Ideagrams: A digital tool for observing ideation processes

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Structured Abstract

Purpose – The paper reports on an ongoing research project of TU Dresden Laboratory of Knowledge Architecture aiming the investigations of the traceability and visualization of upcoming ideas and topics within discussions.

Communication and conversation analysis – to explore knowledge processes communication and interaction analyses emerged as a central scientific approach. Hereby knowledge creation and Knowledge Transfer are understood as collective and co-creative effort. Corresponding analysis tools and methods have been developed for the communication- and knowledge creation processes digital media extensively (Faraj et al 2011). However, research focusing on direct and immediate conversation, and not only based on digital media, rarely exists.

Development requirements – The existing tools for the analysis of digital communication data are yet not widely applied in the domain of spoken discussions. Whereas communication processes in the digital domain create their data automatically, the data from natural settings have to be extracted laboriously (Tonfoni 2004). Since there are no effective methods on data recording of voice communication yet existing, there are no strong and evident methods on computer aided conversation tracking and analysing existing too. The Ideagram tool tries to overcome this shortcoming.

Approach – A prototype of a transcription, visualization and analysis tool was designed, which is able to capture discussions by keywords and analyse them in real-time. The results are presented in several forms: histograms, semantic networks and mixtures between both. These visualizations allow identifying topic and concept dynamics, heuristic paths and creative moments. Central features of the discussion like knowledge communication, orientation for innovation and speech efficiency can be understood and designed. In the different figures - Ideagram - of spoken discussions the logged content is visualised. The program prototype counts the occurrence of the logged words. These can be marked within a chronological re-presentation graph and shows at what time which issue was discussed. By “peaks” and “valley’s” it is

obviously visible where the talk was most or least active. The prototype tool allows analysing the used phrases according to their frequency and their appearance during the captured conversation.

Practical implications & Value – In contrast of conventional protocol and transcription techniques this kind of knowledge mining allows a greater information bandwidth and a more efficient access on core topics, thematic conflicts, idea generation etc. Experiences in very different settings created a very rich data set and allows to state that the application in business and science seems to very useful according to recording, analysing and deepening of spoken discussions. Hence, the Ideagram is still a prototype version and need further investigation and development.

Keywords – Visualisation, Ideation, Creativity, Innovation, Interdisciplinary Groups, Tool, Method, Knowledge Transfer and Management

Paper type – Academic Research Paper

1 Pursuit of Ideas within dialogues - Motivation & Problem description

The interests in IDEAS are as old as human mankind. About 2350 years ago Plato argued that there is a realm of ideas or forms (eidei), which exist independently of anyone who maybe has thoughts, and it is the ideas which distinguish plain and ordinary opinion from knowledge, ideas are unchanging and nothing but just what they are, contrasting material things which are temporary and liable to contrary properties (see dialogues as the Phadeo, Symposium, Republic, and Timaeus) (Radke 2002). Nowadays, knowledge and creativity are described as the engine of welfare in our modern knowledge society (Drucker 2001). Both are based on innovative ideas driving as well the academic as the economic world. Ideas are drawn as an important attributes towards firms and projects potential of innovation, their competitiveness, and their progress in science and business (Taggar 2002; Miron et al. 2004).

This paper reports on an ongoing research project of TU Dresden Laboratory of Knowledge Architecture aiming the investigations of the traceability and visualization of upcoming ideas and topics within spoken discussions. Recordings of talks and discussion as visual recordings or other visualisation techniques are mostly done with pencil and paper. Hence they are hard to analyse digitally or only with an enormous amount of (digital) re-work. To explore knowledge processes communication and interaction analyses emerged as a central scientific approach. Hereby Knowledge Creation and Knowledge Transfer are understood as collective and co-creative effort. Corresponding analysis tools and methods have been developed for the

communication- and knowledge creation processes within digital media extensively (Faraj et al 2011). However, research focusing on direct and immediate conversation, and not only based on digital media, rarely exists yet.

