags like hashtags in Twitter. As a next step, we will assign the PiT concept to more objective media as articles of online news. Big news companies like The New York Times or The Guardian already provide APIs to get access to exactly this kind of data: content, authors, tags and furthermore headlines.

To improve and extend the actual visualization concept of PiT, we plan to make use of colour coding and size of the words, more commonly in word clouds, to encode information. This coincidently solves some issues that were found within the pilot study as a nice side effect. Techniques like brushing and linking seem to be promising and will be used in a multiple view approach. This will emphasize the information visualization aspect of our application even more.

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