A meaningful digital or technological pursuit of dialogues is difficult, and the development trends and quality of vivid discussions are hard to capture. For comprehensive recordings of dialogues conventional recording methods as written notes or audio recordings reach their limits. They are too static and do not cover the complex dynamics of a course of conversation (Selting 2009). An appropriate amount and the shape of the captured data which are either incomplete and thus less meaningful or too broad and complex are also challenging. Moreover the difficulties increase if discussions ought to be recorded in real-time, for instance to pursue the state of the discussion and its development in order to react on this possibly during the talk.

2 Overview on current theoretical background & technical developments

This section describes the underlying linguistic concept of catchwords and the state of the art in capturing discussions.

2.1 Catchwords as markers of idea generation

Several keywords which are captured by the Ideagram-Tool, mentioned as catchwords (Kaempfert 1990: 196), are regarded as markers of the process of idea generation. Catchwords are well researched in the field of public communication in politics. Varying terms and different characteristics in research prevent a general definition of a catchword so far (Niehr 2007: 497, Girnth 2015: 63). An overview of important characteristics of catchwords will be presented in the following as well as their special role in the process of idea generation. On the formal level catchwords involve abbreviations right up to word groups (Niehr 2007: 498). Forming a lexical unit, especially nouns but also adjectives, verbs and names are often used as catchwords (Felbick 2003: 17).

The generation of a catchword during the process of communication can be explained with reference to its semantic characteristics. A lexical unit which already carries a general meaning is mainly associated with a specific sense by a specific person, group or party. This case is labelled by Liedtke (1996: 5) as “process of semantic charge”. The function is not only to facilitate complex suggestions and ideas (Felbick 2003: 19f.) but also to represent the complex reality in a “condensed way” (Girnth 2015: 61f.) allowing for an interactive construction of reality.

The following example illustrates this process: The term “digitalization” refers to the process of digitizing data (also named “digitization”). As a catchword in public discussion it describes the expanding use of computers and other digital media in society. This complex process comprises diverse steps of the development in different areas of society, e.g. in work or private life. This process of reduction in complexity leads to the central property that catchwords are marked by an indefinite semantic field, i.e. different interpretations regarding a catchword are possible (Felbick 2003: 20).

Furthermore, party platforms, ideas or other issues as references of a catchword are connected with individual valuations and objectives (ibid.). Based on these factors there is a potential of conflicts regarding a catchword (ibid.: 21). Referring to the previous example, some people emphasize many possibilities in the use of digital media, e.g. the processing of a huge amount of data to get new insights, whereas other people expound the problems of the “digitalization”, e.g. by questioning the data protection. In reference to Kaempfert (1990: 199f.), beside semantic characteristics which were illustrated before, also pragmatic features in context of the theory of indirect speech acts (cf. Liedtke 1996: 3 and 5f.) have to be consulted for an adequate term description. In general, the discourse forms the framework for the discussion of different meanings or interpretations of a catchword (Felbick 2003: 21). Thus, catchwords are only identifiable within the frame of discourses.

Against this backdrop, the significantly increased usage of a phrase over a short period of time is considered to be another important property of a catchword (Kaempfert 1990: 201). By applying a time-series analysis, the Ideagram-Tool visualizes those increasing numbers of words over time. One should take into account that there is not a specific frequency threshold (ibid.). Function words, carrying mainly grammatical information, can be identified by the highest frequency rates. Regarding catchwords, not the absolute value but the increase in frequency is an important indicator (Felbick 2003: 18). The research focusses predominantly on political and public discourses. Following Felbick (2003: 33), catchwords can be formed even in the smallest discourses, e.g. a conversation between family members or a discussion among students. In addition to the condensation of complex suggestions and ideas, there is another important role of catchwords which is called “appellative function”, i.e. to persuade the interlocutors of the individual attitude or to spur the audience into action (ibid.: 23). In the context of politics, a discussion is metaphorically seen as a fight in which words are used as weapons (Klein 1989: 11).

There are different types or strategies of this semantic fight which can also be assigned to the process of idea generation. On the one hand, there is a dispute in designating. For instance if different ideas are condensed in competitive terms (Klein 1989: 18, Klein 1991: 51–57, Felbick 2003: 38). On the other hand, the "fight" is characterized by a competition based on the meaning of a catchword. In discourse different semantic characteristics or emotional values could be removed from or added to a catchword, to form, confirm or reject an idea or (political) point of view (Klein 1989: 21–23, Klein 1991: 57–65, Felbick 2003: 38). These modifications are possible by changing components of the phrase or words closely related to it, e.g. emotional adjectives referring to a noun, to carry another meaning in a process of semantic shift (Felbick 2003: 39). For instance, a neutral term like "the American State" could be changed in its meaning by replacing one component of the phrase by another one to "the American Empire" leading to completely different associations. As another example, positive or negative connoted adjectives could be assigned to a catchword, like "promising digitalization" versus "unstoppable digitalization" to change the emotional value. To sum up, catchwords are frequently used in discourses to condense complex ideas and to "promote" them. During discussions catchwords could be semantically modified or replaced by other terms to form an idea or reject and replace it by a competitive idea. Based on keywords as feature-set the Ideagram-Tool provides access to the process of idea generation by capturing the frequency of these words during an observed discussion within the framework of a time- series analysis. One has to take into account that not every frequent word is considered to be a catchword. As already mentioned, a significant increase in frequency is an appropriate indicator for catchwords. Furthermore, there are some boundaries in capturing ideas based on catchwords because even discussions about suggestions and ideas without referring to catchwords are possible (Kaempfert 1990: 202). 2.2 State of the art in technical discussion capture and analysis

Communication and discussions are central activities in knowledge based organisations. Therefore many disciplines are working on new methods and tools in order to understand and improve human communication. Computer-mediated Discourse Analysis (CMDA) was defined by Herring (2004) and focusses on all kinds of computer-mediated communication. It uses the advantages of the digital existence of communication data. Because the communication itself and metadata like author and time are usually available, there are many possibilities to analyse the underlying behaviour. In electronic mail or newsgroups it is digitally encoded vie sender-receiver information who said what to whom, which are crucial points in communication analysis. In synchronous text-based communication like chat, the linkages between messages are not stated explicitly and up to now have to be identified manually by coding. If this is done, several analysis procedures are possible in order to detect communication and discourse patterns as well as social communication networks (Holmer 2007).

The research area of Computer-supported Cooperative Work (CSCW) is an interdisciplinary approach of social and technical disciplines in order to design, create and evaluate solutions for supporting human cooperative activities. From the beginning electronic meeting support was one of its main research activities since face-to-face meetings are an everyday activity in organisations (Nunamaker et al. 1991). Most of the early approaches have focussed on written information in meetings like notes and whiteboards and on facilitating discussions by moderated agendas. The verbal communication could be captured by an audio recorder as reference material but the sound stream alone does not help in order to analyse the discussion.

Better approaches are tools which capture the video and audio signals for each participant in order to separate the speakers and make it possible to analyse their contributions separately. Lee et al. (2002) developed the Portable Meeting Recorder, which records a video of the whole group and identifies each speaker by face and audio position. The next generation of Smart Meeting Systems (Yu & Nakamura 2010) were designed to capture the whole meeting including audio and video streams as well as other sensor data like face orientation and body motion (Yu et al. 2010) in order to add more semantics to the data like user intention and attitude towards a topic (Yu et al. 2013). One of the biggest challanges is the capturing and analysis of speech. Automated Speech Recognition (ASR) is a topic were commercial applications like Dragon NaturallySpeaking are available for single user scenarios. But the integration of multiple user streams into a single discussion record and a summary is still a challenging research problem (Renals et al. 2007, O'Connell & Kowal 2009). Most recent approaches tackle the problem of meeting summarization by using keyword extraction and are quite successful for English speakers (Bokaetf 2015).

Nevertheless all of the reported solutions are still research prototypes, require a lot of information technology (like capturing devices for audio, video and other sensor data), prepared rooms and are only tested in English speaking environments so far.

3 IDEAGRAM - Tool & Methodology

Development requirements: The existing tools for the analysis of digital communication data are not extensively applied in the domain of spoken discussions so far. Whereas communication processes in digital domains create their data automatically, the data from usual spoken settings have to be extracted laboriously (Tonfoni 2004). Since there are less methods effective on data recording of voice communication yet existing, there are no strong and evident methods on computer aided conversation tracking and analysing too.

The Ideagram tool tries to overcome this shortcoming. A prototype of a transcription, visualization and analysis tool was designed and developed, which is able to capture discussions by keywords and allows to analyse them in real-time. The results can be represented in several forms: as histograms, semantic networks and mixtures of both. These visualizations permit identifying topics and concept dynamics, heuristic paths and creative moments. Central features of the discussion like knowledge communication, orientation for innovation and speech efficiency can be drawn and analysed, and therefore being understood.

The Ideagram tool was developed in order to capture talks and discussions easily and in real-time. There is no extra technology necessary. Only the software porotype browses via an internet connection is needed. Thus you can use it from everywhere very flexible.

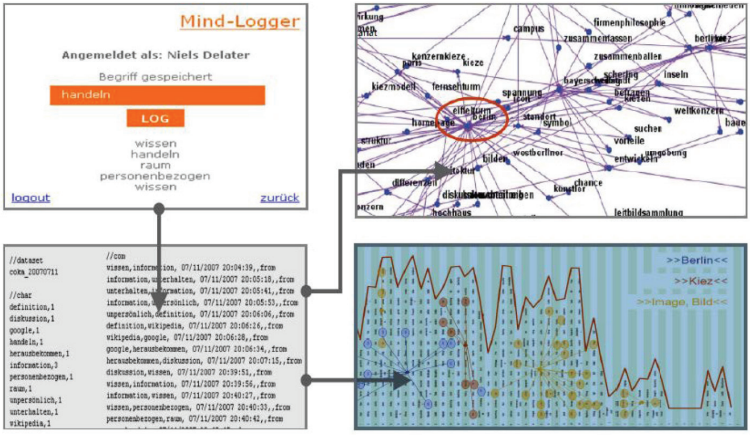

Figure 1: Transcription Tool „MindLogger“ (top left), discussion lag (left down), Network analysis (top right), and chronological Idegram (right down)

To record the spoken discussion a tool named mind-logger is used in a first step. To do the logging a new file has to be created and opened before the discussion is going to start. During the discussion the spoken words are typed into the log. So far the logging is done by one person. By this human coder no complicate voice recognition programmes are needed. The logger has to note the up-coming words, topics and contents in the same manner during one log – one discussion. Hence, the coder has to decide on each word being typed in the same way, e.g. knowledge for knowing,

known, know, learnings, etc. or another example: experience, expertise, know-how, learn, experienced, found out, practised, come to know, and so on. This is necessary because the software is not ably to join or sum up different semantic groups as nouns, verbs, adjectives etc., yet.

Each logged word get a timestamp be pressing enter automatically. So it is possible to visualise them later in a chronological order and with the exact time gap in-between the single logged words (see figure 2). After the talk is finished the discussion-log needs to be closed, and saved on the computer as text file. In order to visualise and being shown it to the discussion audience directly the created log-file has to be re-opened in a second web-based tool of the Ideagram software prototype.

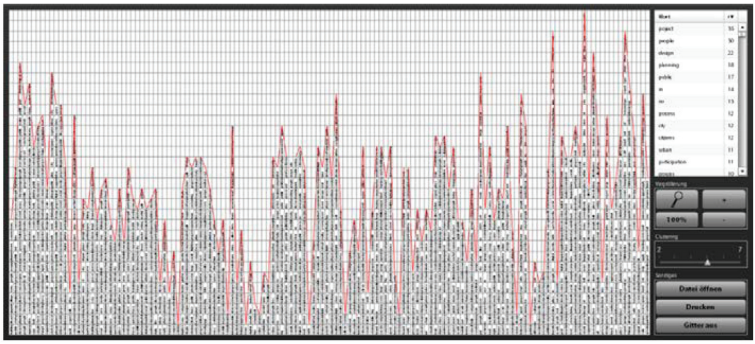

Figure 2: Ideagram of a discussion

Figure 3: Zoom in to Ideagram of a discussion

Within this tool each word being logged within one minute is visualised within one column. The first typed word on the bottom of the column, the last word of each minute on the top. Thus it makes very visible at what times of the discussion most or fewest words were spoken and logged. It shows “peaks” and “valleys” and makes it obviously visible where discussion was slow down or where it speeded-up, where people talked most or less active. The software prototype allows analysing the used phrases according to their frequency and their appearance during the captured conversation. The program counts how often each word appears and represent this analysis within an extra list at the left upper corner (see figure 3).

If one clicks at any of those listed words it get marked with colour simultaneously in the and in Idegram re-presentation. As an example you can see figure 4. Here the word design was selected and get marked in blue colour in the list as well as in the Ideagram. Thus it makes it obvious where the topic and theme design piped-up during the discussion.

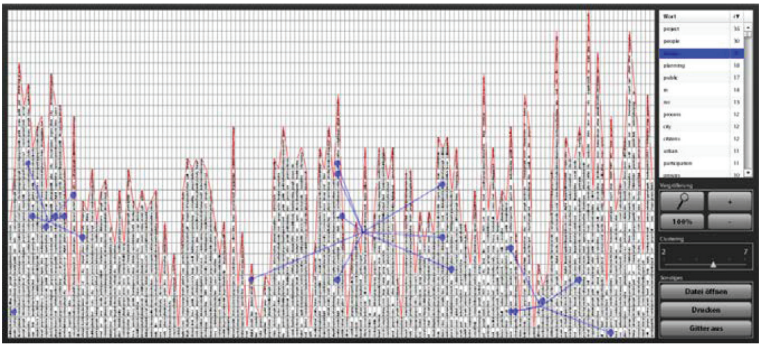

Figure 4: Ideagram of a discussion – word re-presentation

Hence we figured out, that the human coder is very efficient filter relating to the quality of the logs and the visualised Ideagrams out of it. Though, at the same time it is challenging to find adequate people who can code very fast and capture the main issues of a talk without being an expert content wise. In contrast of conventional protocol and transcription techniques this kind of knowledge mining allows a greater information bandwidth and a more efficient access on core topics, thematic conflicts, idea generation etc.

4 Sample Case: U_CODE Project Kick off

So fare we used the Ideagram tool in very different settings: (thematic) podiums & plenary discussions, student talks, brainstorming's, … , or internal Idea Talks at our Knowledge Architecture Lab in Dresden.

To make it more comprehensible we chose the Kick-Of meeting of our Horizon 2020 EU funded project U_CODE from March 2016 to present as a Sample Case for this paper. One hand side all authors were member of this meeting and on the other hand we logged four different types of settings. At this project kick-of 25 people took part and it lasted three days during we recorded four differing discussions: 1) partners self-introduction institution and person wise, 2) work package presentation, 3) free idea, topic and project needs discussion, and 4) final wrap-up and next step discussion.

4.1 IDEAGRAM Partner self-introduction

The aim of the first session was to introduce all partners and to get to know each other institution- and person wise. In figure 5 the whole presentation is visible. There were round about 15 different presentations being held. In this Idegram the valleys are identifiable as the turn taking of the different presenters. Not by surprise the word project was counted most often: 35 times and marked in green colour. Other examples are the word process (12 times, marked in blue), citizen (12 times, marked in light-blue), or participation (11 times, marked in pink).

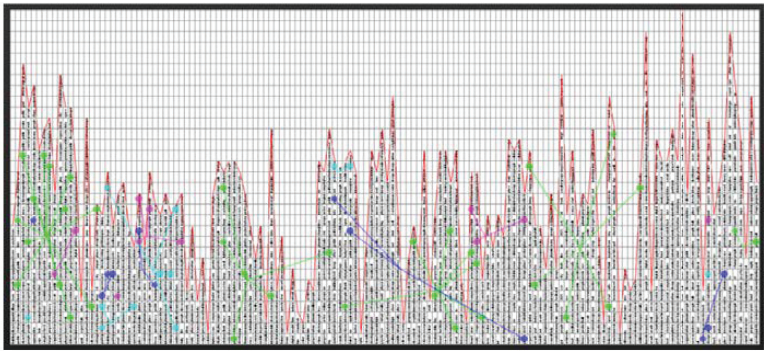

Figure 5: Ideagram of U_CODE partner self-introduction

Due to the frame setting of the talk there was no real surprise by nature. But the popping up of the same words throughout different presentations can be interpreted as a common project understanding and common interests in a first line. As the main threads: "public", "design", "change", "planning", "citizens", "participation", "media" "platform " were identified.

Figure 5a: word list zoom-in

4.2 IDEAGRAM Work Package presentation

The aim of the second discussion was to present the several work packages in contend and methodology detailed to all participants. In figure 6 we marked the basic words as the following ones use (24 times, marked in green), business (22 times, marked in blue),testbed (21 times, marked in yellow), and product (14 times, marked in light-blue) as remarkable for the U_CODE project. Though no surprises appeared the U_CODE aims and structure is visually well readable and re-presented.

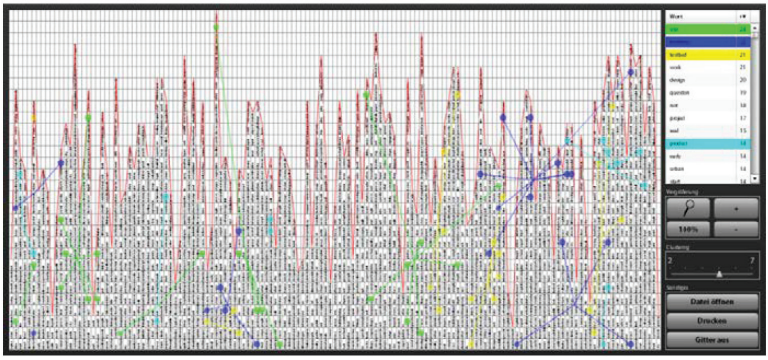

Figure 6: Ideagram of U_CODE work packages presentation

Figure 6a: word list zoom-in

Due to the frame setting of this talk the main threads: “testbed“, “design“, “planning”, “shit-storm“, “public“, “participation“ were identified.

4.3 IDEAGRAM Free idea, topic and project needs discussion

During this discussion a totally different type of an Ideagram was gained. As this talk was not pre-prepared and it was just implemented according to the needs of the Kick-off participants a very different graph evolved. A first reveal is that there are fewer words spoken within one minute but the talk is very smooth and there are only few valleys visible. Besides unsurprising words as public (8 times, marked in green), architect (5 times, marked in blue), citizen (4 times, marked in pink) or participation (4 times, marked in light blue) figure 7 also shows words as involve (5 times, marked in grey) or pain (4 times, marked in yellow) emerged during this vivid discussion.

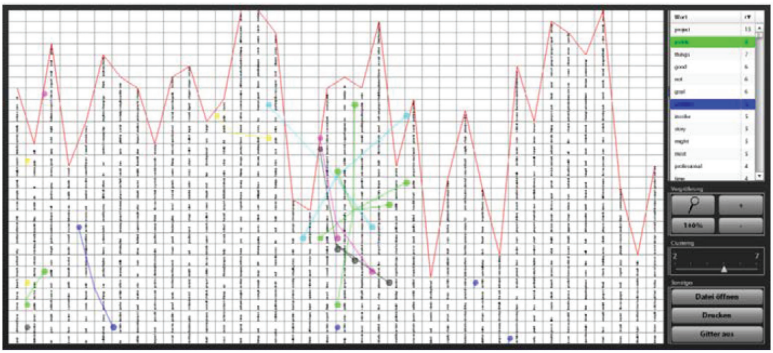

Figure 7: Ideagram of U_CODE aim discussion

During this rather short discussion of round about 40 minutes the following main threads appeared: “public”, “architect”, “involve”, “citizen”, “participation”, “crowd”, “design”, “pain”.

4.4 IDEAGRAM Final wrap-up and next step discussion

At the last day of the Kick-off the final wrap up and next steps discussion was recorded and logged with the Ideagram tool. This final discussion aimed gaining a common language and project understanding and can be described as a sum up in an initial version. Figure XX shows that newly emerged issues and topics during the Kick-off days were agreed upon among all U_CODE partners and appeared in this Ideagram graph finally. In figure 8 words as need (11 times, marked in green), testbed (9 times, marked in blue), or market (8 times, marked in pink) resulted in accordance to the U_CODE product going to be developed during the EU project. More over interesting and unforeseeable words as scrum (8 times, marked in yellow), agile (7 times, marked in light blue), and backlog (5 times, marked in grey) emerged in accordance to how the project participant lined out their way collaboration and working together on the project goals.

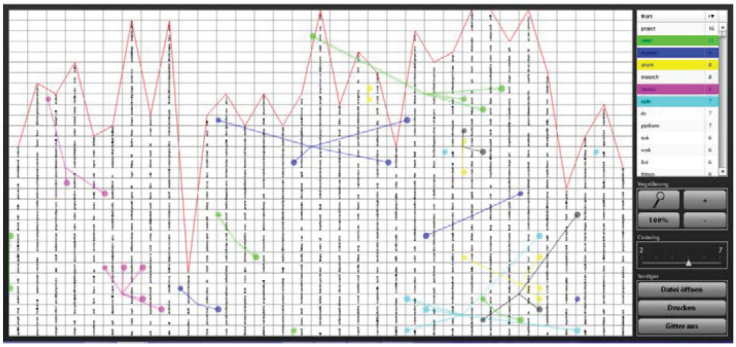

Figure 8: Ideagram of U_CODE wrap-up discussion

Loged issues as “need”, “testbed”, “scrum”, “agile”, “market”, “backlog” can be regarded as the main threads of this Ideagram graph of then round about 30 minutes lasting wrap up.

Figure 8a: word list zoom-in

5 Challenges, Conclusion & Outlook

Whereas researcher of TU Dresden Laboratory of Knowledge Architecture collected a lot of discussions visually with the Ideagram tool in the last years there are still some shortcomings and bucks within the software prototype on the one hand side and on the scientific investigations on the other hand. Since the Ideagram tool was developed about eight years ago it really needs to be updated. Due to the online version there are several uncertainties due to internet connection. Moreover there are some bucks as that the program crashes after marking more than ten words, colours disappear suddenly and so on so restarting is needed very often. So far we used the Ideagram tool in very different settings and gained a large data pool. However, we have a very inhomogeneous data pool and did not investigate the various dialogues systematically yet.

Yet there is no identification of the author of the logged words possible. That means we cannot show who was speaking and originating the different topics and words and who took them over. For the moment we can only count the logged word but we cannot investigate if it was only mentioned by one person or if the other speakers assumed it and developed this issue further. As a next step we want to rework the quality of the visual representation as this is directly linked to the quality of analytical issues. We need to investigate in existing and further developing effective methods on data recording of voice communication. Though the quality of a human coder is still not easily replaced and adopted by computer machines. And last but not least to establish a more scientific approach for the investigation in spoken Idea discussion with using our Idegram tool more systematically.

Following Schröter (2011: 252), there is an advice for further research: Collocations, i.e. different words that are in direct neighbourhood to or in contact with a catchword, could be used to comprehend the complex semantic field of a catchword. Different aspects of an idea are accessible in this way. To convert this approach, it is necessary to detect more extensive phrases, e.g. word groups as lexical units, than only single terms. To detect and understand how ideas are developed and modified or rejected and replaced by other ideas, it would be helpful to include the corresponding author of a phrase in further approaches of the Ideagram-Tool.

Though our Ideagram tool and method is still a prototype with bucks and deficits, we experienced a strong interest in it during the last decade of usage. People want to buy and use this tool. The benefit of recording, visualising and evaluating spoken discussions in real-time was mentioned as most liked by the audiences and very obviously. We state that due to the flexibility and easy use the Ideagram tool but moreover due to its ability of visual output and graphical analysis it is easy understand, utilise and make use of it e.g. by provoking new ideas and deepen the (follow-up-) discussions while showing the graphs to the interested audience. We assume that it is much applicable in business as well as in research.

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